

FIELD ENGINEERING BULLETINTITLE: CHANGING OPERATING-SPEED PAIR AND
MASTER BIAS OPERATION

DATE OF ISSUE 9/15/76

I. APPLICABILITY

All ATR-100's.

II. PURPOSE

To change operating-speed pair and master bias operation for the ATR-100 Recorder/Reproducer.

III. DISCUSSION

The ATR-100 can operate at any tape-speed pair selected from the following speeds: 3.75, 7.5, 15, and 30 in/s. Machines shipped from the factory are set to operate at 7.5 and 15 in/s with four-speed master bias operation. When a speed is selected on the transport control panel for which the signal or master bias has not been set up, the lockout indicator will light and play and record modes for that speed will be inoperative. To change operating-speed pair and master bias operation, jumper plugs are repositioned on audio control PWA no. 5 and on the PADNET PWA (s).

The jumper plugs on the audio control PWA no. 5 permit the user to program the ATR-100 for two-speed dual master bias operation or four-speed master bias operation. When the ATR-100 is programmed for two-speed dual master bias operation, a switch on the front panel of the audio control PWA no. 5 (Figure 1) enables the operator to select one of two different master bias levels for each of the two operating speeds. When the recorder is programmed for four-speed operation, the switch is permanently placed in the left-hand position and a single master bias level is provided for each speed. This master bias level is automatically switched for the speed selected on the transport control panel.

NOTE:

If the audio control PWA no. 5 jumpers are set for four-speed master bias operation, it is only necessary to reset jumpers on each PADNET PWA when changing operating speed pair.

When the audio control PWA no. 5 jumpers are set for two-speed dual master bias operation, then the two speeds selected on the audio control PWA no. 5 must match those selected on the PADNET PWA (s), or the lockout circuitry will operate.

IV. PROCEDURE**A. Operating Speed Pair Change**

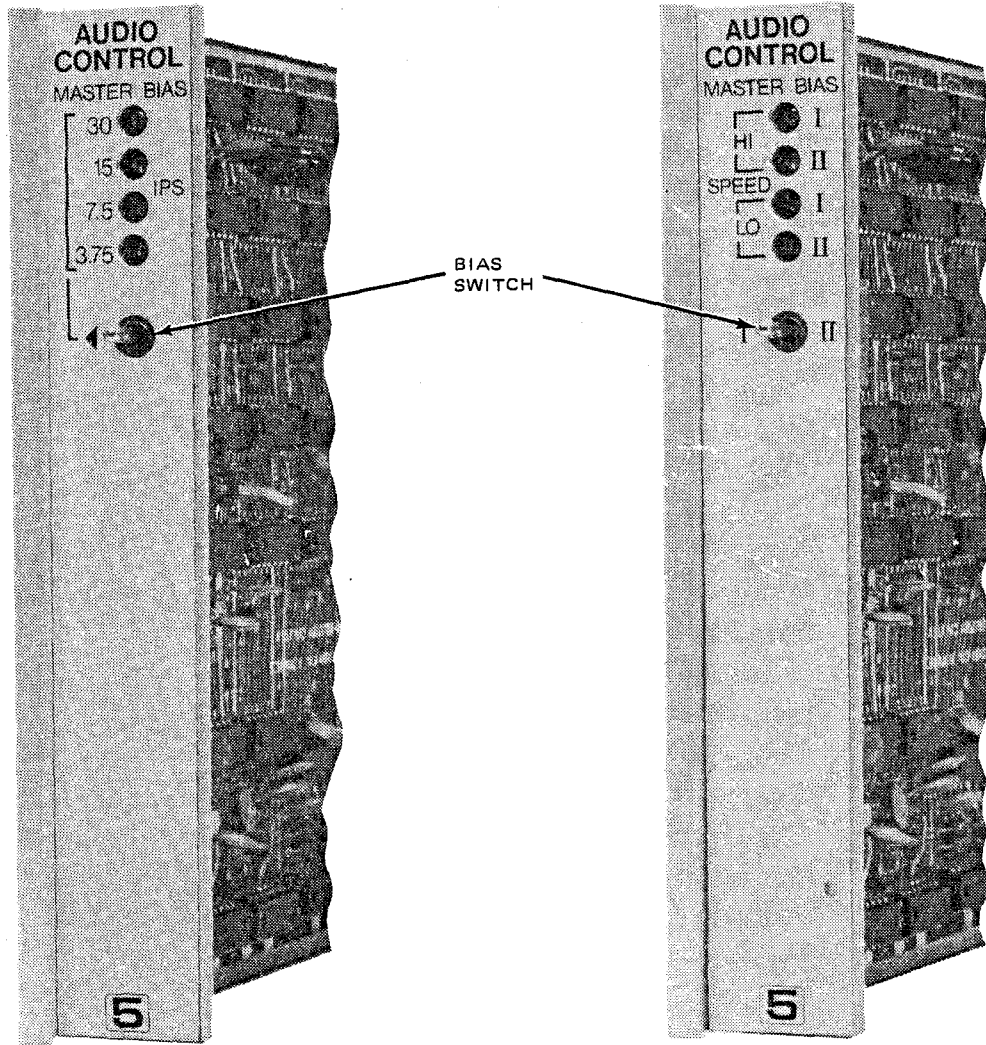
1. With power off, remove the PADNET PWA for each channel from the electronics assembly.
2. Position HI speed jumper J1 to the desired high speed 30, 15, or 7.5-in/s position (Figure 2).
3. Position LO speed jumper J2 to the desired low speed 15, 7.5, or 3.75-in/s position. Reinstall PADNET PWA (s).

B. Two-Speed Dual Master Bias

1. With power off, remove audio control PWA no. 5 from the electronics assembly.

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FOUR-SPEED OVERLAY PANEL

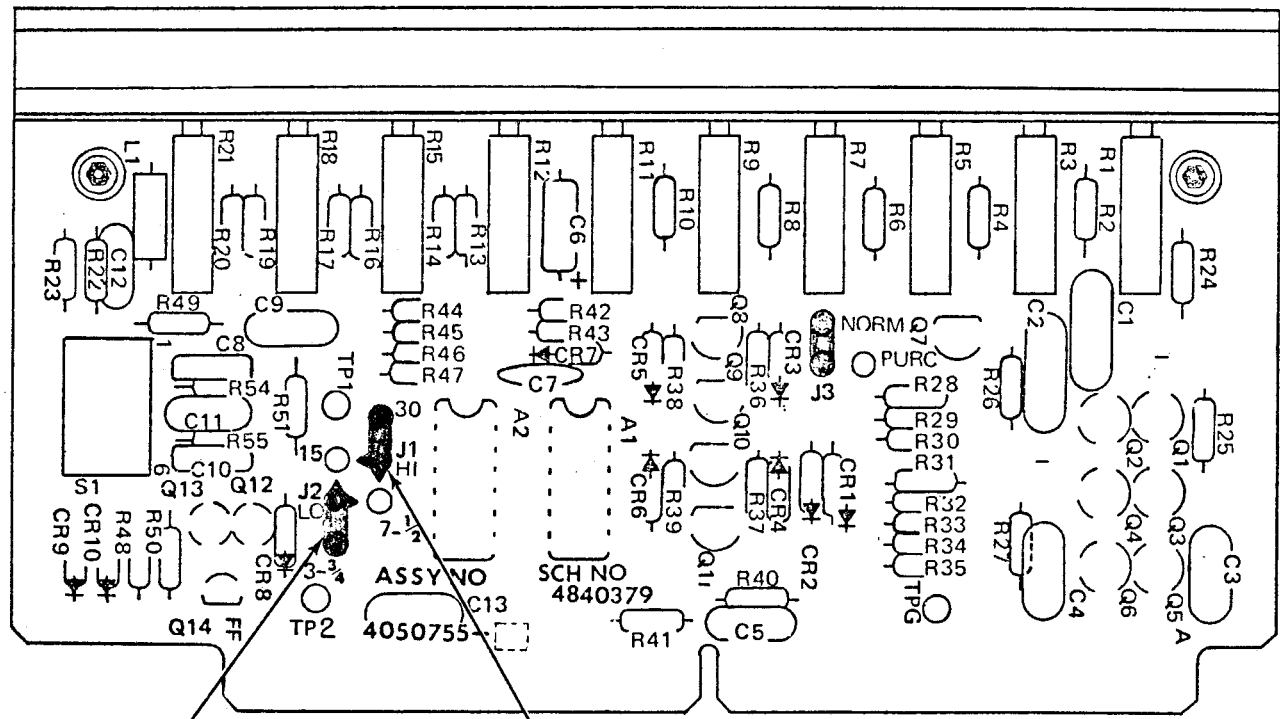
TWO-SPEED OVERLAY PANEL

Figure 1. Overlay panels, Audio Control PWA No. 5.

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LO-SPEED JUMPER J2
(SHOWN IN 3-75 IN/S
POSITION)

HI-SPEED JUMPER J1
(SHOWN IN 30-IN/S
POSITION)

Figure 2. Speed Selection Jumpers, Padnet PWA.

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2. If two-speed overlay panel (Figure 1) is not in the front position on the PWA, remove front-panel screw, interchange overlay panels, and reinstall screw.
3. Position HI speed jumper J1 to the desired high speed 30, 15, or 7.5-in/s position (Figure 3).
4. Position LO speed jumper J2 to the desired low speed 15, 7.5, or 3.75-in/s position.
5. Position jumpers J3 and J4 to the S (stored) position. Reinstall audio control PWA no. 5.
6. For each new speed selected, perform the appropriate signal system alignment procedure indicated in this FEB.

C. Four-Speed Master Bias

1. With power off, remove audio control PWA no. 5 from the electronics assembly.
2. If four-speed overlay panel (Figure 1) is not in the front position on the PWA, remove front-panel screw, interchange overlay panels, and reinstall screw.
3. Position jumper J1 to the 30-in/s position (Figure 3).
4. Position jumper J2 to the 7.5-in/s position.
5. Position jumper J3 to the 15-in/s position.
6. Position jumper J4 to the 3.75-in/s position. Reinstall audio control PWA no. 5.
7. For each new speed selected, perform the appropriate signal system alignment procedure indicated in this FEB.

NOTE:

Rejumping of the "PADNET" PWA only changes the operating-speed pair; it is still necessary to re-adjust both reproduce and record equalization to conform to the desired equalization standard at the new speed, or speeds, which have been selected.

D. Signal System Alignment

The following information is a guide to aligning an ATR-100 system for a speed set other than the factory-delivered configuration. It is a routine procedure, and assumes that the user is familiar with professional audio recorders and their routine alignment. Detailed signal system alignment procedures are included in the ATR-100 Operation and Maintenance manual, Catalog No. 4890407, soon to be released.

1. Reproduce Alignment

When Ampex standard alignment tapes are used, note that the reference 700-Hz tone (500 Hz at 3.75 in/s) is at 185 nWb/m. If the system operating level is to be set to 370 nWb/m for use with Ampex 456 tape, then the standard tape reference level will play back nominally 6 dB below the required output level (or -6 VU). Similarly,

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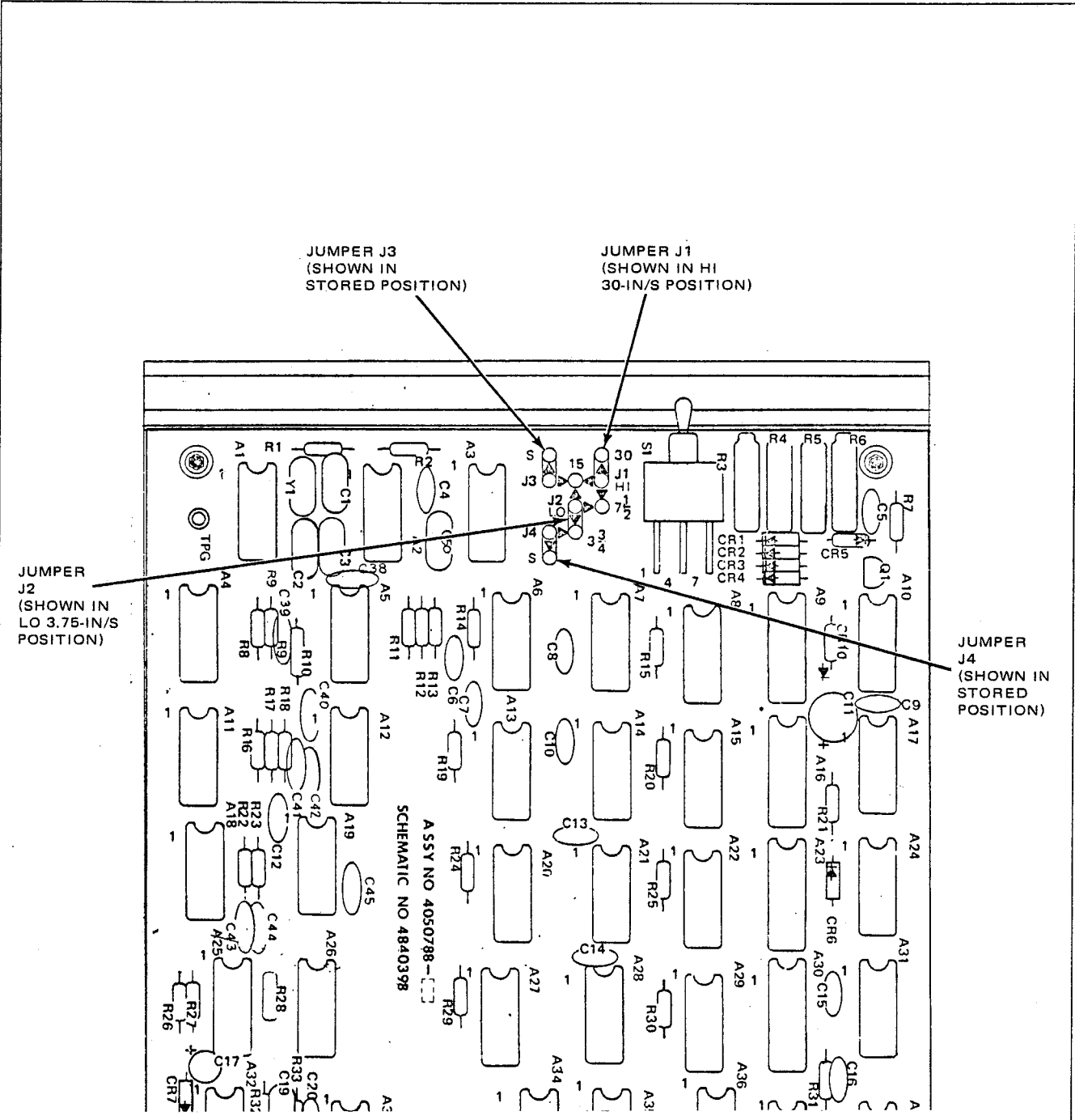


Figure 3. Speed Selection Jumpers, Audio Control PWA No. 5.

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if a 260-nWb/m operating level is to be used, the alignment tape will play back nominally 3 dB low.

When the alignment tape is full width, there will be an error in the level setting due to fringing effects. This will cause the operating level to be set too high, which may result in excessive distortion. Table 1 lists the correction factors for various tape speeds, and reference frequencies.

NOTE:

Table 1 applies to ATR-100 system heads ONLY.

To use the table, set the PADNET reproduce gain so that the reference level plays back higher than the level expected, by the appropriate amount shown in the table.

Adjust the high frequency equalizer in a normal manner. The low frequency equalizers may be set approximately from the alignment tape, but should be set finally when doing overall record-reproduce alignment.

Sel sync levels may be set in a similar manner to the reproduce levels, but it is recommended they be set from a recording, after all other alignment procedures have been completed. No adjustment of the sel sync equalization should be necessary.

Unless different line output/input level sensitivities are desired from those set in the factory, no adjustments should be made to the output/input system. If different operating line level is desired, e.g., + 8dBm, then four adjustments to each I/O module must be made:

- | | |
|---------------------|----------------|
| 1. Record preset | 3. Record Cal. |
| 2. Reproduce preset | 4. Meter Cal. |

The first three are front panel adjustments and the fourth is an on-board adjustment. Assuming no adjustments have yet been made to the I/O system or basic system, the following method will ensure that the interface level to the basic system is maintained at -5 dBm for operating level.

- a. Using an external VTVM, set the input level at 1 kHz to the new desired operating line level. Select input monitoring. Adjust the record preset to give O-VU indication.
- b. Monitor the line output with a VTVM; the output level should be + 4dBm. Adjust the record calibrate preset to produce the new desired line output level. (The VU meter indication will now be incorrect.)
- c. Turn off power and remove the I/O module from the chassis. Adjust the meter calibration preset R21 in the direction desired (cw increases metering sensitivity).
- d. Replace I/O and recheck meter reading. It will be necessary to repeat step c as required until the VU meter indicates O with the new line output level. If an I/O module extender board assembly is available, R21 may be set directly.
- e. Place the system in record and adjust the reproduce preset on the I/O system for O VU (or, alternatively, set the reproduce preset on the I/O while reproducing an alignment tape). DO NOT adjust any presets on the I/O PWA other than R21.

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Table 1.
Fringing Effect Correction Factors for Full Track Alignment Tapes used on 2-Track
or 4-Track ATR-100 Systems.

SPEED	REFERENCE FREQUENCY	CORRECTION FACTOR*	
		2 TRACK	4 TRACK
30 in/s	500 Hz	+1.61 dB	+2.10 dB
	700 Hz	+1.46 dB	+1.85 dB
	1.0 kHz	+1.29 dB	+1.58 dB
15 in/s	500 Hz	+1.29 dB	+1.58 dB
	700 Hz	+1.14 dB	+1.34 dB
	1.0 kHz	+1.01 dB	+1.13 dB
7.5 in/s	500 Hz	+1.01 dB	+1.13 dB
	700 Hz	+0.90 dB	+0.99 dB
	1.0 kHz	+0.81 dB	+0.87 dB
3.75 in/s	500 Hz	+0.81 dB	+0.87 dB
	700 Hz	+0.74 dB	+0.79 dB
	1.0 kHz	+0.69 dB	+0.74 dB

*2 Track - includes 0.56 dB due to 80 mil reproduce core on 75 mil track.

*4 Track - includes 0.6 dB due to 75 mil reproduce core on 70 mil track.

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2. Record Alignment

The settings of the preset record equalizer (S1) on the PADNET will require adjustment for the new speeds and/or equalization standard being used. S1/1 through S1/3 control the equalization for the high speed, and S1/4 through S1/6 are for the low speed. The schematic for the PADNET (refer to Instruction manual, Cat. No. 4890409) shows the functions of each switch position. The equalization standard to be used will either require a constant current low frequency record characteristic (∞) or a low frequency boost (3180 microseconds, NAB). Therefore, the position of S1/3 or S1/6 will be determined by the equalization standard; e.g. NAB 15 in/s for the low speed will require S1/6 to be set "OFF", while AES 30-in/s equalization will require S1/3 to be set "ON" (thus ∞ = ON and 3180 μ s = OFF for S1/3 or S1/6.)

The other two switches (S1/1, S1/2, or S1/4, S1/5) can be set, in conjunction with the normal record equalizer, in any combination to produce the flattest overall response. For Ampex 456 or 406/407 tape, the following settings are recommended:

Equalization Standard & Speed	S1/1 or S1/4 Shelf Down	S1/2 or S1/5 Shelf Up	S1/3 or S1/6 ∞ /3180
30 in/s AES 17.5/ ∞	OFF	OFF	ON
15 in/s IEC 35/ ∞	OFF	OFF	ON
15 in/s NAB 50/3180	ON	OFF	OFF
7.5 in/s NAB 50/3180	OFF	ON	OFF
7.5 in/s IEC 70/ ∞	OFF	OFF	ON
3.75 in/s IEC/NAB 90/3180	OFF	ON	OFF

If Ampex 456 tape is to be used, and four-speed master bias operation is retained, all bias adjustments may be made using the MASTER bias controls on the audio control board only. If operation with any other type of tape is desired, it may be biased by using the master bias controls only.

For Ampex 456 tape, the recommended biasing point is 2.75 dB \pm 0.25 dB of overbias at 20 kHz for 30 in/s, 10 kHz for 15 in/s, 5 kHz for 7.5 in/s, and 2.5 kHz for 3.75 in/s. If the bias normalizing needs to be readjusted, the master bias bus level should be preset to 2.5V peak-to-peak. This voltage may be verified at pin FF on any audio board or PADNET PWA. With the master bias bus set to 2.5 Vp-p, the individual bias normalize presets may be set.

When Ampex 456 tape is used, each channel should be set for 2.75 dB overbias at the frequency appropriate to the speed. For other types of tape, some other amount of overbias may be appropriate. Each channel must be set for the same level of overbias. It is recommended this be done at some high frequency similar to that recommended for 456 tape.

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For Ampex 406/407 tape, 1.5 to 2.0 dB overbias at 20 kHz for 30 in/s, 10 kHz for 15 in/s, 5 kHz for 7.5 in/s and 2.5 kHz for 3.75 in/s is appropriate for ATR-100 heads.

Record equalization adjustment is straightforward. At 30 in/s and 15 in/s, it may be done at operating level. At 7.5 in/s, it should be aligned at 10 dB below operating level, and at 3.75 in/s at 20 dB below operating level.

Initial setting of the high frequency equalizer can be done at specification band edges; i.e., set 28 kHz at 30 in/s to -1.0 to -1.5 dB, using record equalizer; and 35 Hz at 30 in/s to -1.5 dB, using low frequency reproduce equalizer. Similarly, at other speeds the upper and lower band edges specified can be used to make initial adjustments of the record equalizer and low-frequency reproduce equalizers, respectively. The appropriate frequency range can then be swept with the oscillator and any fine adjustments to equalizers made as required.

At slower speeds, it may be necessary to adjust the record head azimuth to maximize output level at high frequencies before completing equalization adjustments. DO NOT adjust azimuth of either head for phasing until the equalization adjustment for that head is correct; i.e., do reproduce adjustments first, then set reproduce azimuth for phasing, then do biasing and equalization, followed by record azimuth. If this order is not followed, the record or reproduce head azimuth may be mechanically misadjusted to correct an interchannel phasing error which is electrical in origin.

Record gain is adjusted conventionally. It should be noted that when making a permanent change of operating level, all changes preferably should be made at the PADNET.