the relay energized. When the STOP button on the tape transport is pressed, the 115 volt d-c no longer reaches pin 3 of 5J7 and relay 3K1 is de-energized and drops out. Slave electronics relay 4K3 provides a coupling contact, 4K3A, when both electronics are in the record mode (concurrent recording). This relay remains energized for a short time after the second relay 3K1 is de-energized to maintain oscillator coupling during the decay period of the oscillators.

NOTE

In catalog numbers 30950 and 30960 slave electronics, relay 4K3A contacts serve as interconnection between the master and slave oscillators. Catalog number 30750 slave electronics did not have relay 4K3.

CAUTION

Before performing alignment and performance checks on stereophonic equipment see special notes on aligning stereophonic equipment.

ALIGNMENT AND PERFORMANCE CHECKS

Equipment Required:

Ampex Standard Alignment Tapes for ¼ Inch Tape.

Speed	*Number Ampex Catalog*
3¾ inches per second (ips)	31331-01
7½ inches per second (ips)	31321-01
15 inches per second (NAB)	31311-01
15 inches per second (AME)	31312-01

A-c Vacuum Tube Voltmeter capable of indicating rms voltages of .004 or less.
Audio Oscillator with stable output from 50 cps to 15 kc.
Earphones or Speaker for Aural Monitoring.
Nutdriver, number 8 (¼ inch).
Reel of unrecorded tape.
Long Screwdriver (approximately 7 inch bit).
Small Screwdriver.

Reproduce Alignment:

Step 1: Remove the head cover.
Step 2: With the equipment connected as

STANDARD TAPES

Order of Recording	*3¾ ips*			*7½ ips*			*15 ips*		
	Tone (cps)	*Level*	*Function*	*Tone (cps)*	*Level*	*Function*	*Tone (cps)*	*Level*	*Function*
First Tone	500	-10 db	reproduce reference	700	-10 db	reproduce reference	700	operating	reproduce gain calibration & reference
Second Tone	7500	-10 db	reproduce head alignment	15,000	-10 db	reproduce head alignment	15,000	operating	reproduce head alignment
Series of Tones	7500 to 50	-10 db	check frequency response*	15,000 to 30	-10 db	check frequency response*	15,000 to 30	operating	check frequency response*
Last Tone	500	operating	reproduce gain calibration	700	operating	reproduce gain calibration	NOT USED		

* Adjust high frequency equalizers if necessary.

shown and all power switches in the ON position, thread an Ampex standard tape for the appropriate speed along the prescribed path.

CAUTION

The standard alignment tape used in the following procedures may be partially erased if the record and reproduce heads are permanently magnetized. Demagnetize the heads before proceeding. Do not replace the head cover on the head assembly.

Step 3: Set the EQUALIZATION switch to the desired speed.

Step 4: Place the METER AND OUTPUT switch in the PLAYBACK position.

Step 5: Terminate the output in a nominal 600 ohms (LINE TERM switch in the ON position or use a 600 ohm external load).

Step 6: Start the standard tape. The first tone on all standard tapes is a reference level, 700 cycles for 7½ and 15 inches per second, and 500 cycles for 3¾ inches per second. For 15 inches per second, adjust the playback level control so the VU meter reads zero or a VTVM across the output reads +8 dbm. For 3¾ or 7½ inches per second adjust the playback level control to a convenient meter reading for checking alignment and response.

Step 7: The next tone will be 15,000 cycles at 7½ and 15 inches per second, and 7500 cycles at 3¾ inches per second for adjusting reproduce head alignment. Take the number 8 nut driver and adjust the left hand stop nut on the reproduce head for maximum output on VU meter or VTVM. If the peak is broad adjust for minimum output variation.

NOTE

If the head azimuth is far out of alignment (possible if inexperienced personnel without proper equipment have attempted alignment procedures) minor peaks may be observed on both sides of the maximum. The proper setting is 15 to 20 db higher than these peaks.

Step 8: Depending on tape speed, tones from 15,000 cycles to 30 cycles now will be reproduced from the standard tape. Adjust the appropriate variable equalizer (2R31 for 7½ and 15 ips, and 2R30 for 3¾) to give the flattest possible high frequency response.

CAUTION

The equalizers should not be used to compensate for system deficiencies (dirty leads, bad alignment, etc.). In general the playback equalizer should not be moved more than 2 db from the standard curve.

NOTE

Catalog #30750 and 30950 electronics used fixed equalization. Variable equalization may be provided in these units by installation of Ampex catalog #31172 kit.

NOTE

When reproducing Ampex standard alignment tapes on multi-track equipment, the bass end of the frequency spectrum will rise in response. The actual amount of rise will vary with the width and location of the track. This phenomena is present because the reproduce head "sees" additional flux on each side of the head at long wavelengths since the standard tapes are recorded across the complete width of the tape. This fringing effect is not present when recording a track the same width as the reproduce head. The electronics should not be readjusted to compensate for this rise.

Step 9: Reproduce level control calibration—The next tone to be heard on the 3¾ and 7½ inch per second standard tapes is a reference tone at operating level. Adjust the playback level control to obtain a zero reading on the

VU meter or a +8 dbm (1.95V) output on a VTVM. On the 15 inch per second standard tape, all tones are at operating level, so this calibration was made in Step 6.

NOTE

Do not change this playback level setting for the remainder of the adjustments.

Reproduce Amplifier Noise Measurement

Step 1: After performing the previous alignment checks, stop the tape motion.

Step 2: Read the stopped tape noise measurement on the VTVM. Noise should be below the level specified in performance characteristics. Inaudible low frequency bounce can cause the meter to read higher than performance characteristics tolerances. Disregard these momentary readings because they are frequencies far below the operating range.

Record Amplifier Erase Current Adjustment

Step 1: After the equipment has been properly installed and connected, and all POWER switches are in the ON position, thread blank tape along the prescribed path.

Step 2: Place the INPUT TRANSFER SWITCH in the UNBAL BRIDGE position.

Step 3: Set the METER AND OUTPUT SWITCH to the ERASE function.

Step 4: Center the noise balance potentiometer. When the user faces the front panel, the slot should parallel the face plate.

Step 5: Place the equipment in the record mode.

NOTE

Erase adjustment on stereophonic recorders must be made with only one amplifier in the record mode at a time as false readings may be obtained if both amplifiers are in the record mode.

Step 6: Using a small screwdriver, set the ERASE ADJUST trimmer on the back of the electronic chassis to obtain vu meter readings at 117 volt ac line voltage as follows:

Full (Single) Track Equipment:	Half Track and Stereophonic Equipment:
+1	−½

NOTE

Erase current will be directly proportional to line voltage and the vu meter readings will reflect any changes from the 117 volt a-c voltage.

Record Amplifier Bias Adjustment

NOTE

This adjustment should be made using the brand of tape that normally will be used on the equipment.

Step 1: Place the METER AND OUTPUT SWITCH in the PLAYBACK position.

Step 2: Place the equipment in the record mode at 7½ ips tape speed.

Step 3: Set the oscillator frequency at 500 cycles per second (cps) with an output of approximately 1 volt.

NOTE

Bias is set at a specific wavelength. It it is desired to set bias as 15 inch tape speed, use a frequency of 1000 cps.

Step 4: Place the RECORD LEVEL knob at a position that will obtain an on-scale VU meter reading.

Step 5: With a small screwdriver set the BIAS ADJUST trimmer for a maximum reading on the VU meter. An accurate way to set peak bias is to adjust the bias control clockwise until the 500 cycle signal drops ½ db below maximum reading. Note the current reading by placing the meter output switch in the BIAS position. Turn the bias control counterclockwise until the 500 cycle signal again drops ½

db and note current reading. Set the bias at the median of these two readings.

Record Level Calibration

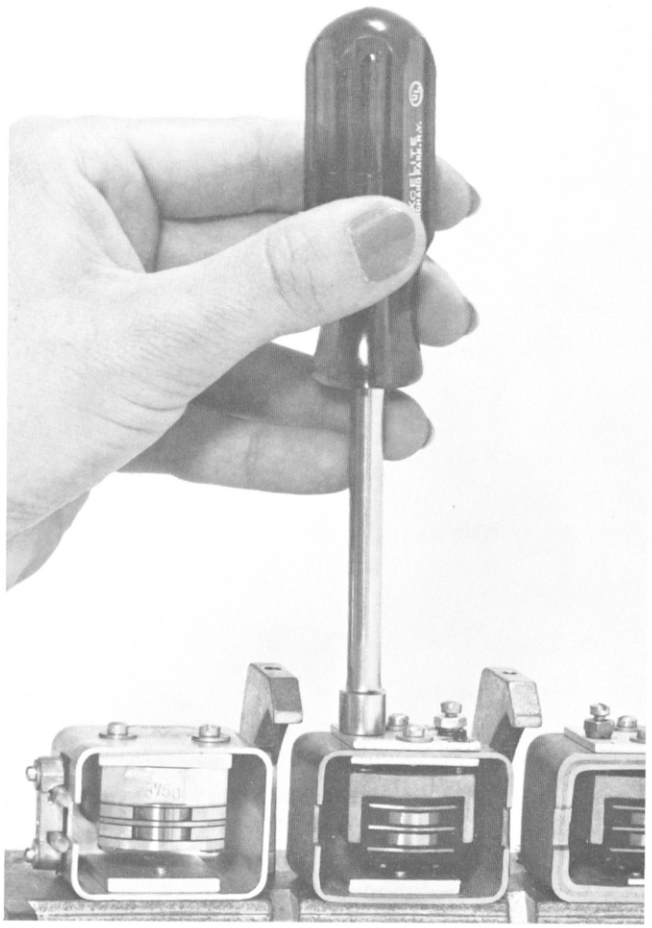
NOTE

The reproduce level must be calibrated using standard tape before calibrating the record level (see Reproduce Level Control Calibration).

Step 1: Set the audio oscillator to 500 cps. Leave the METER AND OUTPUT SWITCH in the PLAYBACK position.

Step 2: Set the RECORD LEVEL knob to a position that will obtain a zero reading on the VU meter.

Step 3: Place the METER AND OUTPUT SWITCH in the RECORD LEVEL position.



Head azimuth adjustment

Step 4: Using a long shank screwdriver (to avoid burns from the hot electron tubes), adjust the record level potentiometer for a zero VU reading.

Record Azimuth Adjustment

Step 1: Set the oscillator at 500 cps.

Step 2: Place METER and OUTPUT SWITCH in the RECORD LEVEL position.

Step 3: Set the RECORD LEVEL knob to obtain a VU meter reading of approximately −20 (−12 on VTVM).

Step 4: Place the METER and OUTPUT SWITCH in the PLAYBACK position.

Step 5: Set the audio oscillator to 7500 cps for 3¾ ips, 15 kc for 7½ and 15 ips.

Step 6: With the nut driver, rotate the adjustment nut on the left side of the record head (as the user faces the front of the equipment) to obtain a maximum VTVM reading. Several peaks may appear, but the maximum peak is obvious because it is much greater than the minor peaks.

CAUTION

The right hand nuts are factory set. DO NOT ADJUST THEM.

NOTE

If it is desired to make this azimuth adjustment using the VU meter instead of the VTVM, place the PLAYBACK LEVEL control in the full clockwise position and adjust the azimuth nut to obtain a maximum VU meter reading.

Overall Frequency Response

To avoid tape compression, frequency response at 15 ips tape speed should be made at least 10 db below operating level (−2 dbm), at 3¾ and 7½ ips at least 20 db below operating level (−12 dbm). The standard alignment tapes are recorded at a higher level to facilitate measurements on the VU meter.

Step 1: Place the METER and OUTPUT SWITCH in the RECORD LEVEL position.

Step 2: Set the oscillator at 500 cycles and adjust the RECORD LEVEL control to obtain a VTVM reading of approximately −12 dbm (.195v).

Step 3: Now place the METER and OUTPUT SWITCH in the PLAYBACK LEVEL position.

Step 4: Make a frequency response check by sweeping the oscillator through all frequencies from 50 to 15,000 cycles.

NOTE

Models using 30750 or 30950 electronic assemblies utilize fixed equalization. Variable equalization may be provided in these assemblies by installation of Ampex Catalog Number 31172 conversion kit.

The high frequency response may vary with tapes of different manufacturers. This machine has been adjusted to give optimum performance within specification with an average tape. The high frequency record equalizers 1C46 or 1C7 (depending on tape speed) may be adjusted to give the flattest possible response with the tape you intend to use. Do not use the playback equalizers 2R30 or 2R31 to compensate for tape variations. The bias setting will also change the high frequency response, especially at the lower tape speeds (3¾ and 7½ ips). Before adjusting the record equalizers make sure the bias has been correctly adjusted as previously described.

CAUTION

Changing bias may change the RECORD LEVEL CALIBRATION and may require re-adjustment as described earlier in this section on "RECORD LEVEL CALIBRATION."

If tolerances are not met, trouble-shooting is indicated or the tape can be faulty.

Overall Frequency Response Using the VU-Meter

Step 1: Thread blank tape along the prescribed path.

Step 2: Place the METER and OUTPUT SWITCH in the RECORD LEVEL position.

Step 3: Set the audio oscillator to 500 cps.

Step 4: Set the record level to approximately −20 reading on the VU meter for 3¾ and 7½ ips tape speed, −10 for 15 ips tape speed.

Step 5: Now place the METER and OUTPUT SWITCH in the PLAYBACK LEVEL position.

Step 6: Note the position of the PLAYBACK LEVEL knob for future reference.

Step 7: Rotate the PLAYBACK LEVEL until the 500 cycle plays back at a convenient reference on the VU meter. Sweep oscillator through the frequency band checking response on the VU meter.

Step 8: Re-establish the PLAYBACK LEVEL CONTROL setting by placing this knob in its original position (see Step 6).

Record Noise Balance Adjustment

CAUTION

For stereophonic equipment see NOTES ON ALIGNING STEREOPHONIC EQUIPMENT.

Step 1: Position the RECORD LEVEL knob fully counterclockwise.

Step 2: Disconnect any input.

Step 3: Plug a set of earphones into the monitor jack and listen for the point of minimum noise while adjusting the noise balance control.

NOTE

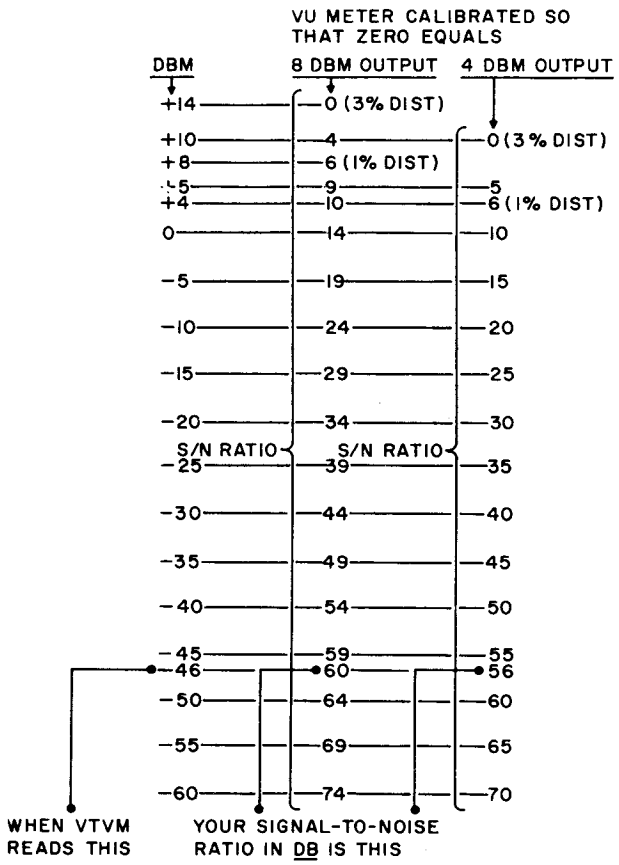
If the slot of the noise balance adjustment is more than 45 degrees from a line parallel to the plane of the face plate, troubleshooting is indicated. If the noise tends to null at either adjustment extreme, it indicates excessive leakage in capacitor 1C10, trouble in the oscillator circuitry or magnetized heads.

Record Noise Measurement

To translate vtvm readings into specific signal-to-noise ratios when the vu meter is so calibrated that zero vu corresponds to +8 dbm output, add 6 db to obtain the output value from the 3% distortion level, arriving at a total of 14 dbm. Having made this computation, bear in mind that, although the noise reading taken on the vtvm is dbm, the measurement is a *ratio* which must include the 14 dbm computed to arrive at the 3% distortion level. Therefore, the vtvm reading must be converted to the signal-to-noise *ratio*.

Example: 14 (dbm, includes +8 dbm normal level and +6 dbm to 3% distortion level)
−46 (dbm, vtvm reading)
60 db signal-to-noise ratio

Any reading below −46 dbm meets performance characteristics specifications of 60 db signal-to-noise and satisfies the signal-to-noise ratio definition.



Signal-to-noise ratio computations

When the VU meter is so calibrated that zero VU corresponds to +4 dbm output add 6 db to obtain the output value to the 3% distortion level arriving at a total of 10 dbm.

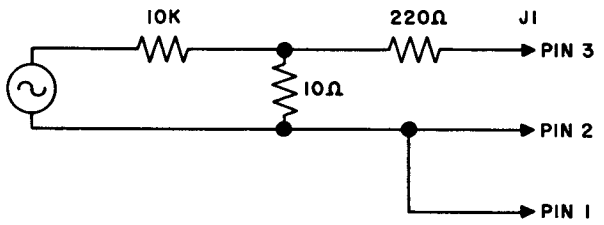
Example: 10 (dbm, 4 +6)
−46 (dbm vtvm reading)
56 (db, signal-to-noise ratio)

Ampex signal-to-noise ratio specifications on audio instruments define in decibels the ratio existing between the level of a steady 1000 cycle tone, recorded at a level at which distortion produced by the approach of tape saturation equals 3% total rms, and that level of total rms noise, in the band from 30 to 15,000 cycles, which exists in reproduction under the same gain conditions.

Ampex audio instruments normally are calibrated so that the VU meter reads zero level when reproducing a steady 1000 cycle tone the level of which produces 1% total rms distortion due to the approach of tape saturation.

A recorded 1000 cycle tone at the 3% distortion level will be 6 db higher in level than the same tone recorded at the 1% level.

Step 1: Place the METER AND OUTPUT SWITCH in the RECORD LEVEL position.
Step 2: Set the oscillator to 400 cps.
Step 3: Adjust the RECORD LEVEL control to obtain a vtvm reading 6 db above operating level (+14 dbm for equipment with 8 dbm output).
Step 4: Record the 400 cps on a section of tape, noting where the recording begins for later reference.
Step 5: Disconnect the oscillator.
Step 6: Set the RECORD LEVEL control to zero. (Fully counterclockwise).
Step 7: Rewind to the beginning of the 400 cps recording.
Step 8: Erase the tape by recording with zero signal.
Step 9: Rewind again to the beginning of the recording.
Step 10: Read the vtvm and check the reading against the table.



Microphone response set-up

Microphone Response

Connect an audio oscillator as shown in the illustration and make the response check by sweeping the oscillator through the frequency range to be checked.

NOTES ON ALIGNING STEREOPHONIC EQUIPMENT

Stereophonic equipment, consisting of two electronic assemblies—a master and a slave, and two track head assemblies, is aligned in an almost identical fashion to the monaural system by considering and aligning each amplifier separately.

Certain simple differences are outlined for the user's guidance. Before attempting alignment of the two track stereophonic equipment, note the instructions for each category.

Head Azimuth Adjustment

Because there are two heads in each record and reproduce stack, make the azimuth adjustment for an average maximum meter indication, adjusting first one head and then the other, and finally adjusting for the average maximum meter indication.

This compromise azimuth adjustment applies to reproduce and record heads alike. When aligning the record heads, energize the record relays by depressing the record buttons on each electronic assembly.

Record Alignment of Stereophonic Equipment

Treat each amplifier as though aligning for single track operation, and following the instructions in this section, proceed in this sequence:

1. Center the noise balance (slot parallel to plane of the chassis face panel if it is not within 45° of center position).

2. Set the ERASE ADJUST trimmer for proper indication.

NOTE

When the METER and OUTPUT SWITCH is in the ERASE position, meter readings must be made with only one amplifier in the record mode because, if both amplifiers are recording, false readings will be taken.

3. Set the BIAS ADJUST trimmer for proper indication.

4. Set the record calibration for proper reading. Repeat on second channel.

Frequency Response

Frequency response checks can be made on both systems simultaneously, or the tracks can be checked individually.

Noise Balance Adjustment

Step 1: Position the number one amplifier RECORD LEVEL knob fully counterclockwise.

Step 2: Disconnect any input.

Step 3: Place amplifier number one ONLY in the record mode.

Step 4: Plug a set of earphones into the monitor jack and listen for the minimum noise location while adjusting the noise balance control.

Step 5: Stop the recorder.

Step 6: Perform steps 1 and 2 on amplifier number two.

Step 7: Place amplifier number two ONLY in the record mode.

Step 8: Listen for the point of minimum noise while adjusting the noise balance control. Noise balance control slots should be within 45 degrees of a line paralleling the face panel of the chassis.

MAINTENANCE AND TROUBLESHOOTING

General Maintenance Information

Faithful adherence to the recommended ROUTINE MAINTENANCE found in SEC-