

RECEIVER/MONITOR APPLICATIONS

Introduction

This section of the manual uses the various VA62 features in combination with each other to isolate problems in a video receiver or monitor. In most cases, we will not repeat operating instructions covered in the "Operation" section. Refer to the earlier section if you have questions about operating a particular function.

The VA62 improves troubleshooting effectiveness because it allows you to use "functional analyzing" to isolate problems in a video receiver or monitor. There are three steps to functional analyzing: 1.) Relate the overall symptoms to a general group of circuits, 2.) Isolate the defect to a single stage, and 3.) Locate the defective component with conventional troubleshooting techniques. The second step is the one that adds efficiency compared to other troubleshooting techniques.

Understanding Signal Substitution

There are two ways to isolate problems in any electronic system: signal tracing or signal substitution. We use signal tracing every time we use a meter or scope to measure a signal. There are three factors that make signal tracing ineffective: 1.) It is centered on the electrical characteristics of the circuits rather than their function, 2.) It requires you to know the typical tolerance conditions to interpret the results, and 3.) A problem in one stage may affect other stages. Of these three limitations, the first causes the most inefficiency.

With signal tracing, you must mentally determine what DC or AC signal is supposed to be at each test point each time you make a measurement. This means determining the electrical functions of the stages leading up to the test point; such as whether they are inverters, waveshapers, current or voltage amplifiers, etc. Without this analysis, you don't know what signal to expect when the circuit is working, and you especially don't know what to expect when a problem exists. The second and third problems just add to this already difficult task. Signal measurements, even in good stages, vary from the schematic, depending on component and power supply tolerances. These tolerances must be considered for each measurement when trying to isolate a bad stage. Then, you must add the effects of a bad stage affecting another stage when troubleshooting a defective unit. It is no wonder that technicians often get lost and troubleshoot circuits that have nothing to do with the actual problem.

Signal substitution, on the other hand, centers on the function of a stage rather than its electrical

properties. You think of a stage as "part of the vertical circuits" rather than "a direct-coupled amplifier with a sawtooth input". You inject a known-good signal at the input of a stage and watch for an improvement at its output. If you are injecting before the defect, the original symptom remains virtually unchanged. If you are injecting after the problem, there is a noticeable improvement in the output. You continue injecting the known-good signals at various test points until you find a stage that produces a poor output when injecting the signal at its input, and improved results when injecting at the input of the following stage. When this happens, you have confirmed that the defect lies between the two injection points.

Signal substitution is much like using a second receiver or monitor identical to the one with the problem. In theory, you could patch a signal from a test point in the good unit to the identical test point in the defective one. If you are making the connection before the problem stage, the symptoms remain, or if you make the connections after the problem stage, the problems clear up. In real life, however, you cannot use a second receiver or monitor because its circuits are not designed to drive external circuits. In addition, you would need many known-good chassis to match the many different varieties of brands or models of units you service. The VA62, on the other hand, supplies signals that are universal to all brands and models of receivers or monitors, and its driving circuits are specifically designed to drive other stages.

Understanding The Block Diagram

Notice that we have referred to the stages of the unit through most of our discussion. How do we define a stage? A stage is best thought of as the components associated with a single tube or transistor in a system made only with discrete components. Now days, of course, many stages are combined into a single integrated circuit. But the individual functions of the stages still take place inside the IC, as the IC in the schematic of Fig. 37 shows.

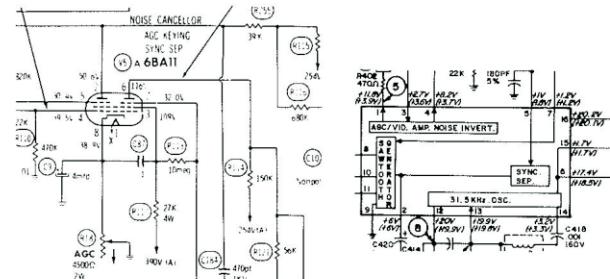


Fig. 37 — A "stage" consists of one functional block, which may be the circuitry associated with a single transistor or tube, or part of an IC.

We can't memorize the schematic for every chassis we might have to service. But we can memorize a block diagram, especially if one block diagram applies to every brand and model of unit we might have to service. We will use a universal block diagram in this manual which comes as close as possible to being universal to all brands and models of video receivers and monitors. You do not have to memorize this block diagram. Rather, become very familiar with it, as this will make it much easier to relate the different VA62 applications to the schematic of the specific unit you are servicing.

A block diagram shows how all of the stages interconnect to form a complete system. A detailed block diagram has a separate block for each functional stage. A more general block diagram combines several of these stages (or blocks) into more general blocks, such as shown in Fig. 38. Notice that this block diagram shows the entire color receiver as having only five blocks. We will call each of these large blocks a "system block" because each block represents a complete system within the unit serving a special and unique function relating to the operation of the other system blocks.

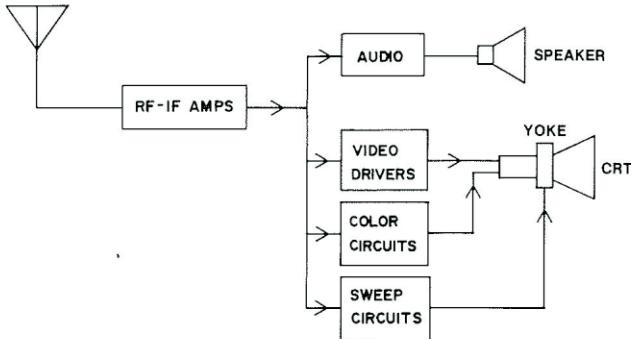


Fig. 38 — A block diagram for a color TV may be shown with only five blocks, but this does not give enough detail for most applications.

Our first troubleshooting step should relate the symptoms of the entire unit to one of these large system blocks. For example, loss of color tells us our next step should relate to the "color" block.

Notice that we cannot isolate a specific defective component at this level. We must have more detail. This is where the second block diagram, shown in Fig. 39, comes into the picture. Notice that this diagram shows the "color system" block, but it has been divided into several smaller blocks. We call these smaller blocks the "functional" blocks, because each has only one function in relationship to all the others within the system or within the unit. Each *functional block*, in turn, forms one *functional stage*, as defined earlier.

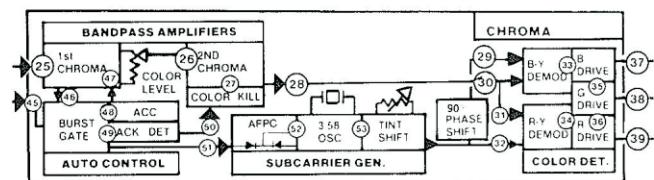


Fig. 39 — The color block of the universal TV block diagram. Notice that each functional stage is shown so you can follow the signals from the input to the output, as well as interconnections and feedback paths.

The goal of functional analyzing is to identify the functional stage (block) that has the defective component. Then, this one stage is the only one we need to troubleshoot with conventional techniques. By narrowing down the number of possible stages with the problem, we have greatly expanded our troubleshooting efficiency.

Understanding ICs And Modules

Modern receivers and monitors no longer use a separate active component (tube or transistor) for each functional block. Integrated circuits combine the functions of several blocks into a single component. The IC is actually not a component, but rather a small circuit module containing dozens or hundreds of individual components designed to provide a specific function. In many cases, the IC has several of the smaller functional blocks. In other cases, the IC is a large part of a system block.

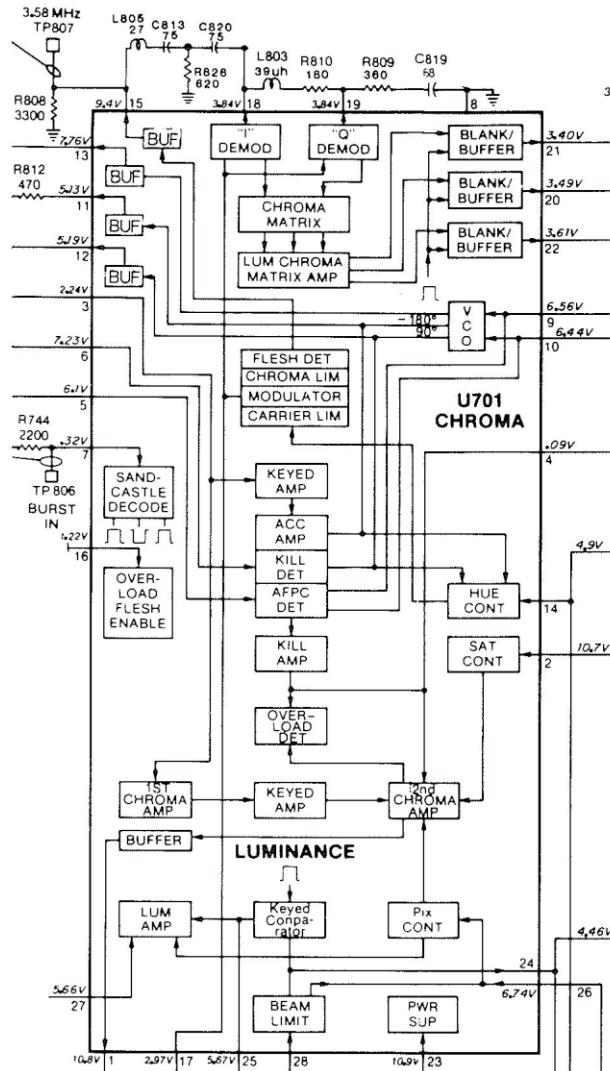


Fig. 40 — Many large-scale-integration ICs include several functional stages inside a single component.

Functional analyzing provides the only reliable method of testing integrated circuits. By testing the functional or system block, you have also tested the IC that forms that block. In most cases, IC testing involves injecting the correct signal at the output

and the input of the IC. If the unit works correctly with the signal injected at the IC output (but not when connected to the IC input), you then test the power supply voltages to confirm the IC is properly powered. If the power supply voltages are correct, the IC is the most likely problem.

The functional analyzing results may occasionally indicate a bad IC, but replacing the IC does not correct the problem. Thus, it may seem that functional analyzing did not work. The opposite is true. The functional analyzing tests, being dynamic in nature, have confirmed that the problem is related directly to the functional block(s) containing the IC. But you must remember that a defective IC support component, such as an external capacitor or resistor, may make the IC appear to be defective. These components should be checked if a replacement IC failed to cure the problem after following the normal functional analyzing steps. Also suspect mechanical problems such as poor solder connections, hair-line cracks in printed circuit boards, or shorts or leakage between foils.

Developing A System

Most technicians have been taught to measure or inject signals starting at the input and working towards the output, or from the output and working towards the input. The most effective way to isolate problems, however, is to pick a test point that is in the approximate center of the total system. This reduces the number of troubleshooting steps needed to isolate a problem to a single stage by approximately 40 percent. This technique is known as "divide and conquer" servicing.

Whenever possible, the division point should be selected at a point that represents the biggest change in the form of the signal. A detector always represents the largest change in a signal because the signal has a carrier at the detector input and no carrier at its output. Therefore, the three detectors (video, audio, and color) are the best place to begin signal substitution for most troubleshooting applications. Output stages represent the second most important division point because output stages are more often damaged than a stage at some point in the middle of the system.

Each section of this "Applications" section has a troubleshooting guide ("trouble tree") based on the divide and conquer approach. Study each tree as you are learning how to use the VA62 for the highest efficiency. In each case, the tree provides the fewest possible steps to go from a general symptom to a single functional stage. You may not always follow every step in the tree because of clues that let you skip a few steps. You will find, however, that the tree is helpful when you are first learning your VA62, or when troubleshooting a particularly difficult problem.

Selecting The Correct Signals

In most cases, there is only one drive signal that applies to a particular stage of a receiver or monitor.

The specific drive signal needed to inject at each test point is shown in the “trouble tree” and the small version of the block diagram that accompanies the later “Applications” sections. Beyond this, use the following guidelines for best results with the drive signals.

1. **Always inject a reference signal at the antenna or IF input.** This reference keeps all stages in sync while you substitute into suspected bad stages, one at a time. *The reference must come from the VA62.* You cannot use a signal from another generator or from a broadcast station as your reference because these other signals are not phase-locked to the VA62 substitute signals.
2. **Use the waveforms shown on the schematic as your guide.** The schematic waveform indicates the correct polarity and amplitude of the signal at a test point. Use the waveforms on page 27 as your guide to compare to the schematic waveform. *Do not use the DC voltage to determine the drive signal amplitude, except as indicated below.*
3. **Never drive the stage with a peak-to-peak signal larger than the B+ voltage.** This is the best way to prevent damage to solid-state components.

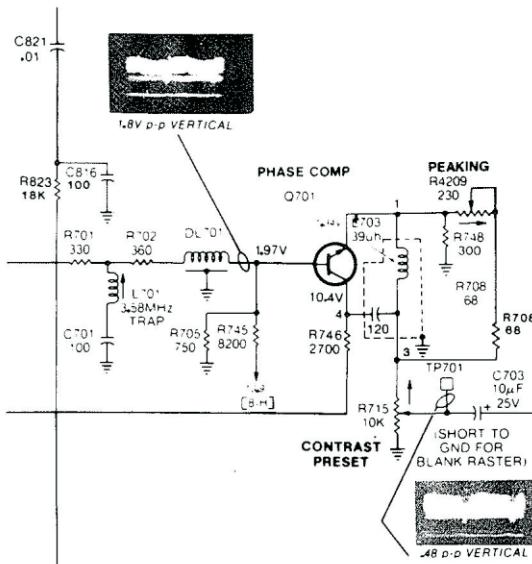


Fig. 41 — Use the schematic waveforms as the reference when available at the test point you want to test. If there is no waveform, use the function of the stage. Never apply a peak-to-peak signal larger than the DC voltage supplying the stage.

4. Use the function of the stage to determine the correct driving signal. This eliminates the need for detailed circuit analysis of each stage. You only need to analyze the single stage identified with functional analyzing. If there is no waveform shown at the test point you want to use, locate the next test points before and after the desired test point that do have waveforms. Use the *difference* between the waveforms as your guide to tell if the in-between point involves a major waveshape (function) change.
5. Start with positive drive if in doubt. Even though the receiver may show strange symptoms when driven with the wrong polarity drive signal, most stages will not be damaged if you inject the wrong drive polarity for a short period of time. The exception is the horizontal output stage. These

stages *always use positive drive*, whether the chassis uses a tube, transistor, or SCR output amplifier.

NOTE: Always monitor the amount of signal needed to drive a test point with the **DRIVE SIGNAL** function of the **DIGITAL METER**. This prevents occasionally missing a defective stage by forcing it to work with too much input signal. For example, if a circuit with a shorted transistor normally requires 0.4 VPP of signal, you may be able to return it to "normal" operation by applying a 2 VPP signal. Monitoring the output also prevents damaging a stage with too much signal.

Selecting The Correct Ground

The common connection of three of the VA62 outputs are isolated from the chassis ground and from each other to allow them to be connected to test points that are not common to the chassis. This isolation allows signal injection or signal tracing in non-grounded circuits, but does not eliminate the need for an isolation transformer in chassis with hot grounds. The three isolated grounds are 1.) The **DRIVE OUTPUT**, 2.) The **DC OUTPUT**, and 3.) The **EXT PPV & DCV IN** connectors. All other connections are common to the VA62 chassis which, in turn, is connected to earth ground through the third-wire ground connector of the AC plug. Always remember to connect the common lead of each output to an appropriate circuit ground point. You cannot, for example, depend on the ground connection of the **RF-IF OUTPUT** jack to provide a ground return for the **DRIVE OUTPUT**.

You must use an isolation transformer (such as the Sencore AC Powerite®) to isolate any TV chassis that does not have its own isolation transformer. This prevents a severe shock hazard, damage to the chassis under test, and/or damage to your VA62. **Do not connect the VA62 to the isolation transformer.** The following explains why isolation is needed.

A chassis that has its own isolation transformer is electrically isolated from both sides of the AC line. The first TV receivers without an internal transformer had a direct connection between one side of the AC line and the metal chassis pan and used a half-wave rectifier to supply power to all internal circuits. As shown in Fig. 42, these units could be serviced without an isolation transformer as long as the common side of the AC line was connected to the chassis. Many technicians learned to measure between the chassis and a solid ground with a AC voltmeter before connecting any test instruments. If the meter showed an AC voltage measurement, the hot side of the AC line was connected to the chassis. Reversing the connection of the AC plug brought the chassis to common-ground potential, allowing grounded instruments to be safely connected to the chassis without damage.

Most receivers now use a full-wave bridge rectifier connected directly between the AC line and the chassis as shown in Fig. 43. Connecting a grounded instrument to the chassis will always result in damage to the receiver or to the test instrument

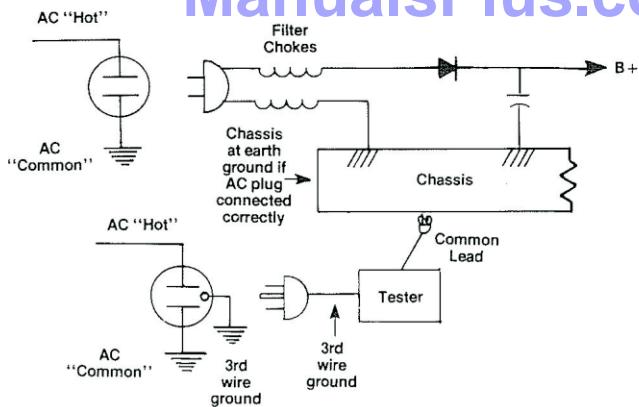


Fig. 42 — The old half-wave rectifier systems connected one side of the AC line directly to the chassis, allowing grounded equipment to be connected if the chassis was connected to the common side of the AC line.

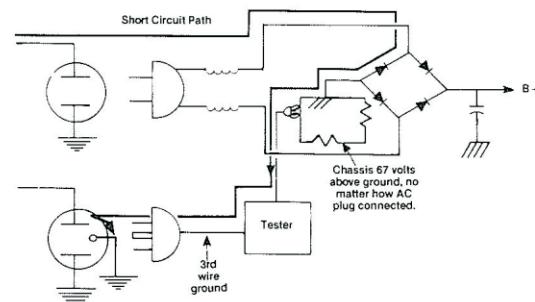


Fig. 43 — A grounded tester will short out part of the power supply of a full-wave bridge system, no matter which side of the AC line is connected to common.

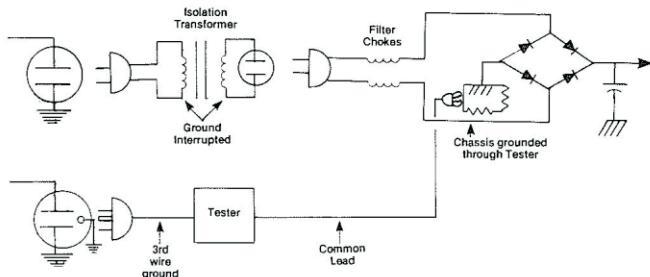


Fig. 44 — The isolation transformer breaks the current path through the power supply by letting the chassis float in comparison to earth ground.

because the test instrument produces a short circuit across half of the rectifier bridge. Reversing the line cord does not help because this simply reverses the connection to the bridge diodes rather than bringing the chassis to the earth ground potential. Defeating the ground connection on the instrument is an extremely dangerous practice, since both the chassis and the case of the instrument become hot. Any contact between the test instrument (or chassis) and earth ground results in a possibly fatal shock hazard. The isolation transformer breaks this path, as shown in Fig. 44.

NOTE: A variac, or adjustable AC transformer, is not an isolation transformer. Use an ohmmeter to measure between the input and the output of a device to confirm it does provide isolation. There should be no resistance reading between the input and the output.

OVERALL TELEVISION PERFORMANCE TESTS

All tests performed with VA62 connected to the TV VHF antenna terminals.

Type of Test	Instructions	Set Should Produce:	Circuits Tested
Tuner Test	Feed in signal on each channel	Each should give good picture unless overdriven by strong local signal	VHF tuner; Fine Tuning
Sensitivity	Set RF-IF LEVEL control to "NORM" and "HI"	Snow-free picture Locked in sync Locked in color	RF/IF gain Sync separators Color detectors
Low-level Sensitivity	Reduce RF-IF LEVEL control to .1 and "MED"	Snowy picture Locked in sync Noisy color	AGC Sync separators Color detectors/ color killers
AGC	Increase RF-IF LEVEL control to maximum ("5" and "Hi")	No picture tear	AGC
IF/Video Amp Frequency Response	Depress all BAR SWEEP buttons. Reduce brightness and contrast until 1 bar disappears.	3.5 and 4.5 MHz Bars should disappear first	3.58 MHz and 4.5 MHz traps
	Continue to reduce brightness/ contrast until second bar disappears	3.0 MHz Bar should disappear second	IF alignment, video amp
	Increase brightness/contrast to normal level	"0 Ref.", 0.5, and 1.0 MHz bars should not show ringing	IF alignment, video amp
AFT Alignment	Fine tune VHF tuner for good resolution on the 2.0 MHz bar. Turn AFT off and on.	Pattern should not lose detail when AFT is on	AFT alignment
Static Convergence	Switch to DOT	Dot should be white	Yoke magnets
Picture Centering	Switch to CROSS	Cross should be centered	Yoke alignment Centering controls
Dynamic Convergence	Switch to CROSS HATCH or DOTS	Lines should be straight Lines/dots should be white	Pincushion Convergence coils
Color Demodulators	Switch to COLOR BARS	Show standard color bars	Color Demodulators
Tint Range	Rotate TV tint control through the entire range	Color should shift at least 3 bars	Tint phase shift
B&W Tracking	Switch to "10 Bar Staircase"	The steps should have no color	CRT drive and bias controls
Color Killer	Switch to MULTIBURST BAR SWEEP with 3.5 MHz bar on	Bar should be grey	Color killer threshold setting
Color Demodulators	Switch to CHROMA BAR SWEEP	Middle bar should be cyan	Tint control or tint range
Color Sideband Check	Reduce color control until either left or right bar disappears	Both should turn grey or black at the same time	Bandpass Amplifier, Alignment

Fig. 45 — Follow these steps to form a full performance test.

The Performance Test

Performance testing is the first and the last step of functional analyzing. You use the performance test before you begin troubleshooting to identify as many symptoms as possible. You use the performance test at the end of the repair to confirm that you have corrected all of the original problems and that you did not miss multiple problems that were masked during the original symptom analysis.

The first thing to look for is major symptoms. There are six: 1.) Poor audio, 2.) Poor video, 3.) Wrong color, 4.) No color, 5.) Poor sync, and 6.) No sweep. The VA62 isolates each of these major symptoms to a single functional stage using functional analyzing. We will cover each of these symptoms in separate sections that include special block diagrams and trouble trees. The trouble trees and block diagrams will give you the step-by-step procedures to follow. The written material for each section will give you hints or explain points that may be questioned in the trouble trees.

After using functional analyzing to isolate and correct the major troubles, you are ready to apply the more detailed performance test shown in Fig. 45. This performance test uses the VA62 reference patterns to test the dynamic operating conditions of the circuits in the receiver or monitor under test. The chart shows which video patterns to use, what to watch for, and which circuits are most likely involved if the receiver or monitor fails a test. It also shows how to "re-enter" the trouble trees using the more subtle symptoms than the six major symptoms covered earlier.

Isolating Main Symptoms

Any of the six main symptoms identified during the performance tests directs you to one of six trouble trees which, in turn, shows you how to isolate the problem to a single functional stage. A completely dead stage is usually easier to isolate than one that simply affects the performance. It does not matter, however, how severe the symptoms are when using the trouble trees; the procedures are the same. You may be able to skip a few of the steps in a particular trouble tree if a severe symptom indicates some of the stages could not be involved.

When isolating functional problems that do not involve dead stages, you must watch for an improvement in the CRT response. While injecting a VA62 drive signal at a test point often returns near-perfect response, some critical circuits may require a waveform unique to a single circuit or brand. There will be a marked improvement in operation, however, compared to the symptom before the VA62 signal was injected.

When you have several symptoms, you need to decide which one to respond to first. You should avoid trying to follow more than one symptom at a time because it is too easy to follow the wrong circuit path when one problem affects another

circuit. Always repair circuit problems in the following order:

1. High Voltage
2. Sweep
3. Sync
4. Video (Luminance)
5. Color
6. Audio

Isolating High Voltage And Sweep Problems

The first trouble tree covers the high voltage and the sweep circuits. Notice that the first step is to measure the high voltage with the HP200 High Voltage probe. This may seem unnecessary, since most technicians listen for the crackle of high voltage when the power is first applied. New chassis, however, don't always give this distinctive symptom because of video safety circuits that kill the CRT beam current for some failures of the vertical or video stages, preventing the electron beam from building a static charge on the CRT face. Second, you not only need to know whether there is any high voltage, but also whether the high voltage is running at the correct level.

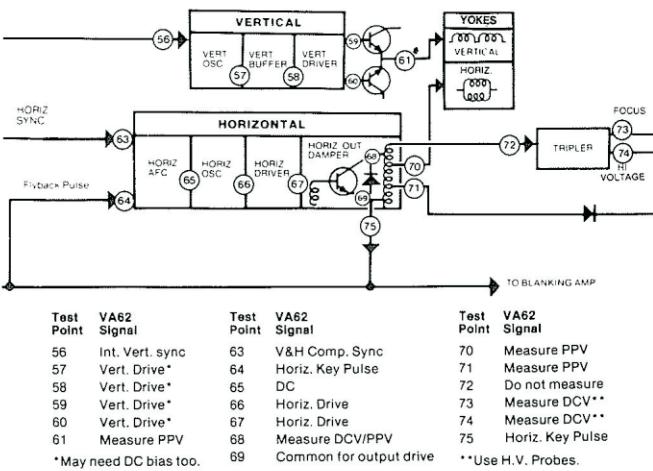


Fig. 46 — Block diagram showing which VA62 signals to inject at each of the test points in the high voltage and sweep circuits.

The VA62 drive signals help isolate problems to any stage up to the output stage. The signals will drive the base of an output transistor, the grid of an output tube, or the gate of an output SCR. If you have driven to this point, and still have problems, you have confirmed that the output stage is the problem. Being able to drive the output side of these amplifiers would give very little additional information, and attempting to add the dozens of signals needed to match all the different output circuits would have needlessly complicated the VA62 operation. Use the following guidelines for the most effective use of the VA62 horizontal drive signals:

1. Use positive drive polarity on any of the horizontal drive signals; XISTOR, TUBE or SCR.
2. The picture may shift horizontally when driving the horizontal stage. This is normal and will not cause damage.
3. In most cases, you are isolating dead sweep stages. Watch for a major improvement, even if there is some distortion, such as foldover.

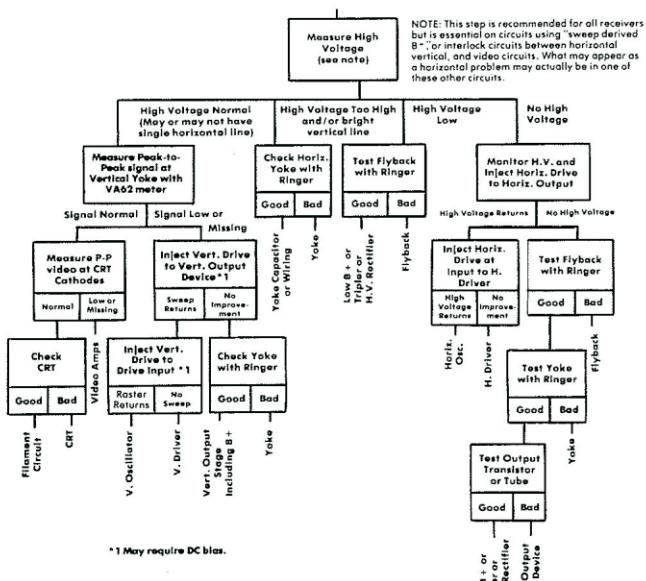


Fig. 47 — High voltage/sweep trouble tree.

4. Use a larger drive signal if you do not know the correct amplitude of a tube grid signal because underdriving the Class C output can cause the tube to draw excessive current.
5. Do not drive the output device for more than a few seconds if you have not tested the yoke or flyback because they may load the output if bad.
6. Only drive the *retrace* SCR or TRIAC of an SCR or TRIAC output. The *trace* device must be turned on by the timing of the coils and capacitors in the circuit.
7. Do not attempt to drive a gate-controlled-switch (GCS) in Sony receivers. Output stages using a GCS require the manufacturer's recommended troubleshooting procedures to reduce the chance of damaging a good GCS.

Once you have isolated a problem to the output stage, you must begin testing components. The VA62 RINGING TEST lets you test the deflection yoke or horizontal flyback transformer. The drive signals and digital meter allow accurate testing of high voltage triplers and integrated flyback transformers that have the tripler built in. Complete details are found in the section entitled "Yoke, Flyback, and Tripler Testing" on page 43. This information, coupled with the DC and AC voltage measurements, allows you to effectively isolate sweep problems.

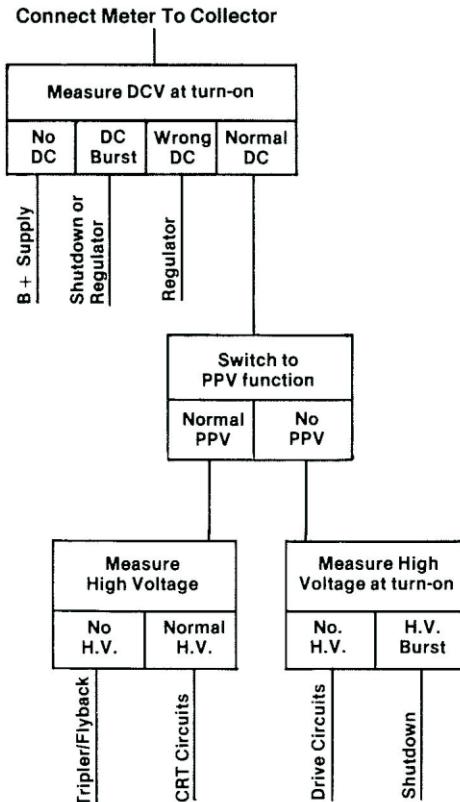


Fig. 48 — Use the 2000 volt capability of the VA62 meter to determine whether a problem is in the startup, shutdown, or output stages.

- WARNING

The following test requires a meter protected to at least 2000 volts DC plus peak AC. Do not use a general purpose meter in place of the VA62 meter.

Connect your DC voltage probe to the collector of the horizontal output transistor *without power applied to the receiver*. Connect the common meter lead to the power supply common point for the horizontal output stage (the "hot" ground in hot-ground/cold-ground systems). Then, watch the meter as you apply power. You will see one of four different conditions, as shown in the trouble tree. The trouble tree procedures correctly isolate the problem to one of the seven general circuit areas shown.

Additional isolation of startup, regulator, or shutdown problems requires the use of an isolated adjustable AC power supply, such as the Sencore

"Powerite"®. You must reduce the AC power supply voltage to a point below the operating voltage of the DC voltage regulator for the horizontal output stage. Then, you can isolate specific problems. The trouble tree for these circuits is shown in Fig. 49.

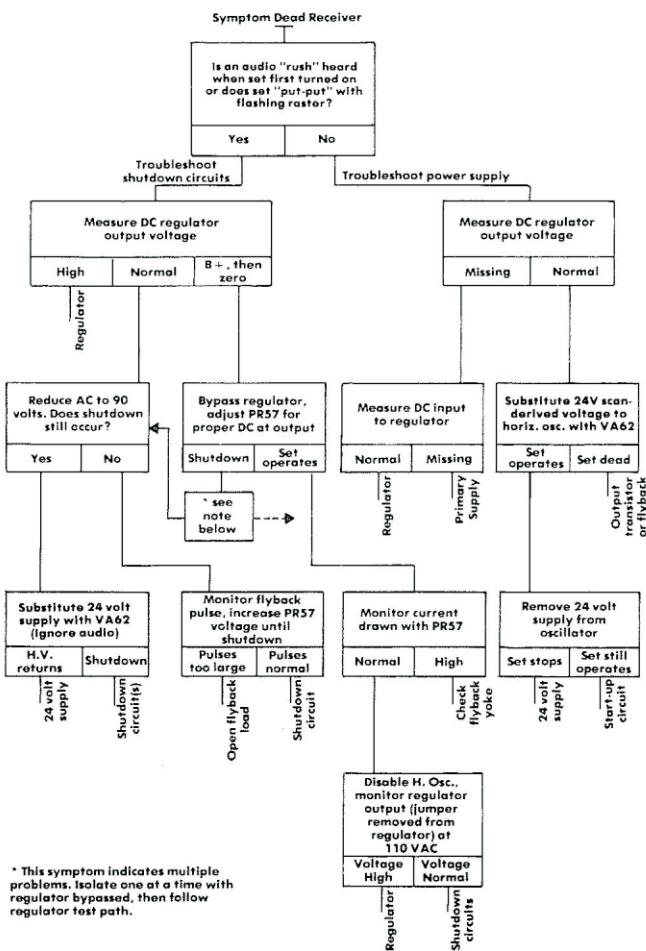


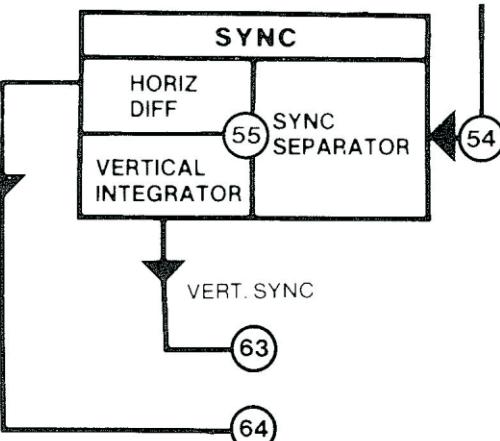
Fig. 49 — The use of an isolated, variable AC power supply isolates any startup or shutdown trouble.

Vertical Sweep

The direct-coupled (DC) transistors of the vertical circuits require special procedures if a defect causes the DC bias voltages to change. You may need to use the VA62 DC POWER SUPPLY to replace the bias voltage before you can feed an AC drive signal through the stage. See the section entitled "Special Power Supply Applications" on page 55 for details.

Each vertical output stage requires a different waveshape for complete vertical sweep or linearity. This is especially true of solid-state output stages because the critical part of the input signal is the current waveform rather than the voltage waveform. The VA62 vertical drive signal produces a waveshape that is a good approximation of all the different driving waveforms normally found in the circuits. There may, however, be compressed linearity in some circuits. Watch for an improvement in the vertical signal, rather than perfect linearity and full screen deflection.

Fig. 51 shows how to isolate any problem to a single stage. Remember that sync troubles could be caused by compression of the sync pulses in the video IF or video detector, as indicated by the trouble tree path ending with "I.F. Stages". This type of compression may be intermittent, and only takes place during weak or strong signal level conditions which change the gain of the AGC controlled stages. Therefore, remember to try different RF signal levels if the sync problem does not show up during testing at normal levels. Follow the "Poor Video" trouble tree (page 39) through the IF stages to isolate the cause of sync compression, using the sync symptom as your guide rather than a video symptom. Remember that some vertical problems may only appear when the sync signal is interlaced or non-interlaced, but not in the opposite mode. Be sure to use both VA62 sync modes to confirm the vertical circuits lock to both types of vertical sync.



Test Point	VA62 Signal
54	Video Pattern
55	V&H Comp. Sync.
63	Int. Vert. Sync.
64	V&H Comp. Sync.

Fig. 50 — Block diagram of the sync circuits showing which VA62 signals to use to isolate a problem.

The right-hand branch of this tree takes you through the AFC circuits that control the frequency of the horizontal oscillator. Note that the DC POWER SUPPLY is used to test for automatic correction response. Injecting the DC voltages *will not* provide complete synchronization of the horizontal oscillator because you are injecting in the middle of a closed loop and bypassing the loop's normal correction feedback. You should, however, be able to cause the frequency of the horizontal oscillator to change (as indicated by changes in the direction of the diagonal lines on the screen) by changing the DC voltage level above and below the normal DC voltage shown on the schematic. Careful adjustment of the voltage should almost bring the oscillator into sync. Details on using the DC power supply for this application are found in the section entitled "Special Power Supply Applications" on page 55.

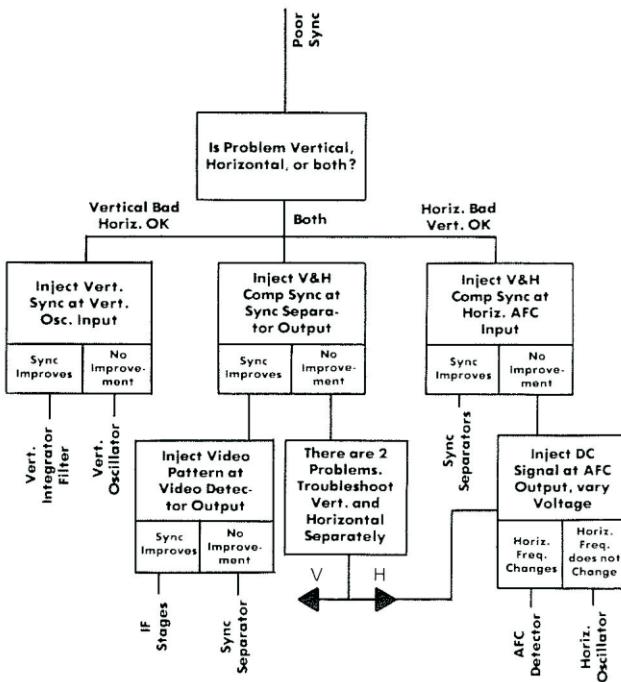


Fig. 51 — The trouble tree for sync problems.

Isolating Video Problems

It is tempting to skip injecting the VIDEO PATTERN signal at the video detector when isolating video problems. *Don't do it.* The biggest trouble with video problems is that you can never be certain if the problem is in the video amplifiers or the IF amplifiers until you divide the circuits in half, at the video detector, with the VA62 drive signal.

If injecting the VIDEO PATTERN signal at the video detector corrects the problem, you have confirmed that the problem is in the RF or IF stages rather than in some stage after the video amplifier. Notice that the first injection step in the IF section jumps all the way back to the tuner link cable, rather than dividing the IF stages in half as you might expect to do. This provides your best effectiveness for two reasons. First, you are dividing the tuner from the IF stages to confirm that the problem is not actually a tuner problem. Second, the IF input cable provides a fast and easy method to inject the signal, compared to trying to inject at the test points in the second or third IF stages.

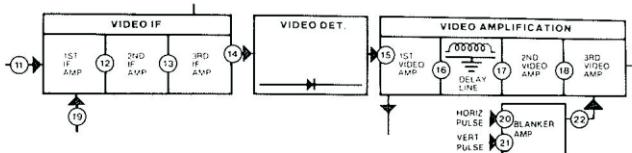
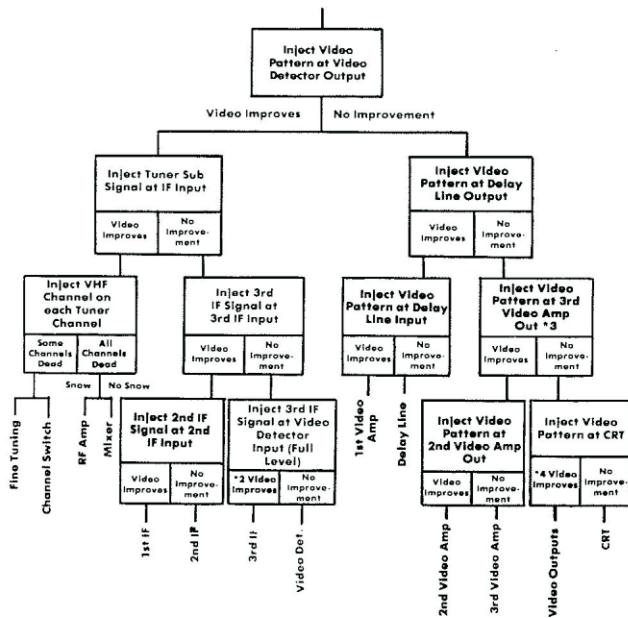


Fig. 52 — Block diagram of IF and video amplifiers showing which VA62 signals to use to isolate a problem.

Remember that the AGC circuits should control the gain of the signal injected at the input of the first IF

stage. (They usually do not control the second IF stage and rarely if ever control the third stage.) Run the VA62 signal level up and down to confirm that the trouble is not an AGC problem. This is especially important before condemning the tuner. An AGC problem can affect the tuner and IF stages in such a manner that it appears that the tuner *must* be bad. Therefore, never test an AGC-controlled stage at just one signal level.

Note that one part of the trouble tree indicates you can inject the IF signal at the video detector input by setting the RF-IF LEVEL switch to the "HI" position and the RF-IF LEVEL VERNIER to the "5" position. The impedance of the detector, however, is relatively low, and this injection may result in a picture with weak contrast or brightness. Your main concern is that the picture improves when injecting at this point, although the improvement may be marginal.



*2 May be snowy or have poor contrast.

*3 Not found in all receivers.

*4 May show retrace lines and high background level.

Fig. 53 — The trouble tree for video problems.

NOTE: Always use the supplied 39G72 matching balun to inject signals into any stage after the IF input. The balun matches the impedance of the generator to the circuits and also blocks DC to prevent loading of bias points.

Use the correct video pattern to isolate a video problem other than a completely dead stage. The three most helpful patterns are the 10 BAR STAIRCASE pattern, the MULTIBURST BAR SWEEP, and the DOTS pattern.

The 10 BAR STAIRCASE pattern helps isolate problems related to brightness or contrast. A properly operating video system should produce 10 distinctive bars, graduating from black to white as you move from left to right on the CRT. (Be sure to adjust the *brightness* and *contrast* controls for best response because they affect the dynamic range of the video stages.) A dynamic range problem will cause two or more of the bars to blend together into a wider bar with a single intensity. Remember that

dynamic range problems are almost always related to a DC problem such as a bad power supply, open bias resistor, shorted coupling capacitor, or DC leakage in a transistor or tube.

The MULTIBURST BAR SWEEP is used for testing AC problems related to restricted frequency response (such as lack of detail) or problems related to overshoot on transitions between bright and dark picture areas (such as harsh edges or white lines around objects). The MULTIBURST BAR SWEEP and the CHROMA BAR SWEEP also provide a dynamic test of the comb filters used to separate the chroma from the luminance information in high resolution video systems. See the section entitled "Servicing Comb Filters" on page 52 for details. Remember that AC problems are usually related to reactive components, such as capacitors, peaking coils, or delay lines.

The DOTS video pattern lets you isolate a few problems relating to smearing to the side of bright objects. Watch for trails of light in the black area to the right of individual dots when isolating a smear problem. Smear can be caused by either an AC component (such as a decoupling capacitor or peaking coil) or DC problem (such as a leaky transistor or IC).

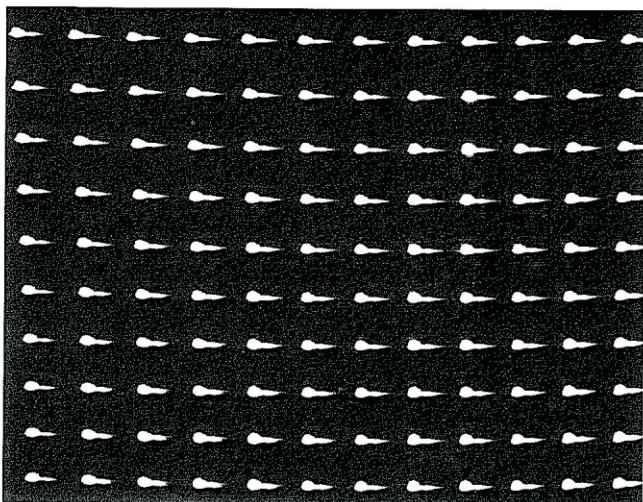


Fig. 54 — The DOTS video pattern is often helpful in identifying problems related to video smear. Here you see the smear forming tails to the right of the dots.

NOTE: The DOTS pattern or the vertical lines of the CROSSHATCH pattern may disappear if the IF stages or video amplifier stages have a loss of high frequency response. You may be able to force the dots or lines through the stage by widening them with the DOT SIZE control, but you should use the MULTIBURST BAR SWEEP pattern to find the cause of the restricted frequency response.

Alignment of the IF traps and bandpass coils often corrects video problems involving sensitivity, frequency response, or ringing. Details on performing IF alignment are found in the section entitled "IF Alignment" on page 57. Be careful with alignment. Too many technicians try to align an IF stage that has a defective component and then blame the alignment procedures or the VA62. You cannot align

troubles out of a stage that has a defect. The results can be a badly misaligned IF section along with the original defect—a doubly troublesome set of conditions. Use functional analyzing to isolate the trouble to a specific stage first.

You can sometimes use alignment to help confirm a stage has a problem, but only if you turn the questionable coils a short distance (less than one turn) and then return them to their original setting. *The only things that cause severe alignment change are replacing a major component (such as a capacitor or coil) or someone trying unsuccessfully to align the stage.* Otherwise, a stage should only require minor touch-up alignment.

Use the VIDEO PATTERN drive signal to substitute for signals after the video detector. Most injection points will return a near-perfect signal to the CRT if you are injecting after the trouble. There are two normal conditions to watch for. First, you may see the pattern shift horizontally when injecting, especially when injecting after the delay line. This is normal since the VA62 signals are in phase with the video detector signal rather than delayed by the video amplifier stages or delay line. Second, you may see retrace lines when you are injecting in any stage after the blanking pulses are added to the composite luminance signals. This is to be expected because the low impedance of the VA62 drive circuits swamps out the signal that is present in the circuits, including any added blanking signals. Do not worry about the retrace lines unless you are troubleshooting retrace problems. If so, you should use blanking signals (HORIZ KEY PULSE for horizontal or VERT SYNC, INTEGRATED for vertical) rather than the VIDEO PATTERN signal for signal substitution.

Isolating Color Problems

There are two overall color symptoms to work with; no color or wrong color. Each symptom has its own trouble tree to keep the number of steps in each tree manageable. First, let's approach the "no color" condition.

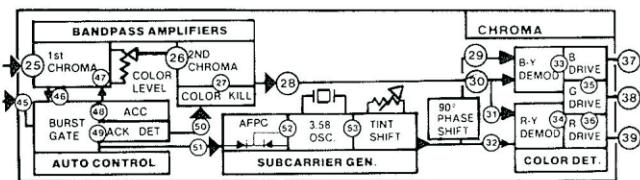
No color:

It may help to think of the color circuits as a small receiver tuned to 3.58 MHz inside the main receiver. As when we troubleshoot the overall receiver, we need a reference signal to keep the good circuits in sync while we substitute signals one at a time to isolate the bad stage. The VA62 separates the 3.58 MHz drive signal from the other drive signals in order to provide this reference. Let's see how this helps.

When everything is operating correctly, the first chroma bandpass amplifier feeds signals in two directions; to the color level control (and later bandpass amplifiers) and to the burst gate. If a problem develops in one of the two paths, we can return color by injecting the VA62 drive signals at a point after the defect. The signal from the antenna comes through the second (good) signal path and

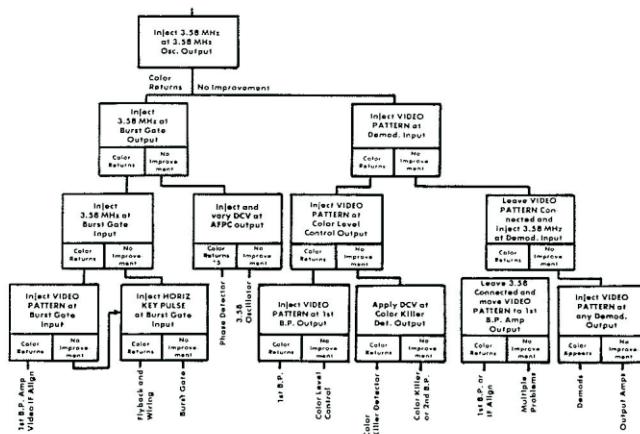
combines with the phase-locked VA62 drive signal to produce color.

If, on the other hand, *both* signals are affected, substituting at any point in the color circuits will not return color because *both* signal paths must have the correct signal in order to supply the color demodulators with the signals they need to detect color. The VA62 supplies the 3.58 MHz DRIVE through a separate level control and a separate output jack than the other drive signals. Thus, we can feed the 3.58 MHz signal at selected points in the receiver's color oscillator path, or we can feed the VIDEO PATTERN drive signal at selected points in the bandpass amplifier path, or we can feed both paths at the same time. The trouble tree shows when and how to do this.



Test Point	VA62 Signal	Test Point	VA62 Signal	Test Point	VA62 Signal
25	Video Pattern	33	Video Pattern	46	Video Pattern
26	Video Pattern	34	Video Pattern	47	DC
27	DC	35	Video Pattern	48	3.58 MHz
28	Video Pattern	36	Video Pattern	49	3.58 MHz
29	3.58 MHz	37	Video Pattern	50	DC
30	Video Pattern	38	Video Pattern	51	3.58 MHz
31	Video Pattern	39	Video Pattern	52	DC
32	3.58 MHz	45	Horiz. Key Pulse	53	3.58 MHz

Fig. 55 — Block diagram of the color circuits showing which VA62 signals to use to isolate problems. Note that the VA62 provides a separate 3.58 MHz drive signal in the 3.58 MHz path and the bandpass amplifier path have a common trouble.



* Color will not be in sync.

Fig. 56 — Trouble tree for the "no color" problems.

The first trouble tree steps (following the "color returns" path) may seem incorrect because you are substituting the continuous wave 3.58 MHz signal in place of the color burst that should be at the burst gate output. This is not a problem, however, since the phase correcting circuits work equally as well with a continuous signal as with a 9-cycle color burst. The same thing applies when injecting the signal at the burst gate input. If the burst gate works, the horizontal keying pulse simply opens for a short period after horizontal sync and takes a "bite" out of the CW signal. If color returns, switch to the VIDEO PATTERN drive signal and see if the

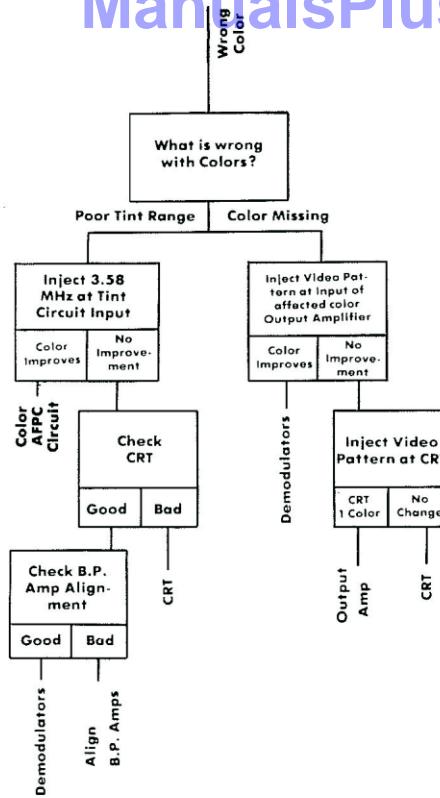


Fig. 57 — Trouble tree for the "wrong color" problems.

color remains. If so, you know the burst gate is capable of separating the color burst from the composite video signal, and the problem is in an earlier stage. If not, the trouble tree loops over to the second test of the burst gate involving the flyback pulse.

The path for "No Improvement" under the first "Color Returns" path involves the use of the DC POWER SUPPLY to test the automatic phase correction circuit. Remember that any time you are breaking an automatic feedback loop with the power supply, the operation changes but will not be totally normal because you have bypassed the corrective feedback. In the case of the AFPC test, this means the DC voltage allows you to change the amount of color rainbowing, indicating a change in oscillator frequency, but will not produce a locked color pattern. See "Special Power Supply Applications" on page 55 for details. You may need to bypass the color killer (by turning the internal color killer control to the fully "unkilled" position or by grounding a test point called out in the service literature) to let the unsynchronized color pass through the bandpass stages.

The only special notes for the branches on the right-hand side of the tree involve the areas requiring two signals to be injected at the same time. The antenna cable must be left connected (even though you are injecting a second reference into the color circuits) because the VA62 must keep the horizontal, vertical, and luminance circuits operating normally while substituting the color signals.

Wrong color:

There are two conditions that will cause the picture to have incorrect colors; incorrect chroma circuit

phase response or a color that is missing after demodulation. There can be some confusion between the two symptoms because the "missing" color may just be weak, and cause the tint to appear to shift toward one end of the color spectrum, just like a phase problem. Generally, however, this type of problem causes color contamination in the steps of the 10 BAR STAIRCASE video pattern. Always use this pattern first when isolating color problems. (See "Adjusting Color Setup Controls" on page 51 for procedures on using the VA62 patterns to set color tracking adjustments). Use the CHROMA BAR SWEEP pattern to isolate problems related to the color detector circuits.

The VA62 helps you isolate problems after the chroma demodulators as you inject the VIDEO PATTERN drive signal into the various output amplifier stages. You must remember, however, that you do not get all the colors when injecting after the demodulators because you are substituting into only one of the three color stages at a time. Thus, if you inject at the red driver, the screen of the CRT should turn completely red. Similarly, injecting at the blue or green drivers will result in a blue or green screen. The main thing you are looking for is the point where the signal is interrupted, so the single-colored screen should not be of too much concern. Also remember that the signals from the VA62 do not have blanking pulses, so it is normal for the screen to show retrace lines when injecting after a point that would normally have blanking pulses. Do not worry about the retrace lines unless you are tracing a blanking problem.

Isolating Audio Problems

The VA62 has audio signals that may be injected at the antenna terminals, in any video IF stage ahead of the 4.5 MHz sound takeoff circuit, through the 4.5 MHz sound IF amplifiers, and at any point after detection. You should hear a tone at the speaker output (if you have the volume control turned up) when using a modulated VA62 signal. The FM audio detector is the best place to begin isolating audio problems because it is approximately in the center of the audio circuits. Beginning your injection at this point breaks the circuits between the modulated and the detected signals.

Remember the difference in the way the AUDIO switch controls modulation in the 4.5 MHz FM position of the RF-IF SIGNAL switch compared to the RF or video IF functions. When injecting an RF or video IF signal, the 4.5 MHz carrier is removed when the AUDIO switch is in the "OFF" position, and present with frequency modulation when in any of the positions marked with a frequency. When the 4.5 MHz FM position is selected, on the other hand, the VA62 provides an unmodulated carrier with the AUDIO switch off, and a modulated carrier when one of the frequencies is selected.

Many IC operated audio amplifiers use a DC control voltage to adjust the volume circuits rather than actually routing the audio signal through the volume control. This means you should apply a DC voltage (from the VA62 DC POWER SUPPLY) at

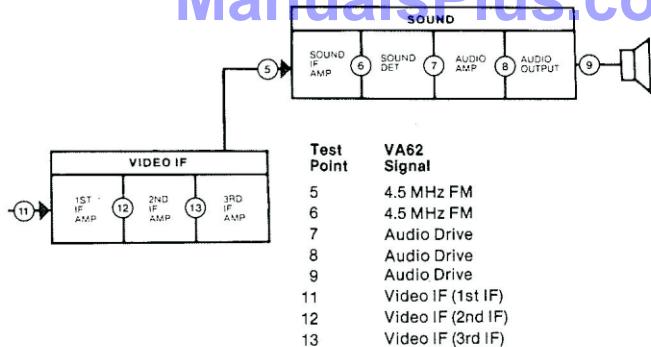


Fig. 58 — Block diagram of the audio circuits, showing which VA62 signals to inject at each test point.

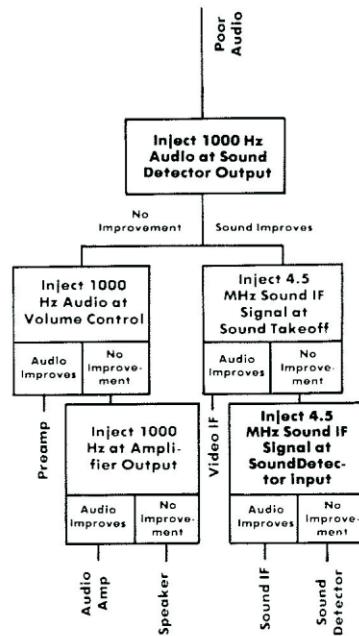


Fig. 59 — Trouble tree for the audio circuits.

the volume control output rather than an audio drive signal. Systems that feed the modulated 4.5 MHz sound IF to the input of an IC and obtain a speaker output from another pin of the IC have little to check. Simply inject at the input with modulated 4.5 MHz and the output (which is the speaker input) with audio drive to determine if the IC is working.

Other systems have replaced the adjustable 4.5 MHz sound IF coil with a fixed-tuned 4.5 MHz ceramic filter. The filter is easily tested by injecting the modulated 4.5 MHz signal at the input and output while listening for a tone at the speaker. If you hear a tone when injecting at the output, but not when injecting at the input, you know the ceramic filter is at fault. These filters are passive devices, so there is no power supply connection to check.

Yoke, Flyback, and Tripler Testing

The VA62 RINGING TEST provides an accurate method to test the coils in a deflection yoke or flyback transformer. This test detects shorted or open windings as well as windings affected by only one shorted turn. In addition to the RINGING

TEST, a special procedure allows a high voltage tripler, or the high voltage tripler section of an integrated flyback transformer (with the high voltage diodes built into the secondary winding) to be dynamically tested. Integrated flybacks should always be tested with the RINGING TEST first to isolate problems in the windings. If the flyback fails the RINGING TEST, there is no reason to apply the tripler test.

The RINGING TEST is much more accurate than attempting to test deflection coils with an ohmmeter. A single shorted turn will cause virtually no change in an ohmmeter reading but will cause the circuit to malfunction. Even one shorted turn will cause the RINGING TEST to indicate bad.

The RINGING TEST gives a good/bad indication (in or out of circuit) based on the number ten. You connect the RINGING TEST leads to the coil, select the RINGING TEST position of the DIGITAL METER switch, and watch the digital meter as you rotate the RINGING TEST IMPEDANCE MATCHING switch through its six positions. If *one or more* of the positions gives a reading of 10 or more (the actual number is unimportant; a test of 20 is no better than one of 12), you call the coil good.

The RINGING TEST is totally reliable because any time the test shows a coil to be "good" you can depend on it being good. A coil that is open or totally shorted will give a reading close to zero in all positions of the RINGING TEST IMPEDANCE MATCHING switch. If any coil of a flyback transformer is shorted (even though it is electrically isolated from the one you are testing) the RINGING TEST will read some number less than 10 in all six of the IMPEDANCE MATCHING switch positions.

There are a few conditions that may cause a good coil to show "bad", but these are rare and covered with a few simple guidelines. A bad coil, however, will never read "good" unless the coil is breaking down (arcing) with voltage applied. If this should happen, you can generally isolate the bad component by listening to and watching the component while the receiver is operating.

The in-circuit test can quickly determine whether the yoke or flyback transformer is the problem in a chassis with a high voltage problem. If the in-circuit test shows good, you know the yoke or flyback is not the problem. If the in-circuit test reads bad, you simply disconnect individual component loads until you either obtain a good reading or else have all the loads disconnected and still have a bad reading. In the first case, you know which circuit is loading the test. Then you can determine if there is a short in that circuit. In the second case, you have confirmed the yoke or flyback to be bad with total reliability so you are certain it must be replaced.

Flyback Tests:

When testing a flyback transformer, you only need to make one set of lead connections to test all of the transformer windings. The connection varies

slightly between tube and transistor receivers, and is covered below. If *any* of the primary or secondary windings are shorted, the winding you made your connection to will read bad. If the winding you have connected to is open, it will also produce a bad reading. If you suspect some other winding is open (because of the circuit symptoms) you simply place a short across the suspected bad winding while you monitor the results of the winding you first connected to. The reading on the digital meter *will drop* if the coil is *good*. The reading *will not be affected* if the winding you are testing with the external short is bad.

How to connect to a tube-type flyback:

1. Disconnect the plate-cap connectors of the horizontal output tube and of the high voltage rectifier.
2. Pull the high voltage rectifier out of its socket to keep the filament (which is powered from a small winding on the flyback) from loading the RINGING TEST.
3. Connect one of the VA62 RINGING TEST leads to the flyback lead that connects to the horizontal output tube plate, and the second lead to the flyback lead that connects to the high voltage rectifier plate.

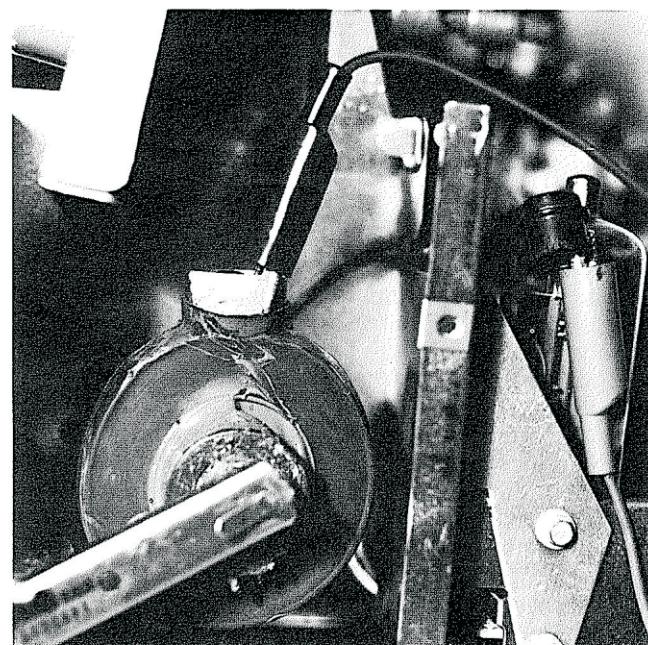


Fig. 60 — Connect between the plate cap of the horizontal output tube and the plate cap of the high voltage rectifier when testing tube operated sets.

How to test a transistorized flyback:

1. Use the schematic of the receiver to locate the winding connected to the collector of the horizontal output transistor. Follow this winding to the B+ power supply for the horizontal output transistor in order to identify the flyback terminal connected to the supply.
2. Connect one of the RINGING TEST leads to the flyback lead connected to the collector of the output transistor and the second lead to the flyback lead

connected to the B+ supply.

3. Move the DIGITAL METER switch to the RINGING TEST position and rotate the RINGING TEST IMPEDANCE MATCHING switch through its six positions, noting the highest reading on the digital meter. If any of the readings is larger than 10, you know the primary of the flyback is good and that none of the other windings contains a short.

4. If none of the positions of the RINGING TEST IMPEDANCE MATCHING switch reads higher than 10, isolate the most likely loading circuits in the following sequence:

A. Unplug the yoke and repeat the test. A bad yoke will often cause the in-circuit test to read bad, but sometimes a good yoke causes a good flyback to test bad because of different matching impedances. Test the horizontal yoke windings to confirm they are good if the flyback tests good with the yoke disconnected.

B. If the CRT filament is powered from a winding on the flyback, disconnect the CRT socket and repeat the test.

C. Disconnect the collector of the horizontal output transistor (usually by simply removing the mounting screws that connect the case to the transistor socket) and repeat the test. If the test now shows the flyback to be good, test the output transistor and the damper diode to confirm that they are not shorted.

D. If there are low-voltage power supplies that are powered from the flyback, disconnect one end of the rectifier diodes one at a time, starting with the lowest voltage supply. It is normal for low-impedance scan-derived supplies to load the test, but you should check for a possible shorted rectifier or other component if the test shows good after disconnecting a load.

5. If the flyback continues to test bad in the circuit after disconnecting these loads, continue disconnecting the individual windings. If the flyback tests bad with all loads disconnected, it must be replaced.

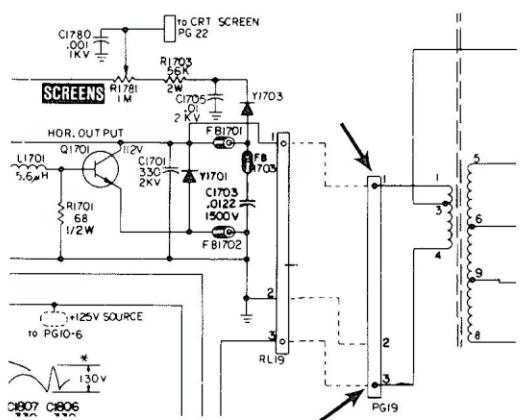


Fig. 61 — Always connect to the winding that connects between the collector of the horizontal output transistor and the B+ supply in solid-state receivers.

Notes on testing flybacks out of circuit:

1. Connect to the same flyback pins used for the in-circuit test and perform the RINGING TEST.

2. Do not lay the flyback on a metal surface, as the metal may affect the flyback the same as a shorted turn.

3. The core and spacers must be in place to test the flyback. If the replacement flyback is the type that comes without the ferrite cores and mounting hardware, be sure to remove them from the chassis and install them into the coils before performing the RINGING TEST.

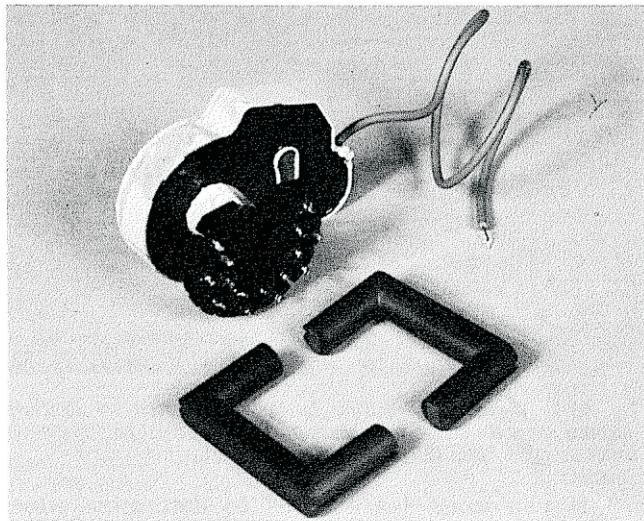


Fig. 62 — The cores and spacers must be installed in a flyback before testing it with the RINGING TEST. If the cores are removed, it will always test bad.

Yoke Test:

The tests of the deflection yoke are very similar to the flyback test just covered. If the yoke is open or has a short, it will show a reading less than 10. If it is good, it will show a reading higher than 10. It is best to test the yoke windings separately. The two vertical windings, for example, should both show the same number of ringing cycles in the same position of the IMPEDANCE MATCHING switch.

Each winding must be individually tested because a short in one of the windings is less likely to couple to the other windings, compared to the closely coupled windings of the flyback transformer. Since there are only three or four windings involved, however, this does not add a great deal of extra bother when the yoke is in question.

Use the following guidelines when testing yokes:

1. Whenever possible, the yoke should be tested while it is still mounted on the CRT. Some yoke failures are dynamic in nature, and the pressure of the yoke mounting hardware is necessary to cause the short. Removing the yoke relieves the pressure which may also cause the short to clear.

2. Sometimes the damping resistors for the vertical yoke are mounted under the plastic covers for the wiring terminals on the yoke. If so, they

must be removed before testing the coil or they will cause the windings to read bad, even if they are good. In other chassis, the damping resistors are in the chassis, and are automatically disconnected from the winding when the yoke plug is disconnected.

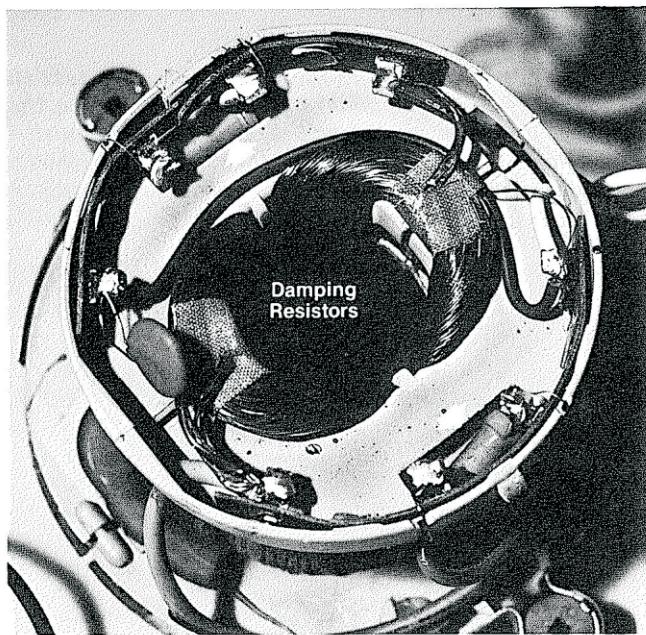


Fig. 63 — The damping resistors for the vertical yoke are sometimes mounted under the plastic yoke housing. If so, they must be disconnected before using the RINGING TEST.

3. If you must trace wires to determine which connectors are for which yoke coils, remember that the vertical windings are located at the sides of the CRT and the horizontal coils are located on the top and bottom of a saddle yoke, or are the toroidal windings of the new toroidal types.

4. Do not test the yoke on a metal surface as the metal may act like a shorted turn and cause all tests to be bad. If the coil must be tested near a metal surface, be sure to separate the coil from the metal surface with at least one inch of non-metallic material such as wood or cardboard.

5. The horizontal yokes found in SCR-drive receivers only read about 8 cycles on the position of the IMPEDANCE MATCHING switch that gives the highest reading. This is generally the only type of yoke that shows less than 10 cycles when good. *There are no known flyback transformers that show less than 10 ringing cycles if the primary winding is used as the test winding.*

Testing Integrated Flybacks

An integrated flyback transformer is a horizontal output transformer that has the high voltage diodes built into the high voltage winding. The integrated flyback can be easily identified. The high voltage lead connects directly from the flyback to the CRT without passing through an external rectifier or tripler.

Two types of failures occur in integrated flybacks. As with any flyback, a winding may become shorted

or open. As with conventional flybacks, the VA62 isolates these problems with the RINGING TEST. The second possible failure is unique to integrated flybacks and involves the combination of the secondary winding and the high voltage diodes. A short in the secondary causes the RINGING TEST of the primary winding to show bad. But an open winding, a shorted diode, or an open diode will not affect the RINGING TEST.

The VA62 provides a simple, effective test of the high voltage secondary circuit. This test isolates problems in the winding or in any of the diodes. It is dynamic in nature for reliable results.

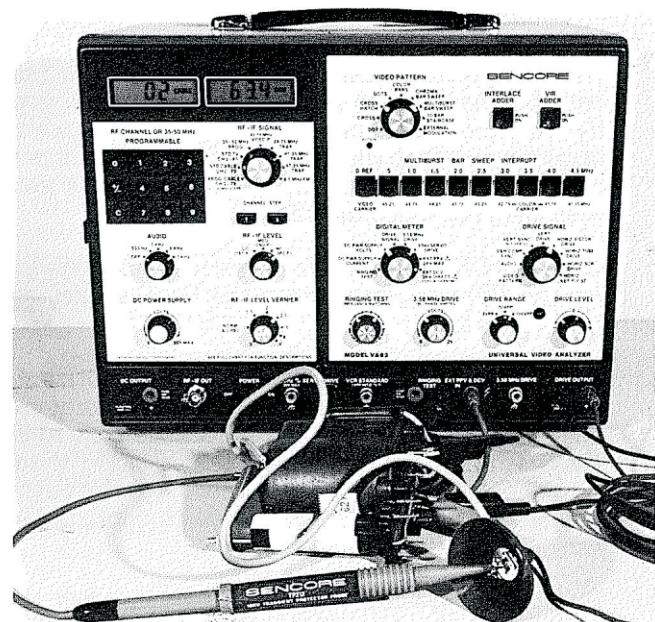


Fig. 64 — Test integrated flybacks by measuring the DC output with the optional TP212 10KV probe while driving the input with a 25 VPP HORIZ. KEY PULSE.

The test involves injecting the VA62 HORIZ KEY PULSE signal into the primary while measuring the DC output at the high voltage lead with the built-in meter. *The (optional) TP212 10 KV Transient Protector Probe must be used to make this measurement to prevent loading of the high impedance secondary circuit.* The ratio of the input to the output voltage level is measured and compared to the normal ratio between the drive signal input and the high voltage output. You will use a 25 volt peak-to-peak input signal so you can use a simple table to determine the normal output voltage for the test. The table is shown in Fig. 65.

The numbers on the left of the table represent the peak-to-peak signal shown on the schematic for the collector of the horizontal output transistor. The numbers along the top of the table show the normal high voltage supplied to the CRT. The corresponding number in the table is the *minimum* DC level that the test should measure at the high voltage connector. A good secondary will read this value *or higher*. A bad flyback will produce a lower voltage.

Be sure you make the connections to the correct pins of the flyback. The drive signal leads must be connected to the leads that connect to the *collector*

of the horizontal output transistor on one end and to the *B+ supply* (for the horizontal output) at the other end.

Collector PPV	CRT HIGH VOLTAGE			
	20	25	30	35
500	1000	1250	1500	1750
700	700	890	1000	1250
900	550	690	830	970
1100	450	560	680	790

Fig. 65 — Use the ratio between the peak-to-peak voltage of the horizontal output transistor and the normal high voltage to determine the DC voltage for the integrated flyback test.

The DC meter (with the TP212 probe) is connected between the high voltage lead (disconnected from the CRT) and its ground connector (the CRT shield wire). When testing the flyback out of circuit, be sure to trace the correct wires. As with the RINGING TEST, be sure the cores and spacers are installed in the flyback if it is tested out of the circuit.

To test the secondary:

NOTE: Do not perform this test unless the flyback has already passed the RINGING TEST.

1. Select the HORIZ KEY PULSE position of the DRIVE SIGNAL switch.
2. Before connecting to the flyback, use the DRIVE SIGNAL function of the DIGITAL METER switch to adjust the DRIVE LEVEL control for an amplitude of 25 volts peak-to-peak, positive polarity.
3. Connect the DCV meter probe (with the TP212 connected) between the high voltage lead and the CRT common point (the lead running to the CRT shield). Select the EXT DCV position of the DIGITAL METER switch.
4. Connect the leads between the DRIVE OUTPUT jack and the primary of the flyback. (CAUTION: Avoid contact with the high voltage leads) Remember that *both* the common lead from the DRIVE OUTPUT and from the EXT PPV & DCV IN connectors must be connected because they are isolated from each other inside the VA62.
5. Read the DC output. *Remember to move the decimal place one position to the right (multiply the reading by 10) to compensate for the TP212.*
6. Compare the DC reading to the table. The secondary and the high voltage diodes are *good* if the voltage is *higher* than the indicated voltage.

Conventional high voltage systems use a voltage multiplier (doubler, tripler, or quadrupler) to convert the flyback output to the high DC voltage needed to operate the CRT. You test high voltage multipliers with a procedure similar to the one used for integrated flybacks.

The DC voltage at the output of a good multiplier, when tested with the VA62, is the multiplying factor, minus one (to compensate for normal circuit losses due to the small duty cycle used and the high frequency involved), times the peak-to-peak value of the signal applied to the input. For example, a *doubler* should produce a DC output *equal* to the peak-to-peak input, a *tripler* should produce a DC output that is *twice* the input, etc.

As with integrated flybacks, the tripler must be tested using the (optional) TP212 Transient Protector Probe. The TP212 increases the DC impedance of the VA62 EXT PPV & DCV IN jack to 150 megohms to prevent loading of the high impedance multiplier output.

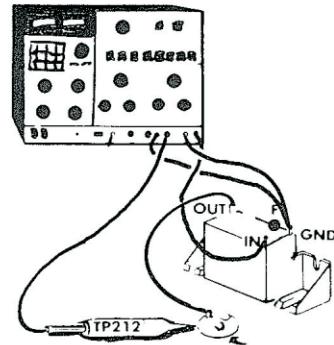


Fig. 66 — Connect the DRIVE OUTPUT to the tripler input and the meter to the high voltage output to test a high voltage multiplier. The DC voltage is one less than the multiplier; a tripler doubles, a quadrupler triples, etc.

Multipliers always have at least three terminals. If there is a fourth terminal, it is for the focus circuits and is ignored in this test. The test involves injecting the VA62 HORIZ KEY PULSE between the input terminal and the common terminal while measuring the DC output between the high voltage lead and the common terminal. Some multipliers call the common point a "DC" or "Reference" terminal while others make the common connection through a metal connector that makes contact to the chassis through the mounting hardware. *Do not* use the terminal marked "control" or "focus" as these terminals connect to the focus circuits. Use the same common terminal connection for the input and the output.

To test a high voltage multiplier:

1. Disconnect the lead running from the flyback to the multiplier and from the multiplier to the CRT.
2. Select the HORIZ KEY PULSE position of the DRIVE SIGNAL switch.

3. Before connecting to the multiplier, use the DRIVE SIGNAL function of the DIGITAL METER switch to adjust the DRIVE LEVEL control for an amplitude of 250 volts peak-to-peak, positive polarity.

4. Connect the DCV meter probe (with the TP212 connected) between the high voltage lead and the common connection on the multiplier. Select the EXT DCV position of the DIGITAL METER switch.

5. Connect the red DRIVE OUTPUT lead to the multiplier input and the black DRIVE OUTPUT lead to the multiplier common point. (CAUTION: Avoid contact with the high voltage leads.) Remember you must connect *both* the common lead from the DRIVE OUTPUT and the common lead from the EXT PPV & DCV IN connectors because they are isolated from each other inside the VA62.

6. Read the DCV output on the DIGITAL METER. Remember to move the decimal one place to the right (multiply the reading by 10) to compensate for the TP212.

7. Compare the DC reading to the table. If the DC voltage is the value shown *or higher* the multiplier is good.

Multiply Factor	Output Voltage
2	25
3	50
4	75

Fig. 67 — A high voltage multiplier should produce these voltages *or higher* when supplying 250 PPV to the input.

AFT Circuits

Performance Testing

There are two types of Automatic Fine Tuning (AFT) problems. First, if the AFT detector is not tuned to the correct carrier frequency, the automatic circuit pulls the fine tuning *off* instead of *onto* the correct frequency. Second, the AFT circuits may not have enough *range* to pull in cable channels that are offset from the normal over-the-air frequencies.

The digitally generated VA62 RF signals provide dynamic tests of both AFT conditions by simply connecting to the antenna. You use the STD TV function of the RF-IF SIGNAL switch to feed FCC-standard channel frequencies into the tuner to confirm the detector is tuned to the correct frequency. A special feature of the PROG CABLE function allows you to test the lock-in range of the system and isolate the second type of problem. Each test is covered separately in the following procedures.

Testing Detector Tuning:

There should be no degradation of the picture when the AFT is turned on after the fine tuning has been properly set with the AFT off. Use any of the VA62 channels to test for this operation.

This test is only performed on non-digital, turret-type tuners because digital tuners do not have a manual fine tuning adjustment. Turret-type tuners may not have a separate AFT switch. If not, the AFT is turned off when you press the fine tuning ring in to adjust the fine tuning for a selected channel.

To test the AFT detector tuning:

1. Turn off the AFT.
2. Set the VA62 RF-IF SIGNAL switch to the "STD TV" position and select a channel on the keyboard that is not used by a local station. Set the TV to the same channel.
3. Set the VIDEO PATTERN switch to the MULTIBURST BAR SWEEP position and confirm all of the MULTIBURST BAR SWEEP INTERRUPT buttons are in the depressed "on" position.
4. Turn the AUDIO switch to the 1 KHz position in order to add a modulated sound carrier to the VA62 signal.
5. Manually fine tune the TV tuner until you have the best possible detail (as shown by separate vertical lines) in the 2.5 and 3.0 MHz bars *and* the least amount of interference from the sound carrier.
6. Watch the CRT as you turn on the AFT.

The video pattern should not become worse; either showing less detail in the 2.5 or 3.0 MHz bar or increased sound beat. If either takes place, the AFT detector needs alignment. Follow the procedures in the section entitled "How to Align the AFT Circuits" on page 49.

Testing AFT Locking Range

The VA62 programmable RF generator includes a special feature that is specifically designed to test the ability of the AFT circuits to lock to a video carrier that is shifted above or below the normal FCC channel frequency. The PROG CABLE function allows the *direction* of the frequency shift programmed into any channel to be reversed without changing the program shift instructions in the microprocessor memory. This feature is part of the RF cable channel functions because proper AFT lock-in is important when the receiver is connected to a cable system that uses offset carriers.

AFT lock-in range is especially important when testing digital tuners that do not have a manual fine tuning control because they must automatically follow the cable-shifted channels. A tuner with fine tuning, on the other hand, can always be re-tuned if the AFT does not have enough range to compensate for the carrier shift.

There are two ways you can perform the test, depending on what information you need. The first method uses a single fixed offset, such as 1 MHz, which you use to check the positive and negative locking ability. This test is the easiest to perform and usually provides the information you need to tell if a receiver will operate over the range of

frequencies normally encountered. The second test is more elaborate, but gives the actual upper and lower frequency locking range of the AFT circuits.

To test over a single preset range:

1. Set the RF-IF SIGNAL switch to the STD CABLE position (the STD function provides a non-shifted signal).

2. Select the same channel on the VA62 and the receiver. Be sure to select a channel that has the desired offset frequency programmed into the VA62 PROG. CABLE memory. The correct frequency shift can be programmed into memory using the instructions on page 17.

3. Set the VIDEO PATTERN switch to the COLOR BARS position. Adjust the receiver fine tuning control for properly locked colors.

4. Move the RF-IF SIGNAL switch to the PROG CABLE position. Confirm that the colors on the CRT remain properly locked. (The digital display will show the same channel as selected in step 2, but the carrier has now been shifted away from the FCC frequency by the amount programmed into memory.)

5. Press the special-function “+/-” key. The digital display will show the frequency shift programmed into memory. (There is no change in the VA62 output at this point.)

6. Press the special-function “+/-” key a second time to reverse the direction of the carrier shift. Make certain the colors on the CRT remain properly locked. (The polarity digit of the digital display will change from a blank to a minus, or from a minus to a blank to show a change in shift direction. The numbers, however, will not change nor is the shift polarity programmed into the memory changed. The RF output shifts direction as often as you press the “+/-” key.)

A change in the color signal indicates the AFT circuits are not following the carrier shift. If desired, you may repeat the test using the MULTIBURST BAR SWEEP pattern while watching for changes in the detail on the individual frequency bars.

To determine the exact range of AFT lock-in:

1. Move the RF-IF SIGNAL switch to the PROG CABLE position and set the VA62 and TV to the same channel.

2. Press the special function “+/-” key. The digital display will show the programmed value presently stored in memory for the selected channel.

3. Enter the first desired frequency shift (remember you must enter three digits, such as 0-2-5 for 0.25 MHz, or 1-0-0 for 1.00 MHz). The display will momentarily blank out and then return to the selected channel number, indicating the carrier has shifted.

4. Check to see the TV picture is still properly locked in.

5. Press the special function “+/-” key. (The

display will show the frequency you just entered. Remember that the microprocessor will round the entered numbers to the nearest 0.25 MHz if you enter a number that is not a multiple of 0.25.)

6. Press the special function “+/-” key again to reverse the direction of the shift. Check to see the TV is still locked in.

7. Repeat steps 2 through 6, using a larger shift frequency each time until the TV fails to follow the shift. Remember that if the TV fails to follow one direction of shift (such as negative) before the other, you do not need to perform step 6 as you continue to shift the frequencies in one direction.

How to Align the AFT Circuits

The VA62 IF generator may be used to align any AFT circuit for optimum operation. You feed the VA62 signal into the same point used for IF alignment. It is a good idea to check the AFT alignment at the conclusion of every IF alignment.

During alignment, you will be referencing the AFT detector to the crystal accuracy of the VA62 generator. You will measure a DC voltage going to the tuner and adjust the detector coil for the same voltage with the AFT circuit turned on and with the AFT turned off. This sets the detector to its most accurate point.

Most AFT circuits have a second or third internal adjustment that affects the lock-in range of the AFT circuit. Circuits with *one* additional adjustment normally use this adjustment to provide an *equal amount* of positive and negative swing around the video carrier. Circuits with *two* additional adjustments usually use one adjustment to affect the positive swing and the other adjustment to affect the negative swing of the detector. Each system uses a similar, but different, alignment procedure. We will start with the one-coil (detector only) system because it is the basis for the other two.

To align the AFT detector:

1. Connect the VA62 RF-IF OUT cable to the input used for IF alignment. (See page 61.)

2. Locate the signal path connecting the AFT detector to the tuner. This may be one or two wires, and may run through a switch (the AFT switch) that is in series or parallel with the circuit.

A. If there is only one wire, connect the common of your VA62 DC meter to ground and the “+” probe to the single line.

B. If there are two wires, connect the VA62 DC meter *across* the two connections at the tuner end of the circuit.

3. Turn the AFT circuit *off* and note the DC voltage fed to the tuner. (It may be zero or some DC value.) This is your reference voltage.

4. Set the VA62 RF-IF SIGNAL switch to the 45.75 MHz VIDEO IF position. Adjust the RF-IF LEVEL switch and the RF-IF LEVEL VERNIER control for a solidly locked picture on the CRT.

5. Turn the AFT switch *on* and note the DC voltage reading. Adjust the detector tuning coil, if necessary, to make the voltage agree with your reference voltage (step 3).

When working with circuits with *two* adjustments, you will first set the detector coil using the preceding procedure. Then, set the second coil for an equal amount of voltage swing (from the reference) when the carrier is shifted above and below the nominal value by a certain amount. Don't let this confuse you. If the reference voltage is zero, you will be looking for an *equal* positive and negative voltage swing. If the reference voltage is *not* zero, you will adjust the circuits for an *equal amount of change* above and below the reference voltage.

To set the second coil of a two-coil system:

1. Set the detector using the preceding procedure. Use the same reference voltage which you found in step 3 of the preceding procedure for the following steps.
2. Switch the RF-IF SIGNAL switch to the "35-50 MHz PROG" position.
3. Select 46.25 MHz (enter 4-6-2-5) to test the circuit 0.5 MHz above the video carrier. Note the DC voltage.
4. Select 45.25 MHz (enter 4-5-2-5) to test the circuit 0.5 MHz below the carrier. Note the DC voltage.
5. Calculate whether the values are approximately equally spaced from the DC reference voltage. If not, adjust the second coil to split the difference.

When working with circuits with *three* coils, you will set the detector using the first procedure. (You will not use any part of the procedure for the two-coil circuits.) The second coil of a three-coil system affects how much the correction voltage changes when the carrier frequency increases from the nominal value, and the third coil affects how far the voltage changes when the frequency decreases from the nominal value.

To set the second and third coils in a three-coil system:

1. Set the detector coil using the first procedure covered. Use the same reference voltage from step 3 of that procedure for the following steps.
2. Use the manufacturer's alignment instructions to determine which coil affects the positive and which coil affects the negative part of the sweep and marker "S" curve.
3. Set the RF-IF SIGNAL switch to the "35-50 MHz PROG" position.
4. Set the generator to 46.25 MHz (enter 4-6-2-5). Note whether the voltage increased or decreased from the reference.
 - A. If the voltage *increased*, adjust the coil that affects the *positive* part of the sweep and marker "S" curve for the *highest* possible reading.

- B. If the voltage *decreased*, adjust the coil that affects the *negative* part of the sweep and marker "S" curve for the *lowest* possible reading.

5. Set the generator to 45.25 MHz (enter 4-5-2-5). Note whether the voltage increased or decreased from the reference (it should do just the opposite of the voltage in step 4).

- A. If the voltage *increased*, adjust the coil that affects the *positive* part of the sweep and marker "S" curve for the *highest* possible reading.

- B. If the voltage *decreased*, adjust the coil that affects the *negative* part of the sweep and marker "S" curve for the *lowest* possible reading.

Adjusting Color Setup Controls

The VA62 video patterns allow you to adjust the controls inside a color receiver or monitor with fewer steps and with better results than with a conventional color bar generator. If you prefer not to use these procedures, the VA62 supplies the signals needed to make these adjustments with conventional methods. You may occasionally need to use conventional procedures if one of the improved VA62 procedures calls for an internal control (such as the color killer sensitivity control) that is not found in some receivers.

Adjusting Purity and Convergence

Use the VA62 patterns with conventional procedures for adjusting purity and convergence. Use the following guidelines to determine which pattern to use for best results:

1. Use the *Crosshatch* pattern for setting the pincushion, size and linearity adjustments *before* adjusting purity or convergence.
2. Use the *Chroma Bar Sweep* for purity adjustments. Obtain a white raster by releasing the 3.0, 3.5, and 4.0 MHz MULTIBURST BAR SWEEP INTERRUPT buttons. Then, turn down the green and blue screen controls to produce a red raster. *Do not* try to make purity adjustments with a white raster because purity error from one gun interacts with the other two to produce white, which may hide true purity errors.
3. Use the *Cross* pattern to center the picture and to rotate the yokes properly.
4. Use the *Dot* pattern to set the static convergence magnets *before* adjusting any dynamic convergence controls.
5. Use the *Crosshatch* or *Dots* pattern as desired for the dynamic convergence adjustments.

Setting the 3.58 MHz Oscillator Frequency

The VA62 eliminates the need for finding the test points and connecting and disconnecting jumpers to adjust the free running color oscillator frequency. You simply adjust the color killer control until the "3.5 MHz" (Color Carrier) bar of the MULTIBURST BAR SWEEP pattern shows a color. The color will *not* usually be locked on the

screen because the Bar Sweep does not have a color burst to reference the receiver's color oscillator. The color oscillator is then adjusted until the "Color Carrier" bar shows a solid color (or a color that changes at a slow rate), indicating the receiver's color oscillator is running at the same frequency as the master oscillator in the VA62.

To set the color oscillator:

1. Feed the "Multiburst Bar Sweep" video pattern to the receiver or monitor. Make certain the 3.5 MHz "Color Carrier" MULTIBURST BAR SWEEP INTERRUPT button is depressed.

2. Adjust the color killer threshold control until the 3.5 MHz bar shows a color (the color will probably not be locked).

3. Adjust the color oscillator frequency control until the 3.5 MHz bar is a solid color from top to bottom. The bar may show a single color or may change colors slowly, but should *not* show diagonal color "barber pole" stripes.

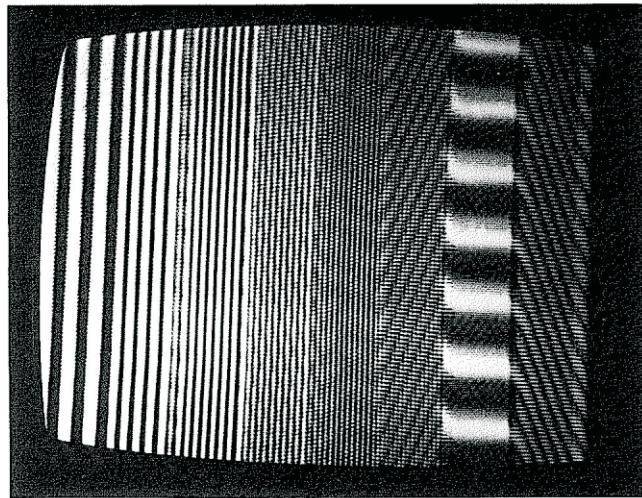


Fig. 68 — Adjust the 3.58 MHz color oscillator in the receiver to eliminate the "barber poling" in the 3.5 MHz bar. The bar should be a solid color from top to bottom, although the color may be changing slowly.

Setting the Color Killer

The MULTIBURST BAR SWEEP video pattern provides a dynamic method of adjusting the color killer threshold (sensitivity) control. The color killer should switch to the B & W mode when no color burst is present on the back porch of horizontal sync. The circuit should switch to the color mode when a color burst signal is present. The MULTIBURST BAR SWEEP pattern does *not* have a color burst, meaning all of the bars should only show shades of grey if the color killer is working properly.

To adjust the color killer:

1. Feed the "Multiburst Bar Sweep" video pattern to the receiver or monitor. Make certain the 3.5 MHz "Color Carrier" MULTIBURST BAR SWEEP INTERRUPT button is depressed.

2. Adjust the color killer control until the 3.5 MHz bar shows a color; then back off the adjustment until the color just turns off.

3. Adjust the RF IF LEVEL VERNIER through its full range of amplitudes to insure the color killer works properly for different signal levels. If necessary, readjust the color killer control to keep the color killed for all signal levels.

4. Confirm that the color returns when you switch the VIDEO PATTERN switch to the "Chroma Bar Sweep" position. If it doesn't, readjust the color killer control slightly until the color killer switches between B & W and color as you switch the VA62 VIDEO PATTERN switch between the "Multiburst Bar Sweep" and the "Chroma Bar Sweep" positions.

NOTE: It is normal for the color killer of some receivers to show a delay of up to 1 second when switching between patterns. Adjust the color killer threshold control to produce the least amount of delay.

Adjusting CRT Color Setup Controls

The VA62 "10 Bar Staircase" video pattern provides a reference for adjusting the color tracking controls (the "screen" and "drive" controls) without the need of using the "setup" switch or an off-the-air signal. Using the VA62 to adjust color tracking produces better results than other procedures because the CRT is operating normally during the adjustment of the controls.

The "screen" controls affect the brightness levels. They must be adjusted for equal amounts of each color (Red, Green, Blue) during peak whites so that a white picture element does not show color contamination. Increasing the setting too far, however, causes the CRT to be over-biased during black picture elements, which results in color contamination in dark picture elements.

The "drive" controls affect the amplitude of the video signal applied to the CRT. These controls affect the balance of the three CRT colors on brightness levels between white and black. Setting these controls with an off-the-air signal is often difficult because the picture usually doesn't contain all the shades of grey needed for correct alignment.

To set the color tracking controls:

1. Connect the VA62 to the antenna terminals and select the "10 Bar Staircase" position of the VIDEO PATTERN switch.

2. Turn all of the CRT "screen" and "drive" controls to minimum. Adjust the front-panel "brightness" and "contrast" controls to the normal viewing position (generally the 50% level).

3. Turn up the red "screen" control until the black bar on the left of the CRT just begins to show red background lines. Turn the control back down until the red background lines just disappear.

4. Repeat step 3 for the blue and the green "screen" controls.

5. Readjust the "screen" controls slightly until there is no red, green or blue tint in the white bar on the right of the screen. For example, if the white bar shows a red tint, reduce the red screen control

setting slightly.

NOTE: Do not worry if any of the bars in between the white and black levels show a color. This is corrected in the next step.

6. Look at the grey bars in the center of the screen. If they have a color tint, adjust the "drive" controls until the center bars show no color. Most Receivers have adjustments for only two of the CRT guns; the third usually runs wide open.

NOTES:

1. Readjust the appropriate "screen" control(s) if the white bar becomes tinted while adjusting the "drive" controls.

2. Readjust the appropriate "screen" control if adjusting one of the "drive" controls causes colored scan lines in the black bar.

3. Test the CRT for color tracking with a CRT tester if the screen shows color in any of the bars after carefully adjusting all of the color balance controls. Restore or replace the CRT if the tester shows poor color tracking.

Comb Filter Adjustments

The VA62 patterns are properly phase-locked for testing and aligning the comb filters used in high-resolution TV receivers and monitors. All of the bars in the "Multiburst Bar Sweep" pattern are phased as luminance signals *except* for the "3.5 MHz" (Color Carrier) bar. All three of the Chroma Bar Sweep bars are phased as chroma signals, but the white edges form luminance signals.

There are two basic comb filter designs: the glass delay-line type and the charge-coupled-device (CCD) type. Each requires a different procedure because of differences in circuit operation. Use the manufacturer's procedures directly when aligning a CCD comb filter. Use the following procedure when adjusting the controls associated with a delay-line comb filter:

1. Feed the VA62 signal into the antenna or IF input. Adjust the receiver for proper reception of the signal.

2. Connect your scope to the comb filter output that leads to the *luminance* (video amplifier) circuits.

3. Set the VA62 VIDEO PATTERN switch to the "Chroma Bar Sweep" position. Confirm that the 3.0, 3.5, and 4.0 MHz MULTIBURST BAR SWEEP INTERRUPT buttons are depressed.

4. Adjust the coil and/or resistor in the luminance circuit path until the center (3.5 MHz) bar of the pattern is reduced to the smallest amplitude possible as shown on the scope.

5. Move the scope to the comb filter output that feeds the chroma circuits.

6. Move the VIDEO PATTERN switch to the "Multiburst Bar Sweep" position.

7. Adjust the coil and/or resistor in the chroma

circuit path until the 3.0 MHz bar of the pattern is reduced to the smallest amplitude possible as shown on the scope.

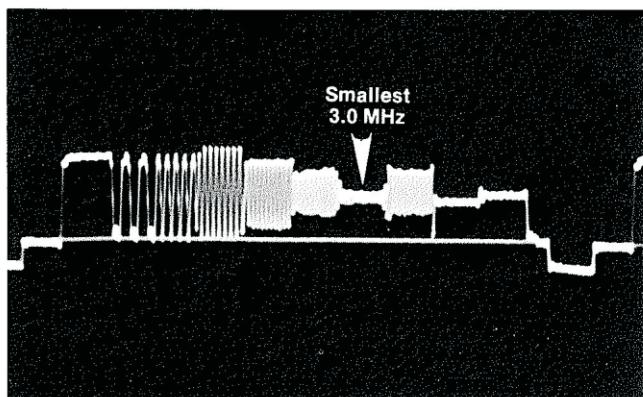
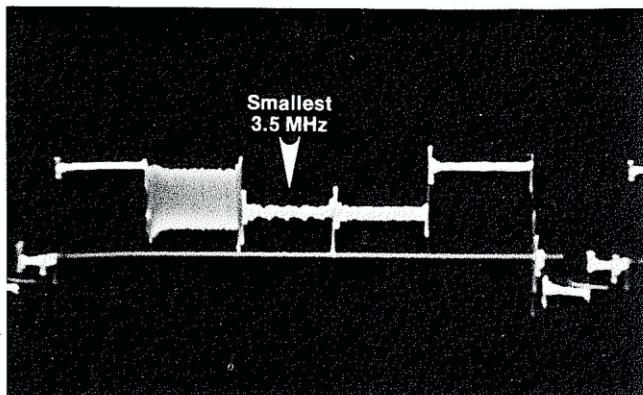


Fig. 69 — (A) The comb filter's luminance controls are adjusted for the smallest amplitude 3.5 MHz bar in the Chroma Bar Sweep video pattern at the luminance output. (B) The chroma controls are adjusted for the smallest amplitude 3.0 MHz bar in the Multiburst Bar Sweep video pattern at the chroma output.

VIR Circuits

The VIR ADDER inserts a standard Vertical Interval Reference (VIR) signal on line 19 of the vertical sync interval of any of the internally generated video patterns. The VIR signal *cannot* be added to a signal supplied to the external modulation jack, even if it comes from a Sencore accessory unit. The added VIR signal causes VIR-controlled tint and chroma level circuits to operate in a dynamic fashion for testing, troubleshooting, or aligning.

Performance testing is done by observing the CRT and watching for changes in color as the VA62 VIR signal is alternately turned off and on. The VIR circuits should bring the tint and color saturation to the correct values.

If the performance tests indicate problems, troubleshooting is done in two steps. First, you must determine if the problem is in the VIR controller circuits or in the color circuits controlled by the VIR stages. This is done with the DC POWER SUPPLY in the same way other automatic circuits are tested.

If the trouble is in the VIR circuit, a dual-trace scope is used to compare the timing of several pulses to the reference points on the VIR signal.

You then troubleshoot the pulse circuits or the sampling circuits, depending on where the problem is.

The VIR circuits cannot do their job of properly controlling the color if the conventional (non-VIR-controlled) circuits do not work properly. Therefore, the VIR performance test starts with the VIR circuits turned off. If the conventional circuits work properly, the VIR circuits are turned on for additional testing.

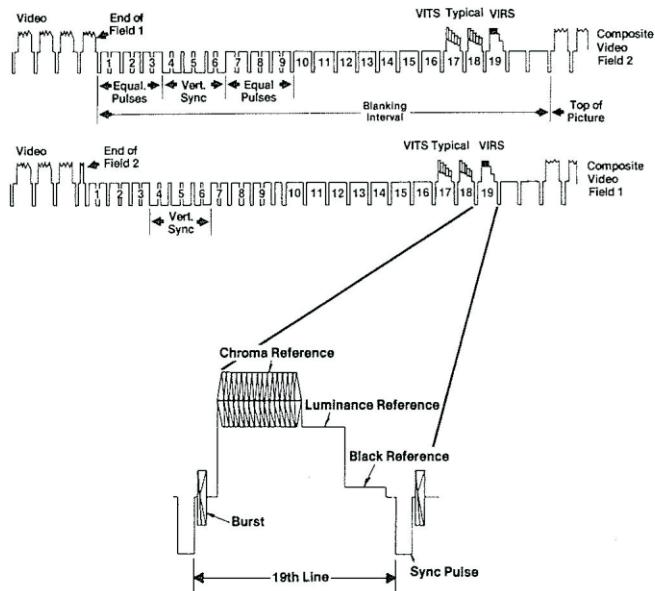


Fig. 70 — The VIR signal, on line 19 of the vertical interval, consists of a chroma reference and a luminance reference signal. It can be used to control the setting of the receiver's color controls because it receives the same amount of phase and amplitude distortion as the color information in the picture.

To test the conventional stages:

1. Supply the VA62 "Chroma Bar Sweep" pattern to the TV receiver.
2. Turn the TV VIR switch and the VA62 VIR ADDER off.
3. Observe the CRT as you adjust the tint and the color level controls through their full range.
 - A. The *tint* control should shift the center bar from bright blue to bright green, with cyan (50% blue, 50% green) near the center of the control's rotation.
 - B. The *color level* control should cause the color intensity to change from zero (no color) to over-saturated.
4. Set the tint and color level controls to the normal (midrange) positions.

NOTE: Some VIR receivers only respond to a fully interlaced signal. Therefore, turn on the INTERLACE ADDER when performing the following tests.

5. Leave the VA62 VIR ADDER switch off, and turn on the VIR switch on the receiver. The VIR indicator light on the TV should *not* come on, and

there should be *no change* in the tint or color intensity on the CRT.

6. Set the user-preference VIR tint and color level controls (*not* the manual controls) to mid-range.
7. Turn on the VA62 VIR ADDER.
 - A. The VIR indicator light should come on.
 - B. The center bar of the pattern should be cyan. If it changes from the manually set tint, it should improve rather than get worse.
 - C. The color intensity should be normal.

8. With the TV VIR switch on and the VA62 VIR ADDER on, adjust the manual (non-automatic) tint and color level controls. There should be *no change* in the colors.
9. With the TV VIR switch on and the VA62 VIR ADDER on, adjust the user-preference VIR tint and color level controls. The tint and color level *should* change. Most VIR user-preference controls have less range than the manual (non-automatic) controls.

Isolating VIR Troubles

If the receiver failed the first part of the test (with the VIR circuits turned off), you must troubleshoot the main color stages using conventional troubleshooting techniques. The VIR circuits will not work properly if there are problems in the main color circuits.

If the manual color controls work correctly, but the receiver does not work properly with VIR, you must begin dividing the stages. Use the following troubleshooting sequence: 1. Confirm the VIR circuits detect the VIR signal, 2. Isolate the VIR controller from the controlled color circuits, 3. Confirm the pulses needed to reference the VIR circuits have the correct amplitude and timing, and 4. Troubleshoot the VIR detecting and memory circuits. This sequence *must* be followed because each stage depends on the previous stage for operation.

VIR Detector

The best indication that the VIR detector works is the VIR indicator light. The light should come on and go off as you turn the VIR signal on and off at the VA62. (Remember that some receivers require interlaced sync for VIR operation.) If the detector is not working, insure that the vertical, horizontal, and video signals needed to run the detector are correct by injecting the correct substitute signals from the VA62. If the detector still does not operate, substitute for the detector output with the DC POWER SUPPLY. (The detector output is usually a DC-controlled circuit that is separate from the DC-controlled circuits that control the tint and color level stages.) You know the detector is the problem if you can force the VIR circuits to operate with the substitute control signal. The problem is in the circuits operated by the detector if you cannot force the mode change. (NOTE: See the section "Confirm Pulses are Present" below.)

Troubleshoot the VIR Controller

With the VIR detector working, you must decide whether the problem is in the VIR controller or in the color circuits controlled by VIR. Use the same troubleshooting techniques you would for any automatic circuits; substitute for the DC control voltage using the DC POWER SUPPLY. First, determine whether the problem is in the tint control circuit, the color level control circuit, or both. Then inject a DC voltage at the VIR detector output, feeding the tint or color level circuits at the normal operating voltage. Raise and lower the voltage while you observe the operation on the CRT. There should be a noticeable change. If there is, you know the color circuits are operating, and you must troubleshoot the VIR circuits. If, on the other hand, there is no change, you know you must troubleshoot the color circuits.

Confirm Pulses are Present

If your DC voltage testing proves that the problem is in the VIR circuits, start by checking that the pulses needed to operate the VIR detectors are present and are of the correct timing and amplitude. You will need to use a dual-trace scope for this. There are generally three pulses needed to operate the VIR circuits: The first one is present for the entire horizontal line that contains VIR, the second is present during the VIR chroma reference, and the third is present during a black reference; either during the back porch of horizontal sync or during the black reference interval on the VIR signal.

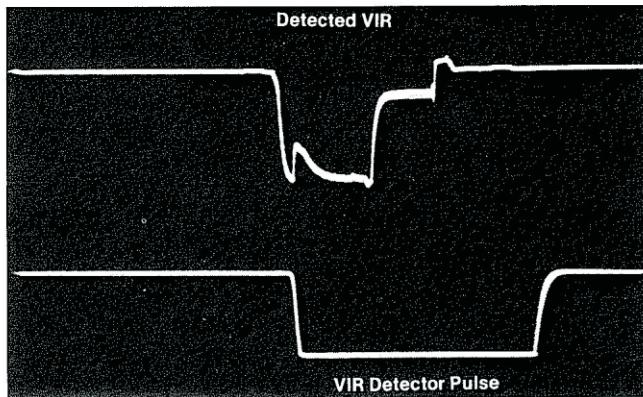


Fig. 71 — The detector pulse must line up with the VIR signal for correct automatic operation.

NOTE: Use the VA62 30 Hz SERVO DRIVE pulse to externally trigger your scope when comparing the timing of the gating pulses with the incoming signals. The 30 Hz signal causes the scope to skip every other sync pulse so the signal in both scope channels come from the same vertical field while the scope is in the dual-alternate mode. If you trigger the scope internally, the scope may trigger from consecutive sync pulses, which puts a half-line shift between the two scope traces and causes the signals to appear to be improperly timed. There will be some noticeable flicker, but the signals should be viewable and easily compared for timing.

The first pulse should line up with the entire line of video information that contains VIR (line 19). If this pulse is missing, the VIR detector may not switch the VIR circuits to the automatic mode.

This pulse is usually formed by a digital counting stage. The stage begins counting horizontal flyback pulses, after detecting vertical sync, until the correct line is identified. If the vertical or horizontal pulses are missing, or if the digital counter is defective, the output pulse may be missing or improperly timed.

The second and third pulses are usually timed in relationship to the first pulse. A fixed delay establishes the starting point for each pulse, and individual pulse-forming circuits determine the pulse duration. One pulse must be timed to coincide with the chroma reference signal in the VIR line. The other pulse must be timed to agree with a black reference point. *NOTE: The timing of these pulses must agree with the VIR signal present at the output of the R-Y or the B-Y demodulators; not the video detector. Delays in the chroma circuits may mean that the VIR detecting pulses must also be delayed.*

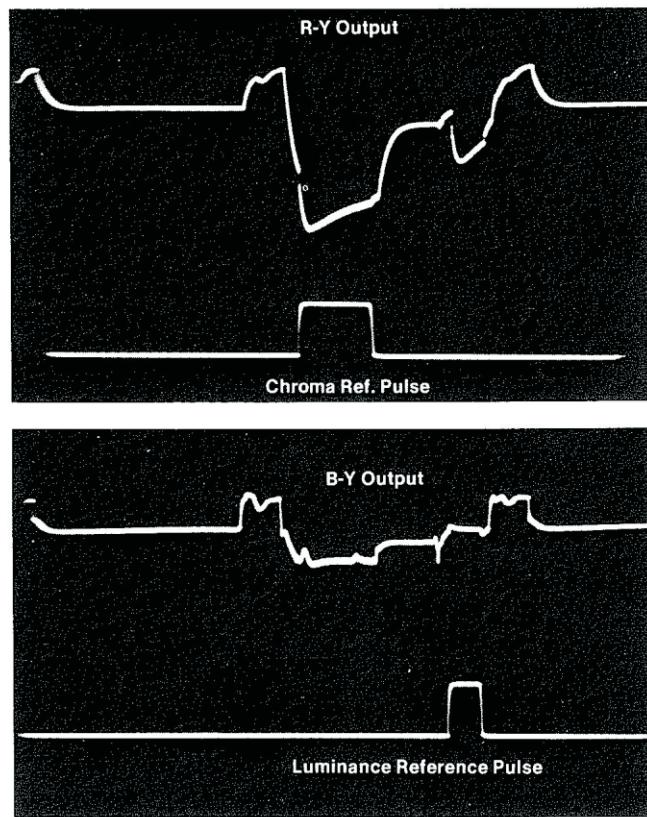


Fig. 72 — The timing of the VIR pulses must line up with the correct areas of the VIR signal. (A) The chroma reference compared to the R-Y output signal. (B) The luminance reference compared to the B-Y output signal.

Troubleshooting the Detectors

VIR circuits have two detectors; one for the tint circuits and one for the color level circuits. The operation of both detectors is similar. A sample of the color demodulator output is fed to an electronic switch controlled by the timing pulses discussed earlier. The electronic switch is turned on only during the time the VIR signal is present at the demodulator output. The DC signal level present at the demodulator at that instant is compared to a reference level. The difference between the two voltages is stored in a capacitor. The capacitor voltage is buffered (to prevent loading) and fed to a DC-controlled color stage to correct the color errors.

The *tint* detector measures the amount of output at the R-Y demodulator. The R-Y output should be zero during the VIR chroma reference interval. Any other voltage indicates the demodulation phase (determined by the tint control) is wrong. A DC correction voltage is fed to the tint circuits if the detector sees any value other than zero when the VIR chroma reference is present.

The *color level* detector compares the B-Y demodulator output to the transmitted black reference. The DC levels of these two values should be *equal and opposite* if the chroma level is correct. A DC correction voltage is fed to the chroma amplifier circuits if the detector senses that the B-Y signal is larger or smaller than it should be.

There are several methods of performing these two functions. Refer to the manufacturer's training material if you need a detailed explanation of the operation of the circuits you are troubleshooting.

Special Power Supply Applications

In addition to its use as a general-purpose power supply, the VA62 DC POWER SUPPLY has special uses in circuit troubleshooting. The supply provides the fastest method to break "closed-loop" automatic circuits so problems can be quickly identified. It can be used in conjunction with the DRIVE OUTPUT signals when troubleshooting direct-coupled (DC) amplifiers, such as in the vertical circuits of solid-state receivers, or DC video amplifiers. Finally, it provides an effective method to troubleshoot problems related to the scan-derived DC power supplies used to power most low voltage stages in modern chassis.

Troubleshooting Automatic Circuits

Modern chassis designs use many different automatic feedback circuits. In almost all cases, these circuits use a DC voltage to control a stage that affects the signal passing through it. The DC voltage normally represents some characteristic (such as amplitude or phase) of an AC signal.

The automatic feedback circuit has two ends. The end that detects the AC signal and converts it to the DC control voltage is the "sending" end, and the end that uses the DC control voltage to affect the signals passing through it is the "receiving" end. Some systems may also include intermediate stages that amplify or change the polarity of the DC feedback signal or of the AC signal between the receiving and sending ends. The entire system forms a closed loop.

The biggest problem with troubleshooting a closed-loop system is that a defect in the sending end causes exactly the same symptoms as a defect in the receiving end. The only way to positively identify which end has the problem is to break the part of the loop that automatically follows changes in the input signal in order to control the loop manually. The best way to do this is to inject a DC voltage in place of the feedback signal, and then vary the voltage while watching for a change in the output of the receiving end.

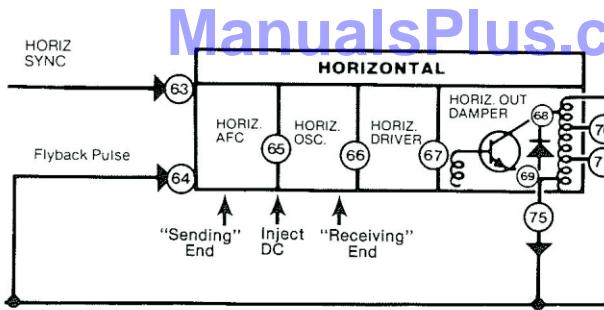


Fig. 73 — The best way to troubleshoot an automatic feedback circuit is to break the DC feedback voltage by injecting a substitute DC from the VA62.

You must remember that you *will not* return the loop to normal dynamic operation with this procedure because the loop normally follows changes in the signal *continuously and automatically*. You are only watching to see that the circuit responds as you vary the DC voltage around its normal operating point. If, for example, you are troubleshooting the Automatic Frequency Control (AFC) of the horizontal oscillator, you should be able to cause the oscillator to shift above and below the correct frequency, as indicated by a change in directions of the diagonal stripes on the CRT. You may be able to get the oscillator to *almost* hold sync with careful adjustment of the DC voltage. But you will not necessarily be able to get the circuit exactly in sync. This is no problem, however, because all you need to do is determine which end of the loop has the problem so you know where to begin troubleshooting.

To troubleshoot feedback loops:

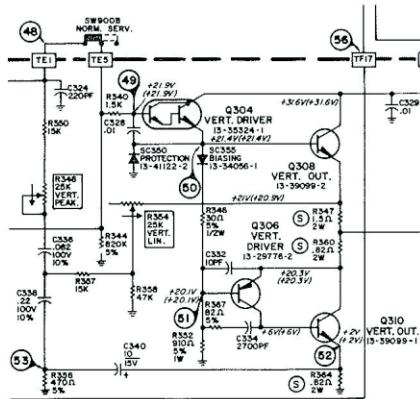
1. Determine the normal DC level from the schematic. If the voltage is not shown, measure the DC level with the EXT DCV function of the VA62 DIGITAL METER.
2. Connect the DC OUTPUT jacks between the DC feedback circuit path and the common point for the circuit (normally circuit ground).
3. Switch the DIGITAL METER switch to the DC PWR SUPPLY VOLTS position and monitor the voltage as you adjust the DC POWER SUPPLY control to the voltage level determined in step 1.
4. Watch the operation of the receiver or monitor as you adjust the DC voltage; both above and below the setting you started with.
 - A. If there is *no change* in the operation, you know the problem is in the *receiving* end because the varying DC control voltage does not cause the receiving end to respond.
 - B. If there *is a change* in the operation, you know the problem is in the *sending* end because the receiving end responds as it should to the substitute DC signal.

Troubleshooting Direct-Coupled (DC) Circuits

Most vertical circuits and many video amplifier circuits are direct-coupled (DC), meaning the output of one stage feeds directly to the input of the next stage without an intervening DC blocking capacitor. DC circuits require special troubleshooting procedures because a defect in one stage may affect

the bias of stages before or after the defect. For example, a bad transistor may cause all of the transistors in a DC string to be biased into cutoff. Injecting a VA62 drive signal into any of the cut off stages will not correct the trouble (even though you are injecting *after* the defect) because the cut off transistors block the AC signal.

When using signal injection with DC amplifiers, you must confirm the DC bias is correct before injecting the AC component. If the DC levels are a long way from the values shown on the schematic, you must supply bias with the VA62 before injecting AC signals.



horizontal output transistor and a startup circuit. These are called "scan-derived", "scan-rectified", "flyback-powered", or "horizontally-derived" systems.

Scan-derived systems form a closed loop. If any part of the loop is open, the receiver will be dead. The best way to troubleshoot these loops is to substitute for the low-voltage power supply to see if the horizontal oscillator operates. Then, follow through the trouble tree in Fig. 76 to identify the problem.

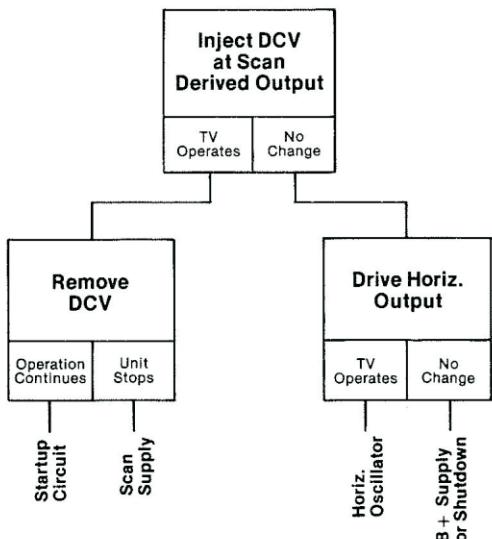


Fig. 76 — Trouble tree for scan-derived power supplies.

Note that some of the scan-derived supplies have a higher voltage than supplied by the VA62. These medium voltage supplies power the vertical or video output stages. It is not necessary to substitute for these stages, however, because the rest of the receiver (such as the audio stages) operate, even with a defective medium voltage supply, giving you symptoms other than a dead receiver to isolate these problems.

There is also no reason to substitute for the primary power supply that drives the horizontal output transistor. This circuit is powered from a simple power supply connected directly to the AC line. The VA62 external DC and PPV meter functions let you trace the signals through this supply without the need for signal substitution.

IF Alignment

The VA62 provides a dynamic system to align the IF stages of any television receiver. The dynamic nature of the MULTIBURST BAR SWEEP works equally as well with tube, transistor, IC, or SAW filter (Surface Acoustic Wave) IF stages. It provides the proper signals for use with conventional diode detectors or synchronous video detectors.

In addition, the VA62 provides a method to dynamically set the IF traps. The three standard trap frequencies (for the sound, adjacent sound, and adjacent video carriers) are generated with a unique combination of a modulated video carrier and an

interfering trap signal, both generated to crystal accuracy. This combination offers several advantages over any other trap setting method: 1. The combination of signals exactly duplicates the video carrier and the interference that the traps are designed to eliminate, 2. The modulated video carrier holds the keyed AGC circuits at a fixed value so they do not "fight" you as you align the trap, and 3. The crystal-controlled video carrier causes synchronous video detectors to operate in a dynamic fashion so the interfering carrier is properly detected.

A third VA62 feature is the programmable IF generator, allowing any carrier frequency from 35 to 50 MHz to be generated with crystal accuracy. The carrier may be generated as an unmodulated signal or as an amplitude-modulated signal, depending on your application. This feature allows "spot alignment", where a badly misaligned system can be roughed-in before final alignment. It also provides a method of setting "odd-ball" trap frequencies that are not covered by the standard trap-setting signals.

How to Learn Bar Sweep Alignment

It's a big mistake to try to learn BAR SWEEP alignment on an IF stage that you know has problems or on a chassis with an "odd" IF design, such as an RCA CTC38 or a system with only 2 IF amplifiers. BAR SWEEP alignment is best learned on a receiver you know works properly. This prevents the problems of trying to align a defective IF. Usually, poor alignment is not the only problem with a bad receiver and, too many times, a technician turns and turns the coil slugs, thinking that there *must be a way* to get them set properly. The technician ends up frustrated and may even think that the VA62 cannot be used for alignment.

It may seem that working with a good receiver for 3 or 4 hours is a waste of time, but *do it* if you want to learn alignment. The time spent learning the procedures will be quickly paid back when the first receiver that actually needs alignment is completed quickly and correctly.

Don't Be a Perfectionist

The other common problem for people learning to use the MULTIBURST BAR SWEEP is spending too much time trying to get a perfect output. We aren't suggesting that you do a sloppy job of alignment. Rather, we are suggesting a practical approach to alignment. The VA62 MULTIBURST BAR SWEEP shows imperfections in IF performance that cannot be seen with any other IF testing or alignment methods. Many of these imperfections are inherent in the IF stages and cannot be corrected with any amount of alignment. Therefore, work for the best possible results; then stop. We will show a number of typical waveforms in a later section so you know what to expect.

In addition to marginal designs, you will find some IF stages in older receivers that have numerous (although minor) changes in component values which compound to degrade picture quality. It is almost impossible to identify all of the components that have changed, and (worse yet) the customer

would not pay for the time needed to do so. Does this cause problems? No. Not unless a component value change is so severe that it causes a major change in the alignment characteristics. If this should happen, the VA62 will help isolate the trouble.

As a general rule, a particular bar of the MULTIBURST pattern can vary in amplitude by as much as 50% from the ideal waveform before there is an objectionable change in picture quality. This is especially true of the higher video frequencies, which contribute the small detail to a picture and are not noticeable at average viewing distances.

Is Alignment Needed?

Many technicians claim that modern IF circuit designs have eliminated the need for alignment. This argument goes back to the first solid-state IF circuits because (supposedly) the inter-element capacity of a transistor does not change like it does in tubes. While solid-state and SAW-filter designs result in smaller amounts of alignment change than we saw in tube stages, circuits still change. These changes are due to aging, component replacement, or unsuccessful attempts by another technician to align the circuits. There are fewer adjustments in today's IF stages than a few years ago. But the adjustments that remain are critical, and must be set correctly for the best picture quality.

A better question than "Is alignment needed?" is "When should I align?" The answer is pretty simple. The IF stages should be aligned whenever a test of the video performance shows a noticeable degradation of picture quality. The VA62 alignment test is so fast and easy to perform that it can be done on every receiver. Then, base your decision about aligning a receiver on the test results.

Set the Traps Every Time

More and more receivers are being used with cable TV. The IF traps must be set right on the nose any time a TV is used with cable. This is because cable produces the signal condition where there is a channel immediately above and immediately below the one being watched. Off-the-air signals never produce these adjacent channels.

Therefore, you should learn to set traps, even if you never plan to align a single IF stage. Some technicians think of IF "alignment" as a nasty word, so it might help to think of trap setting as a procedure separate from IF alignment. However you deal with the idea of alignment, remember that the traps *must* be properly adjusted for any receiver that will be used with a cable system.

Understanding the Bar Sweep Pattern

NOTE: This section describes the MULTIBURST BAR SWEEP pattern in general terms.

The MULTIBURST BAR SWEEP pattern is similar to the multiburst test pattern used by the broadcast engineer to test transmission systems. The VA62 pattern has a number of improvements,

compared to the broadcast pattern, that make it better suited for receiver troubleshooting.

The MULTIBURST BAR SWEEP pattern consists of 10 video frequency bars that alternate between pure black and pure white. The frequencies fall every half MHz, producing a frequency sample at identifiable points in the video frequency spectrum. All ten bars are supplied at the same amplitude so you have a reference signal to feed through any video system to test its frequency response. (NOTE: This is different than the Sencore VA48 which doubled the amplitude of the color carrier bar when injected at RF or IF test points.)

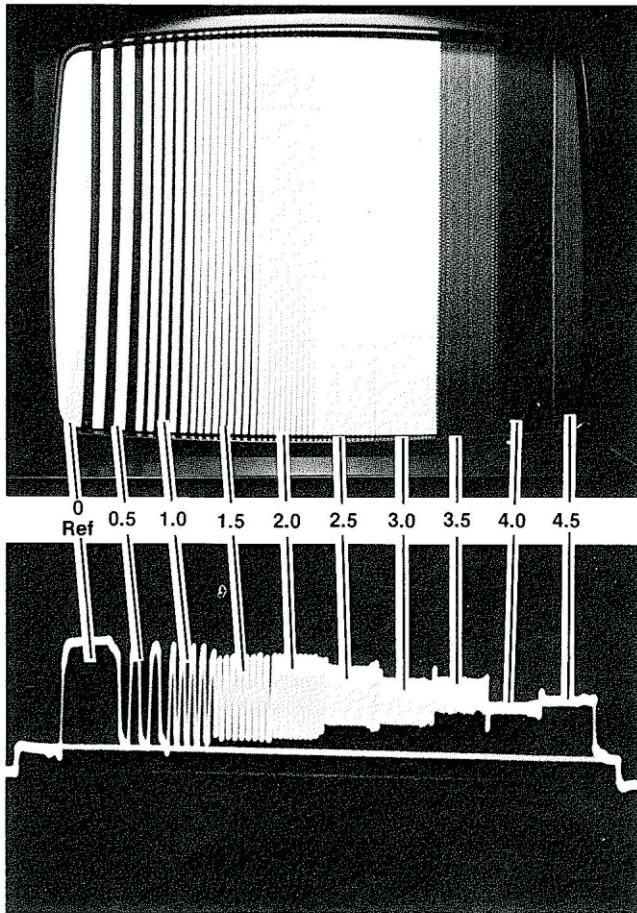


Fig. 77 — The 10 bars of the Multiburst Bar Sweep video pattern provide a complete frequency response test from zero to 4.5 MHz in half-megahertz steps.

If a video system has perfectly flat response, all ten bars show the same amplitude when viewed with an oscilloscope connected to the output. Any variations in frequency or phase response cause changes in the bars; either a reduction in amplitude or distortion such as ringing or overshoot.

The bars are part of a composite video signal, complete with sync pulses. This causes the AGC circuits, and other signal-dependant circuits, to operate the same as when receiving an off-the-air signal. Thus, the VA62 accurately tests the video frequency response of the entire system.

Understanding Alignment

Since the theoretical frequency response of the video signal in an NTSC system is around 4.2 MHz, it

might seem that an ideal receiver would pass all of the MULTIBURST BAR SWEEP frequency bars to the video amplifiers without restricting any of the frequencies. In real life, the IF stages do not have flat frequency response for all of the MULTIBURST BAR SWEEP frequency bars. The signal at the video detector must roll off the high frequency signals in order to prevent interference between the video carrier and the 4.5 MHz sound carrier. If the frequency response is held flat, and then dropped off too suddenly, the square edges of picture transitions will ring and cause annoying harsh edges. If the rolloff is too gradual, much of the high frequency detail (which represents small objects in the picture) will be lost. The correct rolloff is accomplished with two types of adjustments: *traps* and *bandpass coils*.

The *traps* establish the upper and lower frequency limits of the IF circuits. Traps have a high Q, which means they cause a drastic reduction in gain but affect a fairly narrow frequency band. They are designed to have their greatest effect at frequencies most likely to affect the picture. There are three commonly used traps: 39.75 MHz (the *picture carrier* of the next *higher* channel), 41.25 MHz (the *sound carrier* for the channel being viewed), and 47.25 MHz (the *sound carrier* of the next *lower* channel). The traps are important in all receivers because they establish the upper and lower frequency limits of the video system, but are critical when the TV is to be connected to a cable TV system that has a signal on both the next higher and the next lower channels.

The *bandpass* adjustments have a lower Q than the traps so they affect a wider range of frequencies. Their purpose is to allow the frequency response between the 41.25 and 47.25 MHz traps to be adjusted for the best possible picture. Older receivers used a dozen or more adjustments. Many newer IF stages have only two or three adjustments for video response. In either case, alignment is necessary to optimize the tuning of the bandpass adjustments.

SAW Filters

One of the goals of the receiver designer has been to eliminate as many adjustments as possible. Fewer adjustments mean lower cost in manufacturing and service. The Surface Acoustic Wave (SAW) filter has reduced the number of adjustments (excluding detector adjustments) to 2 or 3. The SAW filter is an elaborate crystal transducer which has frequency characteristics that match the needs of the IF stages. The remaining adjustments, however, still must be set to the correct point for the best possible picture. The VA62 MULTIBURST BAR SWEEP pattern and IF generator provide a method to adjust these controls to the correct point, as explained on page 69.

Synchronous Video Detectors

The conventional diode detector has been replaced in many receivers with the Synchronous Video Detector. The Synchronous Detector is always inside an IC (although not all IC detectors are Synchronous Detectors). The Synchronous Detector has a number of advantages over the diode type: 1. It has gain, instead of a loss, requiring less

amplification in earlier stages, 2. It is less prone to picking up unwanted signals because it only detects signals in phase with the video carrier, 3. It requires fewer traps (or traps with lower Q) because it does not generate beat products that radiate back into the earlier IF stages, 4. When properly adjusted, it is more linear, giving better detection of various contrast levels, and 5. It produces no output if there is no carrier present, resulting in a black screen on unused channels.

The Synchronous Detector cannot be properly aligned with a sweep and marker generator. The Synchronous Detector requires a precise IF carrier for correct detection. The VA62 IF generator provides this needed carrier, and the "10 Bar Staircase" video pattern provides the correct reference signal needed to test or align the Synchronous Detector. Special alignment procedures for the Synchronous Detector are found on page 68.

How to Test Alignment Without A Scope

NOTE: Sencore does not recommend attempting to align IF stages without using an oscilloscope. Problems in the video amplifiers may cause you to severely misalign the IF stages if you attempt to do alignment from the screen. Only use the following procedure to test the overall performance of the video system.

The dynamic nature of the MULTIBURST BAR SWEEP provides a method of testing the performance of the IF and video amplifier stages without removing the back from the receiver under test. You know the IF stages *and* video amplifiers work correctly if the receiver passes this test. If it does not, you know there is a problem and should use functional analyzing to determine whether the problem is before detection (the tuner or IF amplifiers) or after detection (the video amplifiers).

There are two things to watch for when you observe the MULTIBURST BAR SWEEP pattern on the CRT. First, the bars through 3.0 MHz should have sufficient amplitude, as explained in the next paragraph. Second, the lower frequency bars should not show signs of ringing or overshoot.

There are two things to watch for as you test for the correct bar amplitude. First, a bar that has made it all the way through the video system will show individual vertical stripes of video, as shown in Fig. 78. A bar that has been restricted in amplitude becomes a uniform shade of grey. A restricted bar also has a lower brightness level, allowing the relative amplitudes to be checked with the following procedure.

Watch the MULTIBURST BAR SWEEP bars as you slowly turn down the receiver's brightness and contrast controls. The bars will disappear (turn black) at different times, depending on each bar's peak-to-peak amplitude at the CRT. Restricted frequency response causes the bars to disappear in the wrong sequence.

The 3.5 MHz bar ("Color Carrier") should always be the first bar to turn black during the test because the video amplifiers have a trap to eliminate the color signal. The 4.5 MHz bar should turn black at

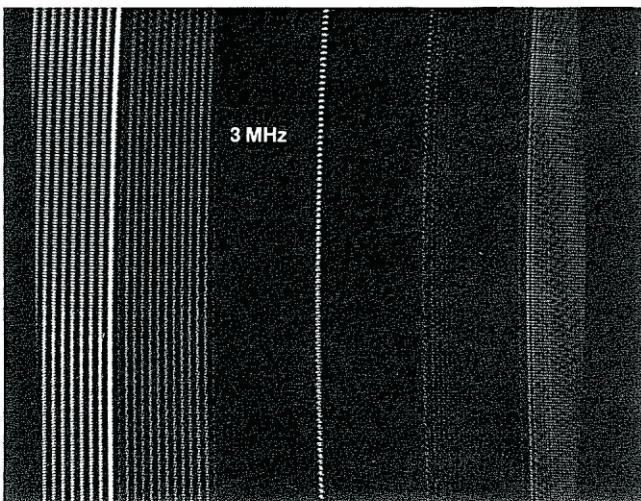
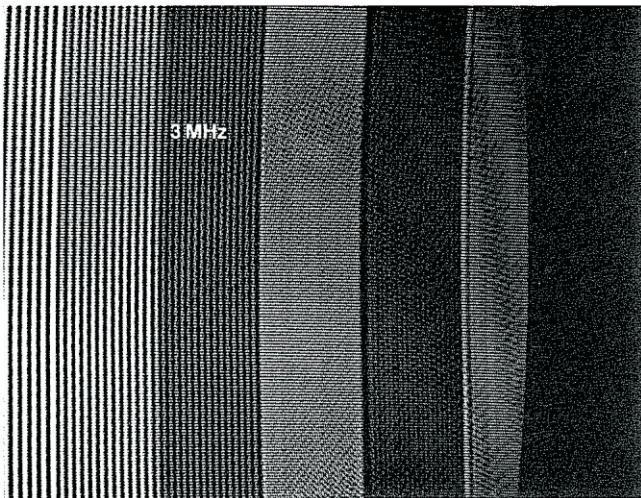


Fig. 78 — (A) A receiver with 3 MHz video response from the antenna to the CRT shows detail in the 3.0 MHz Multiburst Bar Sweep bar in the form of individual vertical stripes. (B) The 3.0 MHz Bar Sweep bar will be grey if some circuit rolls off the frequency response before 3 MHz.

nearly the same time as the 3.5 MHz bar when feeding the signal through an IF strip. (The 4.5 MHz bar should contain detail and brightness when injecting to the direct-video input of a high-resolution system because there is no 4.5 MHz sound trap to restrict the higher frequency response.)

The 4.0 MHz bar will usually not show any detail, although its brightness should be higher than the 3.5 MHz bar. It should disappear after the 3.5 and 4.5 MHz bars. After that, the bars should begin to disappear in sequence, starting from the 3.0 MHz bar. The 1.5, 2.0, 2.5, and 3.0 MHz bars should all turn black at very close to the same brightness/contrast setting. The "0 Ref.", 0.5, and 1.0 MHz bars should be the last to disappear.

You should also watch for signs of ringing or overshoot in the "0 Ref.", 0.5, and 1.0 MHz bars as you reduce the picture controls. The photo in Fig. 79 shows the low frequency BAR SWEEP bars from a bad receiver. Notice how the left edges of the white bars show a bright line. The bars should be a uniform intensity from the left to the right side, in both the white and the black areas. If there is a bright or dark line, you know a circuit is causing video distortion.



Fig. 79 — Ringing shows as harsh white edges on the lower frequency bars. The distortion may show on the white or the black area, depending on the direction of the overshoot in the circuits.

NOTE: The video peaking control (some times called the "sharpness" control) may affect the ringing on the low frequency bars. Set this control for maximum detail when testing the video response. If there is some ringing, set the control to mid-scale to determine if the ringing will be a problem when the control is adjusted for normal viewing.

How to Align Conventional IF Stages

WARNING

Do not attempt to align the IF stages until you have confirmed the IF stages work properly. Attempting to align a defective stage may result in severe misalignment.

Do not despair if you end up totally misaligning a defective IF strip. The VA62 always lets you return the IF stages to normal alignment after repairing the defective circuits. The best plan is to avoid misalignment in the first place by using functional analyzing to confirm the IF stages (and not later stages) are the cause of a poor picture. Then, watch for signs of a defective IF as you go through the alignment steps.

Here is a brief overview of the alignment instructions. We will cover the details in the sections that follow.

1. Connect the VA62 RF-IF OUT jack to the IF input as described in the next section.
2. Connect your scope to the output of the video detector or the first video amplifier and set it to view a horizontal video waveform.
3. Set all traps (this *must* be done before adjusting any other controls).
4. Adjust the bandpass coils in the following sequence:
 - A. Set the coils in the output of the *last* stage for the best video-to-sync ratio on the "10 Bar Staircase" pattern.

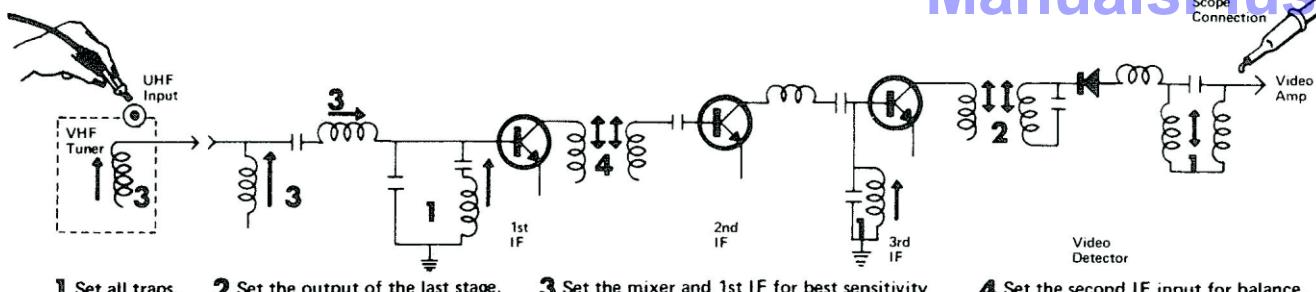


Fig. 80 — The traps and bandpass coils must be adjusted in the correct sequence for best results. The traps must always be adjusted before any of the bandpass coils.

B. Reduce the VA62 RF-IF VERNIER setting and adjust the tuner mixer coil and the input controls of the first IF stage for best sensitivity.

C. Return the VA62 RF-IF VERNIER setting to the "NORM" position and readjust the *same* controls set in step 4B for the best response at 3.0 and 3.5 MHz.

D. Set the remaining adjustments for the best overall response with the least amount of ringing or overshoot.

5. Repeat steps 3 and 4 for the best overall response.

NOTE: Do not bias the AGC circuits when using the VA62 for alignment. The BAR SWEEP pattern has standard sync pulses, allowing the AGC circuits to dynamically follow the applied signal.

The following paragraphs explain the details of each of the above steps. Typical waveforms are shown for comparison. Special conditions are covered at the end of this section. Be sure to watch for these conditions on *every* alignment.

Connecting to the IF Input

There are three ways to feed the VA62 IF signal to the IF stages: 1. Connect to the VHF tuner in place of the UHF tuner, 2. Connect to the mixer test point on the VHF tuner, or 3. Bypass the VHF tuner entirely and feed the signal directly to the input of the first IF stage. The first method is the easiest and most reliable. The second method must be used on UHF/VHF tuner combinations that do not have a cable between the two tuners. The third method should *only* be used on digital tuners that do not have a mixer input test point or cable between the UHF and VHF tuners.

Use one of the supplied IF adapter cables to inject into the UHF input jack or the IF input jack. One cable provides a male phono connector and the other provides a female connector. Use the supplied matching balun to connect to a mixer test point. Connect either of the red balun test clips to ground and the other to the test point. The supplied TP225 "Sure-Hold" probe may be used to connect to the mixer test point if you have difficulty connecting the alligator clips to the test point.

You must switch the VHF tuner to the *UHF* position, when feeding the UHF input jack, in order to route the IF signal through the mixer. Feeding the signal to this test point allows you to accurately

adjust the mixer coil in the tuner as well as make other IF adjustments.

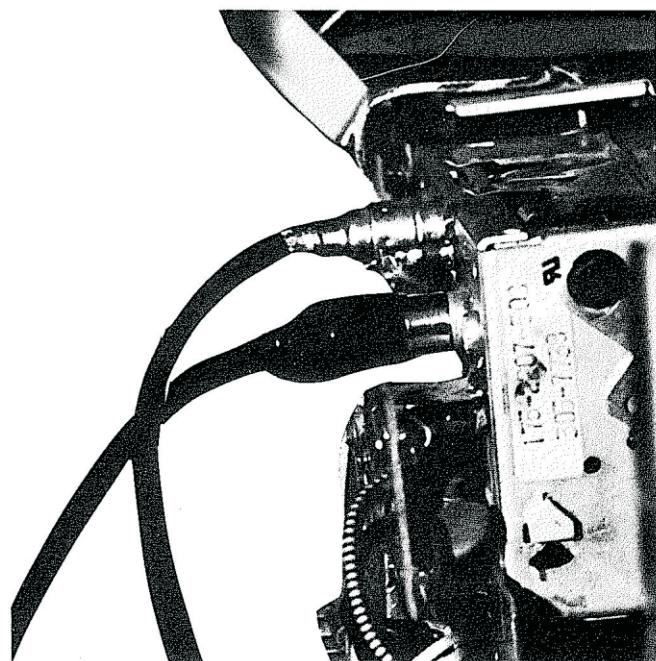


Fig. 81 — The best place to connect for alignment with conventional tuners is the UHF input of the VHF tuner. Remember to turn the VHF tuner to the "UHF" position to route the signal through the tuner.

Connecting the Oscilloscope

Connect your oscilloscope (using a 10:1 lo-cap probe) to a test point after the video detector output but before any video stages with frequency compensation, such as peaking coils or color traps. Ideally, you should connect to the video detector directly or at the input of the first video amplifier. However, avoid using any test point that requires you to remove an IF shield because removing the shield may affect the alignment.

You are usually safe to connect to the *output* of the first video amplifier, as this stage is usually a cathode or emitter follower with no frequency compensation. *Do not connect to the video delay line.* There is often a loss of high frequency detail by the time the signal reaches the delay line, or there may be a peaking coil before the delay line that causes the signal to have abnormally high levels of overshoot or ringing.

Set your oscilloscope to display one or two cycles of the *horizontal* waveform. If your scope does not have video sync separators, you may need to

externally trigger it from a signal in the horizontal stage, from the receiver's sync separator output, or from the VA62 horizontal drive output.

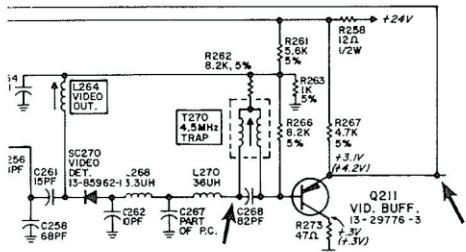


Fig. 82 — The oscilloscope should be connected to the video detector output or to the output of the emitter (or cathode) follower after the detector.

Setting IF Traps With the Trap-Setting Signals

NOTE: The traps must be set before making any other IF adjustments. Often times, the traps are the only part of the IF strip that require alignment.

The three special VA62 trap-setting signals provide a fixed-level carrier, modulated with a video signal. This signal mixes with an interfering signal that

may be adjusted to a wide range of amplitudes. The video signal dynamically clamps the AGC to a fixed level so you can adjust the trap-setting signal for best contrast. The trap-setting signal may be mixed with the video signal as an un-modulated carrier, or modulated with any of the tones selected by the AUDIO switch, depending on which provides the best contrast. The amplitude of the interfering signal is adjusted until good contrast is obtained. The receiver trap is then adjusted for the least amount of the interfering signal.

NOTE: Use the smallest level of interfering signal that provides noticeable interference. If the trap adjustment completely eliminates the interference before reaching a solid null, increase the signal level slightly to confirm a proper null.

With a few exceptions, the results of the trap setting are usually easier to see on the CRT screen than on an oscilloscope. This allows accurate trap setting without needing to connect a scope. The trap-setting signal is generally easiest to use with the MULTIBURST BAR SWEEP. You may find it easier to turn off the 3.5, 4.0, and 4.5 MHz bars to provide a large black area on part of the screen for maximum contrast. The 333 Hz or 1 KHz position of the AUDIO switch usually provides the best contrast for the interference signal.

If you use an oscilloscope to set traps, the best results are obtained using the "10 Bar Staircase" pattern and no audio modulation. The trap is simply adjusted for minimum "thickness" of each pattern step.

To set the traps:

1. Connect the VA62 to the IF input, as explained earlier.
2. Set the RF-IF SIGNAL switch to the desired trap frequency.
3. Set the VIDEO PATTERN switch and the AUDIO switch to the desired positions for best contrast.
4. Adjust the RF-IF LEVEL switch and the RF-IF LEVEL VERNIER until the interfering signal provides a noticeable amount of contrast to the selected video pattern.
5. Adjust the trap coil(s) until the interfering signal has the least affect on the video pattern. (Increase the setting of the RF-IF LEVEL VERNIER if necessary).
6. Repeat steps 2 through 5 for the remaining trap frequencies.

SPECIAL NOTES ON TRAPS:

1. *It is not necessary to use an external attenuator when using the VA62, as the step attenuator reduces the signal by 40 dB compared to the Sencore VA48. Use the "Lo" position of the RF-IF LEVEL switch for all trap setting.*
2. *Some older receivers do not have a 39.75 MHz trap. Simply ignore any reference to setting this*

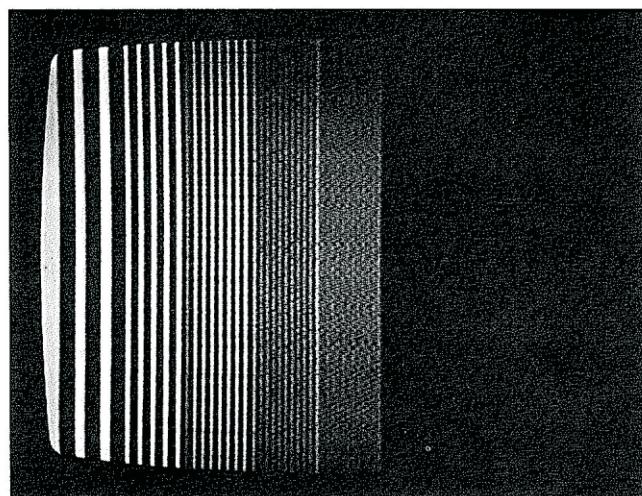
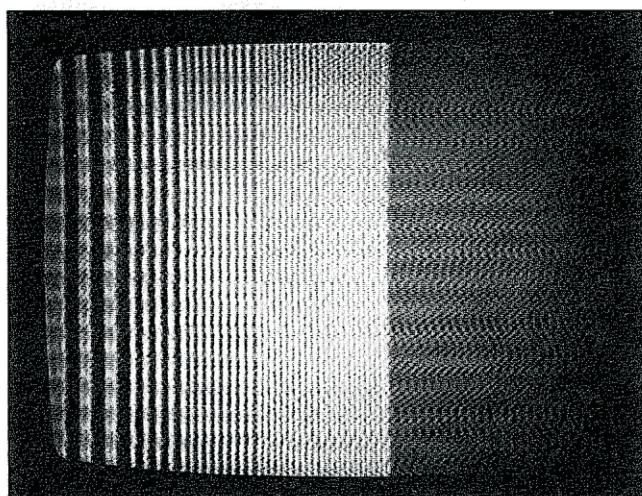


Fig. 83 — The special trap signals provide a fixed video carrier and an interfering signal at the same time. The trap is adjusted until the amount of trap interference (noted in the bars or the black area where bars have been removed) is at a minimum.

trap. You will, however, need to reduce the amplitude of the 3.5 and 3.0 MHz bars when aligning the bandpass coils if the receiver will be used on cable, or the receiver will experience strong adjacent channel interference.

3. Some receivers have a 41.25 MHz trap in the first IF stage and a second one in the last IF stage. If so, misadjust the one in the last IF stage and set the one in the first IF stage first. Then, increase the level of the VA62 trap signal to force signal through the first IF stage while adjusting the trap in the last IF stage for minimum interference.

4. Some traps consist of a coil and a separate potentiometer. The coil sets the tuned frequency of the trap and the pot sets its depth (Q). Always adjust the coil first, before the pot.

5. Some traps have two slugs in one coil. Normally, the slug closest to the printed circuit board (bottom slug) is the frequency adjustment and should be set first. The top slug is usually the depth adjustment and should be adjusted after the bottom slug is set.

6. A few older chassis had three slugs in one IF can; one was a trap and the other two were bandpass coils. There is no way to eliminate the interaction between these slugs. You will have to set the traps, go through the bandpass adjustments, and then set the traps again. If the bandpass is affected, you may have to return to the bandpass slugs a second time.

7. The 39.75 MHz trap is sometimes difficult to set because the response of the lower frequencies is already established by the 41.25 MHz trap. If so, detune the 41.25 trap (with the 39.75 MHz trap signal selected on the VA62) until the trap interference is at maximum. Set the 39.75 MHz trap, and then switch the VA62 to 41.25 MHz to return the 41.25 MHz trap to its correct setting.

8. If you are not sure the traps are being set to the correct point, select the MULTIBURST BAR SWEEP pattern with all of the bars turned on and watch the bars as you adjust the trap. The trap will affect one bar at a time as it moves through the pattern. The trap should move off one end of the pattern just before it reaches its correct setting. The 41.25 MHz and 39.75 MHz bars should move off the pattern to the right, and the 47.25 MHz bar to the left. The video pattern will lose sync any time a trap is set on top of the video carrier. Turning the trap adjustment further returns the carrier as the trap moves past the carrier frequency.

9. A few traps may not appear to null when using the trap setting signals because the IF response is already reduced considerably at the frequency where the trap comes into the picture. These traps can usually be set using the PROGRAMMABLE IF GENERATOR, which only feeds one signal to the IF stage at a time.

10. The amplitude of the interfering trap setting signal should always be as low as possible. If the trap signal overpowers the video pattern signal, check that the RF-IF LEVEL switch is set to the "Lo" position.

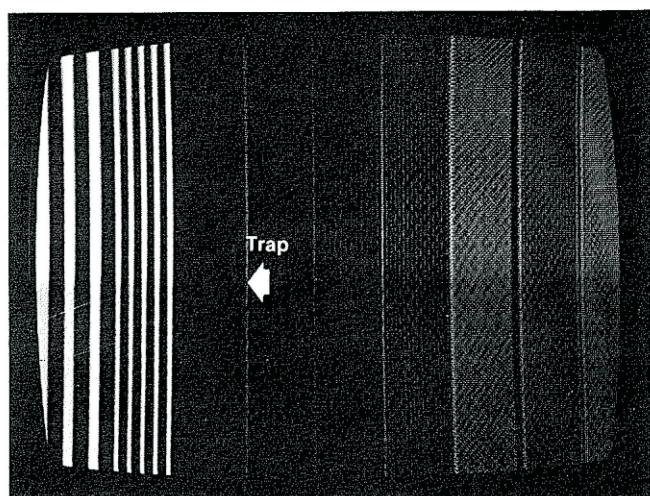
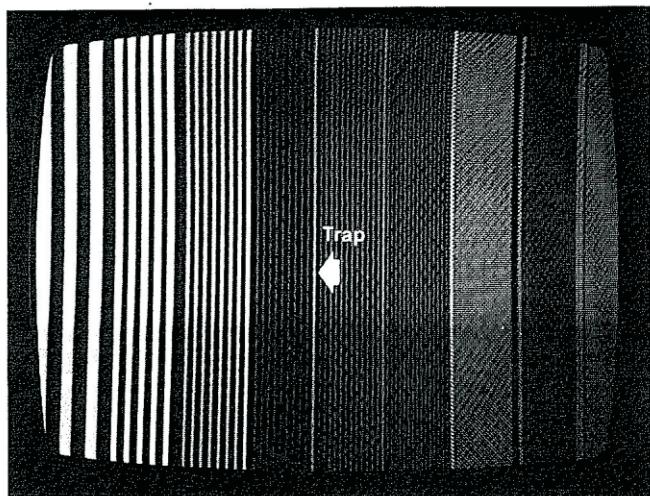
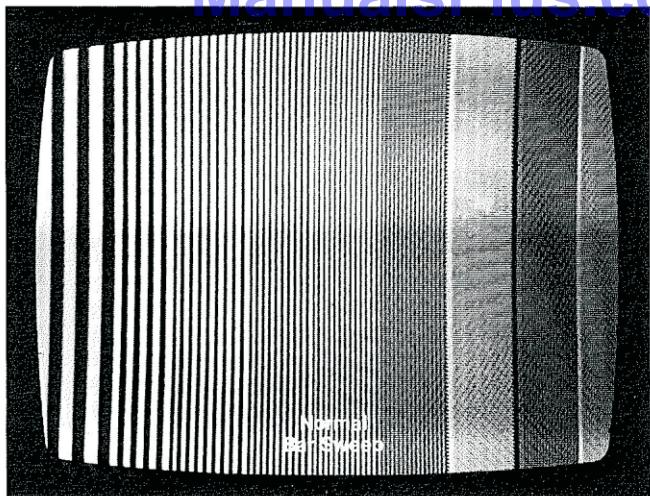


Fig. 84 — (A) Normal Bar Sweep pattern without interference from a trap. (B) A trap has been improperly adjusted and is affecting one of the frequency bars. (C) Adjusting the trap causes the affect on the bar to move through the pattern. The trap should be adjusted until the interference moves out of the picture, and then nulled for minimum interference from the trap-setting signal.

Setting Traps With the Programmable Generator

The VA62 provides a second method to set IF traps. The 35-50 MHz PROGRAMMABLE IF GENERATOR can be used to adjust traps with non-standard frequencies. Or, it may be used to adjust traps that may not show a proper null when

using the special trap-setting signals. The PROGRAMMABLE IF GENERATOR provides either an unmodulated carrier or a carrier that is amplitude modulated with an audio tone. The tone modulation is generally used for setting traps.

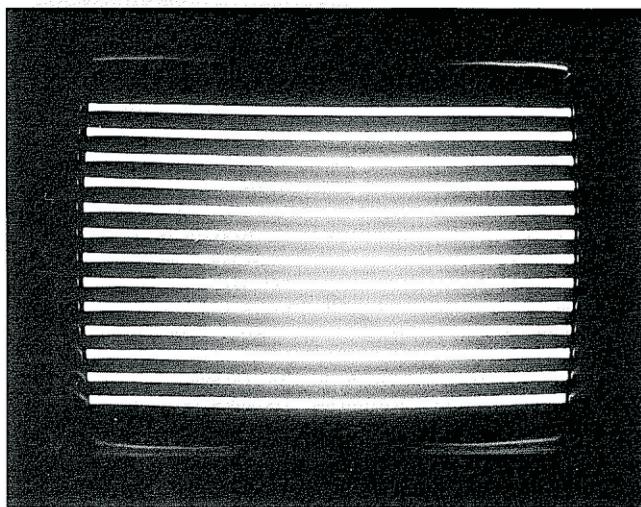


Fig. 85 — The programmable IF Generator may be used to set traps with oddball frequencies. The VA62 is adjusted until the modulation pattern is barely viewable on the CRT, and the trap is then adjusted for the least amount of CRT signal.

When using the PROGRAMMABLE IF GENERATOR, you must be careful to use the *least* amount of signal that will give a modulation pattern on the CRT. If you use a larger amount of signal, the keyed AGC may latch to the audio modulation and flatten out the null-point of the trap adjustments. Using a small signal level, however, forces the AGC circuits to run wide open, giving a much better null.

The PROGRAMMABLE IF GENERATOR may be modulated with any of the tones selected by the AUDIO switch. The 1 KHz position generally gives the best contrast.

To use the PROGRAMMABLE IF GENERATOR:

1. Connect the VA62 to the IF input of the receiver, as explained earlier.
2. Set the RF-IF SIGNAL switch to the "35-50 MHz PROG" position.
3. Modulate the signal by setting the AUDIO switch to the desired frequency.
4. Select the desired frequency by entering *four* digits into the keyboard. For example, enter 4-0-5-0 for a 40.50 MHz signal. If you make a mistake while entering the number, either enter a total of 4 digits to complete the program or press the "C" (clear) button to start over.
5. Adjust the RF-IF LEVEL switch and the RF-IF LEVEL VERNIER until there is a noticeable modulation pattern on the CRT screen. Use the *least* amount of signal needed to get a modulation pattern.
6. Adjust the trap for the least amount of modulation on the CRT. Increase the setting of the RF-IF VERNIER control, if necessary, to locate the true null point.

Setting the Bandpass Coils

After the traps have been set, you need to adjust the bandpass coils for the best balance between two parameters; the best sensitivity and the best overall video response. Because of this balancing, you are always setting the coils for a compromise. It is normal for the setting of one coil to affect the setting of another, meaning you should repeat the adjustment two or three times for best results. Each time you go through the coils, you will be setting the coils closer and closer to their ideal alignment. This is true of any IF alignment technique.

Use the Correct Sequence

You must make the adjustments in the correct sequence because each stage of an IF system is designed to operate at a slightly different frequency. If you adjust the coils in the wrong order, you may exchange the tuning of two stages and cause unstable operation, "critical" fine tuning, excessive noise, or reduced sensitivity.

The correct sequence (after setting the traps) is:

1. Set the detector.
2. Set the first IF.
3. Set the remaining coils.

The block diagram in Fig. 80 shows the correct sequence to follow for consistent results.

Set the Detector First

You first tune the video detector to the 45.75 MHz IF carrier. The coils between the last IF amplifier and the detector affect detector tuning. (Traps in the last IF stage are not detector tuning adjustments.) Some schematics may label these coils "detector" but most simply label them "3rd IF" or "4th IF". However, they have more affect on the detector than on the last IF amplifier.

The "10 Bar Staircase" video pattern provides the best reference for tuning the detector. The detector adjustments affect the linearity of the detected signal between the sync pulse tip and peak white. The "10 Bar Staircase" signal lets you adjust the detector tuning for best overall linearity.

Adjust the detector coils for the largest amplitude signal without compression of the sync pulse or any of the stairsteps. Stages other than the detector can cause sync or stairstep compression. Therefore, set the detector coils for the best linearity, even though the linearity may not be ideal. Then move on through the alignment of the rest of the IF stages. You will then eliminate small linearity errors when you run through the detector tuning a second or third time.

Never adjust an earlier IF stage for so much gain that the video begins to compress. You do not need to switch to the "10 Bar Staircase" pattern when adjusting the earlier IF stages because compression will affect the sync pulses before any other part of the waveform. Simply avoid compressing the sync pulses as you move through the earlier bandpass adjustments.

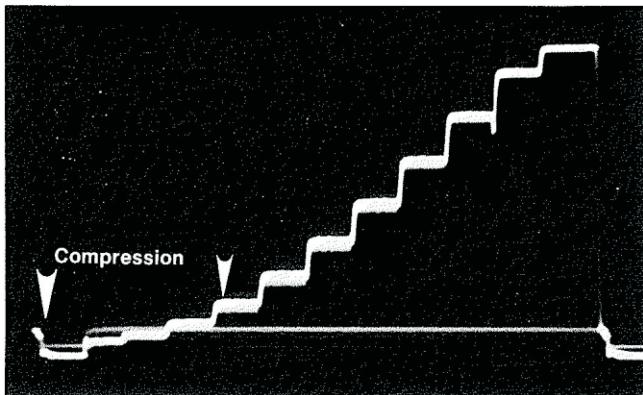
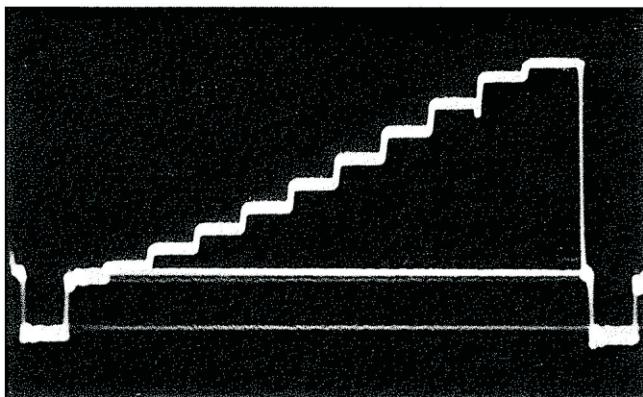


Fig. 86 — (A) The "10 Bar Staircase" pattern has linear steps when the video detector is properly adjusted. (B) Compression of any of the bars causes poor brightness or contrast in an off-the-air picture.

Set the First IF Input Next

After tuning the detector, jump back to the input of the first IF stage. The first IF input includes the adjustments before the first IF amplifier (except for traps) and the mixer coil in the VHF tuner. We consider the mixer part of the first IF stage because it works together with the tuned stages of the first amplifier to match the impedance of the tuner to the first IF stage.

The alignment of the first IF stage affects sensitivity and high frequency video response. You can peak the tuning of the first IF adjustments for maximum sensitivity, but the IF stages will then have restricted video frequency response. This results in poor video detail, weak color, and critical fine tuning. In order to avoid this, the adjustments are done in two steps.

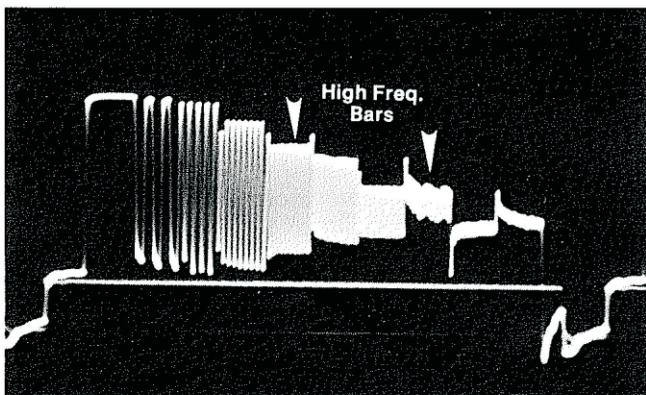


Fig. 87 — After adjusting the first IF stage for maximum sensitivity, it should be readjusted to provide best response at 1000 microvolts on the 3.0 and 3.5 MHz bars.

First, adjust the stages for maximum sensitivity without worrying about bandwidth. Then, readjust *the same coils* for good bandwidth at a normal (1000 microvolt) signal level.

Adjusting for maximum sensitivity involves reducing the output of the VA62 to the lowest setting that produces an output at the video detector. If the receiver produces an acceptable output with the VA62 set to minimum, you don't need to worry about sensitivity. If, however, the picture is lost before you set the output control to minimum, you adjust the first IF coils for maximum gain.

In the case of severe misalignment, this is done in steps. First, you reduce the setting of the RF-IF LEVEL VERNIER control until the signal on the scope becomes noisy. Then, tune the first IF adjustments for a clean waveform. Continue to alternate between reducing the signal level and tuning the IF adjustments until no further improvement is possible.

NOTE: Remember that a defective IF amplifier could be the cause of poor sensitivity. If you must set the RF-IF LEVEL switch to the "Med" or "Hi" positions to force a signal through the first IF stage, or if you cannot adjust the first IF stages for enough gain to feed a signal through with the VA62 RF-IF attenuators set to "Lo" and ".5", you should suspect a circuit defect that must be isolated before completing the alignment.

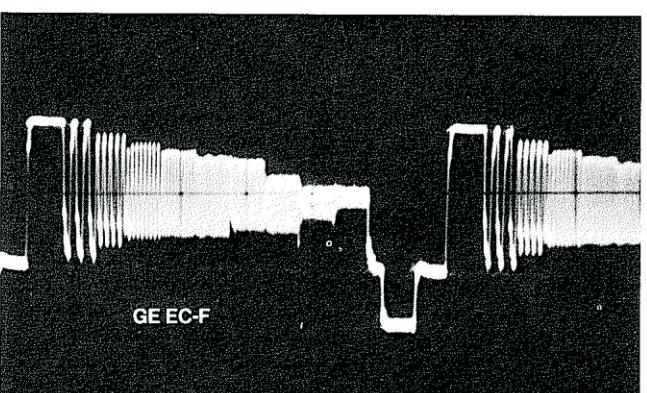
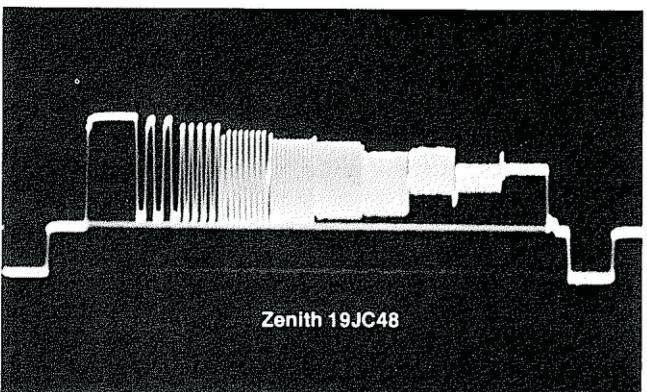
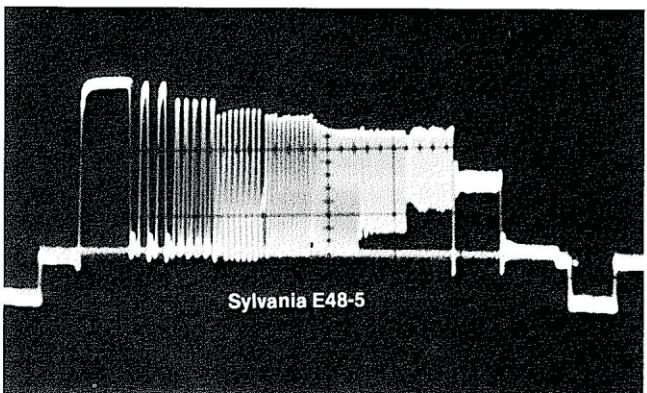
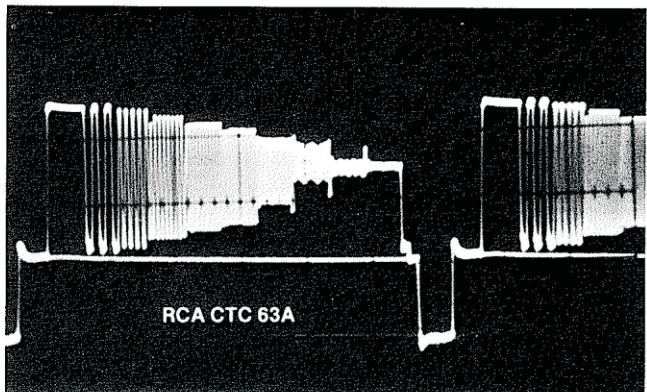
After you adjust the input stages for best sensitivity, increase the setting of the RF-IF LEVEL VERNIER to the "Norm" position. This feeds 1000 microvolts to the input, which is the standard level used for the rest of the alignment. You then adjust the *same coils you just adjusted* for the best amplitude on the 3.0 and 3.5 MHz frequency bars. Do not worry if these bars seem low in amplitude after you adjust the first IF controls, as the other IF stages also affect the high-frequency bars.

At this point, you should begin to watch for symptoms of overpeaking an adjustment. For example, you may be able to increase the amplitude of the 3.0 or 3.5 MHz bars, but may compress the sync pulses in the process. Or increasing the high frequency gain may cause severe overshoot or ringing on the low frequency bars ("0 Ref", 0.5, and 1.0 MHz). Adjust a control only as long as the high frequency bars improve, but stop adjusting it if any other part of the waveform is affected. Don't worry about balancing problems, as the final balance comes in the next step and is then improved further during the second or third time through the complete set of adjustments.

Adjust the Remaining Stages for Balance

The final step is to adjust the remaining coils for best overall balance. Most AGC-controlled IF stages reduce the high video frequencies when receiving low level signals to keep "snow" to a minimum. To avoid this, leave the VA62 set to 1000 microvolts so the AGC stage holds the IF amplifier gain at a fixed level that is not restricting frequency response.

During this final step, you must watch for several conditions in the MULTIBURST BAR SWEEP waveform: 1. The bars must roll off at the correct rate, 2. The lower frequency square waves must show the least amount of overshoot and ringing, 3. None of the bars must drop below the imaginary line



representing the black level, 4. None of the bars should be larger in amplitude than the one to its left, and 5. None of the bars must be missing or greatly reduced in amplitude.

The waveforms shown in Fig. 88 show normal video detector rolloff. Each of these waveforms is the optimum setting of all of the IF adjustments in four different chassis. Notice that the first two bars (the "0 Ref" and the 0.5 MHz bars) are larger than the others. This is caused by the video detector responding to lower frequency video information better than higher frequency information. This is normal for all detectors. As you adjust the IF stages, you want these bars to be as large as possible without causing the sync pulse compression covered earlier and without causing overshoot or ringing.

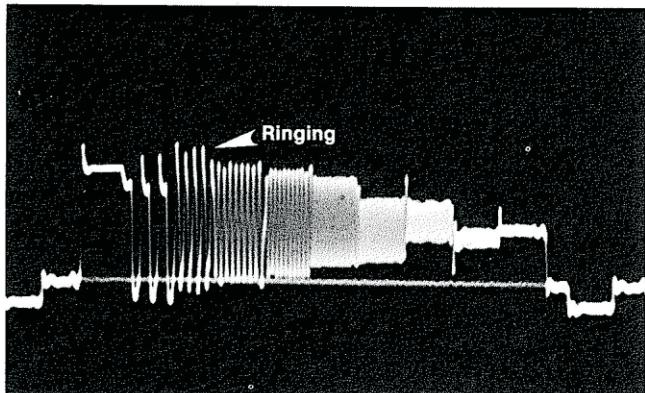


Fig. 89 — The IF stages should not cause overshoot on the low frequency bars. Overshoot causes harsh edges when there is a large contrast difference between an object and its background.

Now, look at the next four bars (the 1.0, 1.5, 2.0, and 2.5 MHz bars). These bars should be as close to the same amplitude as possible. (Black and white receivers roll off more quickly, and are covered separately.) In addition, none should drop below the line representing the black level, as shown in Fig. 90. If a bar does drop below the black reference, a stage is going into oscillation and must be retuned. If the oscillation is allowed to remain, the picture will be noisy on certain sized objects on the CRT, or at certain RF signal levels. To eliminate oscillation, detune the input of a stage slightly (usually the first or second IF amplifier) to reduce the peak-to-peak amplitude of the oscillating bar. Then, bring the amplitude of the bar back up by retuning the output of the same stage or the input and output of another stage.

The 3.5 MHz bar should be 50% of the amplitude of the "0 Ref" bar. In most cases, you will find the bar naturally falls at the 50% level when you adjust the IF stages for flat response on the center four bars. However, you should measure the amplitude of the 3.5 MHz bar at the conclusion of the alignment to confirm it is not too large or too small. Values between 40% and 60% are acceptable.

NOTE: The 3.5 MHz bar should be only 25% the amplitude of the "0 Ref" bar if the receiver does not have a 39.75 MHz trap and will be used on cable. If the 3.5 MHz bar is any larger, the receiver will have excessive adjacent channel pickup.

Fig. 88 — The normal rolloff of a properly aligned IF system. Notice that the first two bars are larger than the others, the next four bars are virtually the same amplitude, and the high frequency bars roll off to nothing.

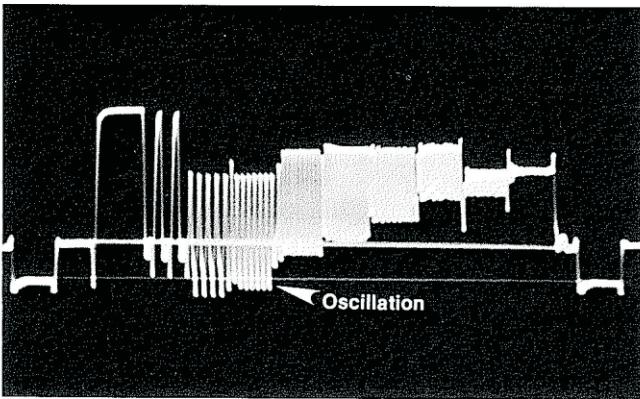


Fig. 90 — Bars that drop into the black or sync area indicate one of the IF stages has gone into oscillation. The IF stages must be adjusted to keep all the bars above the black level.

The 3.0 MHz bar will be approximately half way between the 2.5 and the 3.5 MHz bars in amplitude. It should be centered on an imaginary line running through the center of the lower frequency bars. (The 4.5 MHz bar automatically lies on this center-line because of the action of the 41.25 MHz traps in the IF stages.) The second or third IF stage adjustments usually affect the centering action, although any of the stages may cause some shifting. Note which adjustments cause the bars to shift during your first trip through the adjustments so you can compensate for shifting on later passes.

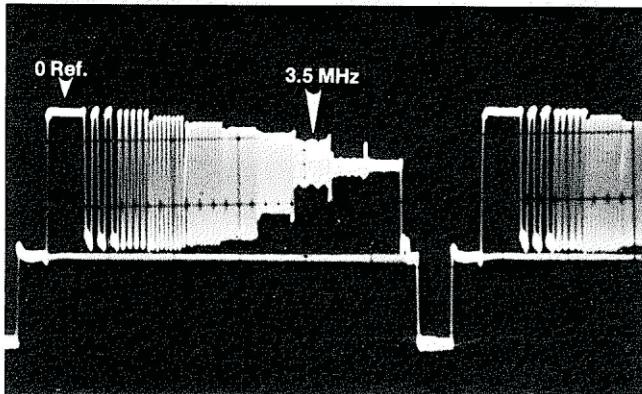


Fig. 91 — The 3.5 MHz bar should be one-half the amplitude of the "0 Ref" bar and its center should be close to the center of the other bars.

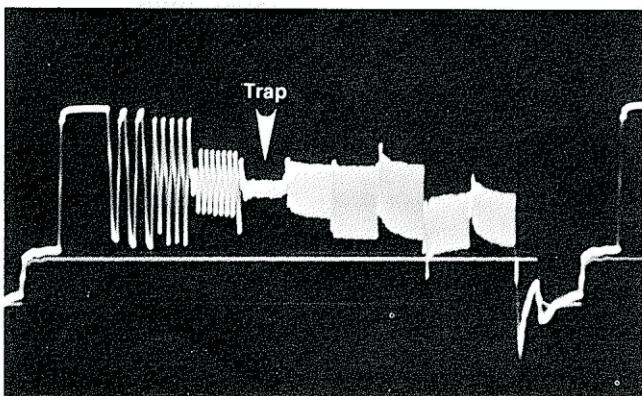


Fig. 92 — Check the setting of each of the traps if one of the bars is totally missing and cannot be adjusted with any of the bandpass coils.

You may occasionally encounter a situation where one of the bars is restricted in amplitude and cannot be increased as you adjust the various IF stages.

This indicates one of the traps is improperly tuned, and is sucking out the bar instead of the interfering carrier frequency as it should. Turn each of the trap adjustments slightly (about $\frac{1}{4}$ turn) to determine which one is affecting the bar (of course, remember to return the traps that do not affect the bar to the correct setting). Then, use the correct trap-setting signal to retune the incorrectly set trap. Pay careful attention to the action of the trap moving through the MULTIBURST BAR SWEEP bars as explained on page 63, as the trap may have two nulls.

Aligning Black and White Receivers

Most B & W receivers do not have as much IF bandwidth as color receivers. The IF response normally extends only to 2 or 3 MHz, and then rolls off quickly before reaching the 3.5 MHz color carrier. This allows extra sensitivity, eliminates the need for color traps in the video amplifiers, and reduces high frequency "snow" on weak signals.

You can determine the normal rolloff of the IF stages by comparing the MULTIBURST BAR SWEEP to the sweep generator curve in the manufacturer's alignment instructions. Details on comparing the VA62 signal to a sweep response curve are found in the next section.

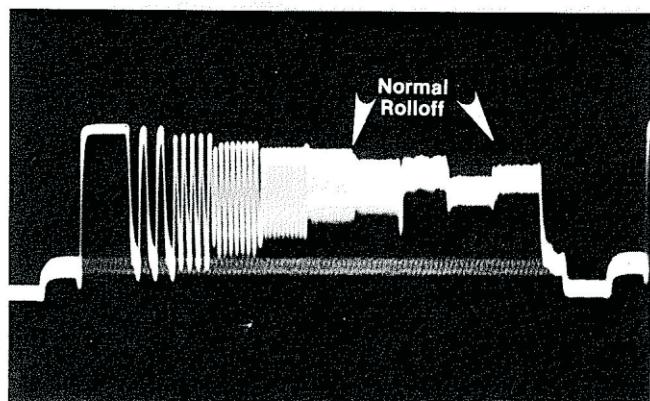


Fig. 93 — A black and white receiver often rolls off the high frequencies (from 3 MHz on) in the IF stages to reduce noise on weak signals and interference from the color carrier.

Comparing the Bar Sweep to Sweep Curves

There may be times when you want to use the manufacturer's literature to determine how quickly the IF response should roll off at the high video frequencies. This is especially helpful when aligning the IF stages of a color receiver that does *not* have a 39.75 MHz trap, or when aligning the IF stages of a black and white receiver.

You can determine the normal rolloff of the IF stages by comparing the MULTIBURST BAR SWEEP to the sweep generator curve in the manufacturer's alignment instructions. Ignore the area on the sweep and marker curve around the IF carrier (45.75 MHz marker). Use the VA62 MULTIBURST BAR SWEEP and the "10 Bar Staircase" video patterns to align for the correct response on the low video frequencies as explained earlier. The dynamic nature of the VA62 patterns provides the best possible alignment of the IF stages at these frequencies.

Use the sweep comparison to determine the correct video response for the MULTIBURST BAR SWEEP frequencies of 2 MHz and higher. The VA62 produces all of these bars at the same amplitude to aid in making this comparison.

The easiest way to compare the rolloffs is to use a dual-trace scope. Connect one of the scope's vertical input channels to the video detector output. Ground the second channel input. Select the dual-trace function and position the straight line from the grounded channel at the *middle* of the "0 Ref." bar. (If you don't have a dual-trace scope, use one of the graticule markings on a single-trace scope. Adjust the position control until the "0 Ref." bar is centered on a major graticule line.)

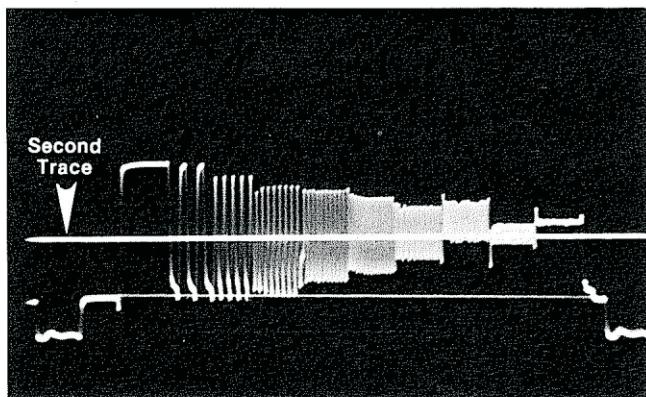


Fig. 94 — Use the second channel of a dual-trace scope to establish a reference line half way through the bars. Compare the portion of the bars above this line when comparing the high frequency rolloff to a sweep curve.

Now, look at the amount of bar rolloff for the 2.0, 2.5, 3.0, 3.5, and 4.0 MHz bars (the 4.5 MHz bar should always be a straight line near the center line). The rolloff of the bars (referenced to the center-line established earlier) should agree closely with the rolloff of the sweep curve near the 42.17 MHz color carrier marker.

Notice that the IF frequency of each of the VA62 MULTIBURST BAR SWEEP bars is marked below each of the MULTIBURST BAR SWEEP INTERRUPT buttons. Use these frequencies when you want to compare directly to a sweep and marker pattern. Remember that *higher* video frequencies produce *lower* IF frequencies because the sideband frequencies are reversed when the incoming RF signal is mixed with the local oscillator frequency in the tuner. You usually don't have to compare the exact frequencies if you remember which bars agree with which areas of the sweep curve in general terms. Do this by thinking of a sweep curve with the 45.75 MHz carrier on the left and the color carrier on the right. The VA62 MULTIBURST BAR SWEEP bars then follow in the same direction.

Aligning Synchronous Video Detectors

The synchronous video detector is an active video detector. It uses a circuit tuned to the video IF carrier to drive a transistorized bridge demodulator. The synchronous detector is always inside an IC. Not all IC detectors, however, are synchronous detectors. The only way to determine if the IC is a synchronous detector is to look for a coil marked "oscillator", "45.75 reference", or "detector

tuning". A conventional detector inside an IC does not have a similar adjustment. The detector may use one, two, or three adjustments.

One of the alignment adjustments always affects the linearity of the detected video signal. This is the only adjustment in a one-coil system. Some multi-control detectors call this coil the "limiter" coil. This adjustment is the most critical of any of the detector adjustments because it causes a major shift in the brightness or contrast of the detected video signal. In addition, minor misalignment of this coil often causes severe overshoot on the leading edge of square waves.

The other adjustments generally determine the lock-in range of the detector's tuned circuits or the amount of DC bias applied to the first video amplifier stages. These controls are not as critical as the linearity adjustment, but still must be properly adjusted for best performance.

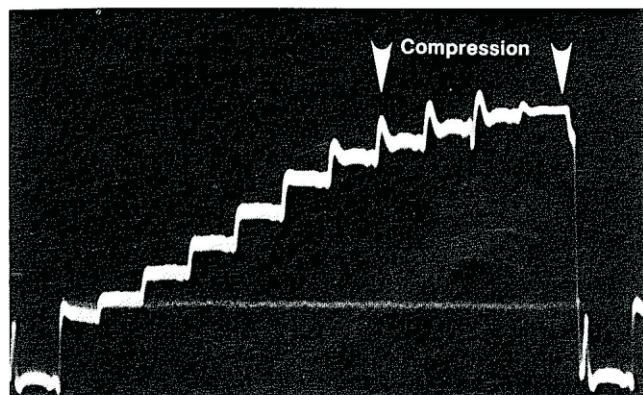
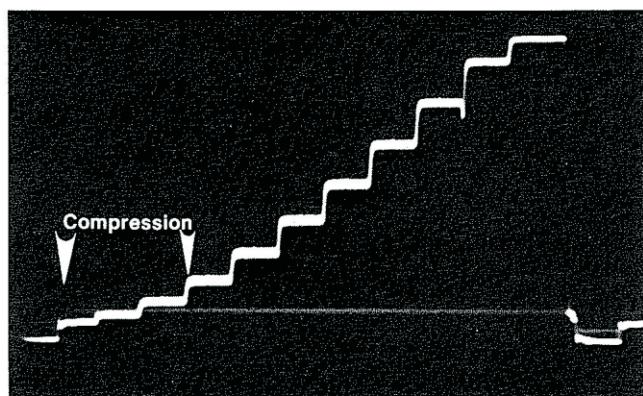
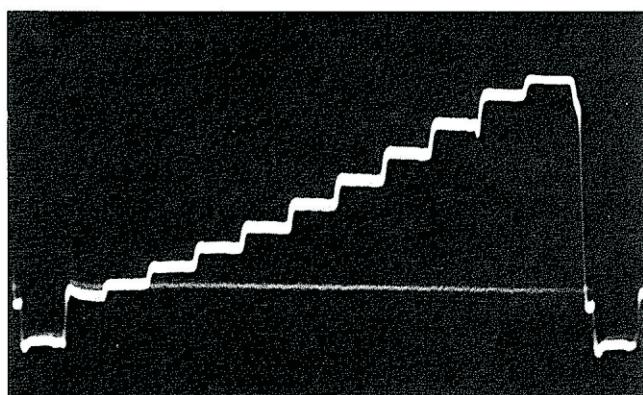


Fig. 95 — (A) Adjust the synchronous video detector for linear steps on the "10 Bar Staircase" pattern. (B) A bow in the middle of the steps indicates non-linear response. (C) Compression will affect contrast, and must be avoided.

Whenever you are aligning the detector, you should inject the VA62's "45.75 MHz VIDEO IF" signal into the IF input, using the same techniques explained under alignment of a conventional IF stage. Details are found on page 61. An oscilloscope must be used (as in conventional alignment) and is connected using the guidelines covered on page 61.

To align a one-coil system:

1. Adjust all traps before adjusting the detector.
2. Set the VA62 RF-IF attenuators to "Lo" and "Norm" output levels.
3. Set the VA62 VIDEO PATTERN switch to the "10 Bar Staircase" pattern.
4. Trigger the scope at the horizontal video rate.
5. Adjust the detector tuning control until the lines between the steps on the scope waveform are as straight as possible. Avoid compression of the top or bottom steps, or bowing of the steps between the two extremes. Also watch for signs of overshoot or ringing on the edges of the steps.

To align Zenith systems with three adjustments:

1. Adjust all traps before adjusting the detector.
2. Adjust the "zero carrier" control for the correct DC voltage at the composite video test point as explained in the Zenith service literature.
3. Feed the VA62 "45.75 MHz VIDEO IF" signal to the alignment test point with the RF-IF output level controls set to "Lo" and "Norm".
4. Adjust the "oscillator" coil clockwise until the pattern on the scope drops out to noise.
5. Count the number of counter-clockwise rotations, of the same slug, needed to reach the *second* point where the pattern drops out to noise.
6. Readjust the slug in the clockwise direction $\frac{1}{2}$ the number of turns from step 5. This centers the slug between the two points at which the detector loses its reference.
7. Adjust the "Limiter" coil for the best linearity of the staircase signal as shown on the scope.

SAW Filter Alignment

NOTE: IF stages using SAW devices almost always use synchronous video detectors. Always confirm the detector is aligned properly before working on the SAW adjustments.

IF stages using Surface Acoustic Wave (SAW) filters do not require alignment in the normal sense. The frequency response of the SAW system is determined almost entirely by the design of the SAW device. The one or two adjustable coils that remain match the input and/or output of the SAW device to amplifiers. These adjustments have much less affect on the detector output than the coils found in conventional bandpass systems because

they provide impedance matching instead of frequency response shaping.

Most SAW systems also include at least one IF trap. As with any IF system, the trap must be adjusted before adjusting any other matching coils. Traps in SAW systems are less responsive than those in conventional systems because the SAW device already provides a great deal of attenuation to the unwanted signal. Therefore, you need to watch the results on the trap setting signal very closely when adjusting a SAW trap.

You may prefer to use the PROGRAMMABLE IF GENERATOR in a chassis that shows little trap action. If so, use 1000 Hz audio modulation. Always use the least amount of IF signal that shows a trap pattern on the CRT.

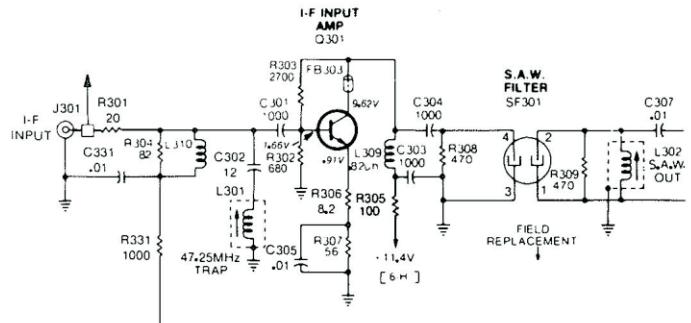


Fig. 96 — The SAW matching coils must be adjusted for the best sensitivity. Use the AGC feedback voltage as your reference.

After setting the trap(s), you are ready to adjust the other matching coils. The coils usually affect low-end sensitivity, rather than frequency response. The easiest way to adjust for best sensitivity is to monitor the AGC voltage with the VA62 digital meter. The procedures will vary slightly, depending on whether there is a test point available to monitor the IF AGC voltage. Some chassis do not provide a test point for this purpose because the AGC detector and the IF amplifier are inside the same integrated circuit. In such cases, you must monitor the tuner AGC voltage, which may only provide dynamic action over a limited range of signal levels. We will provide the procedures for adjusting the coils when an IF test point is available, and then provide a separate procedure if you must use the tuner AGC voltage.

To use the IF AGC voltage as a reference:

1. Connect the VA62 external DC meter to the IF AGC test point.
2. Feed the VA62 "45.75 MHz VIDEO IF" to the IF input using the IF input jack or tuner test point. If neither is available, you may feed to the antenna input *providing you are sure the AFT circuits are properly adjusted*.
3. Set the RF-IF LEVEL switch to "Lo" and the RF-IF LEVEL VERNIER to .5.
4. Adjust the SAW matching coils for the highest possible reading on the digital meter. This provides the best IF sensitivity.

When using the tuner AGC voltage as your reference, you must determine two things: the correct signal level, and whether the voltage must be peaked or nulled for correct response. First, connect the DC meter to the AGC line running to the tuner and monitor the voltage as you change the settings of the RF-IF LEVEL switch and of the RF-IF LEVEL VERNIER controls. You should notice that there are two extremes of voltage. One occurs at high signal levels, and one at low signal levels. Generally, there is only a limited range over which the voltage will change with changing signal levels.

You want to adjust the voltage to duplicate *high* signal levels. For example, if the voltage is at its *minimum* value with the high signal levels, you will adjust the SAW coils for the least amount of voltage. Similarly, if the voltage is at its *maximum* value with the highest signal level, you want to adjust the SAW matching coils for the *highest* voltage.

After you have determined whether you need to peak or null the SAW adjustments, use the following procedures to adjust the SAW matching controls:

1. Adjust the VA62 output through its range of levels to determine where the AGC circuits provide dynamic action (the range of signals that cause the AGC voltage to change as the signal level is changed).
2. Set the VA62 output to the *lowest* level that is within the dynamic range determined in step 1.
3. Adjust the SAW matching coil until the AGC voltage is either peaked or nulled (as determined earlier) with the setting of the VA62 output level in step 2.
4. If the SAW matching adjustment causes the AGC voltage to reach a maximum or minimum value, reduce the setting of the VA62 and repeat the SAW matching adjustment until no further improvement is noted.
5. Repeat steps 1 through 4 for any additional SAW matching coils.

“Spot Aligning” IF Stages

There may be times when you want to set the IF bandpass coils close to the correct settings before doing the final alignment with the MULTIBURST BAR SWEEP pattern. This may be necessary because all of the coils are completely out of alignment or because of major circuit repairs. If this becomes necessary, you can use the PROGRAMMABLE IF GENERATOR to “spot align” the coils.

In spot aligning, you adjust a coil for maximum gain at a certain frequency. The frequency is best determined by referring to the alignment instructions written for a sweep generator as these instructions often indicate which frequency a certain coil is designed to favor in the overall response curve.

The easiest way to determine whether you have

peaked a coil is to monitor the AGC voltage feeding the first IF stage with the VA62 DCV meter. In addition to providing a convenient reference, monitoring the AGC eliminates the need to clamp the AGC with a DC bias while aligning the various stages.

Set the VA62's PROGRAMMABLE IF GENERATOR to the desired frequency. Increase the output of the VA62 until you notice a change in the AGC voltage. Then peak the coil associated with that frequency for the highest AGC voltage.

Spot alignment never gives optimum results when you are finished. You must adjust all of the IF coils for best balance. Use the standard MULTIBURST BAR SWEEP alignment instructions on page 60 to achieve the optimum response. The MULTIBURST BAR SWEEP alignment will be simplified because you are simply balancing the adjustments rather than starting from scratch.

Chroma Bandpass Alignment

WARNING

Never align the chroma amplifiers until you are satisfied the video IF stages are properly aligned.

The video IF stages roll off the color information between 3.08 and 4.08 MHz in order to prevent ringing on low frequency video information. This can easily be seen if you view the CHROMA BAR SWEEP video pattern at the video detector output. The left-hand (3.08 MHz) bar should be the largest, the center (3.58 MHz) bar should be smaller, and the right-hand (4.08 MHz) bar should be the smallest of the three bars.

The color circuits must compensate for this rolloff before the color signals can be detected. Uneven amplification of the upper and lower color sidebands causes phase errors which, in turn, cause the receiver to display the wrong colors. The needed compensation takes place in the chroma bandpass amplifiers.

In order for the bandpass amplifiers to compensate for the rolloff in the IF stages, the signal used to align the chroma bandpass amplifiers must pass through the *video IF stages and the bandpass stages*. Therefore, the VA62 signal is injected at the *same point* for video IF alignment and for chroma alignment.

Connect your oscilloscope to the output of the last chroma amplifier (just ahead of the color demodulators). There are no sync pulses to reference the scope at this test point, so externally trigger your scope from a test point that has sync pulses or from one of the VA62 horizontal DRIVE OUTPUTS.

Use the CHROMA BAR SWEEP video pattern as your reference. Make sure the 3.0, 3.5, and 4.0 MHz MULTIBURST BAR SWEEP INTERRUPT buttons are all depressed to add the three reference bars to the pattern. The ideal alignment of the chroma bandpass amplifiers results in the three bars being as tall as possible and equal in amplitude. If

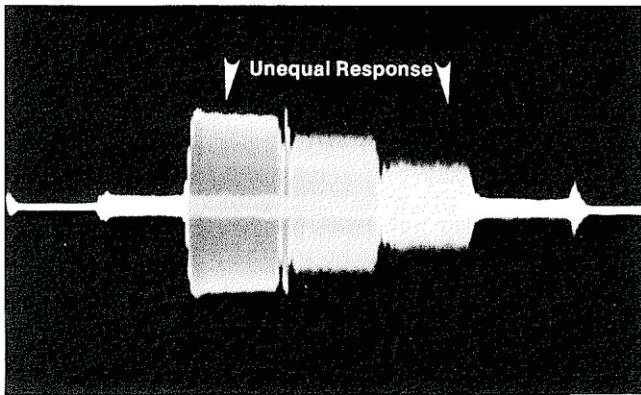
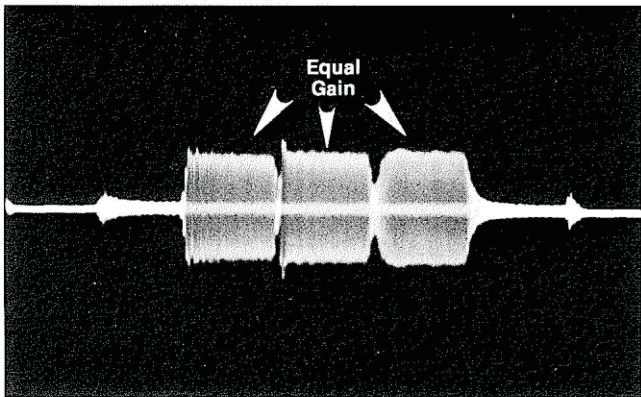


Fig. 97 — In a conventional chroma bandpass amplifier system, the three Chroma Bar Sweep bars should have the same amplitude when injected at the input to the first video IF stage and monitored at the input to the color demodulators. (A) A properly aligned chroma amplifier. (B) Unequal response due to improper alignment.

you must compromise between the two, the equal amplitude is more important than overall gain.

You should check the setting of the 4.5 MHz sound trap if you cannot get all three bars equal in amplitude. Watch the chroma bandpass amplifier output as you move the 4.5 MHz trap a quarter turn in either direction. The bars *should not* be affected if the trap is properly adjusted.

IC Chroma Stages

Chroma amplifiers inside an IC may only have one adjustment that affects the chroma bandpass. This may be called a "crosstalk" control in some receivers. This single adjustment allows you to

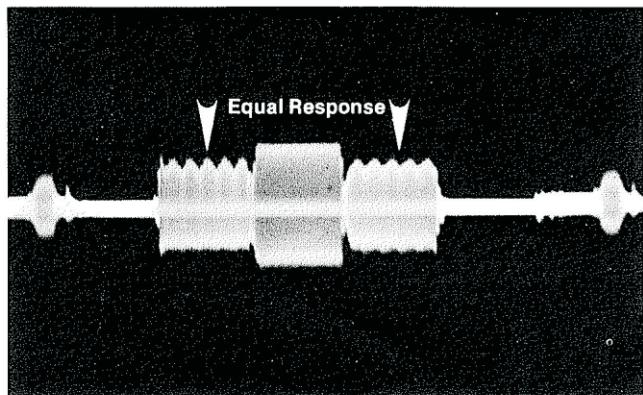


Fig. 98 — The output of an IC bandpass system may have the center (3.58 MHz) bar larger than the other two. If so, make certain the two outside bars have the same amplitude.

balance the upper and lower sideband bars, but does not affect the center bar. The center bar will normally be larger than the other two in these chroma amplifiers. Adjust the control until the left and right hand bars have the same amplitude.

Cable Shifted Channels

Cable systems often shift the frequency of the video carrier of some or all of the channels to prevent interference. This interference sometimes comes from an over-the-air station. At other times, the interference comes from the carrier of one channel mixing with the harmonics of another channel within the cable system itself. The two most common schemes for shifting the frequencies are called the Harmonic Related Carrier (HRC) and the Incremental Coherent Carrier (ICC).

The HRC scheme shifts all of the video carriers so that the video carrier frequencies of higher cable channels land at exact multiples of the video carrier frequencies of low VHF channels. Thus, the upper channels are harmonically related to the lower channel carriers. All carriers that are harmonically related are then phase-locked together so the harmonics of a lower channel cannot cause interfering beats in the carrier of a higher channel.

All of the video carrier frequencies must be shifted from the FCC assigned frequencies in order to get all of the harmonics to fall in line with each other. This is done by shifting all of the carriers (except for VHF channels 5 and 6) *down* 1.25 MHz from the FCC channel frequencies. The FCC frequency assignment includes a gap between channels 4 and 5 which causes channels 5 and 6 to be out of the normal 6 MHz step sequence compared to all other channels. Channels 5 and 6 are, therefore, shifted *up* by 0.75 MHz to make them fall into line with the other channels. This results in a full 6 MHz gap between channels 4 and 5, which is filled with an extra channel on some cable systems.

The ICC system leaves all of the channels (except for channels 5 and 6) *at the standard FCC assigned frequencies*. Channels 5 and 6 are moved *up* 2 MHz to make them fall into normal 6 MHz steps. Now, the harmonics of each carrier never fall close enough to the carrier of higher frequency channels to cause interference. Like the HRC system, moving channels 5 and 6 results in a full 6 MHz gap between channel 4 and channel 5, which may be filled with an extra cable channel if desired.

The extra cable channel between channels 4 and 5 is called "4+", "5A", or "A-8". We will call this extra channel "4+" in VA62 literature. The "4+" and "5A" names are pretty obvious, but not "A-8".

Originally, cable channels were given letter designations, starting at 121.25 MHz. This kept the frequencies occupied by the FM band (88.1 through 107.9 MHz) open. Some cable systems do not carry FM stations and found that TV channels could be placed in the FM band. These extra channels were numbered backwards from "A": A-1, A-2, etc. If you continue to count backwards until you get to the gap between channels 4 and 5, you will find you are eight, 6 MHz channels down from channel "A", leading to the designation "A-8".

The VA62 can provide a signal at channel "4+" for either the HRC or ICC frequency, as needed. Like most digital tuners, however, 4+ is not part of the normal numbering sequence because it is used so seldom in cable systems. Some tuners, for example, assign it channel number "00". Others assign it some other number out of the normal cable tuning sequence. Still others leave 4+ off altogether.

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

Fig. 99 — Both cable shifting methods provide space for an extra channel between 4 and 5.

You can use the PROGRAMMABLE CABLE CHANNEL feature to move channel 4 up or channel 5 down in frequency to produce the correct channel 4+ carrier. The amount of shift will depend on whether you are making the adjustment for an ICC

or an HRC system. The HRC system needs a carrier of 72.00 MHz for channel 4+. This can be obtained by shifting channel 4 up by 4.75 MHz, or channel 5 down by 5.25 MHz. The ICC system assigns channel 4+ to 73.25 MHz (6 MHz higher than FCC channel 4). This can be reached on the VA62 by shifting channel 4 up by 6.00 MHz or channel 5 down by 4.00 MHz.

You may wish to program in all of the other carrier shifts, except for channel 4+, and only shift the VA62 when it is necessary to test an occasional tuner. The instructions for shifting the carrier are included in the *VA62 Simplified Operating Instructions* on the pull chart under the unit.

Some local cable systems may shift the carriers of some cable channels using a different scheme than the HRC or ICC methods. If so, the VA62 PROGRAMMABLE CABLE CHANNEL feature may be programmed for any frequency shift up to ± 9.75 MHz. See page 17 of the operating instructions (or the pull chart under the VA62) for instructions on programming the VA62 memory. Once the memory has been programmed, the shift instructions are kept in non-volatile memory (until reprogrammed), even if the power to the unit is removed—no battery is needed to maintain the memory.

BAND	DIGITAL TUNER NUMBER	ALPHA-NUMERIC DESIGNATION	VIDEO CARRIER FREQUENCY
Low Band VHF	2	2	55.25
	3	3	61.25
	4	4	67.25
	5	5	77.25
	6	6	83.25
	69	A-5	91.25
Mid Band Cable	70	A-4	97.25
	71	A-3	103.25
	72	A-2	109.25
	73	A-1	115.25
	14	A	121.25
	15	B	127.25
	16	C	133.25
	17	D	139.25
	18	E	145.25
	19	F	151.25
	20	G	157.25
	21	H	163.25
	22	I	169.25
High Band VHF	7	7	175.25
	8	8	181.25
	9	9	187.25
	10	10	193.25
	11	11	199.25
	12	12	205.25
	13	13	211.25
Super Band Cable	23	J	217.25
	24	K	223.25
	25	L	229.25
	26	M	235.25
	27	N	241.25
	28	O	247.25
	29	P	253.25
	30	Q	259.25
	31	R	265.25
	32	S	271.25
	33	T	277.25

BAND	DIGITAL TUNER NUMBER	ALPHA-NUMERIC DESIGNATION	VIDEO CARRIER FREQUENCY
Super Band Cable (Cont'd)	34	U	283.25
	35	V	289.25
	36	W	295.25
Hyper Band Cable	37	AA	301.25
	38	BB	307.25
	39	CC	313.25
	40	DD	319.25
	41	EE	325.25
	42	FF	331.25
	43	GG	337.25
	44	HH	343.25
	45	II	349.25
	46	JJ	355.25
	47	KK	361.25
	48	LL	367.25
	49	MM	373.25
	50	NN	379.25
See Mid. Band A-1, A-5.	51	OO	385.25
	52	PP	391.25
	53	QQ	397.25
	54	RR	403.25
	55	SS	409.25
	56	TT	415.25
	57	UU	421.25
	58	VV	427.25
	59	WW	433.25
	60	XX	439.25
	61	YY	445.25
	62	ZZ	451.25
	63	AAA	457.25
	64	BBB	463.25
	65	CCC	469.25
	66	DDD	475.25
	67	EEE	481.25
	68	FFF	487.25

Fig. 100 — Standard (non-shifted) frequencies for VHF and cable channels.