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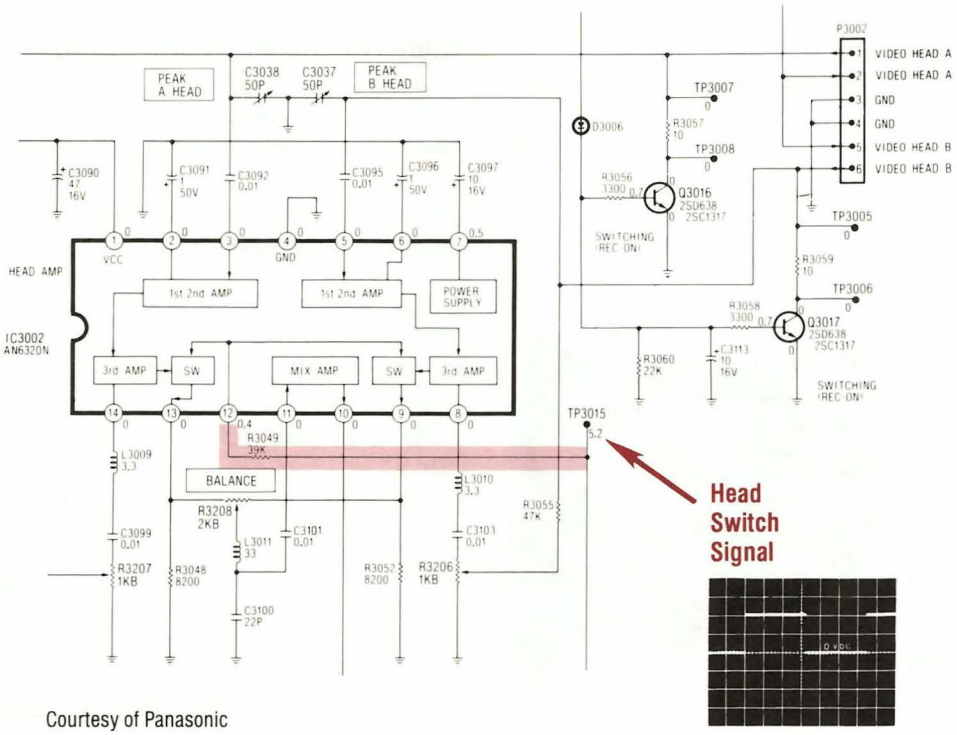
tech tips

Setting VCR Head Switching With The Waveform Analyzer

Many VCR technicians ask how to use their Waveform Analyzer to set the head-switching signals in VCRs. Another name for this adjustment is the "PG Shifter" control. This Tech Tip explains the adjustment in detail.

We will start by explaining how the head-switching adjustment affects VCR performance. We will then explain two ways to adjust the circuits using your Waveform Analyzer. The first method is based on using the CRT in a conventional manner and manually counting sync pulses. The second method uses the Delta Time function to convert the measurement to a digital reading. The Delta Time method can also be used for any other VCR adjustment needing a time delay between two signals, such as the tracking-fix (sometimes called tracking preset) adjustment and the timing of the hi-fi heads in VHS tape decks.



Courtesy of Panasonic

Fig: 1: The head switcher uses a 30 Hz square wave from the servo circuits to turn off the amplifiers of the head which is not contacting the tape.

Why Head Switching Needs Adjustment

Before we explain how to set the head-switching signal, let's be sure you understand what it does. Every VCR uses a pair of video heads when playing a tape at normal speed. Even decks with 3, 4, or 5 video heads use the heads two at a time. A 30 Hz square wave from the servo circuits controls an electronic switch at the head amplifier output. The switch selects the amplifier for the head which is in contact with the tape and turns off the channel for the head which is on the opposite side of the drum. If the second head was not turned off, it would add noise to the playback signal.

Noise appears in the video signal when the switching happens. You can see this noise by adjusting the vertical hold control to display the sync interval on a TV connected to the VCR. The switching noise is a horizontal tear in the picture a few horizontal lines above the black sync bar.

The head-switching circuits change the timing of the switching signal compared to vertical sync. Switching should take place a few lines before vertical blanking, to place the noise in the bottom 3 lines of the picture. Since most TVs are overscanned (the vertical deflection is slightly larger than the CRT screen), switching is invisible, because it happens while the electron beam is below the screen. If the circuits switch too early, the noise moves up into the visible part of the picture. If the circuits switch too late, the noise occurs during the sync pulse, causing poor vertical stability.

Now that you understand how the adjustment affects the circuits, you should have a better understanding of

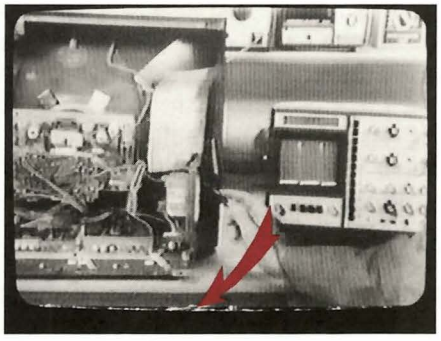


Fig. 2: Noise appears in the picture at the point where the VCR switches from one video head to the other. The switching adjustment keeps this noise close to the bottom of the screen, so that is not annoying.

why the timing must be correct. This understanding should also help understand the alignment procedures. Now, let's see how to adjust the pulse timing. We will start with the conventional CRT-based method.

How To Adjust With The CRT

The first thing you need to do is locate the test points and the controls which affect the head switching. The service literature for the VCR you are servicing is the best source of this information. The service literature also tells you how many adjustments the VCR contains.

TP	ADJ.	MODE	INPUT
TP2005 TP3001	R2023	SP PLAY	
TAPE	M. EQ.	SPEC.	
ALIGNMENT TAPE Color Bars	OSCILLO-SCOPE	T = 6 ± 1 H	

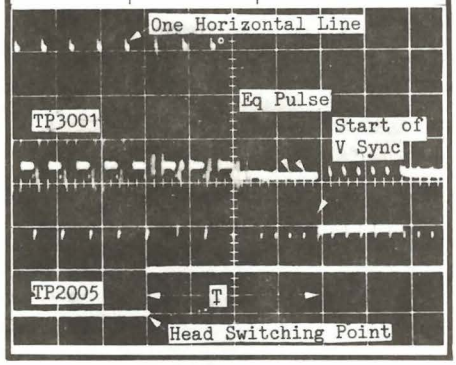


Fig. 3: This is a typical manufacturer's head-switching instruction. Use the service literature to determine the test points and adjustments to use for the adjustment.

Depending on the VCR, it may have one, two, or three adjustments. Most 2-headed VCRs have only one control. VCRs with four (or more) video heads may have two playback adjustments. If so, you will need a test tape recorded at the fastest tape speed (SP or Beta I) to adjust one control and a tape recorded at the slowest speed (EP or Beta 111) to adjust the other. Some early VCRs also have a third adjustment in the recording circuits.

The instructions will usually tell you to adjust the control until the switching square wave is 6.5 horizontal lines ahead of vertical sync. If you are counting pulses to make this adjustment, remember that you must count every other pulse through the blanking interval if your test tape has interlaced sync. This happens because the vertical blanking pulses contain equalizing pulses at twice the rate of the horizontal sync pulses. If your tape has non-interlaced sync, it may not contain equalizing pulses, so you must count every pulse. You can avoid the question of whether to skip pulses by remembering that the blanking interval is always three horizontal lines wide. Count 3.5 horizontal lines from the start of blanking instead of 6.5 lines from sync. This lets you use the same procedure, whether or not your signal contains equalizing pulses.

Setup For The Waveform Analyzer

Refer to the manufacturer's service literature to find the needed test points and adjustment locations. Then, use the following procedures to make each head-switching adjustment with the CRT:

1 . Connect the Channel A probe to the VCR video output and the Channel B probe to the test point with the head-switching square wave signal.
2. Set the TRIGGER SOURCE switch to the "CH B" position (to trigger from the square wave) and the TRIGGER MODE switch to"AUTO''. (The TRIGGER POLARITY switch lets you select the rising or falling transition, depending on which you want to use.)

3. Set the TIMEBASE-FREQ switch to the "1 msec" position (press the HORIZ POSITION control to confirm that it's in the "in" position for a non-expanded trace).

4. Press the A&B (dual trace) selector button (below the CRT) and adjust the inputs and triggering circuits until the two traces are locked onto the CRT.

5. Place the VCR into the record or playback mode, depending on the manufacturer's alignment instructions.

6. With the trace positioned to start at the left side of the CRT, adjust the horizontal vernier control (the small knob in the center of the TIMEBASE-FREQ control) until you see two vertical sync pulses on the channel A trace—one at the left edge and the second one near the right edge of the CRT. (Channel B should show a square wave transition near the second sync pulse.)

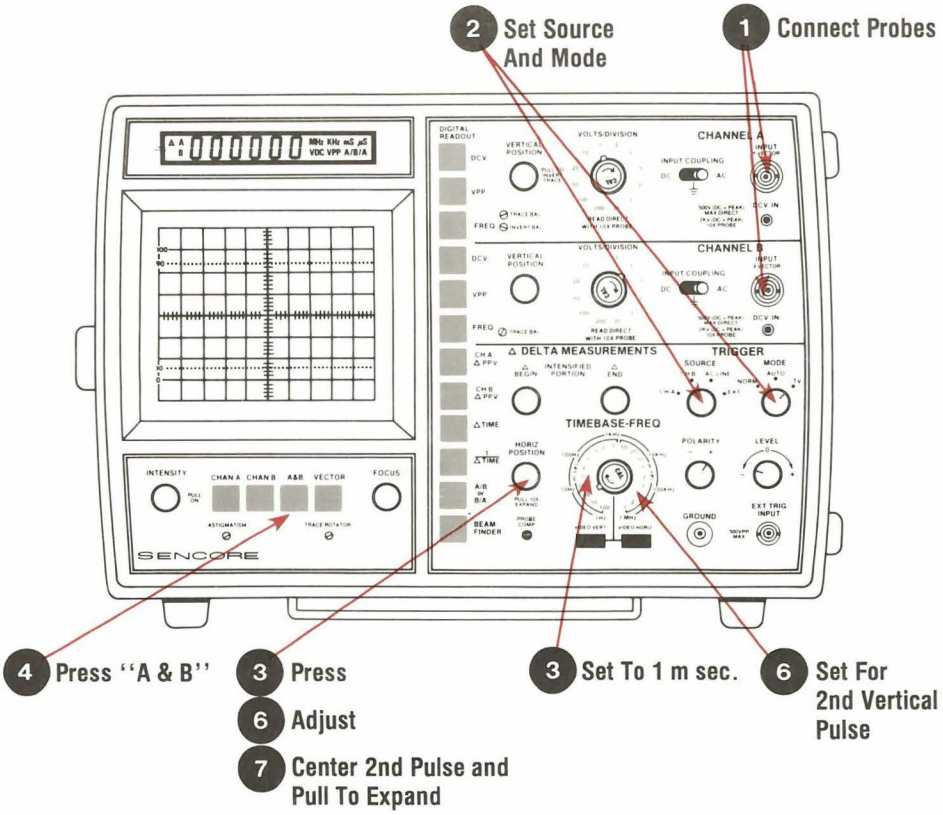


Fig. 4: Follow these steps to display the dead-switching signal on the Waveform Analyzer.

7. Adjust the HORIZ POSITION control until the right-hand vertical sync pulse (and square wave transition) is in the center of the CRT. Pull the HORIZ POSITION control to its "out"~ position to expand the waveforms by ten times.

8. Carefully watch the trace as you adjust the Head Switch (PG Shifter) control in the VCR. Start by adjusting the timing until the square wave just touches the vertical sync pulse. Then, move the transition to the beginning of vertical blanking. Finally, move the transitions 3.5 horizontal lines before blanking (which is the same as 6.5 lines ahead of vertical sync).

Some people prefer to ADD channel A to channel B by pressing the CHAN A and CHAN B CRT buttons simultaneously. This makes it easier to compare the timing of the two signals. When added, the square wave causes a step to appear in the video waveform. Adjust the head-switching control until the step is 3.5 horizontal lines ahead of the vertical blanking. (See Figure 5.)

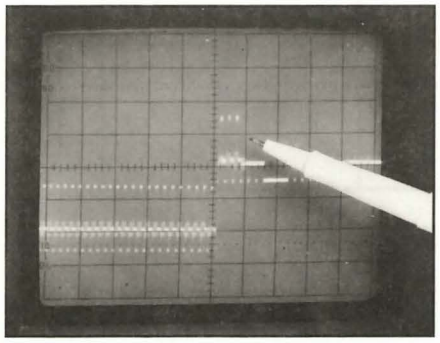


Fig. 5: Pressing the "CHAN A" and the "CHAN B" buttons at the same time adds the two signals, causing a jog at the point where the heads switch.

Using Delta Time To Adjust Digitally

You can use the Delta Time function to eliminate the need to count pulses. You pre-set the Delta Begin and Delta End controls until the digital readout shows the correct time and then adjust the head-switch control until the sync pulse touches the highlighted area of the waveform .

To use the Delta Time function, you need to know how many microseconds to leave between the square wave and the sync pulse. Simply multiply the lines specified by the time for one horizontal line: 63.5 microseconds. Your servicing instructions may use one of three delays: 6, 6.5, or 7 horizontal lines. Figure 6 shows the calculated values for each delay.

Lock the waveforms onto the CRT by following the previous steps 1 through 7. Then, choose the Delta Time function and set the intensified Delta Time bar until its beginning just touches the square wave transition to the left of the sync pulse. Next, adjust the Delta Bar to extend to the right of the transition until the digital readout shows the correct time. Finally, adjust the head-switch control until the vertical sync pulse just touches the end of the intensified Delta Bar.

LINES	MICROSECONDS
6	381
6.5	413
7	444

Fig. 6: The number of microseconds that correspond to typical head-switching specifications.

The Delta Bar lets you pre-set the time difference between signals, because it has the same starting point and the same length in both CRT channels. Since the Delta Bar is referenced to a high accuracy crystal, the digital display gives a very accurate measurement. You are using the intensified area like a tape measure to pre-measure the desired delay before matching the signals to it.

To use the Delta Time function to set head switching:

1. Follow steps 1 through 7 from above to display the two signals on the CRT.

2. Press the "Delta Time" DIGITAL READOUT button and adjust the INTENSITY control until you can see the intensified area. NOTE: You may wish to return the sweep to the non-expanded mode (push the HORIZ POSITION control to its "in" position) until you have located the beginning and end of the Delta Bar. Expand the trace after the Delta Bar is near the sync interval.

3. Adjust the DELTA BEGIN control until the beginning of the Delta Bar just touches the square wave transition in channel B.

4. Adjust the DELTA END control until the digital readout shows the correct amount of time (for example, 413 uS for a 6.5 line delay). Don't be too fussy in this setting, since the circuits only need to be adjusted within 30 microseconds of the ideal amount .

5. Adjust the VCR head-switch (PG Shifter) control until the beginning of the vertical sync pulse just touches the end of the intensified Delta Bar.

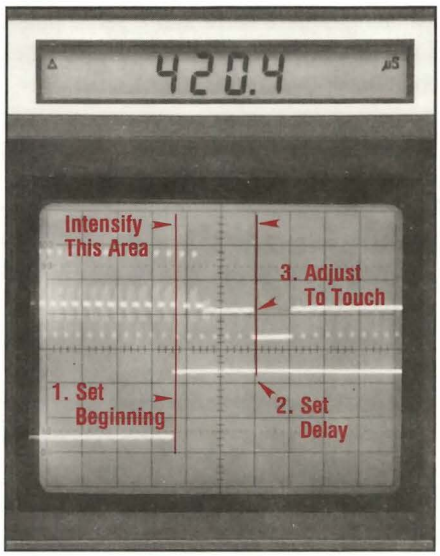


Fig. 7: Use the Delta Time function to pre-set the time needed between signals, and then adjust the circuits until the signals touch the intensified area of the waveform.

Setting Other VCR Controls

You can use this same procedure any time you need to set a time delay between the signals at two test points. Simply

TP	ADJ.	MODE	INPUT
TP2005 TP2006	R2024	SP SELF RECORD-ING	VIDEO SIGNAL
TAPE	M. EQ.	SPEC.	
BLANK TAPE	OSCILLO-SCOPE	(a) T=0.4 ± 0.4msec. (b) T=7.3 ± 0.5msec.	

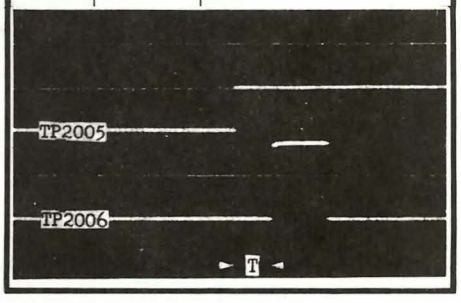


Fig. 8: Tracking fix adjustments usually require that you adjust a signal for the correct delay from the head-switching square wave.

mark the beginning, adjust the length for the correct delay, and then adjust the circuit until the second signal touches the intensified zone. Two common VCR adjustments needing a fixed delay are the tracking-fix and the hi-fi head switching time delays.

The instructions for setting the tracking-fix adjustment are shown in Figure 8. This example calls for a delay of 360 to 440 microseconds between the head-switching square wave and a servo pulse. Figure 9 shows how the display will look when making this adjustment.

Figure 10 shows the procedure for setting the switching signal for the hi-fi heads. Notice that the instructions give two steps: 1) Setting for a time delay, and 2) Checking for a no dropout in the FM hi-fi signal. Use the Waveform Analyzer to set the 5.5 millisecond delay. Then, move one of the probes to the FM test point to confirm there is no dropout. The Delta Time function lets you confirm the timing is correct, without counting or multiplying. The solid sync simplifies the test when confirming minimum dropout.

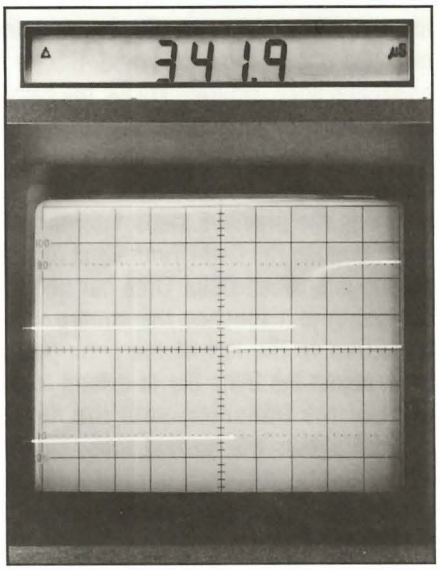


Fig. 9: Adjust the Delta Bar until it bridges between the two tracking fix signals to determine the delay between them.

AUDIO HEAD SWITCHING POSITION ADJUSTMENT
(PG SHIFTER)

1. Set the Tracking Control on the front panel to the center position.

TP	ADJ.	MODE	INPUT
Pin 1 of P4213 TP4206	R4281	SP SELF-RECORDING AND PLAYBACK	(VIDEO IN) VIDEO SIGNAL

TAPE	M. EQ.	SPEC.
BLANK TAPE	OSCILLOSCOPE	TA = 5.5 ± 0.1msec.

Note : TP4206, R4281 : Hi-Fi/Normal Audio C.B.A.

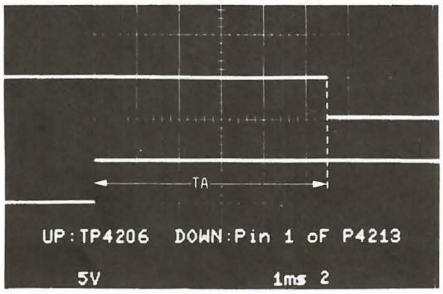


Fig. E9

(Confirmation)

1. Play back the portion just recorded and confirm that the envelope at TP4202 is as shown in Fig. E10.

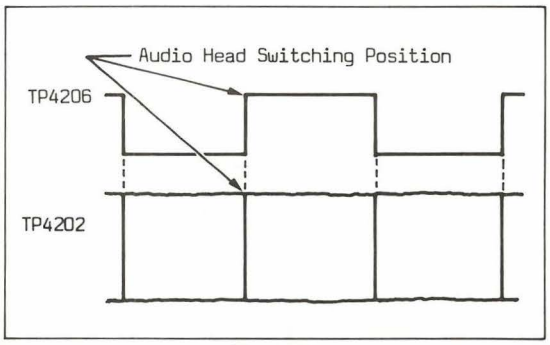


Fig. E10

2. If the envelope has a drop out (A-portion in Fig. E11), adjust the AUDIO HEAD SW (R4281) so that the audio envelope has no drop out portion as shown in Fig. E10.

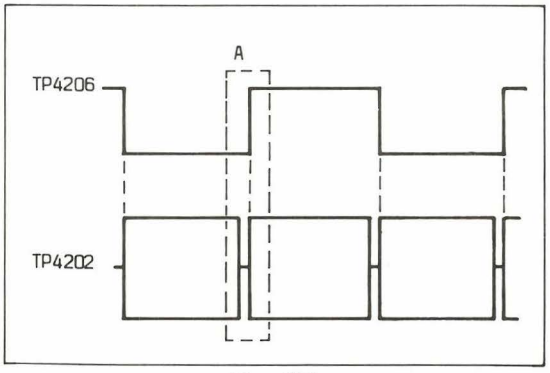


Fig. E11

Courtesy of Quasar

Fig. 10: This service literature shows that the timing of the hi-fi heads needs two steps: 1) Adjusting for a 5.5 mS delay, and 2) Confirming there is no dropout in the FM signal.

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