FULL-TRACK PRODUCTIONS
professional products division

SERVICE BULLETIN

SEATTLE • WASHINGTON • FULLTRACKPRODUCTIONS.COM

Bulletin	Removing the Noise-Balance circuit from early Ampex tape recorders
Applies to	Ampex models 300, 400, 350
Date	2018 August 10
Revision	1
Total pages	3

Problem

Ampex 300, 400, and 350 recorders used a dc noise-balance adjustment circuit that is no longer required now that modern low-leakage coupling capacitors are available. If you do not remove this noise-balance circuit, it is possible to introduce low-frequency noise if you do not adjust the noise-balance control correctly.

Background

In the Ampex 300, 400, and 350 electronics, the record signal is coupled to the record head through a 1 uF / 400 volt metalized paper capacitor. Until the late 1950s, Ampex used metalized paper coupling capacitors since they had generally good performance and were small enough to fit under the typical electronics chassis of that era. According to former Ampex engineer Jay McKnight, the small amount of leakage current contributed by metalized-paper capacitors was not identified as a concern when the earliest of these recorders (the Ampex model 300) was designed in the late 1940s.

Today we know that metalized paper capacitors have *much* higher leakage than modern polyester or polypropylene capacitors. In the older Ampex machines, a small amount of dc plate voltage from the record amplifier would leak into the record head though this 1 uF coupling capacitor—this would add noise and over time, magnetize the record head (which further contributed to noise). Additionally, record heads often became magnetized if they were tested with an ohmmeter.

Once the record head becomes magnetized, then minor irregularities in the recording sensitivity of the blank tape cause low-frequency noise—often called *rocks, lumps and bumps, crackling,* or *grumbling* (or more precisely, *dc noise* or *modulation noise*). [(1)]

Beginning with the Ampex 300, the workaround to this problem was the addition of a circuit to inject a small dc-offset into the record head (after the 1 uF coupling capacitor) to compensate for any dc leakage and record-head magnetization. The noise-balance pot controlled the amount (and polarity) of the introduced dc offset. Adjustment was made by first demagnetizing the tape heads, then recording a tape (with no input) and listening to the playback output with a sensitive speaker and setting the noise-balance pot for minimum crackling noise.

Ampex began using low-leakage coupling capacitors beginning in the mid-to-late 1950s with the introduction of the model 600 and model 351. Consequently, there was no longer a need to introduce a dc offset using the older type of noise-balance circuit. Instead, the later machines used a balance adjustment in the push-pull bias oscillator circuit to adjust for the most symmetrical bias waveform.

Fix

The problem may be fixed by removing the noise-balance potentiometer and associated components. See specific instructions for various models.

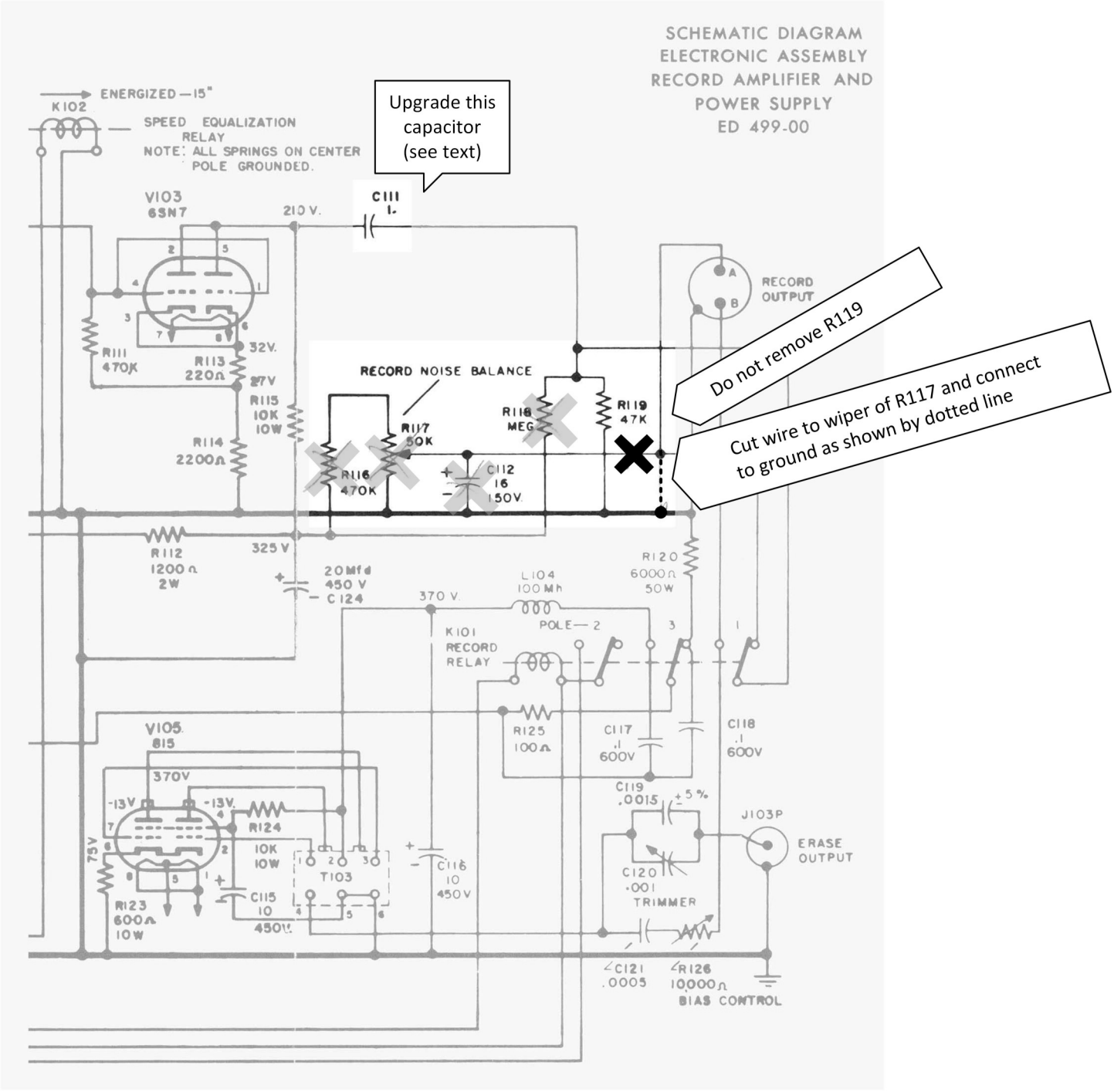
Acknowledgments

Full-Track Productions would like to thank Jay McKnight (*Magnetic Reference Laboratory, Inc.* San Jose, California) for technical suggestions and review of the procedures outlined in this bulletin.

[(1)] *This explanation courtesy of former Ampex engineer Jay McKnight* (see http://mrltapes.com/mcknight_demag.pdf).

Ampex 300 noise-balance removal

- Remove R116 (470K resistor)
- Remove R117 (50K pot)
- Remove R118 (1 Meg resistor)
- **DO NOT remove R119 (47K)**
- Remove C112 (16 uF / 150V electrolytic)
- Replace C111 (1 uFd / 400 VDC) with a low-leakage capacitor of similar value and voltage rating (such as a polyester, polypropylene, or polycarbonate type).
- Connect terminal A of the record-head connector to chassis ground (this terminal was formerly connected to the positive side of C112 and the wiper of R117 (50K pot).



Ampex 400 series and Ampex 350 noise-balance removal

The Ampex 400 (half-track mono) and 401 (full-track mono) were very early one-case portable recorders that used a transport with mechanical controls. The later 400A (half-track mono) and 401A (full-track mono) recorders were also one-case portable recorders but with an improved transport with solenoid-operated controls.

The electronics chassis for the 400/401/400A/401A were similar aside from changes to the head connectors. These electronics had a unique shape (narrow and deep) to fit underneath the 400-series transport in a combined transit case.

The 402 (half-track mono) and 403 (full-track mono) were introduced in 1952 and were available as two-case portable units or mounted in consoles for studio use. The electronics chassis for the 402 and 403 was similar electrically to the earlier 400-series electronics but had an updated mechanical configuration that was more like the model 350 (introduced a year later, in 1953).

Procedure

- Remove R425 (470K resistor)
- Remove R424 (50K pot); carefully unsolder the wire going to the wiper since you will need to reconnect it to chassis ground
- Remove R423 (1 Meg resistor)
- **DO NOT remove R422 (47K)**
- Remove C413 (16 uF / 150V electrolytic)
- Replace C412 (1 uFd / 400 VDC) with a low-leakage capacitor of similar value and voltage rating (such as a polyester, polypropylene, or polycarbonate type).
- Connect the wire that was formerly connected to the wiper of R424 (50K pot) to chassis ground (you can solder it to the lug where the negative side of C413 was previously attached).