TROUBLESHOOTING BETA TRANSPORT MECHANISMS

How to locate and solve cassette loading/unloading problems in Beta-format video cassette recorders.

FOREST BELT

WHEN THE MECHANICAL AND ELECTRONIC functions combine as they do in video cassette recorders, a technician can find himself somewhat confused. Where do you begin to diagnose?

Your best bet probably is to depend on my *Easi-Way Servicing* technique. It offers a logical, step-by-step approach to diagnosing a defective component. The method adapts well to mechanical troubleshooting, even though it originated as an electronics diagnostic procedure.

Let's use that troubleshooting technique to deal with a few common symptoms. Complex though the threading/unthreading operation may seem, it really consists of only a few specific stages. Not many symptoms can actually appear in the operation.

To observe loading/unloading symptoms most conveniently, take the top cover off the recorder. Then, remove the plastic cover from the cassette-lift assembly (omit the cassette) and press the lift assembly down into its ready-to-load position until it latches.

To initiate loading when there's no cassette in the lift compartment, just depress the cassette-in switch. That switch is accessable at the front center of the lift assembly (See Fig. 1), when the assembly is latched down. Now you can see for yourself how the problem you are troubleshooting affects the threading or unthreading mechanism.

Will not load

The symptoms can be separated into two parts. The rare one is when the cassette-lift mechanism pops back up as soon as you push it down. In other words, it won't latch and loading cannot proceed.

A little reasoning and inspection tells you that the cause must be mechanical. The EJECT button slide might be jammed, leaving the trip post for the cassette lift unable to move back for latching. The latching levers are on the right side on the lift assembly; the EJECT button slide is on the left. A linkage bar reaches across underneath.

However, when the EJECT button slide is stuck, it usually leaves the main AC motor on. That's something you would notice right away. (The AC motor and head drum do not rotate during loading, but they do run during the unloading and eject cycle.)

It's far more likely that the lift-latching mechanism has become bent or that some obstruction is holding the latching post out of position. Reach in with a thin probe (a soldering aid works) and try manipulating the latch.

The more common "won't-load" symptom, however, is simply that the tape fails to thread after the cassette has been inserted and the lift latched down.

Again, push down the cassette-lift assembly without the cassette inserted. Press the cassette-in sensing switch. If nothing happens, that could actually end your mechanical analysis. You then proceed with an electronic tracing procedure until you find some logic signal (voltage), or lack of it, that is inhibiting operation. Once the flaw is located, you may have to return to mechanical observation or testing to find the actual trouble . . . and even then perhaps revert to electronic troubleshooting. Let's troubleshoot one case with that symptom, to give you some notion of the procedures involved.

Press down the lift and push the cassette-in switch. You expect the threading motor to turn on and drive the ring counterclockwise, but nothing at all happens. You can't even hear the threading motor try to run. It's time to investigate the

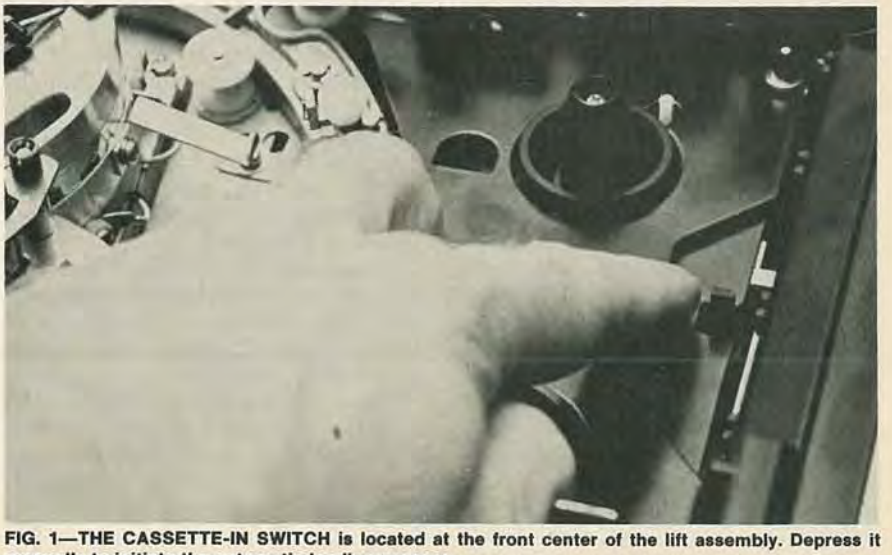


FIG. 1—THE CASSETTE-IN SWITCH is located at the front center of the lift assembly. Depress it manually to initiate the automatic loading process.

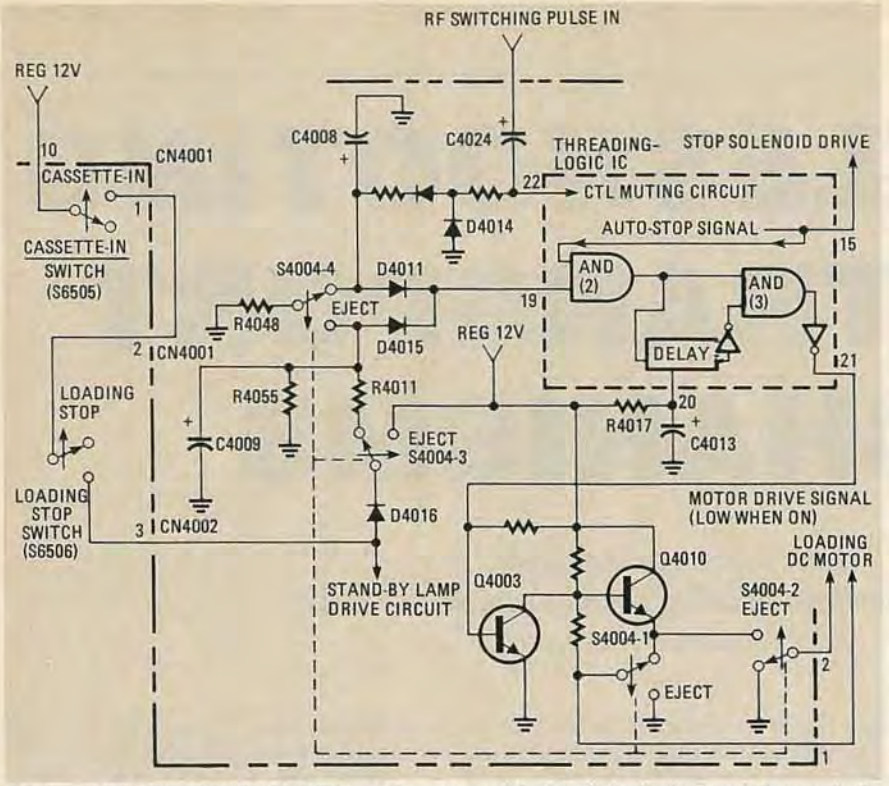


FIG. 2—BASIC THREADING CIRCUIT contains many safety interlocks that prevent damage to the machine during the tape loading process. A microswitch detects when the cassette is in place.

electronic functions of the recorder.

Note—occasionally that test results in the normal operation of the mechanism. Yet, with the machine reassembled, it will not load. If that happens, check the plunger on the cassette-in switch. It may not be closing the switch—usually the fault of looseness inside the compartment or a misadjusted lift assembly.

For further testing the front panel must come off—and the bottom pan that hides two front-panel screws. **Be careful when you handle the uncovered chassis; some AC voltages may become exposed.**

For tracing a problem, a logic probe or a voltmeter can be used. BUT REMEMBER: you're tracing logic signals, not merely voltages. On a voltmeter some signals are normally high and some are normally zero or low.

Probably, you will find it simpler to start your check with the cassette-in switch. Referring to Fig. 2, you should find a logic high at both sides of the switch, with your finger holding the switch down. That is true also for both sides of switch S6506. It should remain closed until the threading-ring cam opens it at the end of loading.

Diode D4016 conducts a logic high, as do R4011 and D4015. Verify both! You should then find a logic high at pin 19, the threading-logic input for the IC.

At this point you must consider additional factors: Check pin 20 of the IC. Suppose you find it at a logic high. You recall that this would inhibit gate AND-3 and keep IC pin 21 at a logic high, which, in turn, keeps the threading motor off. However, remember that you are making tests that may have consumed some time. If your tests took longer than 10 seconds or so, that has allowed time for the delayed-inhibit signal (at pin 20) to build up a logic high. And that's *normal,* under such circumstances.

To check the later stages of threading-logic properly, you must give the system a "fresh" start. Press the EJECT button and let the cassette-lift rise. Then push it back down and again press the cassette-in switch. Now measure IC pin 20 again. It should show a logic low for several seconds. If you wait, you'll find that it rises again to a logic high.

Recycle the cassette-lift assembly again, and check the logic state on IC pin 21 or at the base of Q4003 (both are the same, electronically). The logic state there should be low at the outset. If it is not, check the auto-stop line (IC pin 15). The IC will not deliver a logic low to pin 21 unless the auto-stop line shows a logic high. And don't forget to recycle the cassette-lift assembly, using the EJECT button if it takes you longer than ten seconds to find each test point.

With a logic low at IC pin 21 touch the logic or voltmeter probe to the junction of R4025 and R4026 (or the collector of Q4003 or base of Q4010). This junction should show a logic high.

One machine we tested loaded intermittently. The above junction measured at a logic high, but at times it would jump to a logic low. A poor solder joint between R4025 and the printed-circuit board was the cause. A faulty Q4003 could cause the same symptom.

Even if a logic high shows at the base and emitter of Q4010, a fault in the EJECT switch or its board connections might keep the voltage from the DC motor. For example, one such machine came from its shipping carton with the motor interconnect plug not positioned firmly on its pins on the PC board.

Another thought when servicing this particular symptom: Remember that a linkage or a solenoid must release the brakes on the cassette-reel turntables. Otherwise the brakes hold the tape in the cassette. When the time-delay runs out, the IC logic stops the voltage from reaching the threading motor. Yet, when you try to trace the fault with the cassette out of its holder—as just described—the threading proceeds properly. That's because there's no tape to hold the threading mechanism back. It can be frustrating to try to trace if you forget that particular odd characteristic.

A defect in the gear drive between the threading motor and the threading ring can stop movement, and will bring the electronic-delay into effect after ten seconds. So will something jamming the threading ring. In both cases, you must track the trouble electronically unless you find that the delay mechanism itself is the cause; then you seek a mechanical explanation.

Finally, don't forget that the IC itself can become defective. However, explore all other possibilities before replacing it.

Does not unload

Here's another symptom that is not uncommon. It can create a feeling of real difficulty. However, it's not all that tough to get into the mechanism to unwind the tape (very carefully) so you can test the mechanism and electronic functions. But don't do that before you have tried troubleshooting the electronics.

Troubleshooting in that case goes much the same as for threading. Drop the end panel for access to the EJECT switch. On the front of the machine, press the EJECT button down and see that it latches. Observe the mechanics to make sure the Eject slide moves properly.

Press the STOP button to unlatch the Eject slide. Raise the end panel almost into position and press the EJECT button again. Make sure the tab projecting from the Eject slide contacts the Eject switch properly (see Fig. 3).

Again drop the end panel. Latch the EJECT button down. With your finger, push the Eject switch backward to its Eject position. If the unthreading mechanism does not work now, you must trace the logic through the system again. Hold the EJECT switch back as you trace. Check the auto-stop line first; if it goes low from any cause, unthreading cannot proceed.

Remember also that *unthreading* requires a proper signal from the pulse generator that forms part of the video-head drum. Check the diodes first. Do they

Mechanical Easi-Way Servicing

To use my *Easi-Way Servicing* technique most effectively when electronics and mechanical functions combine, remember this dictum:

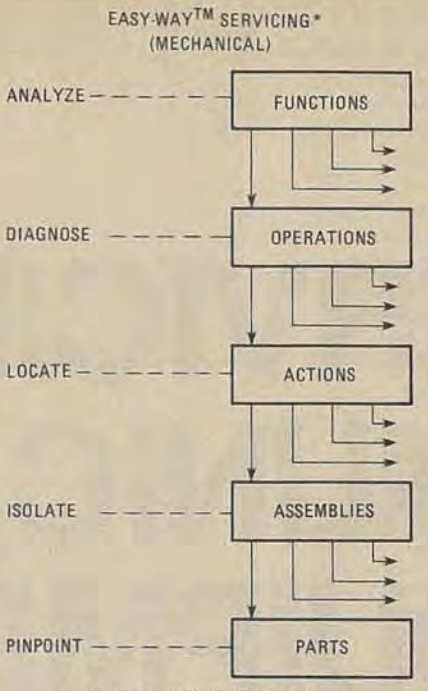
> Analyze the mechanical functions first, then analyze the electronic functions that cause them or control them.

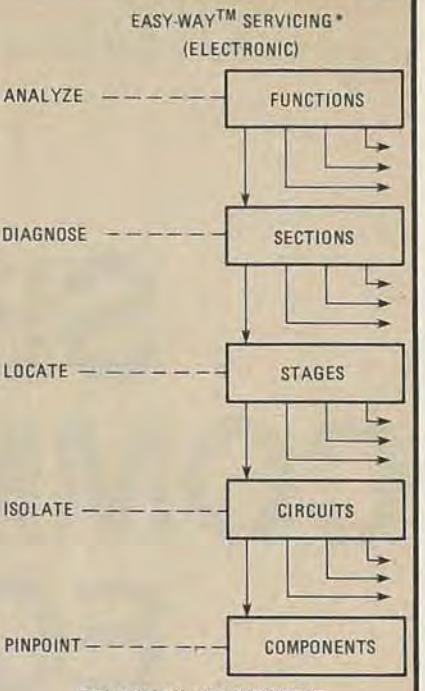
Keep to that rule at every level of the Easi-Way Servicing chart.

For example, first you "analyze the mechanical functions." Having decided which function is inoperative, you can then look for the particular electronic function that causes (or inhibits) the mechanical function.

Next, you "diagnose which mechanical operation" has ceased working within the function. Or, if you already know that the trouble is electronic, you diagnose the electronic section that is preventing operation.

Occasionally, in chasing an electronic fault, you'll find yourself back at a mechanical diagnosis. For example: You work your way down the chart, step by step, eventually finding a tape-slack detector switch holding the auto-stop line low, thus inhibiting operation. Yet, when you examine the tape, it's tight. If the switch is OK electronically, you'll probably find that it or its actuator is misadjusted mechanically.





Obviously, the better you know the recorder you're working on, the easier you can spot potential causes of inhibit signals—whether they are actually protecting something or merely getting in the way of operation. If the machine is unfamiliar to you, this Easi-Way brand of reasoning helps immensely to narrow down the field of search.

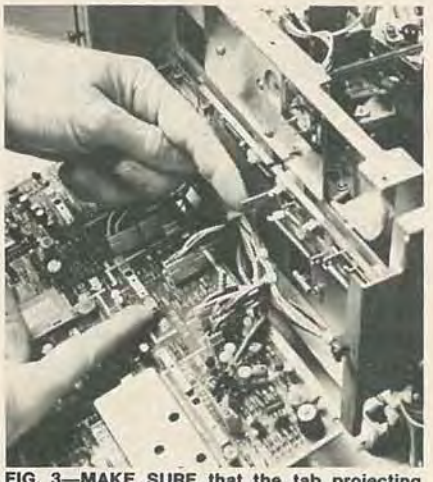


FIG. 3—MAKE SURE that the tab projecting from the Eject slide contacts the Eject switch properly.

deliver a DC voltage (a logic high) to D4011 (see Fig. 2)? If not, use your scope to trace back and find where the pulse disappears. If a logic high is present, make sure that D4011 passes it along to IC pin 19.

If you have to get the cassette out but the Eject mechanism does not work, take off the main cover (and the bottom pan). Remove the four screws that hold the cassette-lift cover. The two screws on the right side are hard to reach when the cassette lift is not raised, but a short, stubby or right-angle Phillips screwdriver will get at it.

First, pull the tape-tension arm toward the cassette and lift the tape clear. The rest of the tape easily comes off from around the video-head drum. Don't let your fingers touch the drum nor any more of the tape than is unavoidable. And then try to touch only the tape edges. Again, move the tension arm and disengage the tape from around the lead guide post on the threading ring.

FIG. 4—WITH THE CASSETTE CLEAR, a small-tipped object such as a pencil may be used to unlatch the tape cover.

Work the cassette upward at the rear first, being especially careful near the left-rear corner where the cover opener is located. Raise the cassette upward, don't forget to make sure that the tape has not caught on something.

Once the cassette is clear, poke a pencil or a small-tipped object into the left-rear corner to unlatch the tape cover (Fig. 4). Only then should you wind the tape back into the cassette by hand. Do not leave the cover closed because you will crimp the tape and perhaps break it.

Now you can proceed with the mechanical and electronic diagnosis.

Other symptoms

The threading motor could keep turning even after loading appears complete. A little thought and study of the schematic suggests various possibilities: threading-stop switch misadjusted and not opening, or defective. Of course, any malfunction that inverts the logic from the IC onward could leave voltage applied to the DC motor.

If, for example, transistor Q4003 should open, the logic would remain high on the base of Q4010 and the motor would continue to receive operating voltage. An open R4024 or 4026 would have the same result, as would a collector-emitter short in transistor Q4010. Similarly, an IC defect that prevents pin 21 from going high can keep the threading motor turning.

Far more troublesome are symptoms in which loading or unloading proceeds only partially. Generally, that kind of problem will prove to be mechanical. And yet, an intermittent microswitch can introduce symptoms that show up only at certain points of strain on the mechanism. You can usually identify those by applying a bit of pressure somewhere in the vicinity of the threading ring, but finding the faulty switch may take a bit of electronic investigation. **R-E**