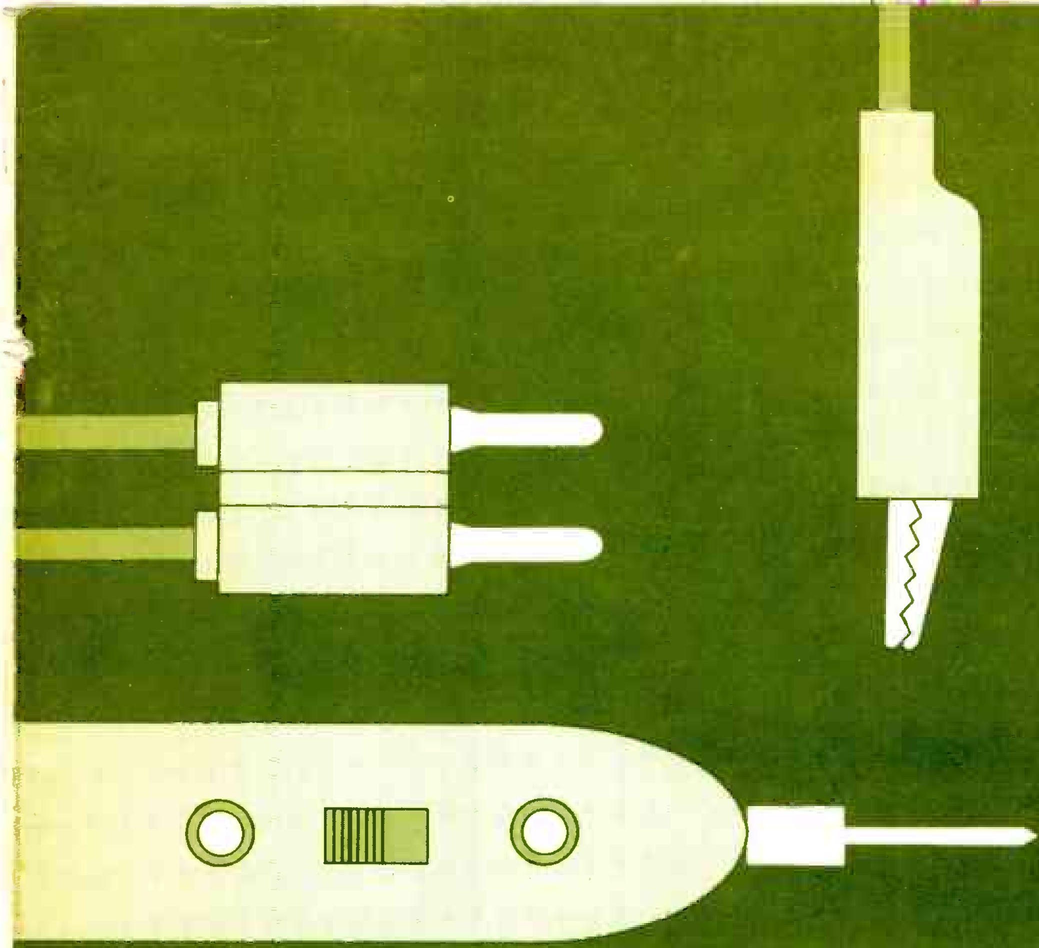

● Oscilloscope Probes . . . Who Needs Them?

● Further Adventures in TV Servicing

nri journal

September/October 1975

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Diode rated 2 amps at 1000 volts, an "open" position on each of the three component selector switches, a "short" position on the switch selector.	

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In this issue, NRI Development Engineer Joe Turner discusses the whys and hows of test probes, and veteran Journal author J. B. Straughn adds another to his ongoing series of TV servicing case histories.

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OSCILLOSCOPE PROBES

...who needs them?

by Harold J. Turner, Jr.

You do, if you have a scope. Why? First of all, to prevent your test instrument from loading the circuit under test. In other words, to make sure that the circuit you are testing works exactly the same while you are measuring it as it does when no test equipment is used. Otherwise, your measurement may be misleading and you might spend hours trying to track down a very simple problem that exists only when the scope is connected. Second, the connection between any test probe and the scope is made with shielded cable, so noise pickup is greatly reduced. Finally, some probes are designed to allow your equipment to do special jobs that would be impossible otherwise.

Most oscilloscopes are sold without the probes needed to get the most use of this indispensable servicing instrument. Test equipment manufacturers market their products in this way because some potential customers will already have suitable probes and might object to paying for something they don't need. Probes are offered separately, either individually or in sets. Some scope users mistake this marketing practice for an assurance that they don't need probes. This is really unfortunate, since many technical people might then go for years without getting the greatest use of their test equipment. This article explains what types of probes are available, what they can do, and how *you* can use them.

THE DIRECT PROBE

The simplest probe consists of a piece of shielded cable with a connector at each end like the one shown in Figure 1. At the oscilloscope end, of course, the connector must mate with whatever type of connector is used on the equipment. The other end is terminated in a probe housing you hold in your hand for testing circuits.

Notice the ground wire connected to the shield at the probe end of each of the probes shown. This ground wire should be clipped to the ground circuit of the

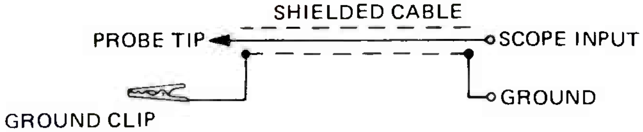


FIGURE 1. THE BEGINNING: A DIRECT PROBE.

equipment under test at a point as close as possible to the measured point. No other ground connection should be made between the equipment under test and the test instrument. If you follow this simple precaution, you will be assured of a very low level of noise pickup.

The direct probe is a big improvement over ordinary test leads because the shielded cable greatly reduces noise pickup. However, the reduction of noise is not free: there is a fairly large capacitance between the center conductor and shield of the cable. The amount of capacitance depends on the type and length of the cable used, but it is usually about 100 pf. The input capacitance of a typical scope is much less than this, so the addition of the shielded cable greatly increases the effective input capacitance. Remember, we want to avoid loading the circuit under test, and placing a capacitor from the test point to ground will certainly affect some circuits. In high-impedance or high-frequency circuits, this extra capacitance to ground acts as a low-pass filter, which will reduce the amplitude of high-frequency signals and distort the shape of complex waveforms. Fortunately, there are many circuits that are not noticeably affected by this small extra capacitance, especially in low-impedance and/or low-frequency circuits. For example, you would use the direct probe in checking the ripple voltage in a power supply or in making stage-gain tests in an audio amplifier.

Only the direct probe permits the full gain of the oscilloscope to be used; all the other types of probes cause some loss of signal strength. This means that the direct probe should be used where the signal to be observed is very small, as long as the lack of isolation does not load the circuit. Now, let's see how we can get some isolation.

LOW-CAPACITANCE PROBE

We cannot eliminate this troublesome capacitance, but we can compensate for it. The easiest way to do this is to add another capacitor in series with the probe end of the cable. Then, these two capacitors (the added one and the scope input capacitance, including the cable capacitance) will act as a voltage divider to reduce the strength of the signal applied to the scope input. At the same time, the effective capacitance from probe tip to ground is reduced.

Usually, a probe is designed so that the attenuation factor is 10:1. This means that the input capacitance also will be reduced by the same factor. The added capacitor will be very small, and the effective capacitance will be even smaller. Remember, capacitors in series add like resistors in parallel.

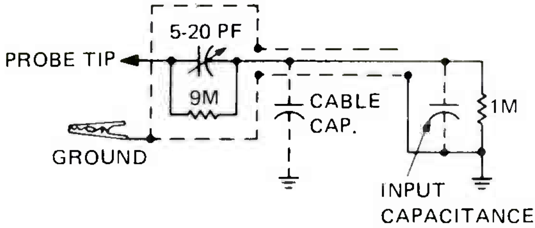


FIGURE 2. BASIC 10:1 LOW-CAPACITANCE PROBE. ADJUSTABLE CAPACITOR IN PROBE IS SET FOR FLAT RESPONSE.

$$C_t = \frac{C_1 \times C_2}{C_1 + C_2}$$

However, since the scope input circuit consists of a resistance in parallel with a capacitance, if we add either a resistor or capacitor in series with the input, the frequency response of the scope will be affected. In most cases, this is undesirable. So, we must use a parallel resistor and capacitor in series with the input, as shown in Figure 2.

The resistor value is made nine times that of the oscilloscope input resistance, and the capacitor is one-ninth the input capacitance (which is the same as nine times the capacitive reactance of the input capacitor). Thus, the input impedance will be ten times as high as it was with the direct probe, so the circuit loading will be only one-tenth as much. Of course, as you can see, this probe also reduces the sensitivity of the scope by a factor of ten to one, so very small signals may not be observed. Still, this type of probe is the one you will need most often, since it keeps circuit loading to a minimum. Usually scope gain is high enough to offset the probe loss for all but very low-level signals.

The series capacitor on such a probe is sometimes made adjustable to match the probe to the scope. The best way to do this is with a square-wave generator furnishing a 1-kHz signal. First, connect the scope directly to the generator to make sure that the response is flat. Then, connect the low-capacitance probe between the two instruments. Naturally, there will be a 10:1 reduction in signal strength. But the important thing is the waveshape. You must adjust the capacitor so that the square wave looks just as it did without the probe: the top and bottom of the signal

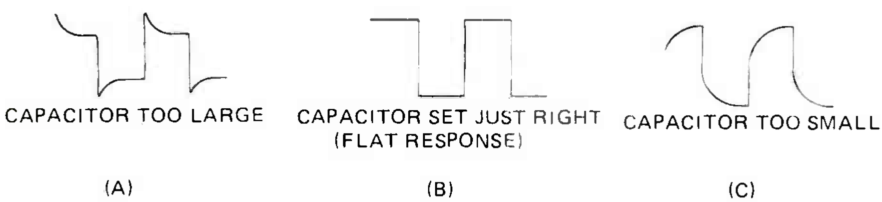


FIGURE 3. WAVEFORMS WITH VARIOUS CAPACITOR SETTINGS.

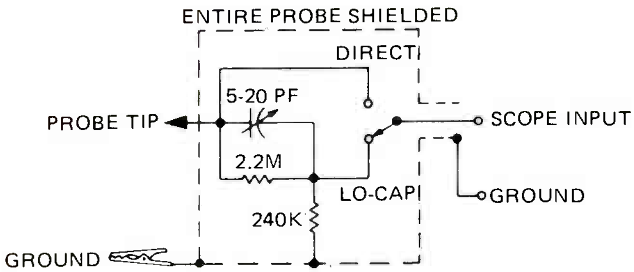


FIGURE 4. A COMBINATION DIRECT LOW-CAPACITANCE PROBE.

must be flat horizontal lines on the scope screen. This shows that the overall frequency response is flat; and the scope and its probe do not favor either high or low frequencies. The waveforms you will see when you make this adjustment are shown in Figure 3. Even if your low-capacitance probe does not have an adjustable capacitor, you can still make this check to see if the probe is working properly.

Figure 4 shows a combination direct-low-capacitance probe. Notice that this probe differs from the low-capacitance probe described before – a second resistor has been added to the probe. This probe is designed for use with an oscilloscope having a 3.6-megohm input impedance. The two resistors in the probe are used, with the scope input resistance, as a 10:1 voltage divider. If only a single series resistor were used, as in Figure 2, its value would have to be 32.4 megohms (9 times 3.6 megohms), and such a resistor is not available at reasonable cost. (Standard resistors are made in values as high as 22 megohms.) Also, on this probe, there is a small switch to allow selection of either direct or low-capacitance functions.

RESISTOR ISOLATED PROBE

Using a resistor or capacitor alone in series with the probe will affect the frequency response, but there are cases where this is desirable. For example, in sweep alignment work, a resistor isolated probe (Figure 5) is used to cause a rolloff of high-frequency response. This is a great help in sharpening the appearance of any markers on the response curve. (For details on why this happens, see pp.30-32 of the RCA "Test Equipment-Book Two-Alignment Techniques" which is available from RCA Sales Corp., 600 N. Sherman Dr., Indianapolis, Indiana 46201.) Also, since the probe acts as a low-pass filter, it prevents any rf or i-f signals from the

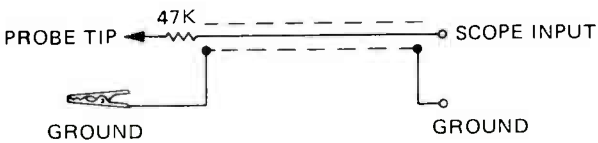


FIGURE 5. ADDING A RESISTOR AT THE PROBE END OF THE CABLE ISOLATES THE CIRCUIT UNDER TEST FROM THE INPUT CAPACITANCE.

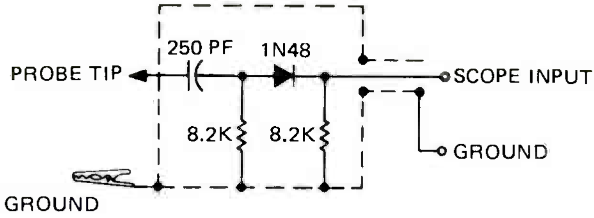


FIGURE 6. A DEMODULATOR PROBE.

receiver under test from getting into the scope and affecting the measurement. Remember, all it takes to make a low-pass filter is a series resistor and a shunt capacitor. The resistor is the one added in the isolation probe, and the capacitor is the cable capacitance. These two act together as any similar RC network in filtering out high frequencies.

DETECTOR PROBES

Although the circuit of a detector probe (sometimes called "demodulator probe") shown in Figure 6 is the most complex one of all we've seen in this article, this probe is no more than an ordinary AM detector circuit. In fact, it is very similar to the diode detector circuits used in almost every radio and TV receiver. The purpose of this probe is to allow the scope to make accurate measurements of the modulation superimposed on very high-frequency carriers. For example, this probe will let you signal trace in the video i-f amplifier circuit of a TV receiver. The frequencies handled by this part of the set are far too high to be seen directly by the scope. (Remember, most good service scopes go only as high as 4.5 MHz or so.) The signal must be modulated; otherwise the output of the probe would be simply a dc voltage, which wouldn't give much indication on the screen of your scope.

IN CLOSING

Let me recommend a handy piece of hardware that has saved me much time over the last few years: the double banana plug. In case you haven't noticed, almost all brands of service scopes use a pair of five-way binding posts for the vertical input connection. Naturally you've seen that these posts will accommodate standard banana plugs, but also the spacing between these binding posts is standardized at three-quarters of an inch (center-to-center), so you can use a dual banana plug (such as the H. H. Smith No. 1675) instead of fumbling around with separate plugs or some makeshift arrangement. These connectors are available from most parts suppliers (including mail-order companies . . . but *not* from NRI) for about 72 cents—a good investment.

The 1975 Gernsback Award Winners

NRI is proud to announce the winner of the 1975 Hugo Gernsback Award. The award has been presented to Lamont Whitlock of Madison Heights, Michigan. Since 1971, NRI has cooperated with Radio-Electronics Magazine in making this annual scholarship award of $125 to a deserving student currently enrolled in NRI. The award is applied toward furthering the selected student's education in electronics. NRI is one of eight home-study electronics schools chosen to perpetuate the scholarship, established by Radio-Electronics in memoriam to Hugo Gernsback, its founder and a notable pioneer in electronics.

This year's Hugo Gernsback Award winner, Lamont Whitlock, was born in 1951 in Mayfield, Kentucky. In 1970, he enlisted in the Marine Corps, where he earned his high school GED certificate with a score of 92 percent. Lamont's interest in electronics began with his military training as a radio-telecommunications maintenance man.

After his discharge, while on a hunting trip in Michigan, Lamont was arrested for carrying an unlicensed weapon and was sentenced to serve a term in the Arenac County Jail. While serving his sentence, Lamont worked as an inmate instructor in weight training, high school GED studies, English, and mathematics. It was there also that he enrolled in NRI's Master TV/Audio Servicing course. Now released, Lamont plans to continue his NRI training with courses in communications electronics and digital computer electronics.

This year's second prize winner is Donald J. Thorne, Sr. A native of Minneapolis, Donald completed his first NRI course in 1961 in appliance service technology. He is presently enrolled in NRI's Complete Communications course. Donald's two oldest sons, Donald Jr. and Edwin, are also enrolled in NRI courses, and the three Thornes are presently planning on going into business together.

NRI and Radio-Electronics Magazine take sincere pleasure in congratulating both of this year's winners.

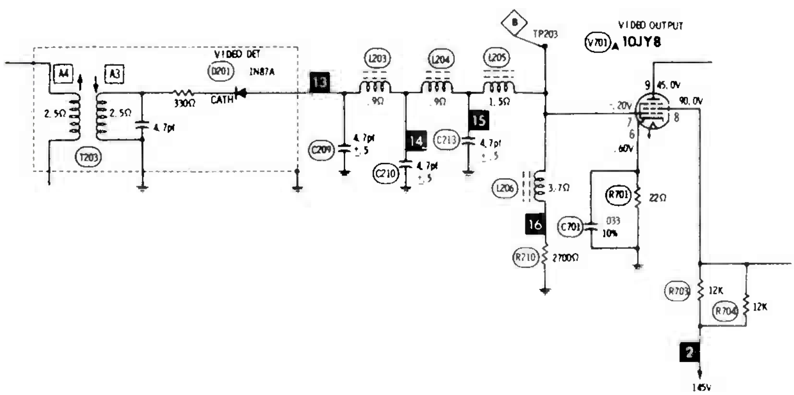
further adventures in tv servicing

J.B. Straughn

TRUETONE MODEL MIC3912B-17

This black-and-white receiver came in with the complaint that there was raster and sound but no picture. I tried adjusting the agc, as this could be the cause of the trouble. The control was defective – the slider was not making good contact with the resistive element. With a voltmeter connected to the agc test point, I could run the agc voltage through its normal range, if only intermittently, and since no picture appeared, I decided that this was not the trouble. I would have to replace the control, however.

Since I had good sound, it seemed that the trouble would have to be in the video amplifier stage or thereabouts. The circuit in question is shown in Figure 1. I



Courtesy Howard W. Sams

FIGURE 1. VIDEO DETECTOR AND VIDEO AMPLIFIER OF TRUETONE MIC3912B-17.

removed the video output tube for a check and found it to be an 8JV8 instead of a 10JY8 as shown in the Sams diagram. A tube substitution book showed the two tubes to be interchangeable. However, the tube layout pasted in the rear cover indicated an 8JV8 tube was originally supplied. I don't know why Sams showed the 10JY8 in the schematic, but I didn't worry about it.

I started checking with the ohmmeter and right off measured only 50 ohms from pin 7 of the 8JV8 to the chassis. Reversing the test probe polarity didn't change the reading as it should, due to the presence of the diode used as the second detector. I figured the diode must be shorted. On the circuit board I followed the lead from pin 7 of the video amplifier under a small flat shield on top of the chassis, which I supposed contained the parts.

I removed the shields, both top and bottom (I had to take off the bottom to get at the lugs of the top shield). There were a couple of small capacitors and a peaking coil under the top box. There was no sign of the second detector diode, and in fooling around inside the shield can, I managed to break the wire of the peaking coil. At this point, I decided the diode must be inside the can of the last video i-f transformer, which I proceeded to remove. Sure enough – the second detector was in the can along with a couple of small capacitors and another peaking coil.

The circuit was not at all like the schematic. Instead, it was like the sketch shown in Figure 2. The thing that got me was that the 330-ohm resistor was missing, and there was an extra peaking coil. In addition, there were two diodes in series for the second detector. From the schematic and parts list, I determined that the damaged coil, L203, had an inductance of 27 μh. The nearest I could come at the wholesalers was 22 μh, which I installed. I also replaced the two diodes (they were shorted) with a single diode.

After putting everything back together, a very good picture was received but the sync, both horizontal and vertical, was soon lost and the picture started washing out. Soon the set was back to where it started with raster and sound but no picture.

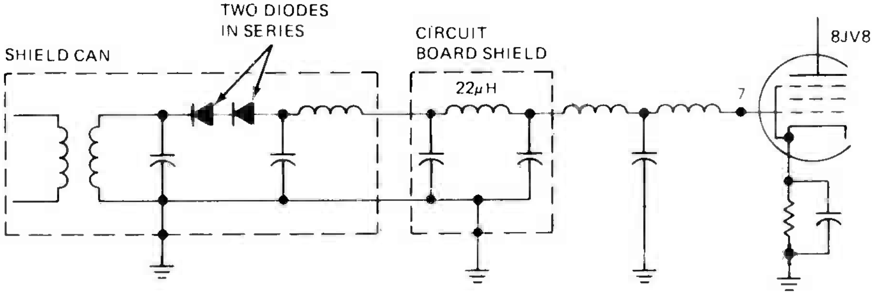


FIGURE 2. ACTUAL CIRCUIT OF TRUETONE VIDEO DETECTOR.

I rechecked the resistance from pin 7 of the 8JV8 tube to the chassis and found it to be an almost dead short, so I removed the i-f can again and found the diode I had installed was shorted. The question immediately arose – why? Also, why did the schematic show a 330-ohm resistor in series with the diode (this is not usual), and why were there two diodes in series installed by the factory? To me, it indicated that the factory engineers had had trouble with diodes burning out, and they were playing it by ear as the sets came off the assembly line. I know that another manufacturer had cured trouble of this sort by using a 470-ohm resistor in series with the diode, so I decided to use a 470-ohm resistor and a single diode.

I picked up a new 8JV8, a replacement agc control, and a pair of 1N87A diodes at the wholesalers. I didn't think the heat from my soldering gun was too much for the diode, but bought a small heat sink for 47 cents anyway to hang between the solder point and the body of the diode. This would absorb any heat that otherwise might flow into the diode and ruin it.

I arranged the circuit as shown in Figure 1, using a 470-ohm resistor in place of the 330-ohm unit. I must confess that I forgot all about using the heat sink, and a check after all the soldering had been done showed that the diode was still OK! Oh well, perhaps I can use it to hold a fishhook if I ever take up fly tying.

After stuffing the coil with connected parts back into the shield, I checked for shorts to the can. There was no short between the primary and can but an almost direct short between the secondary and the shield can. I removed the coil, fished out the sticky tape supposed to surround the coil, and wrapped it around the "works" and reinserted it in the can. Again a short resulted.

After about three more tries I was thinking about using cellophane tape, but happened to see the glassine container in which the diode had been wrapped. I cut it to the desired size and fitted it around the coil and parts. When I put it in the shield can, no short appeared and there was no leakage using the highest range of the ohmmeter.

I cleaned out the holes in the circuit board for the transformer, its can, and the agc control, and inserted these parts in the circuit. I turned the set on and as it warmed up got good sound. As the raster started to appear, the sound decreased. The picture never showed up, but the raster was good. Now I was worse off than when I started – the sound was out too and all I had was a raster. I thought the diode has shorted again, and got ready to go into the set to see what had happened this time.

I had just pulled the line cord out of the wall outlet when it occurred to me that I had replaced the agc control and maybe I should adjust it. This was the trouble – the agc was set so that when it started working with the appearance of horizontal sweep and raster it simply cut off the video i-f amplifier. By turning the control to decrease the agc voltage, the picture came in with the sound. I adjusted the control and the set worked like new. I was very pleased with the set and myself! I had used up two diodes, the agc control, and lots of time and patience. I had also bought a Sams manual for a little over $4. For this, the bill was $37.50. This was not excessive, considering the labor and a round trip of 85 miles to buy parts.

Considering all that I had gone through, it seems to me that the defect in the agc control was the root of the trouble. I think the agc voltage was reduced to the point that excess voltage was applied to the diode and it broke down. These diodes have an inverse voltage rating of only 60 volts, and this could easily be exceeded on a strong signal with no agc. This may be a good point to remember when adjusting agc circuits – don't adjust the agc past the point where the picture starts to lose sync.

The purpose of the two original diodes in series was to limit the current flow and to spread the voltage between them. Don't ask me why a resistor was not used in place of the extra diode. Maybe they had an oversupply of diodes and were short on 330-ohm resistors! Technical people do funny things sometimes for no apparent reason. All of this reminds me of an NRIAA meeting at which I was discussing the NRI vtvm. I was asked why I had chosen 22k-ohm resistors for the cathodes of the 12BH7 tube when the value was not critical. My reply was that I thought red-red-orange resistors looked better than 18k-ohm (brown-gray-orange) resistors. This explanation afforded a good laugh.

I thought I was all through with this set and had written it up for the Journal, but a week later it came back with no raster. The horizontal output tube didn't get as hot as it should, so I figured it had little or no screen or plate current. I got out the schematic again and found that while it had been OK for the previous work, the horizontal sweep circuit was quite different, using a 21Z6 instead of the 38HE7 shown on the schematic. I noted from the schematic that the screen voltage was

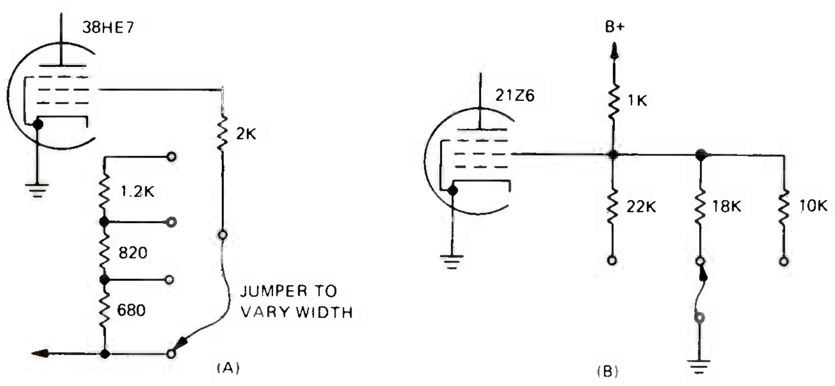


FIGURE 3. WIDTH ADJUSTMENT USING SERIES (A) AND SHUNT (B) RESISTOR.

adjustable to vary the width. The adjusting tap should be an easy place to check the screen voltage, since I assumed both versions used the same type of width control.

The schematic for the set using the 38HE7 is shown in Figure 3(A). Since the chassis had the same tap arrangement, I checked for screen voltage at the moveable jumper lead. No voltage was present. An examination showed the jumper was grounded, and it sure wasn't in the schematic I had.

The next time I went to town I got the correct schematic – see Figure 3(B). The jumper, as you can see, is supposed to be grounded. The screen voltage is adjusted, not by changing the series screen supply resistance, but by using different size shunt resistors from the screen to ground. It could have been done just as well the other way, but that's a designer for you.

An ohmmeter check showed a very low resistance from the screen to chassis. I couldn't see anything wrong, so I started poking aimlessly at the parts near the screen terminal of the 21Z6 on top of the circuit board while the set was turned on. Suddenly there was an arc from the spot I was poking. Before I had time to turn the set off, the high voltage appeared along with raster and picture.

The short at the screen was gone and no amount of probing would make the trouble come back. Such things are a pain in the neck as you don't know what (if anything) you did to correct the trouble. I figured there must have been a piece of conductive material (a strand of wire?) between the screen terminal and a chassis ground, and it got moved while I was poking around. I blew the chassis out with a vacuum cleaner and had no more trouble with the set.

I lost $4.20 on this callback due to the purchase of another Sams manual. I told the customer "no charge" and he departed happy. This is good word-of-mouth advertising and it pays to give your customers a bigger break than normal now and then.

This goes to show that when you order from a wholesaler you should check each item you receive to be sure you get what you ordered. I always plan to do this but forget to do so every time. I have the same trouble when I go to buy bed sheets for my wife. If I ask for a single sheet, I get home and find out I have a double; if I order a double sheet, I invariably get home with a single. My wife has now broken me of this habit and I check every time – I guess she should go with me to buy TV parts. I think I'll teach her the resistor color code!

MOTOROLA MODEL UNKNOWN

My wife took this set in while I was away at the Civil Defense Office and had written "snow" on the service card as the complaint. When the set was fired up it had a narrow raster and sound, but no picture. I don't know just what the customer meant by "snow."

With the back off the set, I checked the tubes in the horizontal circuit to find the reason for lack of width. The tubes checked OK, so I looked for a width adjustment on the rear chassis apron or taps to adjust the screen voltage of the horizontal output tube. There were no taps, but I found an adjustable coil mounted on the rear of the high-voltage compartment, with a knob which would protrude through the rear cover. A check of the back of the cover showed this to be the width control. It consisted of a coil with a variable slug for tuning purposes. When I tried to turn the knob, I found the core was missing and that the end of the adjustment rod had been broken off.

I scrounged around in the junk box and found a ringing coil that had a core that looked like it might work. With some difficulty I worked it into the coil form and got the hex end of the adjustment rod into the core. Because of the condition of the coil mounting, I couldn't turn the adjustment rod and move the core in and out of the coil without holding onto the coil with my other hand. This meant that the set had to be off when adjusting the core, as there was bound to be a lot of sweep energy in the coil. Holding the coil with the set turned on would result in a nasty shock. Therefore, the core position had to be adjusted in small increments with the set off. By using patience, I got the raster to spread out over the face of the picture tube and completely fill the screen.

There was still no picture, however. Since I had sound, I figured the trouble must be in the video-contrast-picture tube line of signal travel. This was my lucky day! The video amplifier, a 10DX8, was shorted. This is an oddball tube which I do not stock, but a local service friend let me have one from his stock at cost, saving me an 85-mile round trip to Montgomery.

The new tube brought in the picture, and after cleaning the tuner the job was complete. I forgot to mention that I retrieved four 100-lira coins and a penny from the set. The owner, who had been stationed in Italy, was glad to get them back. He said his child had slipped them through the louvers in the back of the set!

ZENITH CHASSIS 14Z21

This set was an old friend which a customer had brought it in several months before and had not yet picked it up. A while ago one of my sons wanted to watch a program the rest of the family didn't like, so he borrowed the set to watch in another room. The set had worked fine after servicing, but my son said it didn't work right. I put the set to one side without checking it. You guessed it – the next day the customer came in to get her set.

Fortunately my wife couldn't find it, so I got to work on it again without the customer's knowledge. I turned it on and noted a high hum level. Then I heard an arcing sound. With the works exposed, I found that when the high voltage was about to come on, arcing started at the base of the horizontal output tube. The tube in this set is a single-ended tube (no top cap for the plate lead). Since very high-voltage pulses are present at the plate of this tube, the plate terminal floats free, the circuit board being cut away from around the plate socket terminal. The manufacturer had fastened a fiber disc on the bottom of the socket so a serviceman wouldn't accidentally come in contact with the exposed plate terminal. This disc was held in place with a center rivet to a chassis ground point. The underside of the disc had carbonized from the area of the plate terminal to the center rivet, forming a conductive path. I cut the carbonized portion away, exposing the plate terminal. This stopped the arcing.

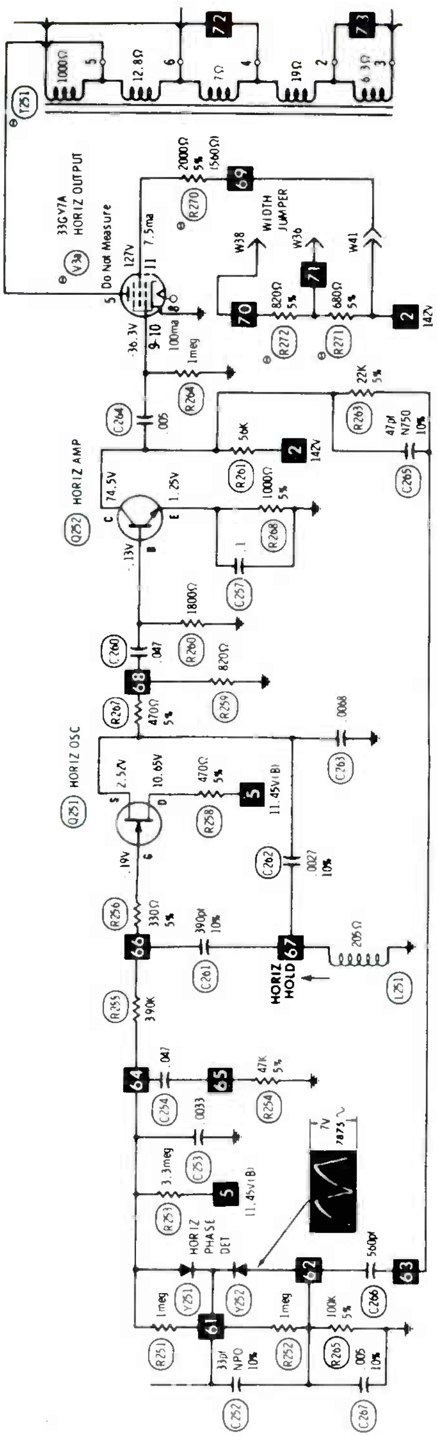
When the raster came on, I had never seen anything quite like it. There was a succession of pear-shaped objects floating from the bottom of the screen to the top. Adjustment of the vertical hold turned this into a stationary image. The bottom of the raster seemed to swirl around and come almost to a point. Remembering the high hum level when the set was first turned on was the clue. A look at the electrolytics showed a brownish buildup on one of the capacitor terminals. This capacitor had become leaky from disuse. I shunted the capacitor with a good one and the set became more lively with a brighter pear-shaped raster and no hum, showing that the B supply voltage had increased with better filtering. In a short time I could remove the shunt capacitor without any effect, showing that the original capacitor had reformed itself. Next I shunted a capacitor across another section of the electrolytic can and the raster became normal. I made a permanent connection and the set gave a beautiful picture.

The original bill had been $18.50. I refigured it, using the latest tube prices (I had put in three tubes originally), the cost of the replacement capacitor, and labor. Now the bill stood at $32.75. I hope she comes for it soon, as sets deteriorate in humid climates if not used, and I don't want to have to run the bill even higher. I sent her a postcard stating that I would sell the set for repairs if she didn't pick it up in two weeks.

TRUETONE GEC3412A-47

This set had no raster, and when I found out that there was no high voltage I invested in a Sams diagram. The horizontal and high-voltage sections are shown in Figure 4. Note that the horizontal oscillator and amplifier are transistorized. I had never seen this set-up before. I quickly discovered that there was no grid drive to the 33GY7, so I decided the amplifier transistor had to be at fault, especially since the collector voltage was around 100 volts and there was no base or emitter voltage.

To be on the safe side I bought both the amplifier and the FET oscillator transistors. I installed the amplifier and was rewarded with nothing. Before taking out the oscillator for replacement, I checked its output with my scope and found no output voltage. Again the dc voltages were off, and a check with the ohmmeter led me to believe the trouble might be in the circuit rather than in the FET. The



Courtesy Howard W. Sams

FIGURE 4. HORIZONTAL AND HIGH-VOLTAGE SECTION OF TRUETONE GEC3412A-47.

gate and source voltages were both zero. The drain voltage was higher than normal, indicating lack of circuit current.

The resistances in the G and D circuits were about as expected, but the S to chassis was about 300 ohms. I disconnected (clipped) the lead of the 820-ohm resistor to ground and the resistance from S to ground remained the same. I removed the FET and the resistance from the S terminal to ground remained the same. I looked the circuit over and the only thing I could see that could cause the trouble was a short in the 0.0027 μf feedback capacitor from the source to the horizontal coil or the 0.0068 μf to ground. I disconnected one lead of the 0.0027 μf capacitor and, sure enough, it was just about a dead short.

I didn't have a 0.0027 μf in stock, but I did have a 0.003 μf, which I figured was close enough. I didn't know the working voltage of the original capacitor, but the replacement was 3 kV, far more than necessary. I couldn't get the new capacitor under the horizontal coil where the original had been, so I straddled it over the top of the coil and its leads fit nicely into the circuit board holes.

After reassembly of the circuit, the horizontal took off and the set was as good as new. I charged the customer $18.75. I could have saved time and money if I had used the scope to localize the trouble at the start.

SEARS MODEL UNKNOWN (STICKER REMOVED)

This set came in with the complaint that a wire had burned out. Removal of the rear cover exposed a large part of the bottom of the circuit board. It was apparent that something had burned. The 5.7-ohm surge resistor in series with the diode rectifier had burned out and one lead of the diode (cathode) had come unsoldered. After checking for short circuits, I replaced the surge resistor and reconnected the diode. When I turned the set on, I found that I had B+ but no tubes lighted.

After considerable searching and tracing, I discovered an open between the filament of the 33GY7 (at the head of the heater string) and the on-off switch. This, I concluded, was where the wire burned away. I rewired this circuit and the tubes lit up, but no sound or picture appeared. I got out my substitute tuner and could get no signal when fed into the control grid of the 4EH7, which is the first i-f tube.

Going to the input of the second i-f, a 4EJ7, I received a fairly good picture and sound. I tested the voltages and found no screen voltage on the 4EH7. I suspected a break in the circuit board—no schematic was available as the model number was missing. I found the B supply connection to the first i-f transformer with a voltmeter and ran a connection from pin 8 (the screen) of the 4EH7 to B plus. It didn't help, so I tested the 4EH7 and found it to be shorted and defective as far as emission was concerned.

I then picked up a 6EH7 and placed it in the circuit. The tube flared up like a Christmas tree light but the set came on with a fine picture and good sound. Soon, however, it faded from view. I rechecked the first i-f tube operating voltages and found that when the picture went off, the control grid swung positive—an indication of gas in the tube. About this time I realized the boner I had pulled when I put in a 6EH7 instead of the 4EH7 supposed to be used. No wonder the tube lit up so brightly! The heater current was far too high and the heat caused the tube to become gassy. With the correct replacement the set worked fine. I had to replace five tubes and the surge resistor. The total bill came to $27.90.

Helpful Hints 3

Before purchasing a replacement CRT for a television receiver, check with your electronic wholesaler to see if the tube has a "dud" value. Some "bad" CRT's are worth money when turned in to your electronic parts dealer at the time of purchasing a replacement. These picture tubes can be rebuilt, and should *remain under vacuum and should not be damaged or cracked in any way.*

CRT's that do not have a dud value should be "aired" by releasing the vacuum within the tube before disposal. A tube that has not been aired is a potential danger to anyone who handles the bad tube.

Some precautions should be taken if you have to release the vacuum in a picture tube. First, place the picture tube to be aired inside a carton (use the carton the new tube was in) face down with the carton flaps closed and the neck exposed. Avoid hitting or jarring the faceplate or bell. Remove the socket from the pin area and then with a pair of pliers snap off the glass tip which was originally used to seal the tube.

Once aired, the tube is safe for handling. The tube will not be reusable in this condition because the phosphor surface is generally blown free with the rapid inrush of air. The picture tube vacuum should not be released on the customer's premises.

—by James Crudup

A Reminder

Always be sure to include your student number whenever you contact NRI. This will help to ensure that we can serve you promptly and efficiently.

HAM NEWS

By Ted Beach K4MKX

The last weekend in June was a hectic one around the Beach household. Our 11-year-old son was to go on his first full week scouting trip on Saturday, and our 10-year-old daughter was off to a horseback riding camp on Sunday. And guess who had forgotten that that was Field Day weekend? Yep, yours truly, and I didn't want to miss this one as it was my very first (in almost 20 years of hamming) and I had promised to transport two generators to the site in our station wagon. This was for the newly formed Arlington Amateur Radio Club, and since I was a charter member, I just *had* to go.

Suffice it to say that a deal was worked out with my understanding XYL to get Bobby off on Saturday and to drive Carolyn the 45 miles to camp on Sunday while dear old dad relaxed (!) out at the old FD site. I was up bright and early Saturday morning, hauling the generators around.

I won't go into all the details of the weekend, but I will say that we had lots of fun, and I learned quite a bit about amateur radio in a little over twenty-four hours that Field Day. We operated four stations—80/75, 40, 20, and VHF. I helped put up the 80 and 20-meter antennas (inverted vees) and took some of the operating time of the 80/75 station.

We used a barefoot KWM2 on 80 and at first it didn't look like we would even get started. The cut-at-home antenna would not take a load, and after all the time we had spent getting the apex up at a height of about 85 feet, we were not in too big a hurry to let the thing down to prune and tune. Fortunately we had a little time before the melee began and someone had brought a huge box with lots of knobs and ceramic standoffs sprouting from all sides that he declared was an "antenna tuner" that would match the KWM2 to the coax. Wonder of wonders, it did! Now we could tune up the rig and twist a knob or two on the box and have a 1:1 SWR over a 50 or 60-kHz band.

I don't know if all the power was going to the antenna, but as far as the rig was concerned, it was looking into a 50-ohm resistive load, and that's what counts. Had we been using an open line to the inverted vee instead of almost 150 feet of RG8 and a balun, I'm pretty sure most of the power would have been going into the antenna. Anyway, everything worked well, and we made a decent number of contacts both on CW and sideband. Nothing earthshaking, but respectable for the first time out.

Well, after we had packed it all up Sunday afternoon, I did a little thinking and reading on "antenna tuners" and decided to try my hand at one for my little station (still using the Ranger and SX100). Running that low power (about 90 watts) I decided I could get away with the relatively inexpensive and readily available capacitors with about 0.032" spaced plates. These are good for about 1000 volts (if the humidity is low!) and should work okay under most conditions.

I did not want to have to use any special type of roller inductor (very expensive and hard to come by) so I decided to use plain old stock coil material. Also, I thought that it would be quite nice not to have to tap the coil or use plug-ins—wouldn't we all like that?

Then I came upon a coupler in the 1957 ARRL Handbook which was just what I was looking for. This handbook was published in the days when the "multiband" tuners were popular, and someone had designed this coupler around such a tuner. After reading the article, I remembered that I had built a receiver some years ago and had used such a tuner in the front end and it had worked quite well. It had two ganged capacitors and two coils and covered the entire range from 3 MHz to 30 MHz. Figure 1 shows the arrangement as published in the 1957 Handbook.

L1 and L2 were separate coils mounted at right angles to one another to reduce coupling, and the outputs were taken from the A and B links. L1 is larger than L2 and at the lower frequencies L2 can be disregarded, L1 being tuned by C2A and C2B in parallel over the 3.5 to 7.3 MHz range. At the higher frequencies, L1 reactance is very large and can be disregarded, L2 being tuned by C2A and C2B in series over the 14 to 32-MHz range. Outputs for 80 and 40 come from link A, while outputs for 20 through 10 come from link B.

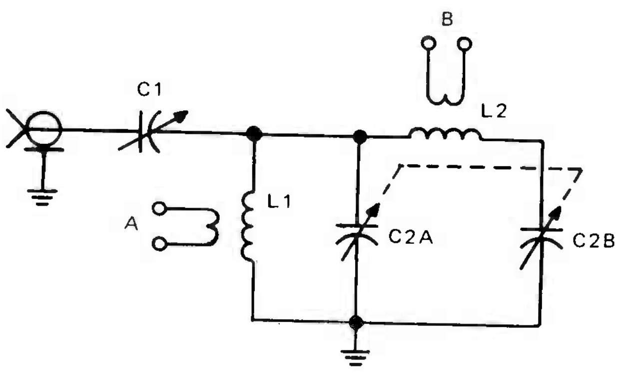


FIGURE 1. MULTIBAND COUPLER

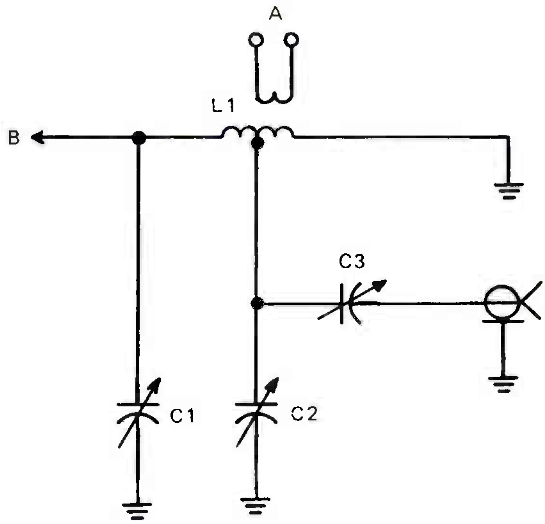


FIGURE 2. REVISED MULTIBAND COUPLER.

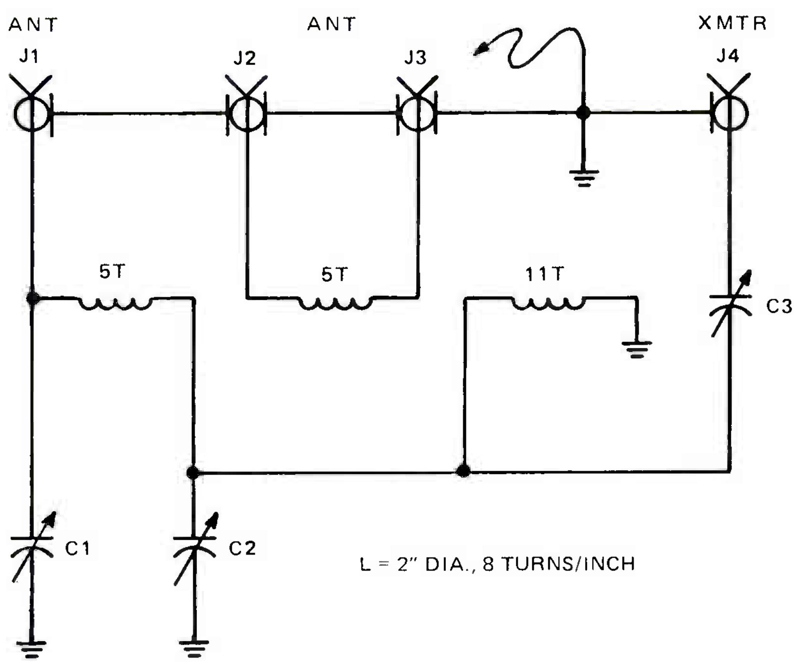


FIGURE 3. FINAL VERSION OF THE MULTIBAND COUPLER.

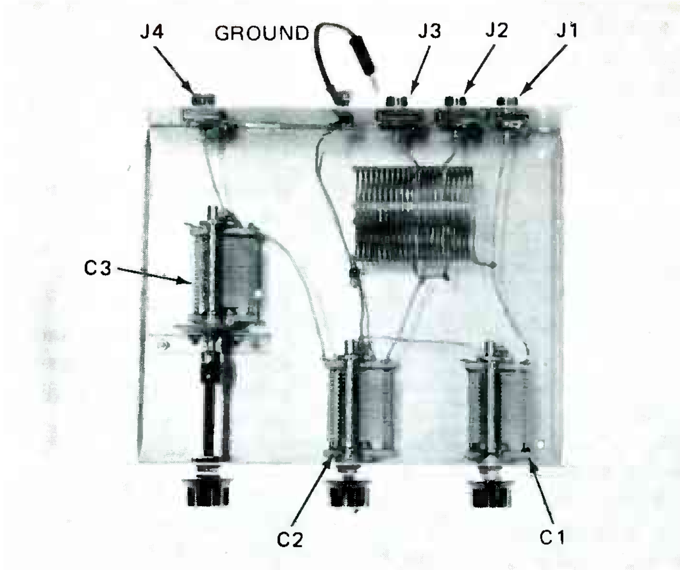


FIGURE 4. PROTOTYPE COUPLER.

I didn't use this arrangement. Instead, I used the configuration shown in Figure 2, originally as a receiver front end and more recently as a transmission line coupler (a more apt name than "antenna tuner"). In the receiver, the link (A) was near the ground end of L1 which is now a single, tapped coil and the B terminal went to the grid of the rf amplifier. C3 was not used. C1 and C2 were two sections of a broadcast variable (about 400 pf maximum capacity) and were ganged together. At any rate, having the two coils of Figure 1 tightly coupled as in Figure 2 did not seem to alter the operation of the tuner in the least, and the mechanical construction was simplified greatly by having only a single coil.

Anyway, I thought I would try the configuration of Figure 2 as a transmission line coupler and the results can be seen in Figure 3 and Figure 4. I used three separate capacitors for C1, C2, and C3 and a single length of coil stock for L1 and the link. Figure 4 shows the physical layout of the prototype as installed in a salvaged Conar Model 682 enclosure (which had been retooled by the U.S. Postal Service). All three capacitors are 235-pf variables with 0.032" spacing. This spacing should prove adequate for rigs running 200 watts or less. L1 is a length of B&W 4032 air inductor constructed as shown in Figure 3.

As you can see, there are four coax connectors; two for the link, one for the C3 input from the transmitter and one for the auxiliary output from C1. Note that C3 has an insulated shaft and is mounted on an insulator since both terminals are above ground. Normally, you should use the two outputs from the link to match to the transmission line. If the line is unbalanced (coax), ground one of the two link coax connectors. That is what the little jumper with the banana plug is for in Figure 4. Do not use the ground plug for balanced lines—just connect the line to the two coax connectors with two banana plugs. On the higher bands, you can try the coax output from J1 for a match to the line if you want.

To tune the coupler, connect a reflectometer in the line between the coupler and the transmitter and set C1 and C2 to maximum capacity, C3 to mid capacity. Tune the transmitter resonance (dip the final) and adjust C1 and C2 together for *minimum* reflected power. Then adjust C3 for the least reflected power and load up the final amplifier. When you have the transmitter loaded to almost full (rated) power, readjust C1, C2, and C3 for the deepest possible null in reflected power. You should be able to achieve a 1:1 SWR.

Depending on the type of antenna you are coupling into, you may have to readjust C1 and C2 as you depart from the original operating frequency—no big deal, just keep the reflectometer in the "reflected" position and keep your eye on it as you vary your frequency. If you see the needle creeping up, tweak C1 and C2 to bring it back down. What could be easier? No switches and no expensive parts and it's simple to use! Now you can load up that old wet kite string and work the world!

If you used a larger coil (higher Q) and capacitors with wider spacing I'm quite sure the same configuration would easily handle a full gallon with almost any antenna. I fully intend to try this out just as soon as I can find some suitable capacitors. These are becoming rarer and rarer at hamfests and in surplus stores.

Now, let's see who we have heard from since last time. As usual, those listed first are students and graduates of our Amateur Radio Course, while those listed last are other students and graduates.

W4ADK had a tale of woe to tell us. Simon is a ship's radio officer and went in to take his Advanced and Extra tests at the same time but missed out on Extra. He didn't say whether it was the code or the theory that did him in, but we're sure that next time around we'll have a new Extra amongst us! Best of luck, Simon.

Simon	W4ADK	A	Jamestown NC
Flynt	WN4LNV	N	Atlanta GA
Mike	WN7WLM	N	Reno NV
Greg	WN8UTC	N	Vandalia OH
David	WNØPHJ	N	Minneapolis MN
John	WN4LCZ	N*	Greenville SC
Don	WN7BLQ	N	Tacoma WA
Jim	WA7ZVS	A*	Tuscon AZ
Phil	WA4LJJ/KA7		Sasebo JAPAN

*Just upgraded – congratulations!

The case of WN7WLM is very similar to that of many of our Amateur Course students. Mike started the course many months ago (I won't say how many, but his Novice License is expiring) and as soon as he got his first ticket he got on the air. So much for studying! Anyway, Mike says that now that he has returned from his vacation (a cruise, no less, from San Francisco to Ft. Lauderdale, Florida and back) he will diligently pound the books instead of the brass. While on his cruise, he tried some 40-meter QRP work without a great deal of luck. He worked a few 6's and a Kentucky station, but considering that he was running only 3 watts to a Heath HW7 and had to compete with the ship's radio gear, I guess he did all right. Fine business, Mike, and thanks for the handmade shipboard QSL—it looks real nice.

WN8UTC writes that he is really enjoying his course and looks forward to getting the N removed real soon. Best of luck, Greg, and we'll look for you on the air now that I have my station back in operating condition.

WNØPHJ got his Novice ticket even though he took one of the newer (and tougher) exams that the FCC has been dreaming up lately. Seems as how we had told him in our lessons (based on information from the Friendly Candy Company) that there would be no schematics on the Novice test. Not so, says David. They showed him a transmitter schematic and asked him to identify the output tank circuit. Sorry about that, OM, but it looks as if you did okay anyway. We're going to have a lot of updating to do in our lessons when the new changes in class are put into action. Wow! I don't like to think about it.

Even though John, WN4LCZ, is listed as a Novice, he informs us that he passed his General in July. The new license was not yet in hand, so he did not know whether he would get a B or an A — I'm not real sure myself just where the 4's stand right now. I think we're still in the B's. At any rate, congratulations, John.

WN7BLQ is waiting for a new SB401 to go with his SB303. In the meantime Don is using a Viking Adventurer just so he can get going. He has separate inverted vees for 80 and 40 and plans to try and load a CB vertical on 10 and 15. Don says that he knows that he would not have answered three of the questions on the Novice test if he had not taken the NRI course.

WA7ZVS jumped from Novice to Advanced at one sitting. Nice going, Jim. At present he is using a Heath HW16 and a 14AVQ but plans to use a Swan 500 in the near future.

Last, but not least, we got a nice note from Wilmer Giese, an ardent supporter of the Society of Wireless Pioneers. The widow of an old-time ham from Baltimore (ex-3BBW) gave Wilmer a bunch of old (antique?) gear including coils, capacitors and quartz crystals. He would be more than willing to give this equipment to anyone who would like to have it. You can drop him a note at:

Bay City — Box 20 — 8
Stevensville MD, 21666

That just about makes it time to QRT for this time. Do let us hear from you from time to time—and remember—KEEP STUDYING!

Very 73 — Ted — K4MKX

NRI HONORS PROGRAM AWARDS

In the tradition of NRI's pursuit of excellence in training, the following graduates who earned NRI electronics diplomas in May and June also earned unusual recognition under the NRI Honors Program. On the basis of their grades, these graduates distinguished themselves by earning the right to honors listed below and to the appropriate Certificate of Distinction in addition to their regular NRI Diploma. This distinction is made part of their permanent NRI records.

WITH HIGHEST HONORS

George E. Allan, Vancouver BC, Canada
Jay D. Cason, Merritt Island, FL
Ronald E. Dick, Dartmouth NS, Canada
James R. Duncan, Crofton, MD
James C. Holliday, Aurora, CO
Thomas L. Jackson, Meridian, MS
R. B. Maranto, Baton Rouge, LA
Terrance V. Minsel, Findlay, OH
Charles Mitcheli, Roselle, NJ
Klaus Dieter Schuenemann, Kansas City, MO
Robert M. Scott, Bloomfield, NJ
T. C. Truemper, Aurora, IL
Michael Vana, Schaumburg, IL
Earle A. Young, Rochester, NY

WITH HIGH HONORS

James R. Barnhill, Brandywine, MD
John W. Black, Marietta, GA
Stephen P. Bower, Boise, ID
Eduardo M. Cagandahan, Jersey City, NJ
John C. Conrad, Milford, DE
Douglas J. Cooper, Kittery, ME
Robert L. Cwik, Woodstock, IL
J. Martin Davis, West Milton, OH
Robert DiLauri, Belleville, NJ
Manuel Dominguez, Squamish BC, Canada
Edward R. Evanoff, Jenkins, KY
Roger G. Garrett, Springdale, OH
Bernard E. Grenat, Lafayette, IN
Calvin A. Gundlach, Dunedin, FL
Dennis A. Hubbs, West Hartford, CT
Richard C. Judy, Roanoke, VA
John Kraehling, Cary, IL
George R. Lauder, Windsor ON, Canada
Kenneth Lee, Mississauga ON, Canada
Joseph J. Lesko, Lancaster, CA
H. D. Lif, Loring AFB, ME
Troy Wayne Maddox, Corinth, MS
Glenn H. McKenzie, Ocean Springs, MS
Ronald B. Moore, San Diego, CA
Carl J. Morin, Skowhegan, ME
Robert D. Overby, St. Paul, MN
Wesley Pate, Lawton, OK
Leger Philip, Charlottetown PEI, Canada
Cliffore Reid, Staten Island, NY
Claude A. Rodgers, Ranger, TX
Rudolf Saunders, Jr., Gambrills, MD
Tom M. Savage, San Lorenzo, CA
Carl Richard Schluter, Irving, TX
Richard M. Tavalsky, Johnstown, PA
David A. Tyo, San Diego, CA
Stanley J. Urevick, Arnold, MD
Kevin Wells, Churchill Falls NF, Canada

WITH HONORS

Dana C. Aultman, Buxton, NC
Charles A. Balaza, Browns Mills, NJ
Alva L. Baldwin, Forsyth, MO
Leonard P. Bechard, Saint Catherines ON, Canada
J. V. Black, Anniston, AL
Oral W. Boyer, Mount Vernon, OH
Wayne E. Bratcher, Cheyenne, WY
Bryce A. Carr, Hilo, HI
Garry O. Caudell, Ashland, KY
Billy D. Copeland, Wichita, KS
Roy I. Crockett, Jr., Pocomoke City, MD
Paul G. Enders, Indianapolis, IN
Edward C. Evans, II, Mount Union, PA
Frank H. Fugeman, Ashland, KY

Donald William Geddes, Devon AB, Canada
Leonard M. Hetrick, Washington, DC
Wayman Huddleston, Hyattsville, MD
Kurt Jaeger, Maurertown, VA
Daryl M. Jenkins, King George, VA
Charles B. Jones, Kingsport, TN
Robert F. Kassmann, Rochester, NY
Roy H. Lauritzen, Salt Lake City, UT
Jack Alvin Lord, Los Angeles, CA
Austin A. Lunnen, Via Marys Hr Labrador NF, Canada
Shirley E. McEwin, North Las Vegas, NV
Lee F. Neeley, APO New York
Earl Lee Owens, Centerville, IN
Michael K. Owens, Long Beach, CA
Laurence L. Plate, Jr., Santa Barbara, CA
Robert R. Platt, St Albert AB, Canada
Michael J. Regan, Wantagh, NY
Robert D. Reib, White Sands Missile Range, NM
Roy M. Schumaker, Boulder, CO
Robert D. Scott, Chamblee, GA
Joseph Sharp, Orange, VA
Richard D. Shipley, Salem, OR
Richard M. Thomas, South Pasadena, CA
George Toth, Queens, NY
Thomas E. Townsend, Winchester, KY
James S. Troutman, Washington, DC
Peter Vickers, Needham, MA
Robert J. Vint, Tucson, AZ
William H. Wagner, East Lake, OH
C. L. Waldron, Roanoke, VA
James Westley White, Albuquerque, NM
Robert Williamson, Massapequa, NY

DIRECTORY OF ALUMNI CHAPTERS

CHAMBERSBURG (CUMBERLAND VALLEY) CHAPTER meets at 8 p.m., 2nd Tuesday of each month at Gerald Strite's TV-Radio Service Shop, RR2, Chambersburg, Pa. Chairman: Gerald Strite.

DETROIT CHAPTER meets 8 p.m., 2nd Friday of each month at St. Andrews Hall, 431 E. Congress St., Detroit. Chairman: James Kelley, 1140 Livernois, Detroit, Mich. 841-4972.

FLINT (SAGINAW VALLEY) CHAPTER meets 7:30 p.m. second Wednesday of each month at Andy's Radio and TV Shop, G-5507 S. Saginaw Rd., Flint, Michigan. Chairman: Larry McMaster, (517) 463-5059.

NEW YORK CITY CHAPTER meets 8:30 p.m., 1st and 3rd Thursday of each month at 199 Lefferts Ave., Brooklyn, N.Y. Chairman: Samuel Antman, 1669 45th St., Brooklyn, N.Y.

NORTH JERSEY CHAPTER meets at 8 p.m. on the second Friday of each month at The Players Club, located on Washington Square.

PHILADELPHIA-CAMDEN CHAPTER meets 8 p.m., 4th Monday of each month in RCA Building, 204-I, Route 38 in Haddonfield Rd., Cherry Hill, New Jersey 08034. Chairman: Joe Szumowski.

PITTSBURGH CHAPTER meets 8 p.m., 1st Thursday of each month in the basement of the U.P. Church of Verona, Pa., corner of South Ave. and 2nd St. Chairman: George McElwain.

SAN ANTONIO (ALAMO) CHAPTER meets 7 p.m., 4th Thursday of each month at Alamo Heights Christian Church Scout House, 350 Primrose St., 6500 block of N. New Braunfels St. (3 blocks N. of Austin Hwy.), San Antonio. Chairman: Robert Bonge, 222 Amador Lane, San Antonio. All San Antonio area NRI students are always welcome. A free annual chapter membership will be given to all NRI graduates attending within three months of their graduation.

SOUTHEASTERN MASSACHUSETTS CHAPTER meets 8 p.m., last Wednesday of each month at the home of Chairman Daniel DeJesus, 12 Brookview St., Fairhaven, Mass. 02719.

SPRINGFIELD (MASS.) CHAPTER meets at 7:30 p.m. the second Saturday of each month at the shop of Norman Charest, 74 Redfern Dr., Springfield, Mass. 01109. (413) 734-2609.

TORONTO CHAPTER meets at McGraw-Hill CEC, 330 Progress Ave., Scarborough, Ontario, Canada. Chairman Branko Lebar. For information contact Stewart J. Kenmuir (416) 293-1911.

FLINT-SAGINAW VALLEY CHAPTER WORKS HARD BEFORE VACATION

At the May meeting Steve Avetta showed how to adjust the tone arm on an RC turntable.

Also, Larry McMaster brought a set in with a tuner problem, which turned out to be a B+ resistor which had changed in value.

Roger Donaven brought in a set for troubleshooting and it had an AGC problem. All the members pitched in to troubleshoot and finally found a leaky capacitor which had caused the difficulty.

At the May 28 meeting one of our members brought in a black-and-white TV with all kinds of problems. Steve Avetta made a short order fix in the sound, and then found that insufficient width existed. A check of the horizontal output screen resistor showed that the resistor had increased in value. After replacing it, it was found that the tuner was quite dirty and would not receive half of the channels. After cleaning the tuner everything was back in good shape.

NRI AA OFFICERS	
Richard G. Moore	Vice President
Homer Chaney	Vice President
Angelo J. Colombo	Vice President
William D. Harris	Vice President
Tom Nolan	Exec. Secretary

Alumni News

Andrew Jobbagy demonstrated a Magnavox color TV with a problem. This set had one vertical line in the center of the picture tube. After many checks and a lot of troubleshooting, this solid-state receiver turned out to have a horizontal centering pot that was open. Why was it open? A 1-microfarad capacitor across the centering pot was bad.

The chapter learned one thing from this set. It seems that the tuner had been hit by lightning and the heavy surge caused all kinds of problems. Never give an estimate on a set which has been hit by lightning because you never know what will be bad and therefore you cannot price it ahead of time.

The Saginaw Valley Chapter was invited in July of this year to attend a lecture at General Motors Institute. The lecture was given by Dr. Ronald R. Martin, Director of the Particle Accelerator Research Facilities, a division of the Argon National Laboratories at LaGrange Illinois.

It was Mr. Martin who discovered the first excited state of the proton. He also worked on the first alternating gradient synchrotron. He now is working on a 200-million-volt synchrotron for proton radiography for safe early cancer detection.

A lot of the members have enjoyed their summer vacations including Mr. Jobbagy with a visit to Florida and Mr. Higa who went to Hawaii. Now all of the boys are getting ready for the German October beer festival which will be held a mile from our meeting place.

DETROIT CHAPTER RECESSES FOR SUMMER

At the May 9 meeting, Mr. Bruce Rittenhouse brought in a defective Conar color bar generator. After testing diodes and transistors with his new B&K transistor checker, Bruce found a defective transistor which will be replaced by the owner of the bar generator, Mr. Prince Bray. At the June meeting, which was the last meeting until September, an election of officers was held. The new officers are Mr. James Kelley, Chairman; Mr. John Nagy, Vice Chairman; Mr. Earl Oliver, Treasurer; and Mr. Ray Berus, Secretary.

After a short meeting, coffee and donuts were served compliments of Mr. Nagy and Mr. Belton.

We wish to extend a cordial welcome to any students studying an NRI course in the Detroit or suburban areas, and invite them to attend our meetings starting in the fall on the second Friday of September.

SPRINGFIELD MASSACHUSETTS CHAPTER HOLDS GOOD MEETING

The Springfield Massachusetts chapter of the National Radio Institute Alumni Association held its regular monthly meeting in the shop of Norman Charest, 74 Red Fern Drive, Springfield on May 10. The meeting was called to order by the Secretary, Preston Atwood, with nine members present. Discussing old business, the members were interested in a discussion at the April meeting relating to the connection of the complete bridge rectifier containing the four diodes into a circuit designed for two diodes. Al Dorman reported that he had sent for an original replacement.

The chapter voted to spend some of the money in the treasury on some educational material such as video tape or audio tape. The members also enjoyed viewing a number of pictures of the association taken in past years and sent in by Mr. Lyman Brown.

Mr. John Park gave a brief summary of the trouble he was having with a sync section of a color TV set. He found a capacitor between the video and sync separators which he replaced, and that cleared the trouble.

After adjourning the meeting at 8:15, the chapter worked on an RCA transistor demonstrator set but still ended up with a motorboating at low volume.

The meeting ended with the usual social time and good refreshments.

SOUTHEASTERN MASSACHUSETTS CHAPTER STUDIES TRANSISTORS

At the May 28 meeting, Mr. Carl Merrill, foreman of a local television business, gave a discussion of transistor checking using a current tracer along with other methods of checking transistors.

Mr. Merrill's talk was quite enlightening, as he explained among other things how to check transistors with an oscilloscope (his favorite) if no other means or equipment is available. He also explained avalanche breakdown of transistors, and discussed ways to tell if a certain transistor with no markings is of the NPN or PNP type, whether silicon or germanium material. For this demonstration he used a Hickock Model 440 semiconductor current tracer, an RCA Model WC528B quick tracer transistor diode checker, a Leader LBO 511 oscilloscope, and Models 220 and 215 Hickock in-circuit semiconductor analyzers.

The lecture was enjoyed by the whole chapter and a lot of new information was learned.

The members agreed due to the coming warm weather, with vacations and outdoor interests, to hold our next meeting in September at which time National Secretary Tom Nolan will be in attendance.

Speaker Carl Merrill demonstrating techniques in transistor checking.

CONAR ANNOUNCES AN INDUSTRY FIRST...

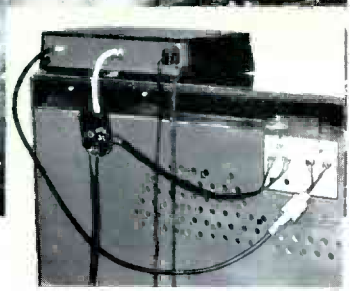
JERROLD Universal TV Remote Control

Suggested List $99.95

$74.50

Shipping Weight 10½ Pounds
Shipped Parcel Post or UPS

- **TURNS TV SET ON & OFF, FINE TUNES, CHANGES ALL VHF CHANNELS INSTANTLY**
- **INCLUDES VARACTOR DIODE CONVERTER PLUS BUILT-IN SIGNAL AMPLIFIER**
- **CAN IMPROVE PICTURE QUALITY AND ELIMINATE DIRECT PICKUP GHOSTS**
- **SAVES WEAR & TEAR ON TV TUNER**



For easy connection to any TV set, order Model TRC-300K hookup kit which includes all necessary cables, signal splitters and matching transformers.

Only $7.45 Stock No. AC300
1 lb. P.P. Ins.

The Jerrold Universal TV Remote Control is completely solid state. The only moving parts are the pushbuttons used to change channels, the on-off switch and the fine tuning control. All incoming channels are converted either to Channel 2 or Channel 3 (whichever is not received off-the-air in your area).*

Tuning is accomplished by means of a varactor diode oscillator. Varactor diode oscillators are unique because their frequency can be varied simply by changing the bias voltage. Each channel pushbutton selects a voltage divider which determines the precise voltage to be sent to the varactor diode.

The Jerrold TV Remote Control is rugged enough to outlast several TV sets. It can pay for itself by eliminating tuner repairs and cleaning.

Built-in amplification helps to clean up "snow" in many cases. The conversion process eliminates direct pickup which can cause ghosts on sets connected to MATV systems.

**Specify Channel 2 (Stock No. AC 122) or Channel 3 (Stock No. AC 123), whichever is unused in your area.*

A New, Solid-State, Universal Remote Control

Conventional TV remote controls are relatively noisy electromechanical devices which rely on a motor to rotate the tuner to the desired position.

However, physical motion is not really necessary to tune in a TV channel; you can do the same thing electronically. What a TV tuner actually does, of course, is to convert incoming channels to a fixed intermediate frequency, for amplification and detection. The tuner does this by mixing the incoming frequency with an oscillator signal to provide the desired difference frequency.

Recent technological advances have made it possible to generate the right local oscillator frequencies by means of varactor diode oscillators. The big advantage of a varactor diode oscillator is that its frequency is very easy to change by varying the varactor diode bias voltage.

The varactor diode oscillator has been adapted by Jerrold Electronics for their new, solid-state Universal TV Remote Control. It not only changes channels without touching the TV set tuner, it does it from anywhere in the room. It also turns the TV set on and off and fine tunes. Completely solid-state, it utilizes no moving parts except the control switches themselves.

Jerrold's Remote Control consists of two units: a converter which connects to the TV set, and a remote pushbutton console which can be placed anywhere in the room within 25 feet of the converter. The two units are connected by a slim 25-foot control cord.

HOW IT WORKS

The Remote Control includes a series of 12 pushbutton switches, one for each vhf channel. Each switch selects a voltage divider network which determines the precise voltage to be sent to the varactor diode in the variable oscillator circuit. The fine tuning control makes minute, continuous changes in the varactor biasing voltage. Generally speaking, however, once the TV set fine tuning and the remote control fine tuning are adjusted to the centers of their ranges, no fine tuning is required when switching from channel to channel.

The power supply for both units is in the converter. A low voltage is sent to the remote control over the 25-foot control cord. The remote control, in turn, sends the appropriate biasing voltage to the variable oscillator.

Since the maximum voltage carried over the control cord is 20 volts dc, it is completely safe.

The output of the converter is a strong, clean Channel 2 or Channel 3 signal, which is sent through a matching transformer to the TV set's "VHF ANT" terminals.

The converter includes an ac convenience outlet, to accommodate the TV set. The set must be plugged into the convenience outlet if it is to be turned on and off by the remote control.

GREAT PROFIT POTENTIAL

The new Jerrold Universal TV Remote Control represents tremendous profit potential for TV technicians. You can easily sell several units per week, simply by demonstrating the unit to customers after you have repaired their TV sets. (Suggested retail is $99.95–Conar's price is $74.50. Four sales per week means almost $100 per week extra profit.)

Just hook the unit up to the back of the set (it only takes a minute or two) and let the customer play with it. Explain that in addition to providing the convenience of remote control, the TRC-12 saves wear and tear on the TV set. It can actually pay for itself over the course of years in reduced service calls.

When you come to a TV set with tuner trouble, you may be able to make a sale provided the tuner is still functional on either Channel 2 or 3. Hook up the TRC-12 and show the customer how well the set works. Then, offer a choice: you can rebuild the tuner, or install the remote control permanently. Most customers will be willing to pay the difference to get the remote control and to eliminate the need for you to pull the chassis and keep the set inoperative while the tuner is being repaired.

The TRC-12 has a unique capability that makes it especially desirable for apartment dwellers. Most apartment buildings have MATV systems and many MATV systems in cities suffer from direct signal pickup, which shows up on the TV screen as a leading "ghost." The conversion process eliminates the possibility of direct pickup, exorcising all leading "ghosts." Further, the TRC-12 provides 4.5 db of signal amplification.

There are many possibilities for selling the Jerrold Remote Control. The percentage of sales following demonstrations is very good.

CONAR

DIVISION OF NATIONAL RADIO INSTITUTE
3939 WISCONSIN AVENUE • WASHINGTON, D.C. 20016

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- ☐ C.O.D. (20% deposit required)
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- ☐ Add-on CONAR Account
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NRI Student or Graduate No.

Name

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City State Zip Code

Ship to another address? Give Directions here

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To speed handling, any correspondence should be on separate paper.

All prices are net F.O.B., Wash., D.C.

Please include postage for weight shown and insurance on Parcel Post orders.

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A 20% deposit is required on C.O.D. orders. SELECT-A-PLAN ORDERS: Please complete and sign reverse side.

Thank you for your order.

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CONAR SELECT-A-PLAN

SELECT YOUR TERMS TO FIT YOUR BUDGET

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1. Complete other side of this sheet.
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3. Insert amount of down payment (at least 10% of total order) and other information in Payment Agreement below.
4. Sign Payment Agreement and fill in Credit Application.

IMPORTANT: When you have made three monthly payments, you can "add-on" purchases with no down payment. If you are under 21, please have the Payment Agreement and credit application filled out and signed by a person over 21. He can make the purchase for you and will be responsible for payment. If you have a CONAR account open or recently paid-in-full, just sign the Payment Agreement.

NOTICE TO THE BUYER: (1.) Do not sign this agreement before you read it or if it contains any blank space. (2.) You are entitled to a copy of this signed agreement. (3.) The Finance Charge will be waived if the unpaid balance is paid within 30 days. If paid within 60 days, the Finance Charge will be reduced by 2/3; if paid within 90 days, the Finance Charge will be reduced by 1/3. Accounts extending beyond 30 days will pay up to $3 in Credit Service Charges before the above reductions are made.

SELECT-A-PLAN SCHEDULE

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IF UNPAID BALANCE IS	STANDARD PLAN Financial Charge	STANDARD PLAN Monthly Payments	EXTENDED PLAN Financial Charge	EXTENDED PLAN Monthly Payments
20.01- 25.00	1.05	3.50		
25.01- 30.00	1.50	4.00		
30.01- 35.00	2.05	4.50		
35.01- 40.00	2.65	4.75		
40.01- 50.00	3.00	5.00		
50.01- 60.00	4.15	5.50		
60.01- 70.00	5.50	6.00	6.40	4.50
70.01- 80.00	7.00	6.50	8.00	5.00
80.01- 90.00	8.00	7.75	10.10	5.00
90.01-100.00	9.00	8.75	12.60	5.25
100.01-110.00	10.00	9.75	14.80	5.50
110.01-120.00	11.00	10.75	16.20	6.00
120.01-130.00	12.00	11.75	17.60	6.50
130.01-140.00	13.00	12.75	19.40	7.00
140.01-150.00	14.00	13.75	21.60	7.50
150.01-160.00	15.00	14.75	23.20	8.00
160.01-170.00	16.00	15.75	24.80	8.50
170.01-180.00	17.00	16.75	26.20	9.00
180.01-200.00	18.00	17.00	27.90	10.00
200.01-220.00	20.00	18.50	29.80	11.00
220.01-240.00	22.00	20.00	32.40	12.00
240.01-260.00	24.00	22.00	35.20	13.00
260.01-280.00	26.00	24.00	38.20	14.50
280.01-300.00	30.00	24.50	41.20	15.50
300.01-320.00	32.00	25.50	44.20	17.00
320.01-340.00	35.00	27.00	47.80	18.00
340.01-370.00	38.00	28.00	52.40	18.50
370.01-400.00	42.00	29.50	57.20	20.00
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Enclosed is a down payment of $ .... on the merchandise I have listed on the reverse side. Beginning 30 days from date of shipment, I will pay CONAR $ .... each month for .... months, plus a final monthly payment of $ .... Title to and right of possession of the merchandise shall remain in you until all payments have been made. If I do not make the payments as agreed, you may declare the entire balance immediately due and payable. In satisfaction of the balance, you may at your option, take back the merchandise, which I agree to return at your request. I understand that a 1% accounting charge will be added to my unpaid balance if my payments become 60 days or more in arrears. I agree that the above conditions shall apply to any add-on purchases to my Select-A-Plan account. The statements below are true and are made for the purpose of receiving credit.

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PLEASE ALLOW ADEQUATE TIME FOR NORMAL ROUTINE CREDIT CHECK. ONCE YOUR CREDIT IS ESTABLISHED, ONLY YOUR SIGNATURE IS NEEDED TO ADD ON PURCHASES

A → WHERE DO YOU LIVE?

PRINT FULL NAME .... Age ....

HOME ADDRESS .... CITY .... STATE .... ZIP CODE ....

HOME PHONE .... HOW LONG AT THIS ADDRESS ....

( ) OWN HOME ( ) RENT RENT OR MORTGAGE PAYMENTS $ .... PER MO.

WIFE'S NAME .... MARITAL STATUS ( ) MARRIED ( ) SINGLE

NUMBER OF DEPENDENT CHILDREN ....

PREVIOUS ADDRESS .... HOW LONG? ....

B → WHERE DO YOU WORK?

YOUR EMPLOYER .... POSITION .... MONTHLY INCOME $ ....

EMPLOYER'S ADDRESS .... Street .... City .... State .... HOW MANY YEARS ON PRESENT JOB? ....

PREVIOUS EMPLOYER .... Name .... Address .... HOW LONG? ....

WIFE'S EMPLOYER .... Name .... Address .... MONTHLY INCOME $ ....

C → WHERE DO YOU TRADE?

BANK ACCOUNT WITH .... Street .... City .... State .... ( ) CHECKING ( ) SAVINGS ( ) LOAN

CREDIT ACCOUNT WITH .... Street .... City .... State ....

CREDIT ACCOUNT WITH .... Street .... City .... State .... TOTAL OF ALL MONTHLY PAYMENTS INCLUDING CAR $ ....

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It Grips . . . It hangs from the ceiling.

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HANG IT ...
HEAR IT!

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Record your own cassette blanks direct from the radio in mono or stereo or from your record player. Record direct from microphone. Ideal for dictations, an executives dream.

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CONAR'S PRICE
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Meet 2003, a high performance stereo-speaker system. Pair-up with Weltron's 2001 or 2004 and discover advanced sound. Versatile too. Hang it from the ceiling or attach it to your wall.

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CONAR'S
PRICE
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Stock No. AC560
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