VLBA ACQUISITION MEMO #361

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To: VLBA Data Acquisition Group

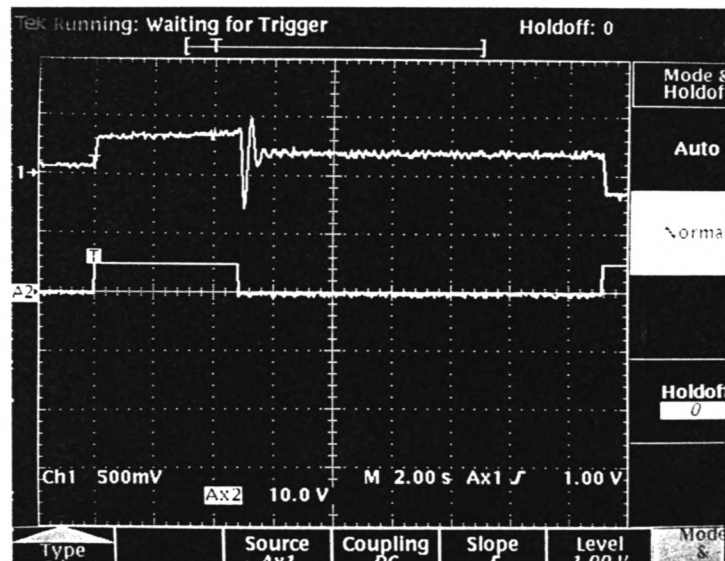From: Alan E.E. Rogers,
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Subject: Reel servo stability margin

The reel servos in the Model 96 are operated in 2 gain modes. The low gain provides good stability without oscillations for normal record and playback*. The high gain mode is needed for accelerating and deceleration (or "slewing") from one speed to another at the highest acceleration 67.5 inches/sec/sec. The current version of the firmware (Ver. 7.0) switches into high gain immediately at the start of a slew and into low gain immediately following the end of slew. Switching out of high gain without sufficient time to allow the overshoot transients to die out can result in dropping the loop when the low gain takes effect. The most marginal cases are tape slewing when the reels are either full or empty and the reel is pulling the tape out of the vacuum column. Figure 1 shows the oscillatory transient in the loop position (upper trace) which follows the switch to low gain (lower trace goes to zero). In this case, a fast-forward was issued from the beginning of tape and we are looking at the take-up reel servo.
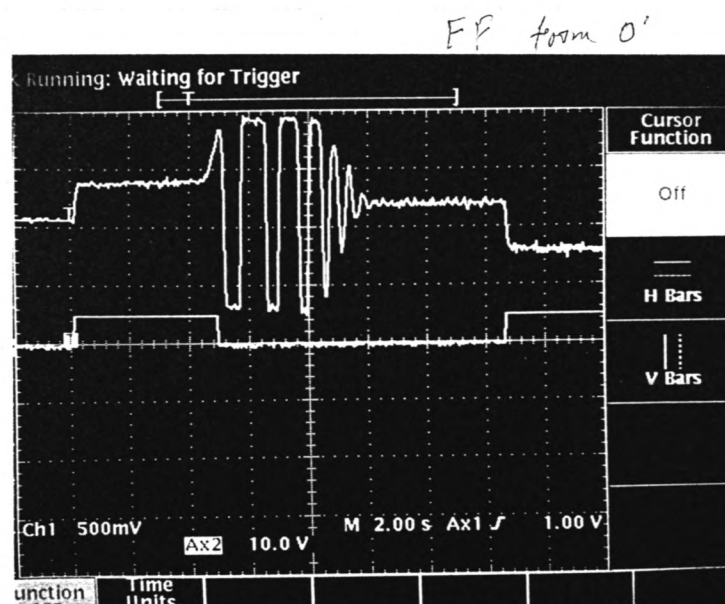

Changing the take-up reel from a 14 inch to a 15 inch glass reel is sufficient to produce complete failure (with a loud squawking sound) of the servo as shown by the violent oscillations shown in Figure 2. In this case the tape didn't break, but in other cases it did break, and sometimes the tape pulls out past the loading block without breaking. A 40% loss of reel servo gain, either by having dirty loop sensor windows or other maladjustment can cause failure. Future improvements in the firmware made by adding a one second lag to the switch from high to low gain should improve the performance enough that we will have more that 50% margin.

*The possibility of choosing a single value of servo gain and current limiting to be able to use a single mode is worth investigating.

FIGURE 1. 14" Take-up Reel

FIGURE 2. 15" Take-up Reel