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tips**

## Testing VCR Servos With The VC93 All Format VCR Analyzer

This Tech Tip explains the VC93 Servo Analyzer Tests; how they work and how to localize a problem to the defective drum or capstan servo section. If you need additional information on how VCR servos work, ask for a copy of Tech Tip #176, which takes you through servo circuit operation.

### Servo Functional Analyzing

The main difficulty in troubleshooting servo problems is to determine which servo loop is at fault. Defects in one servo loop can produce symptoms that look like a problem elsewhere. In addition, non-servo related problems can sometimes appear as a servo problem. Functional analyzing, using the VC93 Servo Analyzer tests and the SC61 Waveform Analyzer, takes the guesswork out of servo analyzing.

Servo functional analyzing is a three step process:

1. Use the VC93 Servo Analyzer tests to determine if a problem is servo related.
2. Use the same VC93 Servo Analyzer tests to localize the problem to the defective drum or capstan servo section.
3. Use the SC61 Waveform Analyzer to check key signals to isolate the defective component or circuit within the bad servo section.

The first two steps of this three step process will be covered in this Tech Tip. The third step of the process is covered in Tech Tips #187 and #188, which pertain to isolating capstan and drum servo problems once they have been localized with the VC93.

### Understanding The Servo Analyzer Tests

The VC93 uses five Servo Analyzer tests to determine if the servos are at fault or if the problem exists elsewhere. These tests are the:

1. Servos Locked test
2. Capstan Speed Error test
3. Capstan Jitter test
4. Drum Speed Error test
5. Drum Jitter test

All applicable tests should be done before troubleshooting further. The Servo Analyzer tests prove if the problem is servo related and then localizes the problem to the capstan or drum servo loop. Each test result is displayed as a "Good/Bad" indication and a percent-of-error reading. See Fig. 1. If the signal being monitored by the VC93 is varying widely, no "Good/Bad" indication is displayed. Dashes displayed on the Servo Analyzer Readout indicate that the signal being monitored by the VC93 is missing.

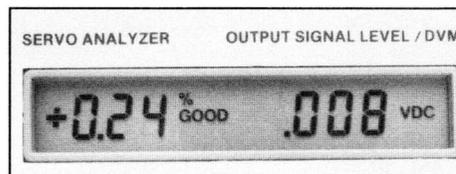


Fig. 1: The Servo Analyzer readout displays the test result as a percent-of-error reading and "Good/Bad" indication.

### Servo Analyzer Test Leads

The five Servo Analyzer tests are performed using either the Servo Performance Test Lead or the Servo Troubleshooting Test Lead. The Servo Performance Test Lead connects to the VCRs' audio and video output jacks for a

fast, easy overall check of the servos. See Fig. 2. This test lead must be used with the SENCORE Servo Performance Test Tape. This tape is recorded with a 479.520 Hz audio tone (vertical frequency x 8) and a 10 Bar Staircase video pattern. The audio signal on this tape is locked to the vertical sync pulse of the video. The VC93 monitors the change in frequency and phase of the audio and video signals in the Servo Analyzer tests.

The VCR must produce an audio and video signal in order for the VC93 Servo Performance Test Lead to work. A signal that has insufficient amplitude or is missing will give inconclusive results on the servo tests. If this happens, use the Servo Troubleshooting Test Lead to confirm your results.

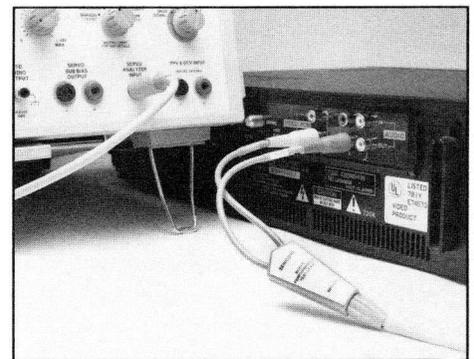


Fig. 2: The Servo Performance Test Lead easily connects to the VCRs' video and audio output jacks for a quick check of the servos.

The Servo Troubleshooting Test Lead connects to the key servo reference signals (CTL and SW30) to analyze the condition of the servos even if the audio and video signals are missing. SW30 and CTL are universal test points that are often marked in the VCR. You can usually find these signals without a schematic. See Fig. 3 on the next page.

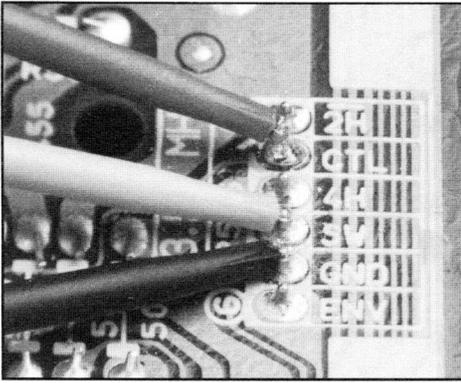


fig. 3: The universal testpoints (CTL and SW30) are often marked in the VCR.

Note: Some manufacturers may refer to SW30 as 30 Hz, headswitch, or SW RF. Any of these testpoints will work to test servo operation.

All servo tests should be done starting with the Servos Locked Test. The Servos Locked test is the first test done to check the overall operation of the servos. Turn the Servo Analyzer switch to the next test and complete all servo tests for a complete check of the VCR.

Note: Since 8 MM does not use a CTL pulse or linear audio, the capstan servo tests. DO NOT APPLY, immediately go to the drum servo tests.

Servos Locked Test: The Servos Locked test compares the change in phase of the CTL pulse to the SW30 pulse when using the Servo Troubleshooting Test Lead, or the phase of the audio signal to the video vertical sync pulses, when using the Servo Performance Test Lead and Sencore Servo Performance Test Tape.

VCRs lock the drum and capstan phase circuits to a common REF 30 source. See Fig. 4. The REF 30 signal is usually internal to the servo IC and can't be viewed or measured. Since the SW30 pulse is derived from the PG pulse and is more universal to VCRs, it is used to check servo lock. If both servos are operating properly, the capstan reference signal (CTL pulse) and drum reference signal (SW30 pulse) will be locked together. The VC93 compares these reference signals to each other to determine if the servos are locked to each other. If the servos are locked to each other, then they must be locked to the internal reference (REF 30) signal. If either servo is not locked to the internal reference (REF 30) signal, then either the capstan or the drum loop is bad.

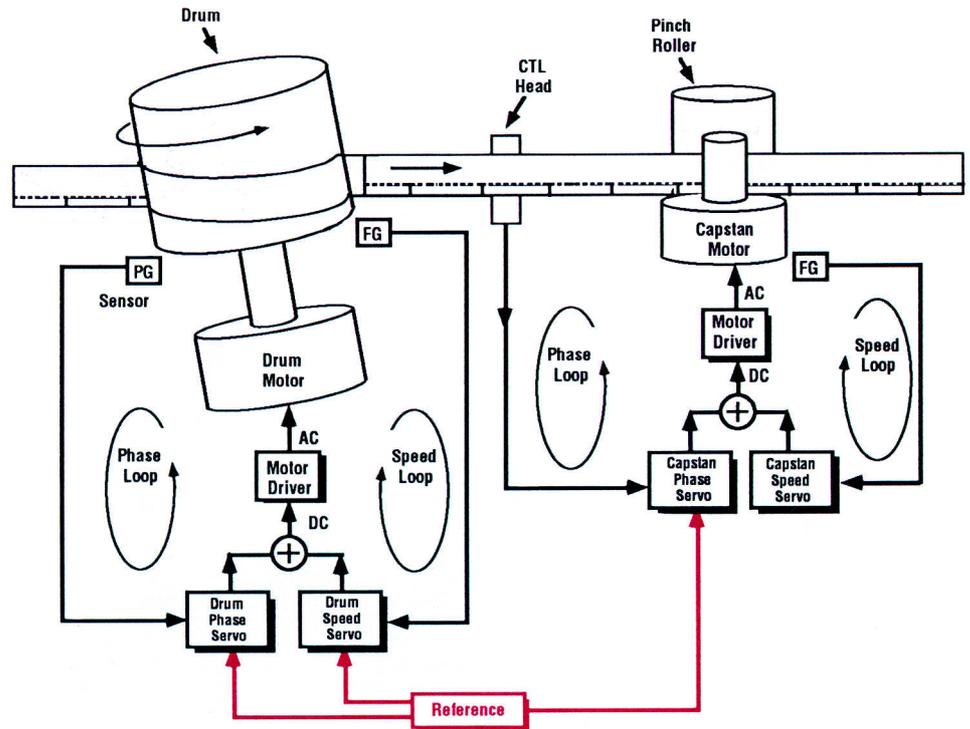


Fig. 4: The capstan phase loop and drum phase loop must be locked to REF 30 for proper operation.

The results of the Servos Locked test are displayed as a percentage reading indicating how well the capstan and drum are locked. Refer to Table 1. A percent-of-error reading greater than 1.5% will give you a "Bad" indication. A "Bad" servos locked reading indicates that either the capstan or the drum servo phase circuit is defective. A "Good" indication means that the servo phase circuits are operating properly.

The remaining four Servo Analyzer tests further test the VCR servo circuits and help localize problems to the capstan or drum servo loop causing the problem. See Fig. 5.

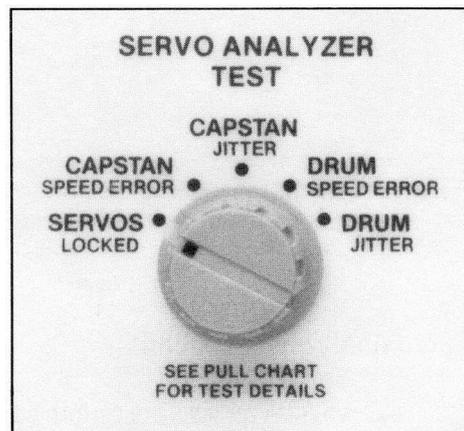


Fig. 5: The Servo Analyzer tests localize the servo defect to the capstan or drum servo.

The capstan tests should be done before the drum tests. If the test results indicate a capstan problem, refer to Tech Tip #187.

Capstan Speed Error Test: The Capstan Speed Error test checks how fast the tape is being pulled through the machine. The VC93 analyzes the frequency of the CTL pulse when using the Servo Troubleshooting Test Lead or the playback audio signal when using the Servo Performance Test Lead and Sencore Servo Performance Test Tape. It compares the signal to an internal 29.97 Hz reference signal. This test checks the tape speed, not just the capstan motor speed. Mechanical problems such as tape drag and slippage as well as capstan circuit problems will cause this test to show a "Bad" indication.

The Capstan Speed Error percentage readings tell how far off the actual tape speed is from the desired speed. A percentage error more than +/- 0.5% will give you a "Bad" indication. This indicates a problem in either the capstan phase or speed circuit. If a large percentage (more than 10%) error is displayed, this most likely indicates a speed loop problem. If a small percentage (under 10%) error is displayed, this most likely indicates a phase loop or speed loop problem. If a "Good" indication is displayed, then the capstan speed is within normal tolerances.

If this test produces a "Bad" indication, or no indication at all the VCR has a problem in the capstan phase or speed loop or it may be caused by a mechanical tape path problem. A capstan that is running at the wrong speed is often the result of a missing CTL or FG pulse, a bad motor or motor drive, or a bad capstan control circuit.

**Capstan Jitter Test:** The Capstan Jitter test analyzes the CTL pulse for minute speed variations when using the Servo Troubleshooting Test Lead, or the playback audio signal when using the Servo Performance Test Lead and Sencore Servo Performance Test Tape. This test analyzes the short term variations in the capstan reference signal to determine how constant the capstan speed is. These short term variations are called jitter.

The Capstan Jitter percentage readings indicate the amount of tape speed variation. All VCRs have some speed variation due to tape stretch, the tightness of the capstan phase loops, and other mechanical variations. A "Bad" indication shows that the capstan speed variations are greater than 0.5%. This will produce unacceptable audio and may also affect the video performance. A "Good" indication means that the capstan circuits are working properly.

If the test produces a "Bad" indication, it means that there is a problem with the capstan electrical servo circuits or there is a mechanical problem. Excessive capstan jitter is often caused by a missing CTL pulse, excessive oxide buildup on the capstan or

pinch roller, or a bad capstan servo control circuit.

The drum tests are done after the capstan tests. If the test results indicate a drum problem, refer to Tech Tip #188.

**Drum Speed Error Test:** The Drum Speed Error test analyzes the frequency of the SW30 pulse when using the Servo Troubleshooting Test Lead, or the playback video vertical sync pulses when using the Servo Performance Test Lead and Sencore Servo Performance Test Tape. It compares this signal to an internal 29.97 Hz reference signal. The SW30 signal is universal between VCRs and is derived from the drum PG signal that is used by the drum servo circuits.

The Drum Speed Error percentage reading displays how far the drum speed is off from the desired speed. Incorrect drum speed will cause the horizontal sync pulses in the playback video to occur at the wrong time. If the drum speed is slightly off, the symptom appears as a misadjusted horizontal hold control on the playback monitor. Modern VCRs sometimes mute the playback video when the drum speed is off.

The "Good/Bad" indication is based on the amount of frequency offset that can be tolerated by most television receivers. Speed errors greater than +/-0.10% produce a "Bad" indication. A "Good" indication means that the drum speed circuits are working properly. A "Bad" indication is most likely caused by a missing FG pulse from the drum motor.

**Drum Jitter Test:** The Drum Jitter test analyzes the frequency variation of the SW30 pulse when using the Servo Troubleshooting Test Lead, or the playback video vertical sync pulses when using the Servo Performance Test Lead and Sencore Servo Performance Test Tape. This test analyzes the drum servo reference signal for short term variations in the speed of the drum.

The percentage reading indicates how much speed variation there is in the revolving drum. A "Good" indication shows that the drum servo is working properly. A "Bad" indication shows that drum speed variations are greater than 0.10% which will give unacceptable picture quality. Excessive drum jitter is often caused by problems such as bad motor bearings, excessive oxide buildup on the drum, a missing drum PG signal, or a defective drum servo control loop

TEST	MAXIMUM ALLOWABLE PERCENTAGE READING
Servos Locked	1.5%
Capstan Speed Error	+/-0.5%
Capstan Jitter	0.5%
Drum Speed Error	+/-0.1%
Drum Jitter	0.1%

Table 1: "Good/Bad" limits allowable for Servo Analyzer tests.

**For more information,  
Call Toll Free 1-800-SENCORE  
(1-800-736-2673)**

**SENCORE**

3200 Sencore Drive, Sioux Falls, South Dakota 57107  
Fax: 1-605-339-0317 www.sencore.com

# NOTES

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3200 Sencore Drive, Sioux Falls, South Dakota 57107  
Fax: 1-605-339-0317 [www.sencore.com](http://www.sencore.com)