

Quiz

Power supplies, reactance.

Terry's Talk on NABEF

She had a blank CD, so no slides. Wait until tomorrow.

Tape Recorders Downstairs

Tensions very important on tape. Must stretch tape across heads, taut but not enough to deform it. Reel of tape on supply and take-up sides. Tension at head is low – usually 8 ounces across the scanner. Tape wraps around scanning unit. Different wraps: half, full, omega. Diagram 1.

Capstan and Pinch Roller

Capstan and pinch roller. Capstan is shaft driven by motor directly or through belts. Stainless steel or other high quality material that doesn't wear very fast, precisely machined. Pinch roller made out of rubber, friction pinches tape between roller and capstan. If roller stops pinching, tape should stay where it is (no slack). Will have tension on both sides of the reel.

Tentelometer

Tentelometer. Registered trademark of the Tentel corporation. Measures tape tension. Very delicate piece of equipment. This one measures up to 12 ounces or equivalent in grams..

As tape moves through machine, can simulate it by putting weight onto tape. This is how we calibrate these devices; hang the tape from the tentelometer and read the tension. Meter should read whatever the weight weighs. The rollers are stationary, and the roller in back moves back and forth; this results in varying tension readings.

Tape Head Degausser

Why tape on end of degausser? So we don't scratch the heads we are degaussing.

How to degauss the heads? Find the gap (the black line running vertically where the metal doesn't touch). Degauss with AC. Do this just like we degauss monitors. This is for audio heads.

What about video head? Much smaller gap than the audio head. The wheel that rotates is the scanner; the heads are mounted on the scanner. The head core is called a wafer; it is made out of ferrite (powdered iron that is sintered (heated) into a ceramic-like solid). Ferrite is brittle, so heads are easy to break.

Scanner has an upper drum and a lower drum, with the video head in the middle. Up to 9000 RPM, often 1800 or 3600. Tape comes in at an angle to draw the helix angle and recording video on slant tracks (helical scan tracks). That's why it's called helical scan recording.

Head Clogging and Cleaning

Head can get clogged a lot faster than an audio head, since the head is spinning. Clogging caused by particles on the tape. Head spins and generates huge amounts of heat. If something breaks down, head will spin in one place and heat the ferrite material and plastics down and weld to the head surface, shorting out the head; this is called **head clog**.

How to remove this material from the head? Take Q-tip with a wood handle (they don't shed as much) with tightly wound. Sometimes material melted on has sharp edges. Soak Q-tip tip in alcohol. Want to go against the toothbrushing rule; go across the head. Don't do it while it is running; make sure tape is stopped. If go up and down, the flimsy material will break. Replace whole head is about \$2000 (ouch). Break Q-tip by bending it so you get long fine shards to work with; start scratching front of head with very thin part of shard that has been soaking in alcohol. Combines scraping and soaking with alcohol. Not recommended by any manufacturer. Steve has found this useful. Move the Q-tip in the same line as is the gap (collinear to the gap), not perpendicular to the gap (which is what bends and breaks the ferrite material).

Occasionally must change the pinch roller, since it hardens over time. Pay attention to the manufacturer's recommendations. Will either use alcohol or soap & water. Using wrong one with wrong pinch roller will cause damage.

Most problems with these machines will be mechanical; electronics are much more long lived than the mechanics. Provide an air bearing to the tape in order to aid movement.

Careful when working on running tape machine; can break head easily. Home deck heads are just as sensitive as heads on professional decks. They are pretty tough in the scope of their design; they touch fast-moving tape for a long time without going bad.

When clean a machine, clean with what manufacturer recommends. Won't recommend soap and water on steel stuff like capstans. If don't know, clean it with alcohol, except the pinch roller.

Tape is filthy. Active ingredient is rust; it will come off the tape. The roller has bearings on top and bottom. Helps to align tape especially with multi-track tape. Bearings can be expensive (\$200) and can be damaged by what's coming off the tape. Must get up underneath and clean on either end. Can take apart some of these; take the cap off and roller off and see bearings. Don't get body oils on the bearings, but if you have tape residues on it take it apart.

Bearings

Bearings. To hold it still, have a preload which puts pressure in the center of the bearing. Ball bearings roll within a race. Diagram 2. Finite amount of lubricant wears out, if get dirt in there it can cause premature failure. Preload pinches center part while sitting on shaft, allowing outer part to turn. Cleaning a bearing. These are sealed so you can't take them apart; you have to replace them.

Tape may wrap around a post; a convenient way to turn a tape. Post may require tension. Posts get dirty and tape can snag on the dirt. Clean post with cloth with alcohol on it; don't touch post with your fingers. Make sure clean where post connects.

Make sure every part of tape deck is clean where tape touches. Clean recorder before adjusting recorder, since cleaning will misadjust stuff.

How often to clean is up to manufacturer recommendation. Usually so many hours or once a month. Most of these decks have hour meters.

Degaussing Order

First the audio heads, control track heads, time code heads, any stationary heads, actual video head. All the metal in the recorder is potentially magnetizable. Rollers, posts, capstan. Won't damage the heads or tape, but can erase the tape so don't have a tape on the machine when degaussing.

Probably have longitudinal heads on all our equipment. Ensure degauss scanner to degauss metal around the scanner.

Audio deck is easier. Have 1, 2, or 3 heads, depending on machine quality. In video machine, have video head, up to 6/8/10 heads on the scanner, may have 2/3/4 heads (on what?). C format may record video on a track (slant) giving lots of space from the tape edges (keeps from losing information loss from edge damage) records everything except vertical interval, then another head records just the vertical interval. Preserves vertical interval. Diagram 3.

Track Placement on Tape

Diagram 4. Record longitudinal audio track on one side, then audio track on other side, then control track closer, then time code closer.

High fidelity audio on VHS. Longitudinal audio is not high fidelity. Where is high fidelity audio recorded on the tape? Can't move tape fast enough to go longitudinal. Record high fidelity audio helically like the video.

Recording Video Onto Tape

Baseband video on VHS 0 to 2.5 MHz. Modulate video so that lowest point on waveform is at 5.5 MHz and highest level is 6.6 MHz. Have FM bandwidth of 1.1 MHz. Compressed 0 to 4.2 MHz into 1.1 MHz. FM the television signal within this bandwidth. Since 4.2 is lower than the lowest frequency, still works. This way, there is room for audio (4 channels). When play back, what are the problems? Time base errors. Taking a scanner with mechanical stuff and trying to make it accurate like electronics; see jitter. We saw time base errors. Spec on color is +/- 10 Hz. We can't lock onto this. If remove chrominance from 4.2 MHz, save 1.5 MHz. Beat the color down to the kilohertz range with a beat frequency oscillator, so high frequency problems don't mess up the color nearly as easily. So don't have to worry about misalignment messing up interleave. This is called **color under**. Not used much today. This way the jitters don't change the color phase. Must do time base correction on the luminance but not so noticeable.

FM'ing the video onto a carrier, and the carrier doesn't take as much space as the video (the signal being modulated onto the carrier). This is called **narrow-band FM**.

Some problems with FM. Sidebands can occur in odd places, so must adjust according to the manufacturer recommendation.

Next

Thursday we will work on recorders in lab. Today we will work on projects for the remainder of the day. Today's writeup should include percent completion.