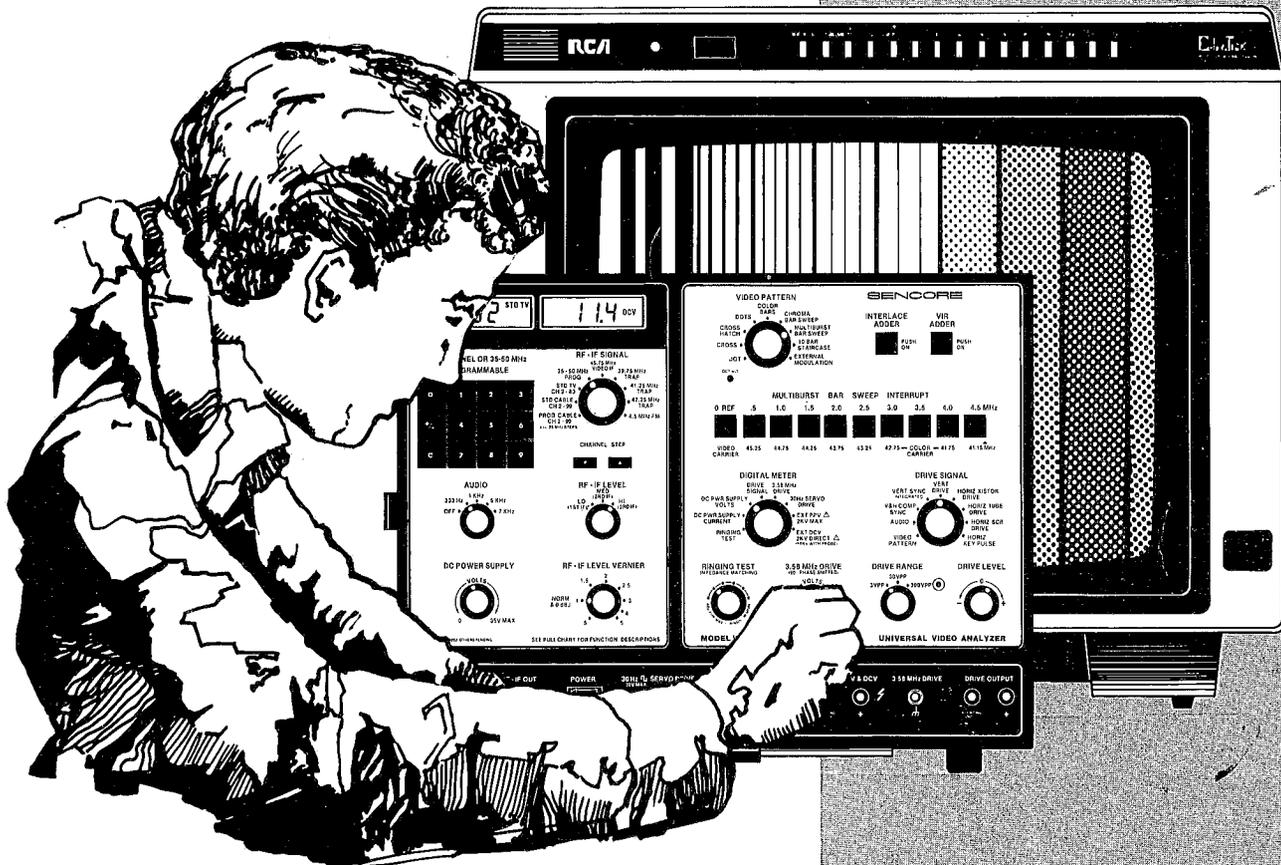


# SENCORE

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ELECTRONIC TEST EQUIPMENT

## Simplified Operating Guide For The VA62A Universal Video Analyzer



*Sencore's Exclusive, Time Tested, Troubleshooting Methods To Increase Your Troubleshooting Skills, Profits, And Free Time Using The VA62A Universal Video Analyzer And The RCA CTC108 Color TV Chassis.*

Price \$20.00

INNOVATIVELY DESIGNED WITH YOUR TIME IN MIND

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This booklet is a comprehensive, simplified guide to video troubleshooting, combining many\* of the most effective time saving test methods and troubleshooting practices available. In the pages to follow, hands-on examples show how to:

1. Locate defective circuits, quickly, without error, and without disconnecting components. You solve challenging problems fast.
2. Prove beyond doubt which circuits are good. You aren't led astray by unusual symptoms.
3. Restore the set to operation without replacing parts, to prove that you really have located the fault. You gain confidence and avoid embarrassment.

Each innovative feature of the VA62A, is the result of thousands of suggestions sent in by service technicians like yourself. Examples of its use, presented in this booklet, will add to your technical "know how" and guide you toward success in the challenging field of video service. Why the RCA CTC108 chassis? It was chosen because it is popular, and contains circuits which are both easy to understand and representative of circuits found in most modern TV sets. It is also the chassis used by Sencore Sales Engineers in hundreds of seminars conducted throughout the nation each year.

In order to get you "up and running" with confidence, a simplified block diagram for the RCA CTC108 chassis, and the VA62A front panel operating guide, is provided as part of the back cover. The block diagram shows the signals and levels that are found at important test points throughout the CTC108 chassis. Each test procedure also includes reference to the block diagram, to help you see how problems in any stage will affect the whole set. The short review of

television theory is provided to turn your thoughts toward video, and to ease you into the "hands-on" section with a little preparation.

As is often the case with simplified books, there are a couple of things that must be emphasized. Be sure to use a "known to be good" CTC108 chassis. To know how "good" circuits respond to various tests, is basic to success in video service; there is too much to learn to begin working with a bad chassis right away. Please pay particular attention to warnings, and use caution when connecting test leads. Should you have problems, review the troublesome procedure, the VA62A *Operation and Application Manual*, block diagram, and schematic, and strive to solve the problems yourself. If problems persist, give us a call; we are anxious to help you get the most value from your test equipment investment.

Here is what you need to get started:

1. VA62A Universal Video Analyzer
2. Test leads, adaptors and manual for the VA62A
3. Oscilloscope with 10:1 probe
4. Isolation transformer/POWERITE®
5. Operating RCA CTC 108 TV chassis

\*Additional test procedures are found in the following:

*The Sencore News*  
*VA62A Operation and Application Manual*  
*Practical TV Troubleshooting Using a Video Analyzer, Goodman, TAB*  
*Universal TV and VCR Block Diagrams, Sencore*  
*TV and VCR Functional Analyzing*  
*Troubleshooting Guide, Sencore*

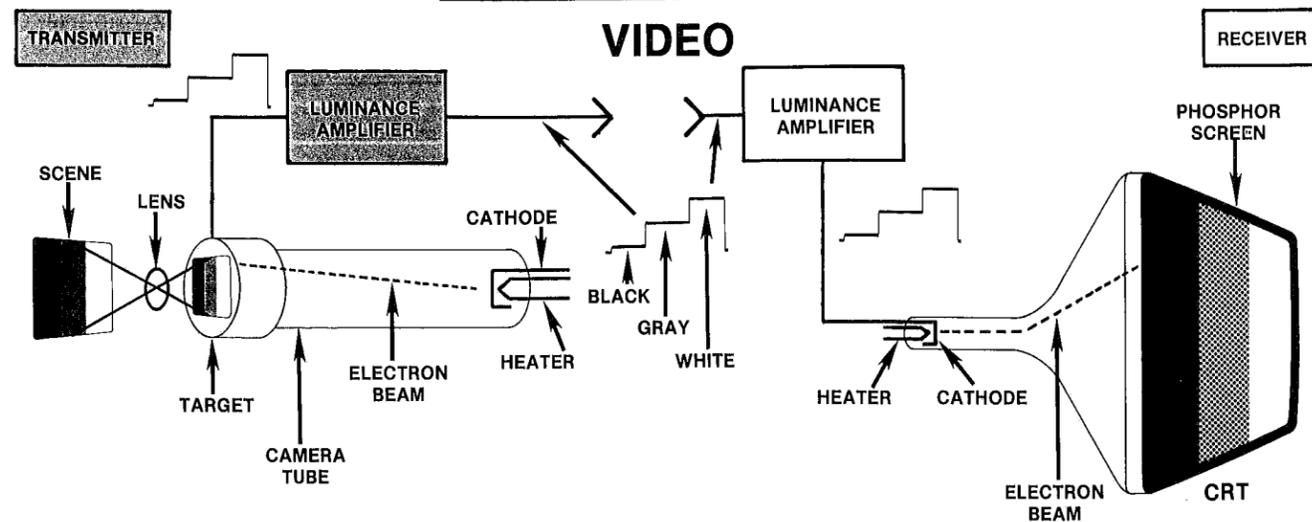
Schematics — Courtesy of RCA

POWERITE is a registered trademark of Sencore, Inc.



To get the most benefit from the VA62A, you must understand the signals and the circuits used in television receivers. Every VA62A test, based directly on typical receiver operation, will increase

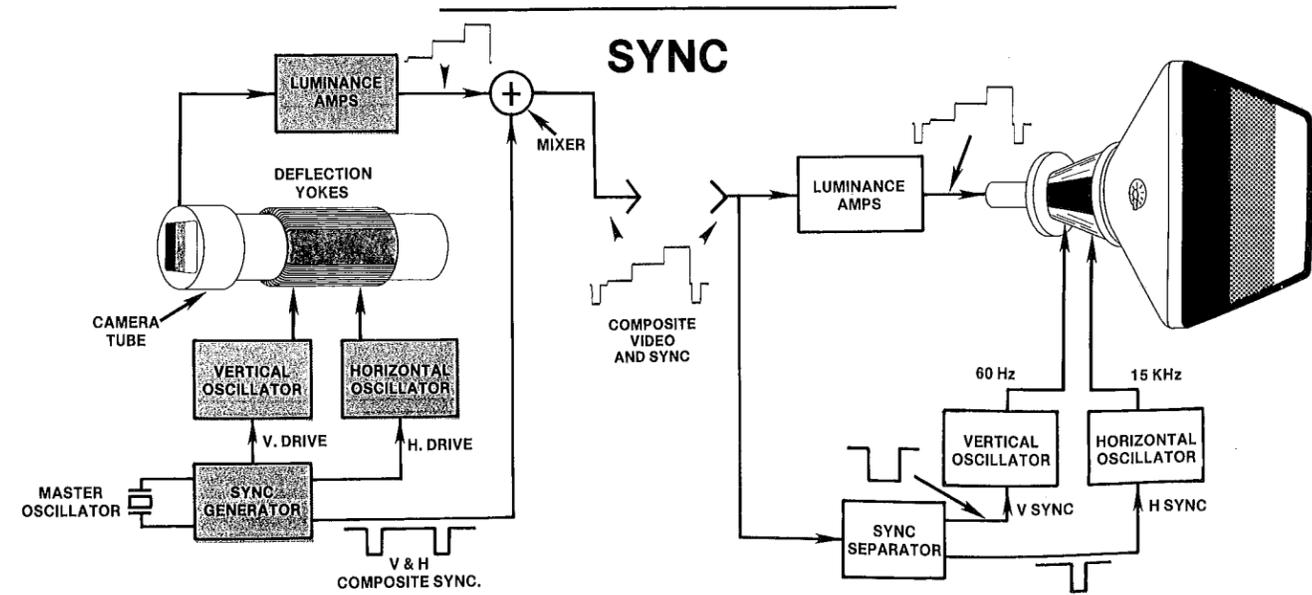
your confidence and troubleshooting success. Let's review the television system by discussing the transmitted signals and the receiver counterparts. We'll begin at the TV screen itself.



**THE TV SCREEN REPRODUCES THE CAMERA'S IMAGE**

The CRT in the TV is a mirror-image of the pickup tube in the camera. Both the CRT image and the camera signal begin with electrons formed into a beam and accelerated by high voltages; both CRT and camera have deflection coils to move the electron beam across the image surface. Scanning circuits form 525 horizontal lines as the beam is moved from side to side and from top to bottom.

The surface scanned by the electron beam in the camera tube (the "target") changes its electrical properties, depending on the amount of light shining on it, while the phosphor surface in the CRT, emits light of varying intensity depending on the signal applied to it. In the camera, sensitive amplifiers boost the tiny changes in beam current that result as the beam moves from areas of one light intensity (luminance) to another. In the receiver, this "luminance" signal is applied to the CRT to produce an exact replica of the image seen by the camera.



**TV THEORY**

**KEEPING THE PICTURE IN SYNC**

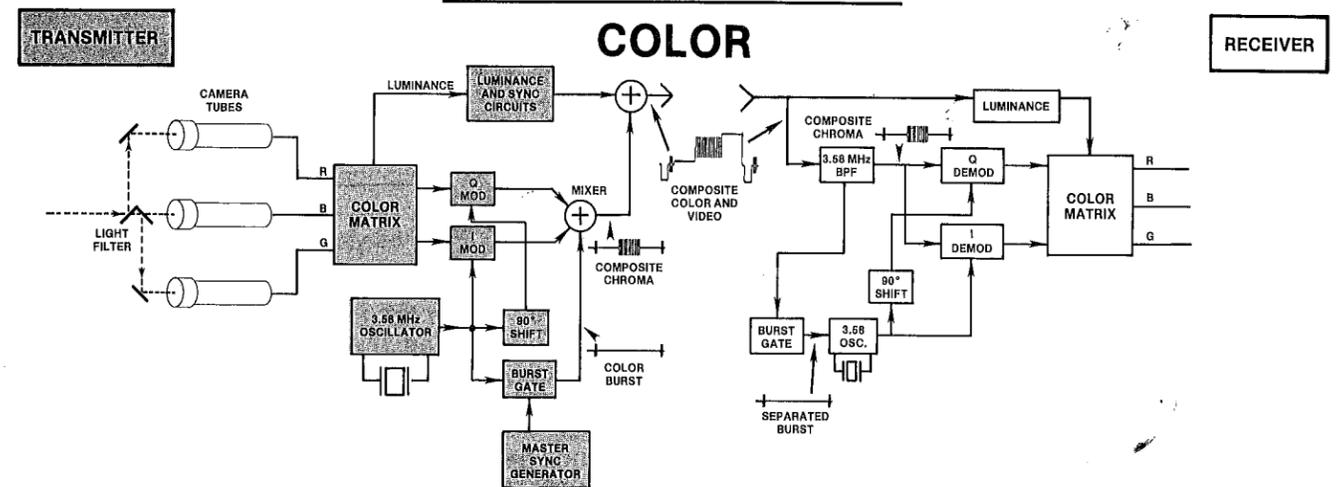
The movement of the electron beam in the CRT and in the camera tube are controlled by magnetic deflection coils. Both tubes require separate coils to move the beam vertically and horizontally. They each require the same sawtooth current waveform (from amplifiers driven by oscillators) to sweep the electron beam vertically and horizontally across the tubes' surfaces. The vertical oscillator operates at 59.94 Hz, while the horizontal oscillator operates at 15,734 Hz.

At the TV station, a master sync generator supplies timing signals to the camera's vertical and horizontal sweep circuits to keep them in step. Sweep oscillators in the TV receiver must also be kept in step with the master sync

generator to keep the picture from rolling vertically or tearing horizontally.

These important vertical and horizontal synchronizing signals are added to the luminance (video) from the camera at a level which is "blacker than black" to form the COMPOSITE video waveform. (The most important thing to recall about this waveform is that the part above the "black" level is "luminance" and the part below is "sync.")

In the receiver, this COMPOSITE signal must be decoded. First, the composite video is applied to a level-sensitive circuit called the "sync separator". The sync separator blocks the video and produces an output which contains only the synchronizing pulses. These separated sync pulses are routed to the vertical and horizontal oscillator circuits to keep them properly synchronized.



**ADDING COLOR TO THE PICTURE**

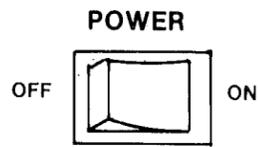
Color information, which indicates how much red, blue, and green content the picture has at any screen location, is added to the composite video signal in a way that maintains compatibility with monochrome receivers. This is accomplished by adding a special high frequency color subcarrier at 3.58 MHz.

(in-phase) and the Q (quadrature-phase) signals. These signals then feed balanced modulators. The phase of the 3.58 MHz signal feeding the "Q" modulator has been shifted 90 degrees compared to the signal feeding the "I" modulator. The result is two double-sideband, amplitude-modulated suppressed carrier color signals (in quadrature with suppressed 3.579545 MHz [3.58 MHz] subcarriers) which are easily detected in the receiver.

The color process begins in the camera where light from the scene is separated into its three primary colors with filters, mirrors, or prisms. Each primary color lands on the target of a separate pickup tube to produce the three color video signals (red, blue, and green).

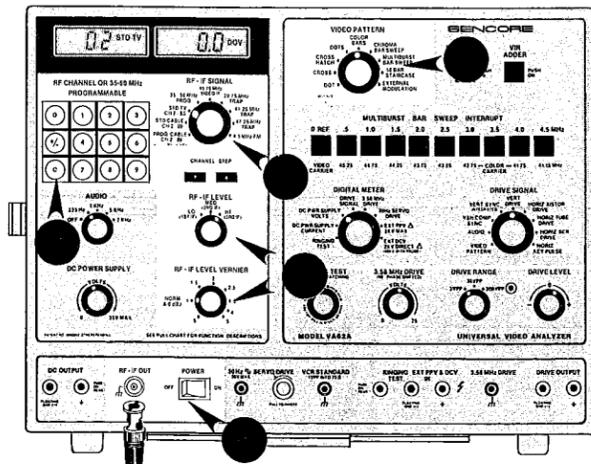
The subcarrier signals are combined with the "color burst" which is a sample of the master chroma sub-carrier. Color burst occurs immediately after the horizontal sync pulse and before video signal time. The I and Q subcarriers and color burst are combined with the composite (luminance and sync) information to produce the composite color video signal.

In encoding the color signal, a matrix combines the red, blue, and green signals into the I



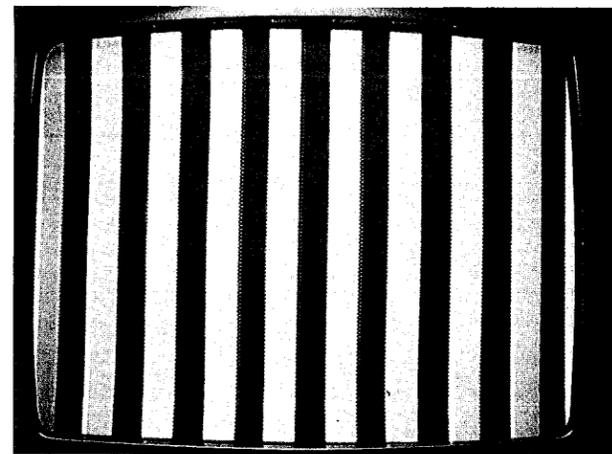
# GETTING STARTED

## Initial VA62A Setup



### THE SETUP YOU USE MOST OFTEN

Nearly all of your work with the VA62A starts by feeding a signal into the antenna terminals. Use the following set up to test a receiver when you begin troubleshooting.

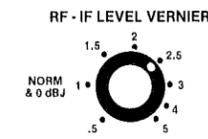


The setup you use most often produces a normal picture on a good TV.



The "F" connector simplifies connection of the VA62A to the TV.

- Turn the VA62A's power switch to the "on" position. Turn on the isolation supply and adjust the AC volts control for 117 volts. Turn on the CTC108 television and set it to channel 2.
- Turn the RF-IF SIGNAL knob to the STD TV position. Press the C (clear) button on the keypad. Push zero (0) and then two (2) to enter the STD TV channel 2.
- Connect the BNC/F cable to the RF-IF out of the VA62A.
- Hook the 'F' end of the RF-IF cable to the antenna input of the CTC 108 television chassis.
- Set the RF-IF level knob to the HI position and the RF-IF LEVEL VERNIER to position 1.
- Turn the VIDEO PATTERN knob to COLOR BARS. A rainbow gated color bar pattern is now displayed on the screen of the television. Spend some time getting familiar with the features of the VA62A, flip the switches, turn the knobs—you won't hurt a thing.



# GETTING STARTED

## Understanding The RF-IF Attenuator Settings

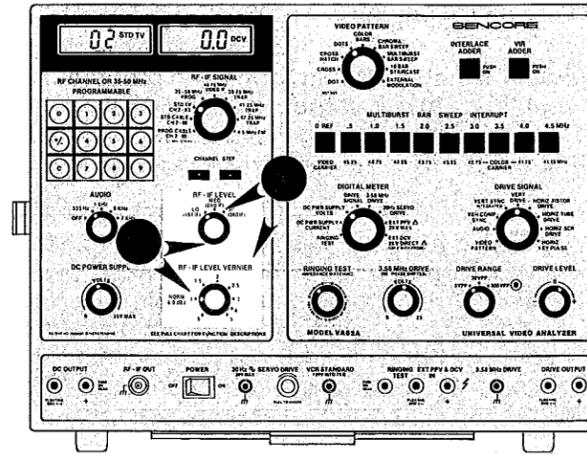


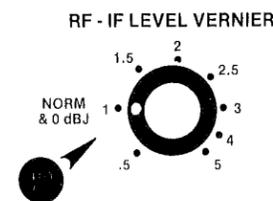
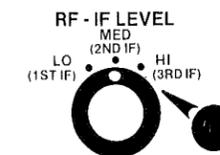
TABLE I  
RF SIGNAL OUTPUT LEVELS

Signal	RF-IF Level Control Setting			
	5	1 (norm)	2.5	5
Lo	5uV	10uV	25uV	50uV
Med	50uV	100uV	250uV	500uV
Hi	500uV	1000uV	2500uV (2.5mV)	5000uV (5mV)

TABLE II  
IF SIGNAL OUTPUT LEVELS

Signal	RF-IF Level Control Setting			
	5	1 (norm)	2.5	5
Lo	500uV	1000uV	2500uV	5000uV (5mV)
Med	5000uV (5mV)	10mV	25mV	50mV
Hi	50mV	100mV	250mV	500mV (.5V)

So far, we have the RF-IF LEVEL knob and the RF-IF LEVEL VERNIER knob adjusted to produce 1000 microvolts. All receivers will give a clear, snow-free picture at this signal level unless they have a sensitivity problem. The calibrated attenuator of the VA62A lets you accurately reduce the RF output to much lower levels if you need to test the receiver for "fringe" reception. The MED position of the RF-IF LEVEL knob provides one-tenth the signal as HI and the LO position provides one-one hundredth the signal. The following procedure will help you learn about the RF-IF signal levels.



- To inject a normal RF signal into the antenna terminal, the RF-IF LEVEL CONTROL must be set on HI and the RF-IF LEVEL VERNIER must be set to a value of 1.
- To inject normal IF signal into the IF section, the RF-IF-LEVEL knob must be set on LOW and the RF-IF LEVEL VERNIER must be set to a value of 1.
- To see how the signal level affects the picture quality, watch the TV as you turn the RF-IF level to MED and slowly turn the RF-IF LEVEL VERNIER from the 5 position to the .5 position (make sure the VA62A and the television are set to channel 2 and that a video pattern is on the screen).
- Return the RF-IF LEVEL to HI and the RF-IF LEVEL VERNIER to the 1 position.

The NORMAL RF and the NORMAL IF signal levels have been set to be equal to the levels found in a television that is receiving a 1000 micro-volts "off the air signal". The normal settings let you detect weak tuners or IF stages.



# GETTING STARTED

## Programmable Cable Channels

### HOW TO FIND TUNER LOCK IN PROBLEMS

You must be able to duplicate all cable system formats in order to test receivers for cable compatibility. The RF carrier frequencies are often shifted up or down to avoid interference between channels. The frequency shifts are found in the HRC and ICC systems (please refer to the sample chart).

A common tuner-related problem affects the ability of the automatic fine tuning (AFT) circuits to lock on to these shifts. The VA62A helps find these locking problems with its Programmable Cable function. This function lets you program any amount of frequency shift into each cable channel to duplicate the shift of the cable system. The following procedure explains how to program in a channel 2, HRC frequency shift of -1.25 MHz.

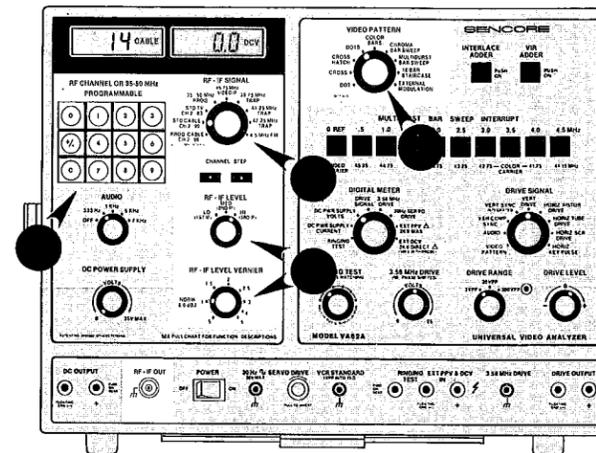
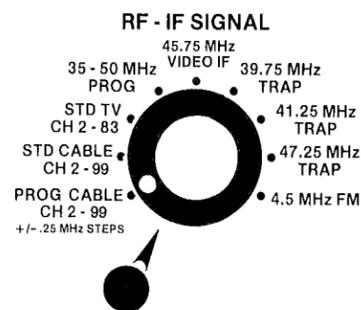


Entering cable shifts with the keyboard.

- Rotate the RF-IF SIGNAL knob to the PROG CABLE position.
  - Press the (0) & (2) buttons on the keyboard to enter the proper channel and observe the left LCD; it should now read "02 CABLE."
  - Press the (+/-) button on the keyboard to activate the shift memory.
  - Press the (+/-), (1), (2), and (5) on the keyboard to enter a shift of -1.25 MHz (to change from minus to plus shift, press the (+/-) button again). The display will blank out and then re-display channel 02, with the carrier shifted -1.25 MHz from the 55.25 MHz carrier frequency.
- Poor cable channel reception may be caused by improper tuning or defective AFT stages.
- The programmed shift will be in the VA62A's memory even after the unit is turned off and turned back on.
- Now, clear the programmed carrier shift by entering (+/-), (0), (0), and (0) on the keyboard.

Example of HRC and ICC Cable Frequency Shifts

Channel	HRC Frequency Shift (MHz)	ICC Frequency Shift (MHz)
2	-1.25	0
3	-1.25	0
4	-1.25	0
4+	4(+4.75) or 5(-5.25)	4(+6.00) or 5(-4.00)
5	+0.75	+2.00
6	+0.75	+2.00
7	-1.25	0



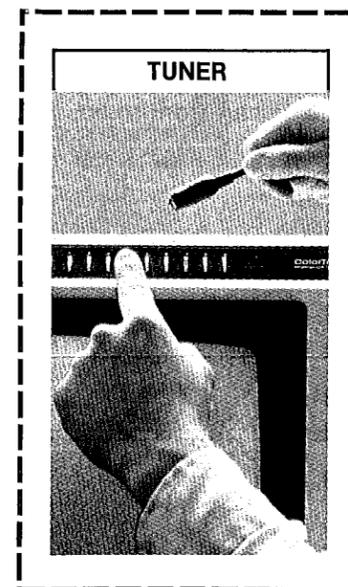
The VA62A is also an RF generator and a digitally controlled tuner; it has all-channel capabilities and generates standard VHF and UHF channel frequencies plus mid-band, super-band, and hyper-band cable channels. For example, let's program the VA62A to generate the cable channel 14.

- Select the STD CABLE position with the RF-IF SIGNAL knob.
- Set the VA62A to the normal RF level (RF-IF LEVEL: HI and RF-IF LEVEL VERNIER: 1)
- Enter channel 14 on the VA62A's keypad.
- Set the CTC108 television to channel 14 (be sure to check that the CABLE/NORM switch is set to the CABLE position), and observe the pattern on the television screen.
- Rotate the VIDEO PATTERN knob through all the pattern positions. Observe the response on the television.

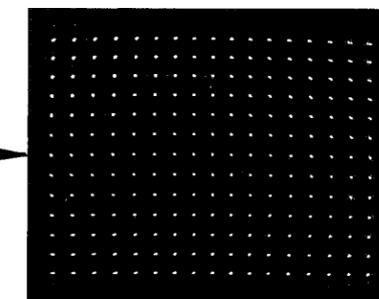
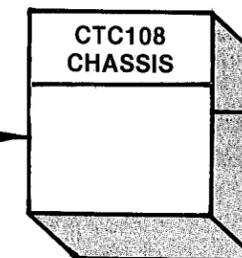
When a signal is fed into the antenna of a television set, the VA62A functions as a miniature transmitting station with video patterns and all-channel capabilities. This is useful when looking for improperly operating channels.

Now spend some time programming different channels. Use the CHANNEL STEP buttons to step up or down through the channels one at a time or enter the channels with the keypad.

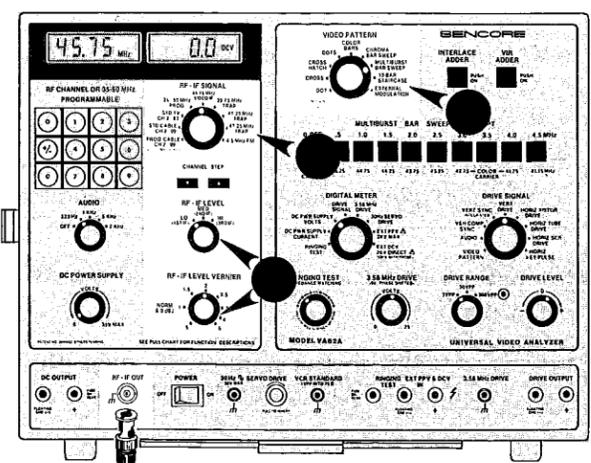
NOTE: Local channels may cause interference if they are on the same channel being generated by the VA62A.



The VA62A generates all standard and cable channels.



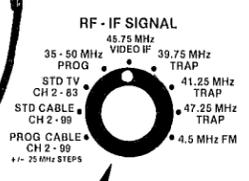
The pattern selected by the VIDEO PATTERN switch is displayed on the TV screen.



### INJECTING IF FREQUENCIES WITH THE VA62A

Let's move a little farther into the television receiver, past the tuner and into the IF stages. The VA62A provides a modulated 45.75 MHz IF signal that contains all the necessary luminance, chroma, sync, and audio information. When this signal is injected into the IF, tuner problems are bypassed and all the circuits to the CRT are tested.

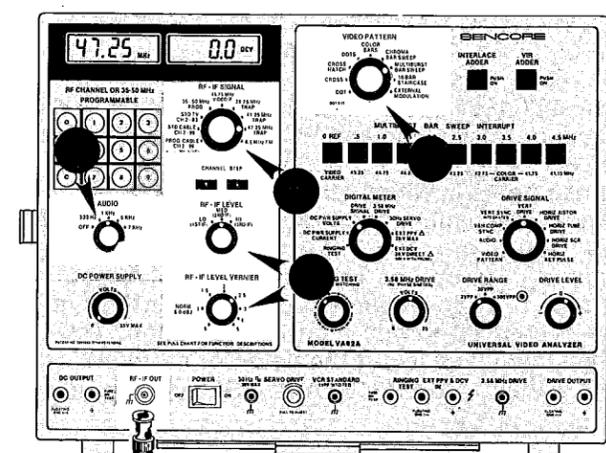
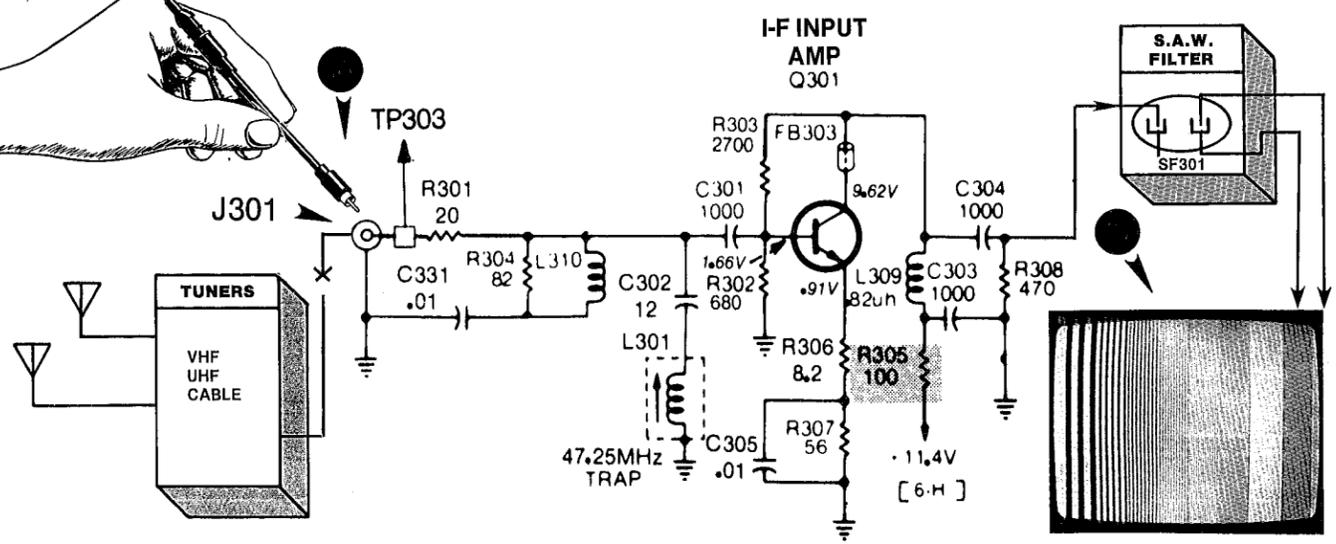
- Set the VA62A's RF-IF SIGNAL knob to the 45.75 MHz VIDEO position.
- Connect the "F" female/RCA phono male adaptor cable to the RF-IF cable of the VA62A. Disconnect the television tuner/IF cable from the IF connector J301. Connect the VA62A's RF-IF cable to the IF input as shown.



- Set the VA62A to the NORMAL IF output level (RF-IF LEVEL: LOW and RF-IF LEVEL VERNIER: 1)
- Rotate the VIDEO PATTERN knob to the MULTIBURST BAR SWEEP pattern and observe the pattern on the TV's screen.

The MULTIBURST BAR SWEEP is a black and white pattern. It is used to check the overall frequency response of the IF and video stages. The MULTIBURST BAR SWEEP INTERRUPT buttons allow you to identify any frequency bar or to remove any of the bars from the pattern. Press the interrupt buttons and watch the results on the screen.

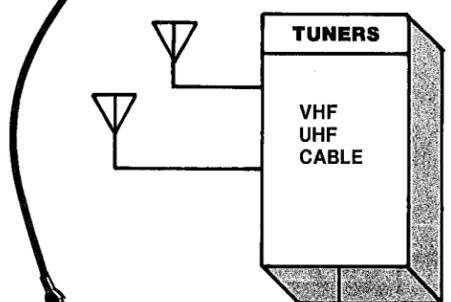
How does signal injection into the IF help in troubleshooting? When you suspect the problem is a faulty tuner, just inject a signal into the IF and watch for the results on the TV screen. If the pattern on the screen improves, your suspicions are confirmed.



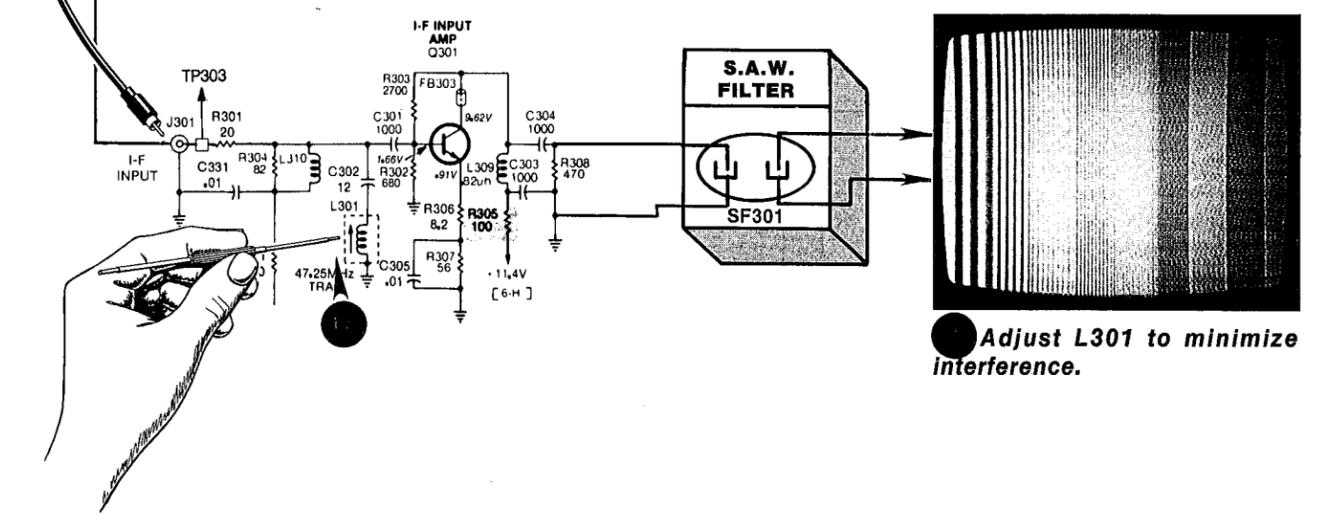
### HOW TO SET IF TRAPS

Cable TV makes correct settings of IF traps more important than ever before because cable systems have an adjacent carrier on every channel. The VA62A has three special (patented) signals which let you adjust all standard IF traps by simply looking at the receiver's CRT. The following steps will show how this is done as you actually adjust the one trap found in the CTC108 chassis.

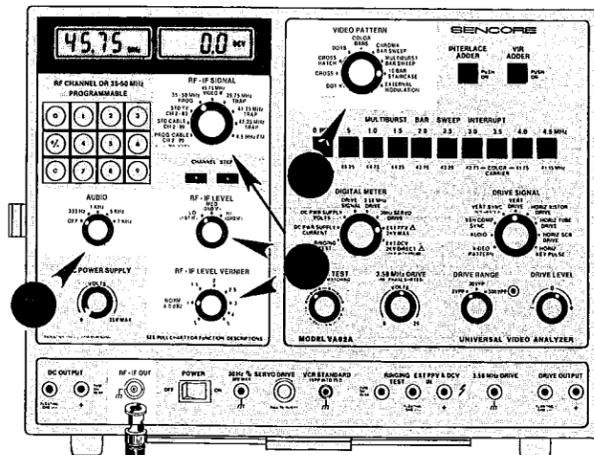
- Turn the RF-IF SIGNAL knob to the 47.25 MHz TRAP position.
- Set the AUDIO knob to 1 KHz and the VIDEO PATTERN to MULTIBURST BAR SWEEP (switching on the audio isn't a must but it makes it easier to see the interference bars when completing the alignment).
- Set the IF signal level to about 25 mV (RF-IF LEVEL: MED and RF-IF LEVEL VERNIER: 2.5)
- Adjust L301 for the least amount of interference on the television screen. There may still be a small amount of interference; if so, alternately lower the IF signal level and re-adjust L301 until the interference pattern is minimized. Misadjustment may affect the performance of the video detector, or move the trap into the video.



You have just adjusted the 47.25 MHz adjacent sound trap. This is the only trap in the CTC108 chassis. Use the same process (with the correct trap frequency) on other IF systems with 39.75 MHz or 41.25 MHz traps. Be sure to check traps for all your cable TV customers.



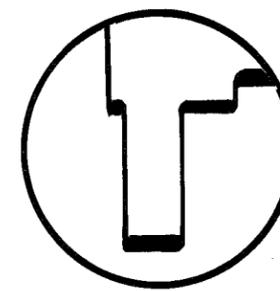
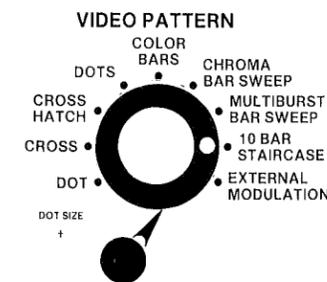
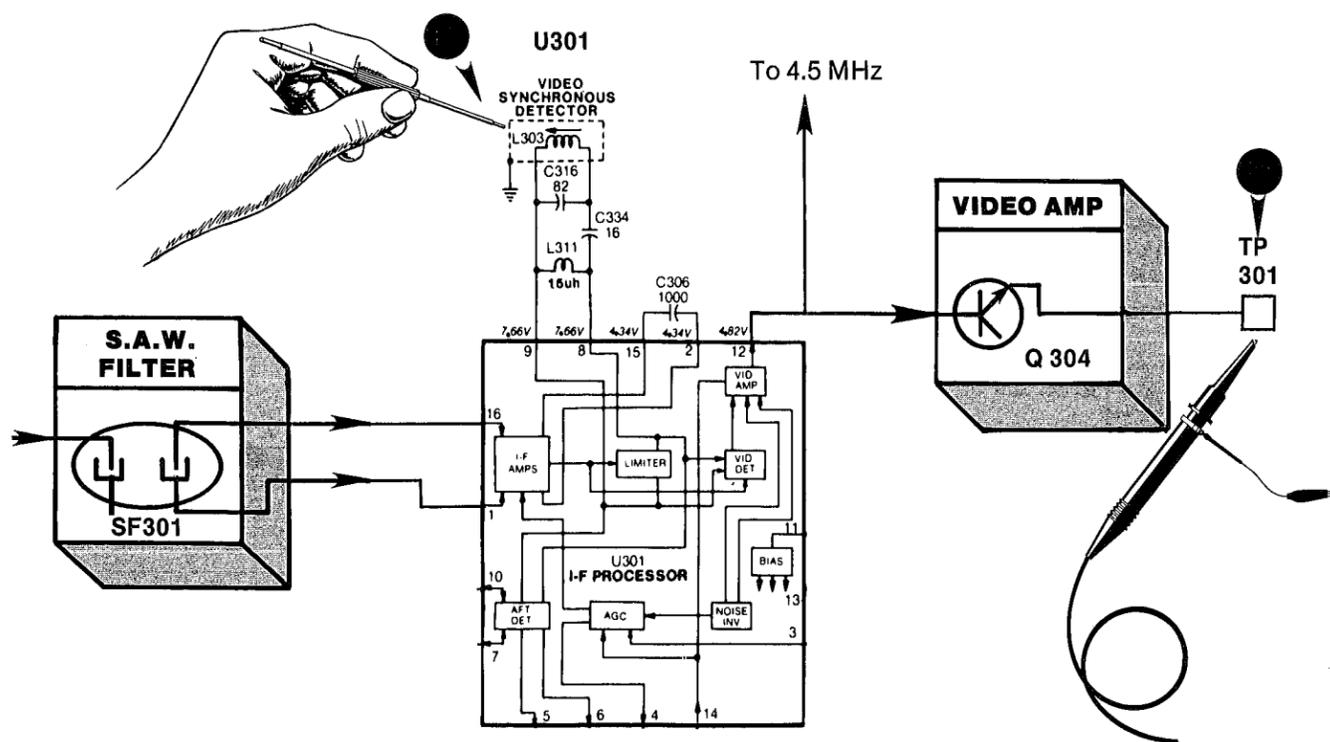
● Adjust L301 to minimize interference.



**HOW THE VIDEO DETECTOR ADJUSTMENTS AFFECT PICTURE QUALITY**

The CTC108 uses a video detector similar to most modern televisions and VCRs. The "Synchronous Video Detector" is a special IC with a carefully tuned network which directly affects the picture's overall dynamic range from black to white. In this section, you will learn how even slight misadjustment of the detector may result in losses of 10 to 40 percent of the brightness range compared to normal receiver operation. You will then learn how to set the detector correctly using the VA62A's "10 BAR STAIRCASE" video pattern.

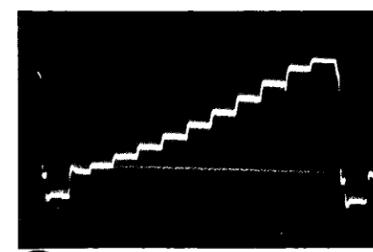
*Note: After gaining experience with the VA62A, many technicians use the TV screen for troubleshooting and alignment. We recommend that you use an oscilloscope and monitor the output of the detector, the VA62A drive output, and each referenced test point to become thoroughly familiar with the waveforms that you will find in a good chassis.*



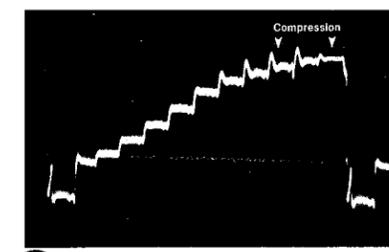
- Turn the AUDIO knob to the "off" position (this will remove the audio troubleshooting signal from the video information).
- Set the VA62A to the NORMAL IF output signal level (RF-IF LEVEL: LOW and RF-IF LEVEL VERNIER: 1), RF-IF SIGNAL switch to 45.75 MHZ VIDEO IF.
- Set the VIDEO PATTERN knob to the 10 BAR STAIRCASE pattern. This pattern consists of ten levels of brightness equally spaced between black and white. It dynamically checks the TV's video, brightness, and contrast range.
- Connect the oscilloscope to TP301 on the CTC108 television (sweep setting to the horizontal line rate).
- Adjust L303 until a linear 10 bar staircase is observed on the scope display.

*Note: The setting of the 47.25 MHz trap (L301) may affect the performance of the detector. Always check the sync pulse shape to be certain that it is free of distortion. When this trap does cause problems, you must repeat the procedure on page 11.*

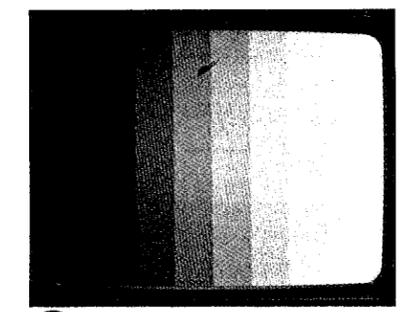
It is a good practice to make this simple synchronous detector alignment on every television before it leaves your shop. Always check for a good staircase pattern with a clean sync pulse. This will eliminate those troublesome loss of contrast and sync problems.



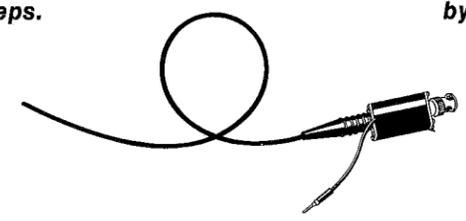
● Always check for a clean sync pulse and linear stair steps.

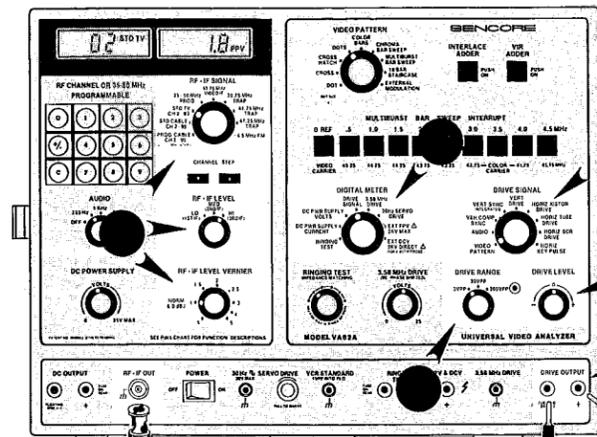


● Note the ringing in the stair steps and sync pulse caused by misadjustment of L303.



● A correctly adjusted synchronous detector produces the full dynamic range from black to white.

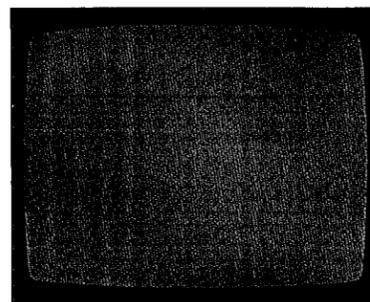
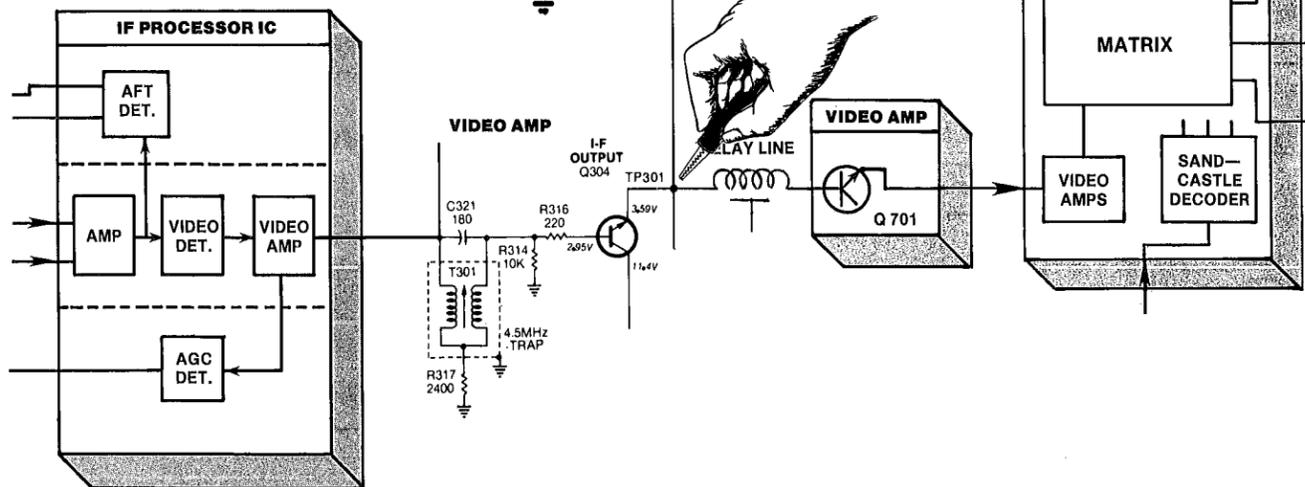




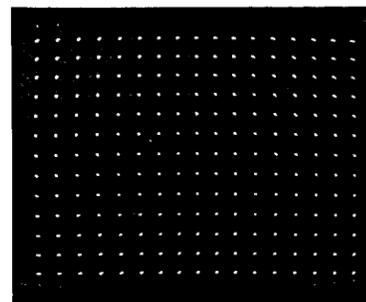
**SIGNAL SWAMPING IN VIDEO CIRCUITS**

One of the main advantages of the VA62A is that you don't have to disconnect components in the circuit when you inject a substitute signal. Swamping means that the VA62A output circuits remove the original signal before replacing it with a new one. We will show you how this works by injecting a drive signal into a video test point. Use this same video signal to move through the video amplifiers for any problem affecting the luminance (black and white) portion of the picture. Look for an improvement on the CRT as you move through each test point.

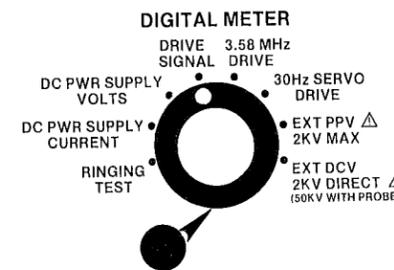
**RF-IF OUTPUT TO ANTENNA INPUT ON TV**



The VA62A's low impedance has swamped the incoming video.



Injecting a drive signal returns operation to normal.

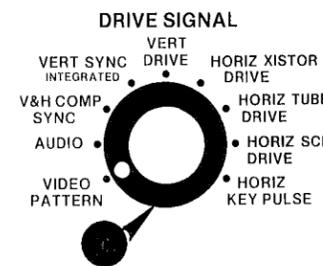


**IMPORTANT:** The RF-IF OUTPUT of the VA62A must be connected to the antenna input of the television receiver. This keeps all the signals in the television phase-locked to the DRIVE SIGNAL that is being injected from the VA62A.

Set the VA62A to the NORMAL RF output signal level (RF-IF LEVEL: HI and RF-IF LEVEL VERNIER: 1) and RF-IF knob to STD TV (channel 02).

Turn the DIGITAL METER knob to the DRIVE SIGNAL position.

Turn the DRIVE SIGNAL knob to the VIDEO PATTERN position.

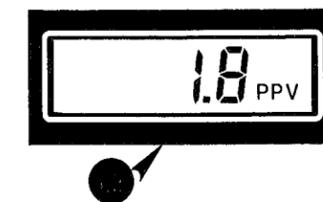


Connect test leads to the DRIVE output jack of the VA62A.

Turn the DRIVE RANGE knob to the 3 VPP position.

With the DRIVE LEVEL knob set on zero, connect the (+) test lead to TP301 and the (-) test lead to ground. The television screen should go to (near) black. The low impedance of the VA62A's drive output has swamped out the signal that was coming through the television from the antenna input.

Turn the DRIVE LEVEL knob in the negative direction until the right-hand LCD reads about 1 or 2 VPP or until the video pattern reappears on the screen.



When troubleshooting, it is helpful to start by injecting a signal at the video detector to effectively divide the set in half. If the pattern on the screen improves, you know that the problem lies before the the video detector. If the pattern doesn't improve, you know the problem lies after the video detector. We use this same process to

isolate problems in any circuit from the detector to the CRT.

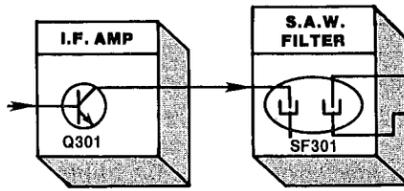
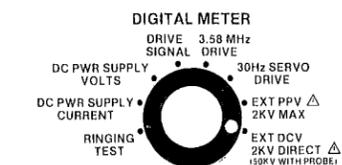
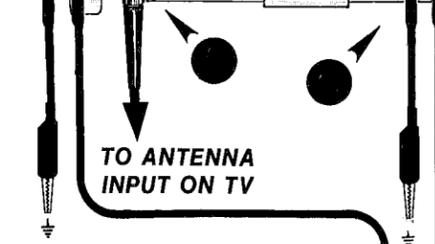
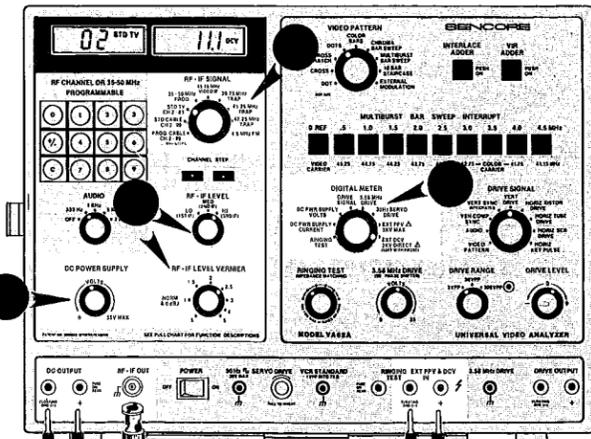
Always check the peak-to-peak voltage level and the polarity of the signal on the schematic before injecting into the circuit. This will keep you from driving a stage too hard.

### AGC CIRCUIT ANALYSIS

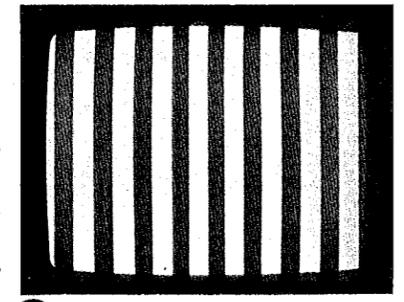
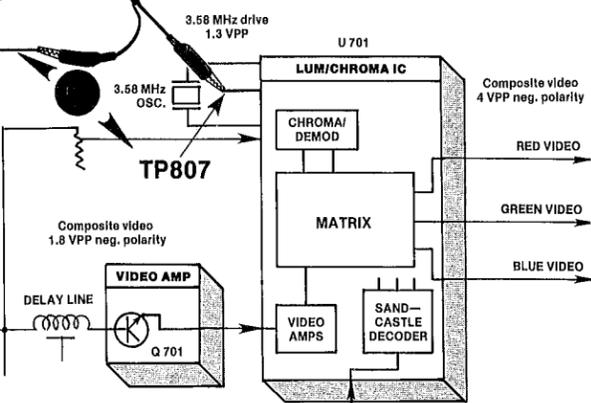
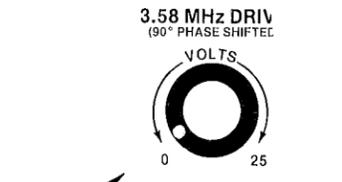
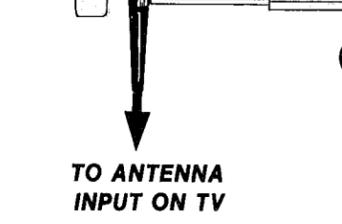
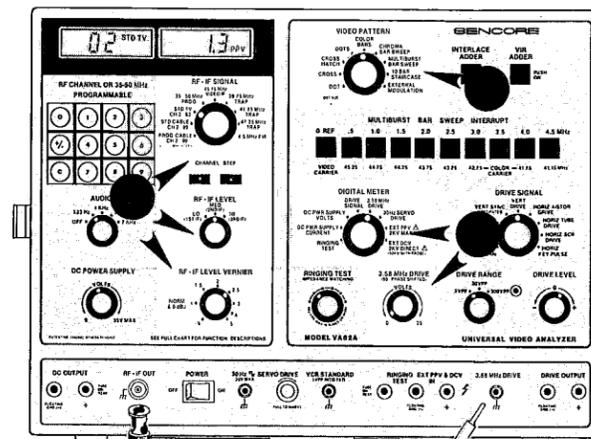
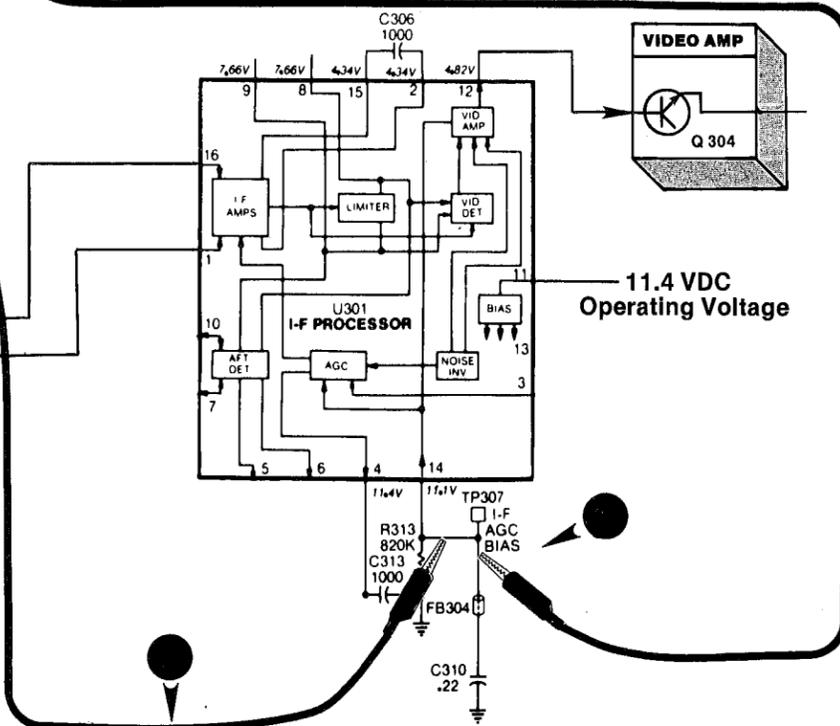
The automatic gain control circuit changes the DC bias of the IF stage and the tuner to compensate for changing input signal levels. Use the VA62A's external digital voltmeter to monitor these changes for proof of AGC performance. When AGC troubles are suspected avoid confusing symptoms by clamping the AGC line to a fixed level with the VA62A's DC supply.

● Connect the RF-IF cable of the VA62A to the antenna input of the CTC108 television. Turn the RF-IF LEVEL SIGNAL knob to the STD TV position. Use the Keyboard to set the VA62A to channel 02. Enter channel 2 on the CTC108 chassis.

- **B** Set the VA62A's DIGITAL METER knob to the EXT DCV position.
- Connect test leads from the EXTPPV & DCV jack of the VA62A to TP307 and to ground.
- Vary the signal level with the RF-IF LEVEL and RF-IF LEVEL VERNIER and observe the AGC response on the digital meter.
- Substitute a DC voltage from the VA62A for the AGC bias normally provided by the AGC system. If operation is restored, then the RF and IF sections are normal and the trouble is in the AGC circuit.



**CAUTION**  
When substituting voltages, never exceed the level of the DC operations voltage of the circuit.



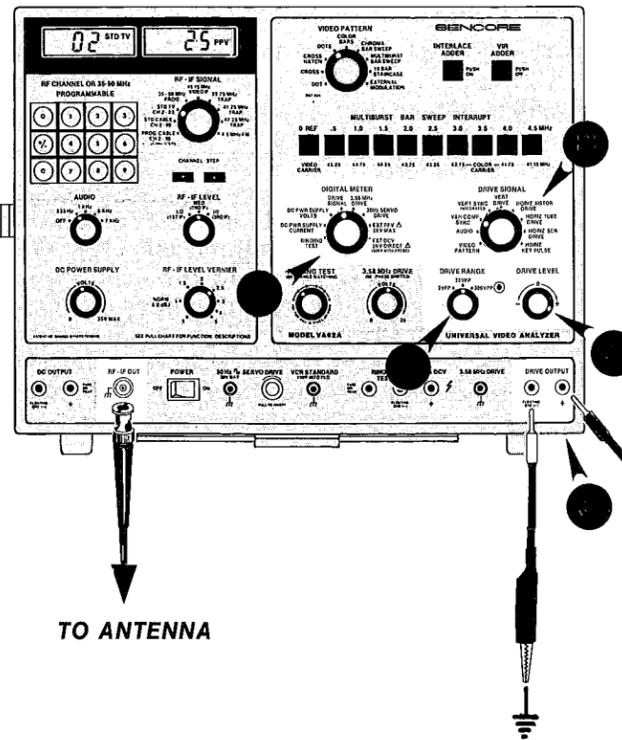
● If any color returns, the color circuits are working.

### HOW PHASE LOCKED SIGNALS SIMPLIFY COLOR TROUBLESHOOTING

All VA62A signals are phase-locked to each other, which means that the signal you substitute is always in sync with the reference signal at the antenna, which is feeding all the other circuits. This can best be seen when injecting color signals. The substituted signal will still be in color, even though it's coming from the VA62A drive section instead of from the receiver's color section. *Note: changes in tint are normal because of phase differences from one receiver to the next. The fact that color returns, proves that the color circuits are working from the injection point to the output.*

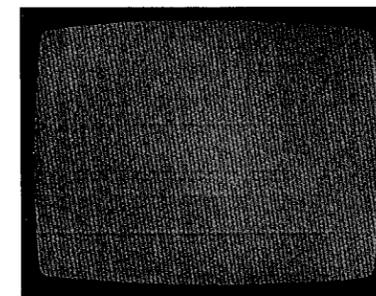
- Set the VA62A to the NORMAL RF output signal level (RF-IF LEVEL: HI and RF-IF LEVEL VERNIER: 1) and the RF-IF SIGNAL knob to STD TV (channel 02).
- Connect the RCA PHONO/ALLIGATOR CLIPS test leads to the 3.58 MHz DRIVE output jack.
- Turn the DIGITAL METER knob to the 3.58 MHz DRIVE position. Turn the 3.58 MHz DRIVE knob to the zero volts position.
- Turn the VIDEO PATTERN knob to COLOR BARS.
- Connect the (+) lead to TP807 and the (-) lead to ground.
- Slowly turn up the 3.58 MHz DRIVE knob until you see a distinct shift in color tint. This shift lets you know the VA62A's 3.58 MHz drive signal has replaced the "on board" 3.58 MHz oscillator that references the demodulators. The voltage level is monitored on the right LCD.

Failure of the 3.58 MHz oscillator is one of the most common problems in video troubleshooting. Inject the 3.58 MHz drive, if color is restored the crystal oscillator is probably bad. Problems in the chroma bandpass filter, the first and second chroma amplifiers, and color demodulators may also be tested with this phase-locked signal.

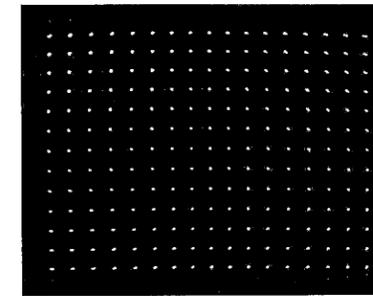


**SYNC CIRCUITS**

Sync problems are often tough to isolate because the problem may be in the sync separator, or it may be in the horizontal or vertical oscillator. The VA62A provides the signals needed to inject into the input and the output of the sync separator to confirm that it works correctly. Sync signals are phase-locked to the RF reference signal feeding the antenna, so the picture on the CRT returns to full synchronization when injecting at the correct test point.



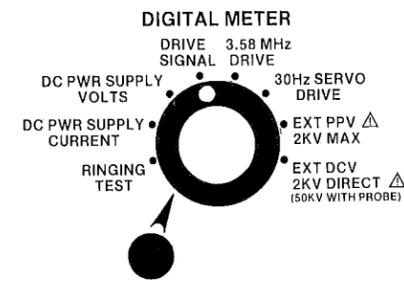
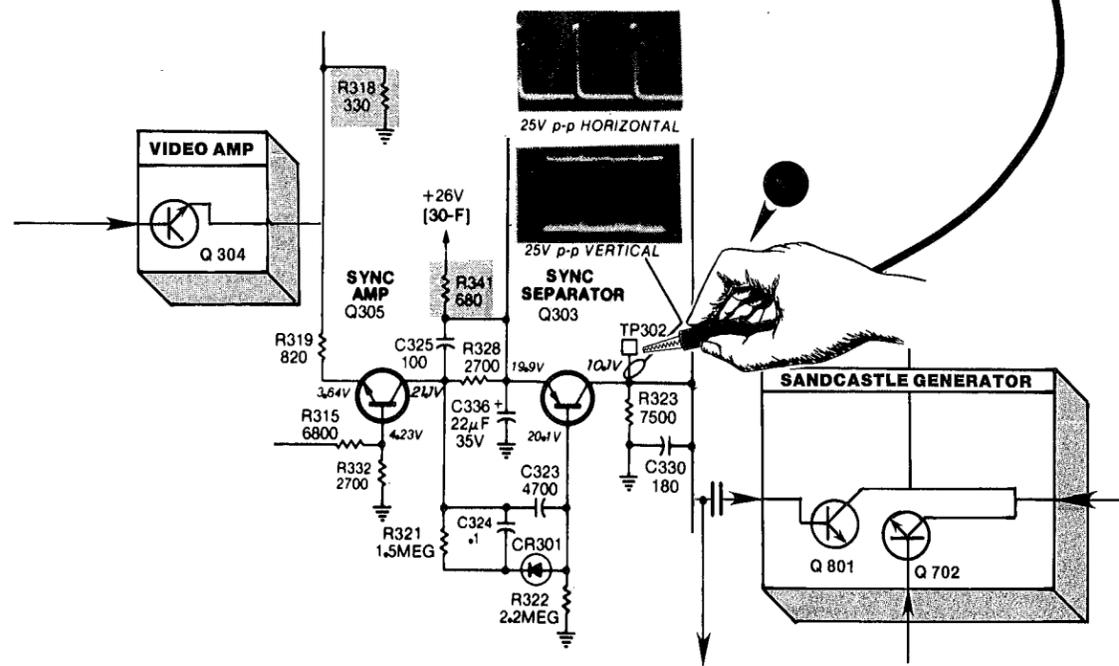
The VA62A swamps the circuit's signal and leaves the screen blank.



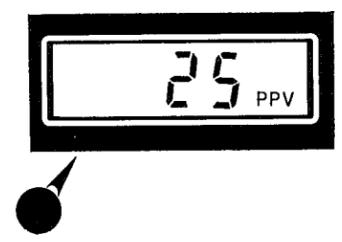
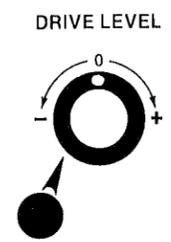
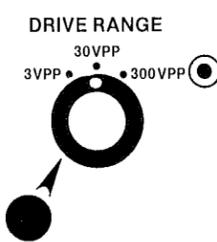
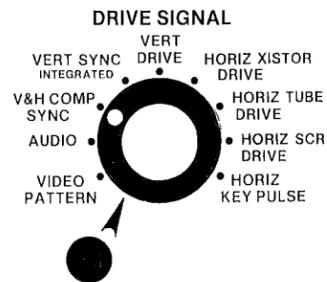
The DRIVE signal returns circuit operation to normal.

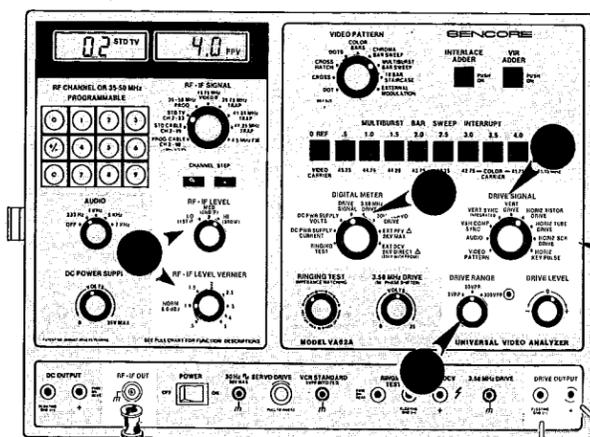
TO ANTENNA

**SYNC SEPARATOR**



- Turn the DIGITAL METER knob to the DRIVE SIGNAL position.
- Turn the DRIVE SIGNAL knob to the V&H COMP SYNC position. Composite sync includes both vertical and horizontal sync pulses to make troubleshooting the sync separator easy.
- Connect the test leads to the DRIVE OUTPUT jack of the VA62A.
- Turn the DRIVE RANGE knob to the 30 VPP position.
- With the drive level on 0, connect the (+) lead to TP302 and the (-) lead to ground. Since the VA62A swamps out the signals the screen should be blank.
- Turn the DRIVE LEVEL knob in the positive direction until the right LCD reads 25 volts or until the video pattern reappears on the screen.

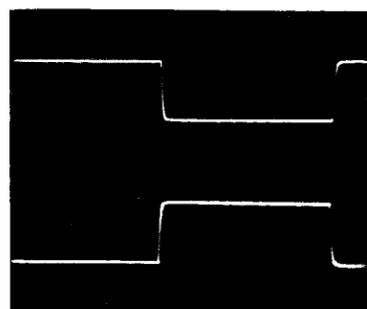
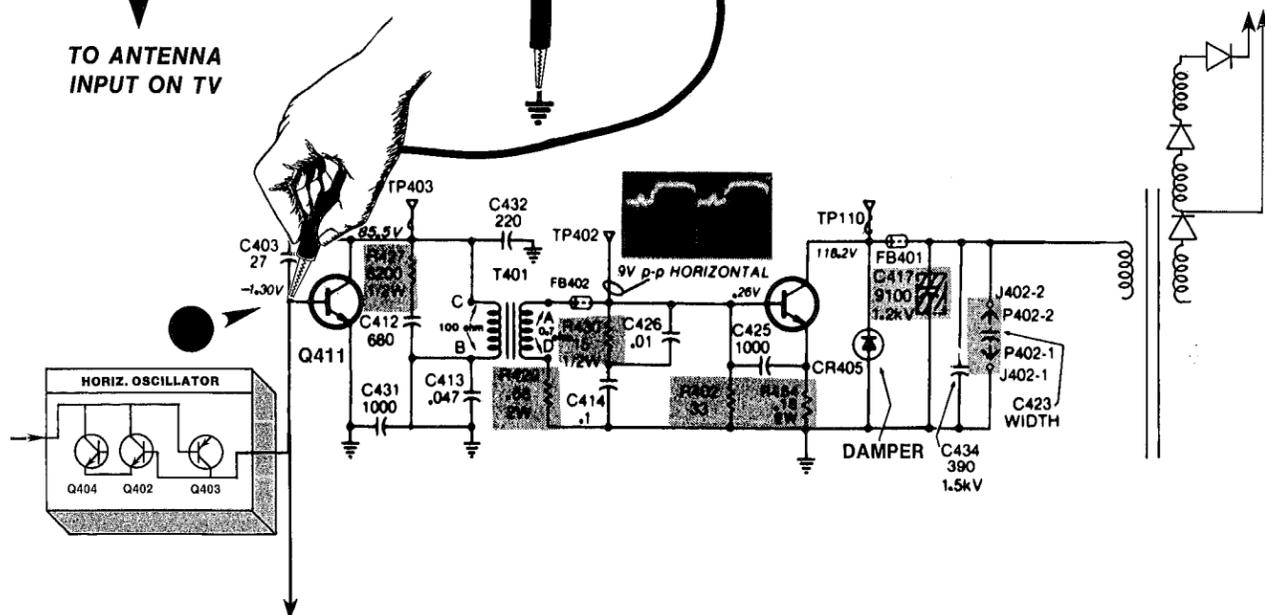




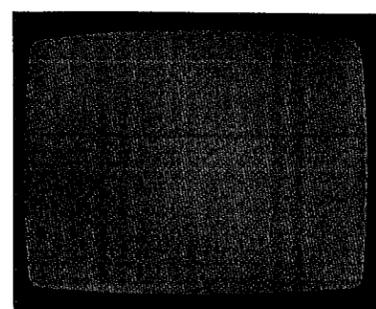
### ISOLATING HORIZONTAL PROBLEMS

Loss of horizontal drive becomes confusing because so many other problems (shutdown, regulator, and DC power supply) cause nearly the same symptom. The VA62A lets you inject horizontal drive signals into any stage to quickly isolate the problem.

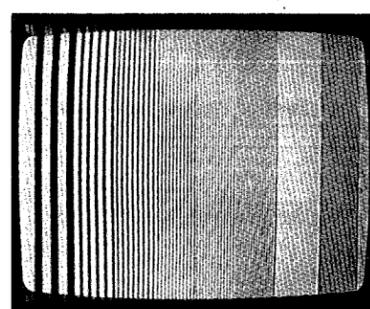
TO ANTENNA INPUT ON TV



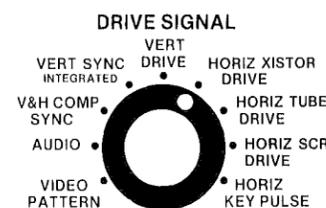
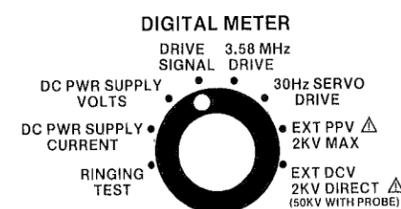
The horizontal transistor drive is a 50% duty cycle waveform.



Swamping the horizontal signal results in shutdown.



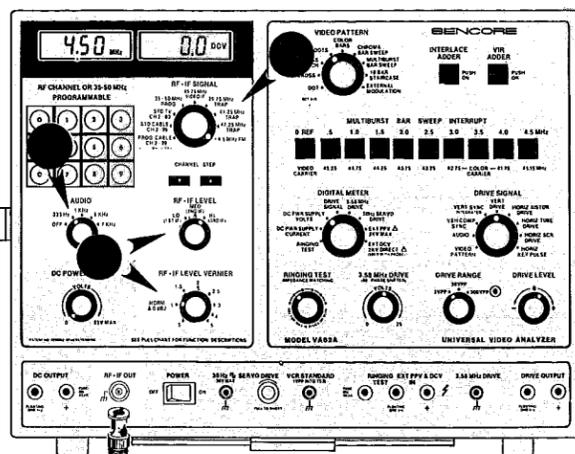
Injecting the horizontal drive signal restores the TV to normal operation.



- Set the VA62A to the NORMAL RF output signal level (RF-IF LEVEL: HI and RF-IF LEVEL VERNIER: 1).
- Turn the DIGITAL METER knob to the DRIVE SIGNAL position.
- Turn the DRIVE SIGNAL knob to the HORIZ XISTOR DRIVE position.
- Connect the test leads to the DRIVE OUTPUT jack of the VA62A.
- Turn the DRIVE RANGE knob to the 30 VPP position.
- With the DRIVE LEVEL on 0, connect the (+) lead to the base of Q411 and the (-) lead to ground. The set will go into shutdown because the VA62A has swamped out the horizontal oscillator signal.
- Turn the DRIVE LEVEL knob in the positive (+) direction until the set comes out of shutdown and a pattern appears on the screen. The right hand LCD will read about 4 volts peak to peak.

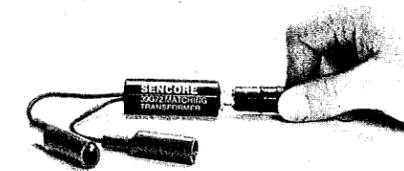
The generated sync pulses are driving the horizontal stages of the receiver. This drive signal is phase-locked to the signal being injected at the antenna terminal input, causing the picture to return in full horizontal synchronization.

The phase-locked VA62A drive signals may be injected into any stage after the detector. If operation returns, you know that all circuits from the injection point to the output work correctly.



### HOW TO FIND AUDIO PROBLEMS

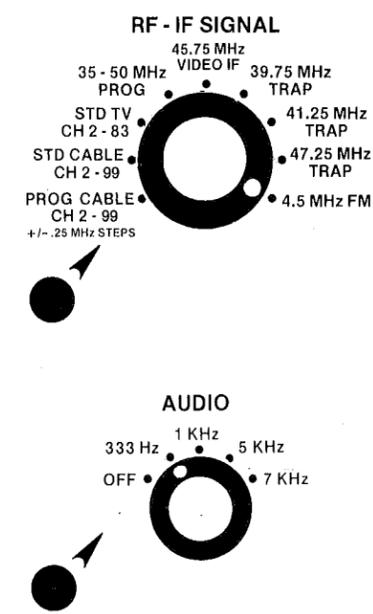
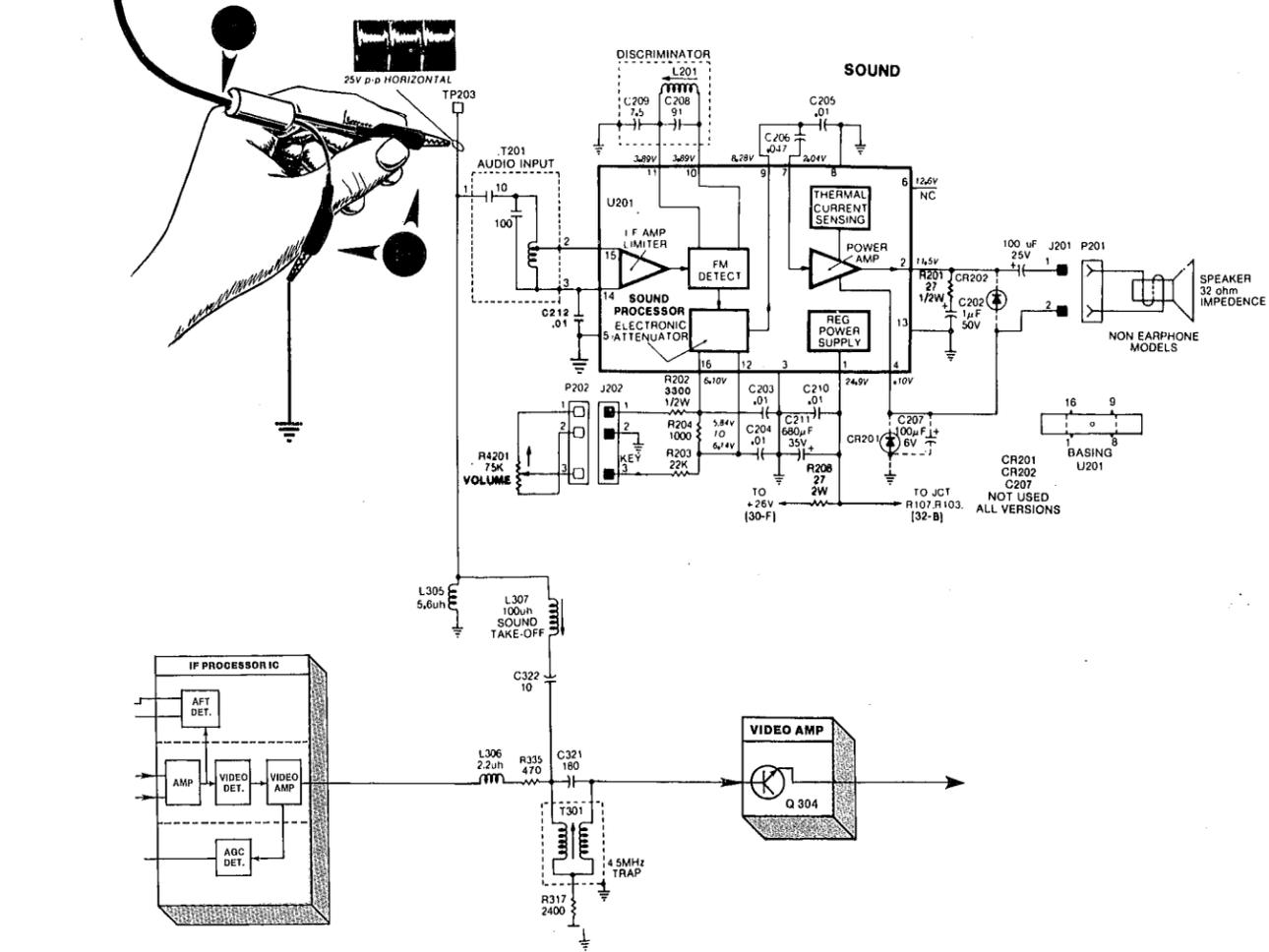
We will now see how to use signal substitution to confirm which audio stages work correctly. When using signal substitution, always duplicate the signals normally found in the circuit. This means you need two types of audio signals: (1) frequency-modulated 4.5 MHz carrier to inject ahead of the detector. The VA62A supplies both of these signals.

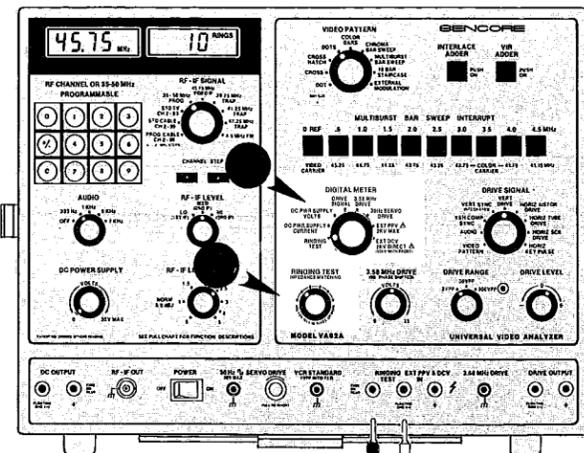


Sencore's troubleshooting "BALUN" provides impedance matching and isolation for injecting signals in any RF/IF circuit.

- Connect the 75 to 300 ohm matching balun to the 'F' end of the RF-IF cable.
- Set the VA62A to the NORMAL RF output signal level (RF-IF LEVEL: HI and RF-IF LEVEL VERNIER: 1).
- Turn the RF-IF SIGNAL knob to the 4.5 MHz position.
- Connect one of the balun's leads to TP203 and the other one to ground.
- Rotate the AUDIO knob through the different audio frequencies. There should be an audio tone coming out of the television's speaker. This test has shown us how to dynamically test the audio stages of a television receiver. The VA62A's AUDIO drive output is capable of driving any portion of the audio after the FM detector, including the speaker.

Signal substitution quickly identifies which circuits work correctly. If you inject audio, and hear a tone in the speaker, you know that all circuits from the injection point to the speaker work correctly. If, on the other hand, you don't hear a tone, you know that the problem is after the injection point, and you must move closer to the output.



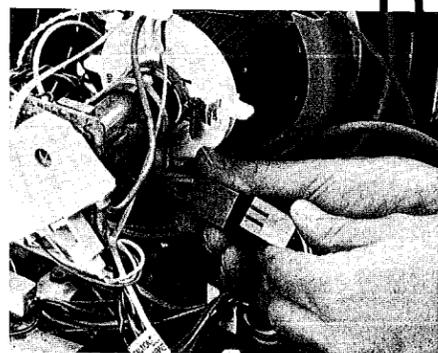
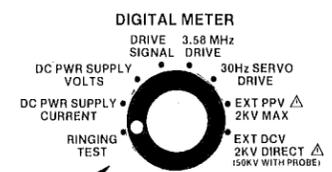


### TESTING DEFLECTION YOKES AND FLYBACK TRANSFORMERS

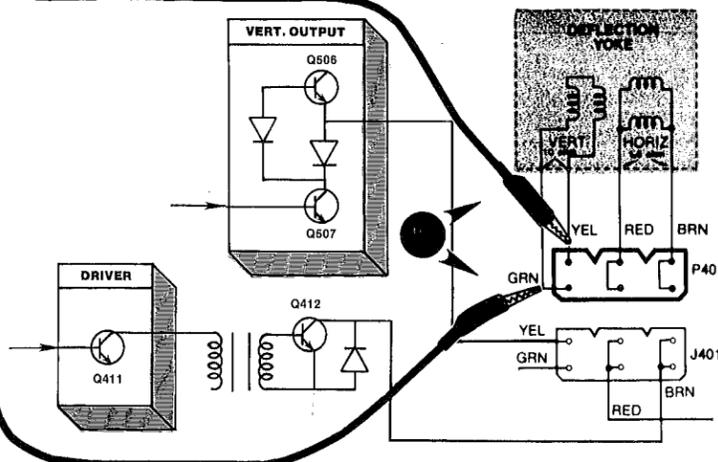
The deflection yokes and flyback transformers are often the cause of vertical or horizontal deflection problems. Trying to drive these components with a substitute signal can be misleading because of the many different driving waveforms, different circuit impedances, and different bias levels. For this reason the VA62A provides the time tested RINGING TEST which provides guaranteed good/bad results. A good coil will show a number of 10 or larger in AT LEAST ONE position of the special RINGING TEST IMPEDANCE MATCH knob positions. If all positions of the switch show a reading LESS THAN 10, the coil is bad.

- Connect the test leads to the RINGING TEST jacks of the VA62A.
- Turn the DIGITAL METER knob to the RINGING TEST position.
- Disconnect the molex plug that ties the horizontal and vertical output circuits to the deflection yoke.
- Connect one test lead of the VA62A to the yellow wire of the deflection yoke and the other test lead to the green wire of the deflection yoke.
- Turn the RINGING TEST knob through each of its positions. Watch the right hand LCD for the results.

It is important to note that there are two deflection coils. When they are rung individually they should ring close to the same values. Parallel coils should be separated and rung individually. A yoke with a shorted turn in one of the windings will cause a trapezoidal shaped raster (or a raster that is distinctly non-linear). Observe the number that appears on the right LCD as the RINGING TEST knob is turned through all its positions. If any of the numbers are more than 10, we know that the coil doesn't have a shorted turn.



● Disconnect the molex plug to test the deflection yoke.



Now that you have "hands on experience" with the VA62A, we are confident that you will agree that it saves valuable troubleshooting time and creates more real profits. Performing the procedures in this *Simplified Operating Guide*, gave you practical experience with important functional analyzing concepts, including signal substitution, signal injection, and signal swamping. We urge you to continue the study and use of these time tested methods by reviewing the *VA62A Universal Video Analyzer Operation and Application Manual*, and by subscribing to the *Sencore News*.

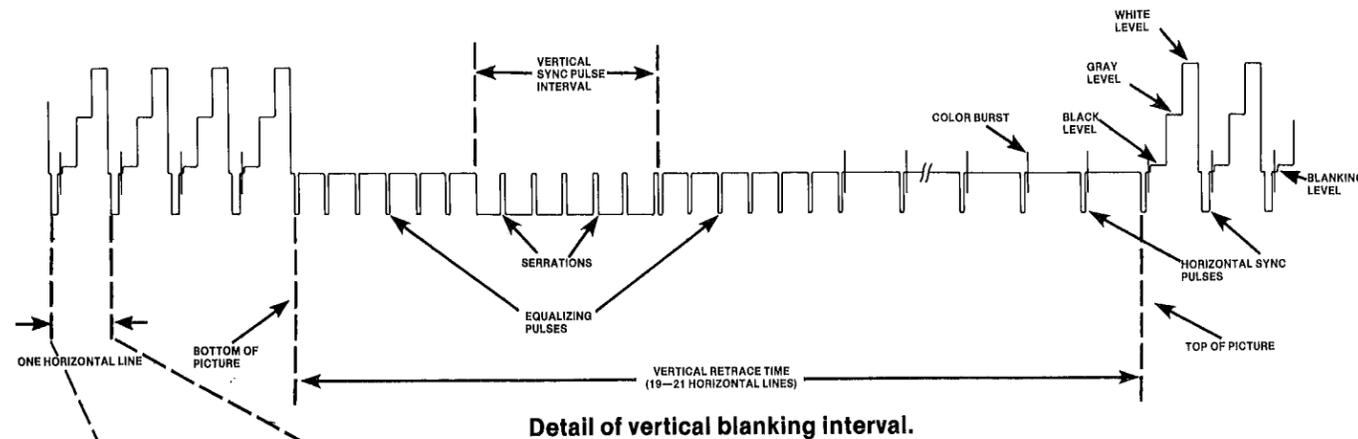
#### Remember these time and trouble saving tips:

- Isolate the equipment under test.
- Never plug your test equipment into the isolation supply.
- Inject the VA62A's RF signal at the antenna as a reference to keep all good circuits in sync. This allows operation to return to normal when phase-locked drive signals are injected after the defective stage.
- Determine if the IF stages are good by injecting the standard TV IF frequency (45.75 MHz from the VA62A), at the first IF.
- When traps are set wrong, they may affect the video or operation of the synchronous detector. Until you gain confidence in setting traps using the TV screen, use an oscilloscope to monitor the output of the detector when setting traps.
- Set the DRIVE SIGNAL levels to the values shown on the schematic for the equipment you are servicing. Never drive a circuit with a signal level greater than the circuit's DC supply voltage.
- Even a slight misalignment of the synchronous detector affects the dynamic range of the video. Use the Staircase pattern and an oscilloscope to check and adjust the synchronous detector.
- Substitute the VA62A's 3.58 MHz DRIVE signal to identify color problems.
- Use the VA62A's 4.5 MHz FM and audio signals to test the TV sound system.
- The RINGING TEST checks deflection yokes and flybacks for opens or shorted turns. Each yoke coil should have nearly the same number of "Rings."

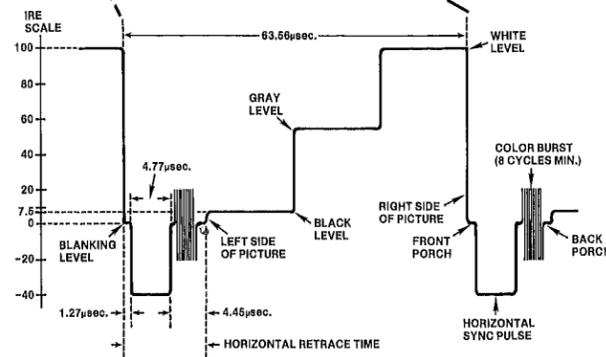
Be sure to call 1-800-SENCORE (736-2673) for your personal copy of other Sencore Simplified Guides and Tech Tips. Each is designed to give your shop the "Sencore Advantage."

Notes:

# The Only NTSC Video Servicing System Guaranteed To Cut Your Servicing Time By 54%\* Or Your Money Back.



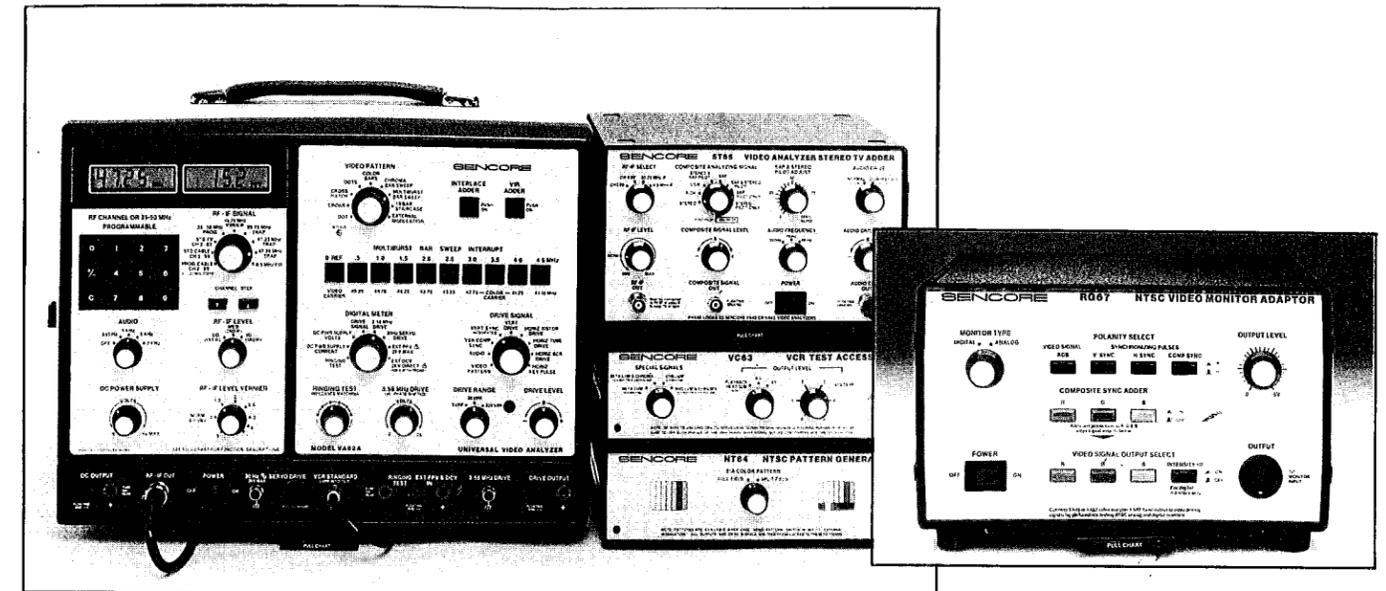
Detail of vertical blanking interval.



Detail of one horizontal line of video and sync.

Summary of NTSC Television Standards	
Horizontal scan frequency, Hz	15,734.26
Vertical scan frequency, Hz	59.94
Color Subcarrier, MHz	3.579545
Channel Band width, MHz	6
Lines per frame	525
Lines per field	262.5
Frames per second	30
Fields per second	60
Fields per frame	2
Video Band width, MHz	4.2
Video signal	AM
Audio signal	FM
Video Modulation	Negative
Aspect ratio	4:3

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When you invest in a VA62A Universal Video Analyzer, you not only cut your video troubleshooting time by at least 54%, you make an investment in your future with an obsolete-proof instrument. Expand into NEW profit generating services like VCRs, Stereo TVs and VCRs, and RGB Video Monitors with easy to add accessories.

- VA62A Universal Video Analyzer \$3,495
- VC63 VCR Test Accessory \$495
- NT64 NTSC Pattern Generator \$495
- ST65 Video Analyzer Stereo TV Adder \$995 Patent Pending
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Based on a survey of servicers using the VA62A Universal Video Analyzer techniques over previous methods.



# CONTROLS

1. VIDEO PATTERN SWITCH selects the patterns that will be available for Injection.

1a. DOT SIZE control gives control over dot size and vertical line width on the screen for easier convergence.

1b. DOT provides an electronically centered dot for static convergence.

1c. CROSS provides an electronically centered cross pattern to center the picture area.

1d. CROSS HATCH for dynamic convergence and linearity adjustments.

1e. DOTS for dynamic convergence.

1f. COLOR BARS are standard gated-rainbow phase-locked to horizontal sync for color circuit troubleshooting or alignment. NTSC level of 75% cyan bar saturation is maintained.

1g. CHROMA BAR SWEEP, three bar color reference test pattern used for chroma alignment and troubleshooting. Borders of the pattern are set to 100% white level for proper VCR white level adjustments. Each bar can be turned on or off with the corresponding MULTIBURST BAR SWEEP INTERRUPT switch.

1h. MULTIBURST BAR SWEEP, a ten bar multiburst pattern for luminance video frequency response checks and troubleshooting, and IF alignment. Each bar can be turned on or off with the corresponding MULTIBURST BAR SWEEP INTERRUPT switch.

1i. 10 BAR STAIRCASE provides a ten-step staircase pattern to check and align video linearity.

1j. EXTERNAL MODULATION allows any 1 VPP, 75 ohm, negative sync, composite video signal to modulate VA62A through jack in lead compartment.

2. INTERLACE ADDER provides a fully interlaced pattern for testing circuits where full interlace is necessary such as vertical countdown and VIR circuits.

3. VIR ADDER provides a standard VIR signal for testing and set up of VIR controlled units.

4. MULTIBURST BAR SWEEP INTERRUPT switches allow each MULTIBURST BAR SWEEP (1h) frequency bar to be turned on or off as necessary. The 42.75, COLOR CARRIER and 41.75 switches also allow the CHROMA BAR SWEEP bars to be turned on or off.

5. DRIVE SIGNAL switch provides drive signals necessary for signal injection in TV and VCR circuits for troubleshooting. All are controlled by DRIVE RANGE switch (8) and DRIVE LEVEL control (7) and supplied through DRIVE OUTPUT jacks (9).

5a. VIDEO PATTERN provides a composite video pattern selected by the VIDEO PATTERN switch (1) for injection anywhere composite video is necessary.

5b. AUDIO provides audio tones at 4 frequencies; 333 Hz, 1 KHz, 5 KHz, or 7 KHz by AUDIO switch (25).

5c. V & H COMP SYNC provides separated composite sync for isolating sync problems by injecting after separation but before vertical integration or horizontal differentiation points.

5d. VERT SYNC INTEGRATED provides an internally integrated vert sync pulse for injection into vertical oscillator.

5e. VERT DRIVE provides the correct signal to feed the base or grid of the vertical output stage.

5f. HORIZ XISTOR DRIVE provides a horizontal drive waveform to drive the base of a horizontal output transistor.

5g. HORIZ TUBE DRIVE provides a horizontal drive waveform to drive the grid of a horizontal output tube.

5h. HORIZ SCR DRIVE provides a horizontal drive waveform to drive the retrace SCR of an SCR output section.

5i. HORIZ KEY PULSE provides a properly timed flyback pulse for AGC keying, burst keying, etc.

6. DIGITAL METER switch selects the function displayed by the DIGITAL METER (31).

6a. RINGING TEST provides test of deflection yokes and flyback transformers. Use with RINGING TEST impedance matching switch (14) and RINGING TEST Input jacks (13).

6b. DC PWR SUPPLY CURRENT monitors DC current drawn from adjustable DC POWER SUPPLY (23).

6c. DC PWR SUPPLY VOLTS monitors output voltage from adjustable DC POWER SUPPLY (23).

6d. DRIVE SIGNAL measures the actual peak-to-peak level of signal selected with the DRIVE SIGNAL switch (5) at the DRIVE OUTPUT jacks (9).

6e. 3.58 MHz DRIVE measures the actual peak-to-peak level supplied by the 3.58 MHz DRIVE control (1) to the output jack (10).

6f. 30 Hz SERVO DRIVE measures the actual peak-to-peak level supplied by the 30 Hz SERVO DRIVE control (7) to the output jack (18).

6g. EXT PPV measures the peak-to-peak voltage (to 2000 VP-P max) of an AC signal (5 MHz max) applied to the EXT PPV & DCV IN jacks (12). Autoranged.

6h. EXT DCV measures the DC level of a signal applied to the EXT PPV & DCV IN jacks (12) to 2000 volts. Autoranged.

7. DRIVE LEVEL allows vernier control between ranges of DRIVE RANGE control (8). All signals from the DRIVE SIGNAL switch (5) can be varied, either in a positive or negative polarity.

8. DRIVE RANGE switch provides three ranges for signals from the DRIVE SIGNAL switch (5): 3 VP-P, 30 VP-P, 300 VP-P. The 3 V range is impedance matched to IC circuitry, the 30 VP-P is impedance matched to transistor circuits and the 300 VP-P is impedance matched to tube circuits.

8a. An LED INDICATOR flashes when the DRIVE RANGE switch (8) is set to 300 VP-P range.

9. DRIVE OUTPUT, supplied through banana jacks for signals selected by DRIVE SIGNAL switch (5). A floating ground connection allows direct injection to non-common ground systems.

10. 3.58 MHz DRIVE output, is supplied through a shielded RCA phono jack.

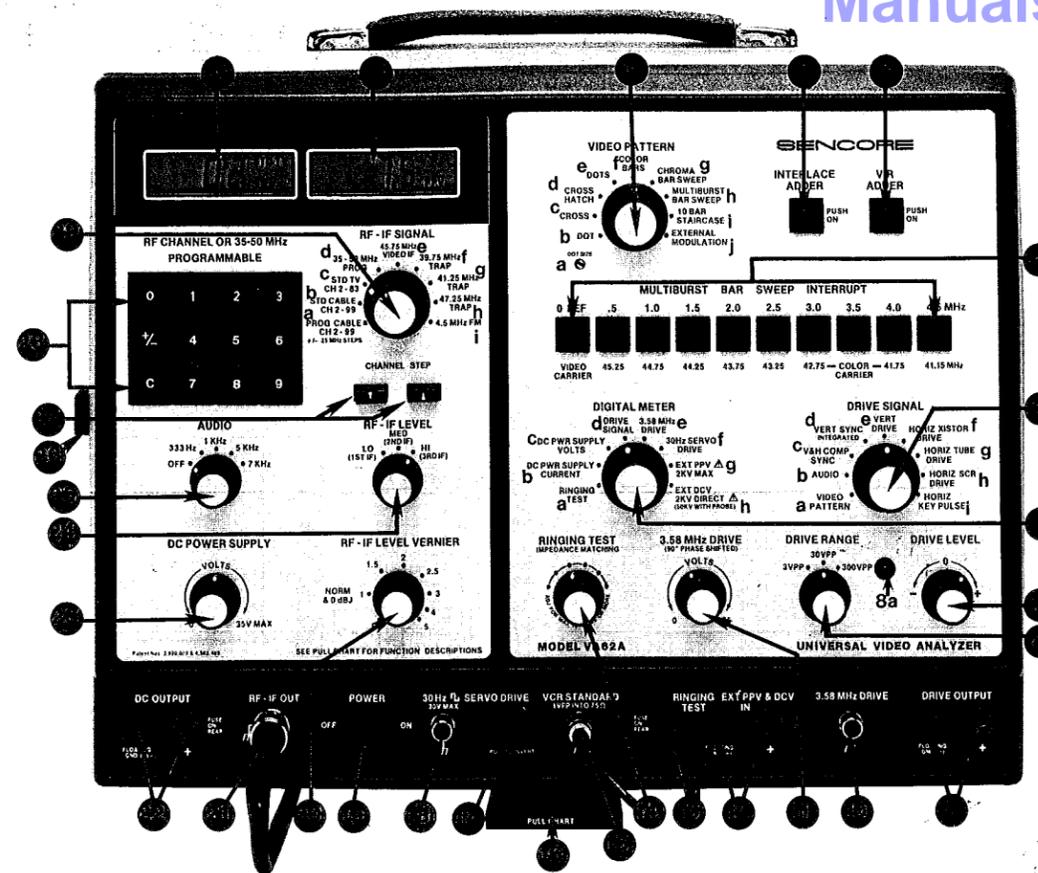
11. 3.58 MHz DRIVE provides a 90 degree phase shifted output, locked to the color burst, through the 3.58 MHz DRIVE jack (10). The control provides a 0 to 25 VPP output for isolating color problems.

12. EXT PPV & DCV IN jacks provide inputs for measuring PPV and DCV. Common negative is floating ground allowing measurements on non-common ground chassis.

13. RINGING TEST input jacks allow connection of test leads to yoke or flyback for RINGING TEST (14). Ground connection common with EXT PPV & DCV IN jack (12).

14. RINGING TEST impedance matching switch matches the test circuits to the yoke or flyback under test when DIGITAL METER switch (6) is set to the RINGING TEST position (6a). Switch is rotated until the DIGITAL METER (31) shows a reading of 10 or more. Readings of less than 10 in all 6 positions indicate a bad coil.

15. VCR STANDARD output jack, is a RCA phono jack providing a 1 VP-P composite video signal, (when terminated in 75 ohm) for direct video input.



16. PULL OUT CHART provides a quick reference for setting up the controls.

17. 30 Hz SERVO DRIVE control adjusts level of 30 Hz servo drive square wave from zero to 30 VPP. Polarity can be inverted by pulling knob (17).

18. 30 Hz SERVO DRIVE output supplied through an RCA phono jack provides the 30 Hz servo drive square wave, controlled by 30 Hz SERVO DRIVE control (17).

19. POWER SWITCH is illuminated when on.

20. RF-IF LEVEL VERNIER provides a fine adjustment of RF or IF levels for sensitivity testing or signal matching.

21. RF-IF OUT BNC jack supplies all RF or IF signals.

22. DC OUTPUT jacks are banana type with a floating negative, allowing injection into non-common ground points.

23. DC POWER SUPPLY controls a DC voltage source, adjustable from zero to 35 VDC at 1A current maximum.

24. RF-IF LEVEL control allows for three RF or IF signal levels for special tests. RF-IF VERNIER (20) provides signal levels between these ranges.

25. AUDIO switch provides four audio frequencies to modulate the RF-IF SIGNAL (29) or the AUDIO position (5b) of the DRIVE SIGNAL switch (5).

26. LATCH for optional PC230 cover which protects the front of the instruments in portable applications.

27. CHANNEL STEP switches allow stepping through RF channels one step at a time in the up or down direction.

28. RF CHANNEL OR 35-50 MHz PROGRAMMABLE keyboard is a soft-touch key pad that allows random keying of any channel required for RF, plus allows keying IF frequencies from 35-50 MHz for nonstandard IF traps. Also used for keying programmable cable offset frequencies.

29. RF-IF SIGNAL switch selects the function of the RF or IF signal generator which is fed through the RF-IF LEVEL switch (24) and the RF-IF LEVEL VERNIER (20) to the RF-IF OUT jack (21). Video modulation is controlled by the VIDEO PATTERN switch (1), and audio modulation is controlled by the AUDIO switch (25)

29a. PROG CABLE provides a user-programmable memory that stores a frequency offset for each cable channel to match the offset of local cable systems.

29b. STD CABLE provides any cable channel-VHF midband, superband, or hyperband at FCC specified 6 MHz steps.

29c. STD TV provides all VHF and UHF TV channels at FCC specified carrier frequencies.

29d. 35-50 MHz PROG provides any frequency from 35.00 MHz to 50.00 Mhz for spot alignment, AFT testing, and other special tests.

29e. 45.75 MHz VIDEO IF generator provides a crystal controlled IF carrier modulated with video and audio information to troubleshoot or align any IF stage.

29f,g,h. TRAP SETTING SIGNALS provide combination of a video modulated 45.75 Mhz IF carrier plus an interfering carrier of 39.75 (adjacent video), 41.25 (sound), or 47.25 (adjacent sound) MHz to adjust standard IF traps.

29i. 4.5 Mhz FM sound IF provides modulated or unmodulated sound carrier for troubleshooting or alignment of the audio IF or detector.

30. RF-IF DIGITAL READOUT shows the selected RF channel, cable offset (during programming), or IF frequency. Annunciators show selected functions, ranges, etc.

31. DIGITAL METER READOUT displays digital results of function selected by DIGITAL METER switch (6) for monitoring internal or external voltages or for testing yokes or flybacks.