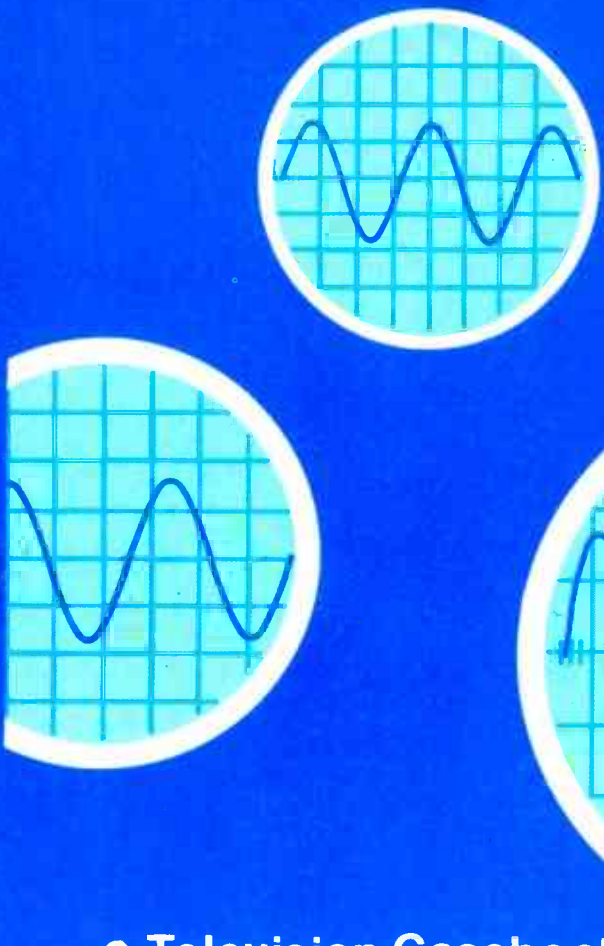
CONAR'S NEW SIGNAL GENERATOR



- Television Casebook
- Electronic Ignition Diagnosis

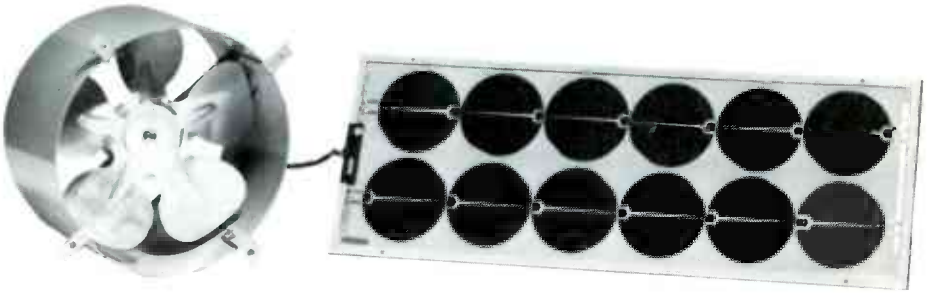
nri journal

Summer 1979

SUPER SUMMER SPECIAL FROM **CONAR**

A SOLAR-POWERED ATTIC FAN – JUST WHEN YOU NEED IT MOST!

The Solarvent Fan



This revolutionary fan requires no connection to 110 volt wiring, no fuel of any type – it operates whenever the sun shines! Powered by a Solarex photovoltaic panel, the Solarvent Fan moves up to 250 cubic feet of air per minute without adding a penny to your electric bill. It's ideal as an attic fan, and under the National Energy Act, the Solarvent qualifies for a tax credit of up to 30% of the cost of the fan. This tax credit can be deducted directly from the tax owed.

The Type 460 Unipanel. Manufactured by the world's leader in terrestrial photovoltaics, the Type 460 Unipanel comprises 12 high-efficiency space-quality Solarex solar cells mounted on a weatherproof substrate and encapsulated in specially formulated clear silicone rubber. Weatherproof and self-cleaning, the Type 460 generates over six watts in full sun, and provides enough power to start the fan in 15% of full sun (in early morning sun or on overcast days).

Fan Unit. The Solarvent Fan uses an efficient five-blade, eight-inch-diameter aluminum fan driven by a powerful permanent-magnet dc motor selected for compatibility with the Type 460 Unipanel. Its hardened stainless steel shaft and permanently lubricated sintered bronze bearings ensure quiet operation and many years of trouble-free service.

Stock No. SE003 . . . . . **$285.00**

~~$299.95~~

SALE PRICE

$285.00

Stock No. SE003

NOTICE FOR APPLIANCE AND AIR-CONDITIONING STUDENTS

Special NRI Student Discount! Two or more Solarvent Fans shipped to the same address – $250.00 each. Here is your chance to cash in on the energy crisis. Resell the fans at the full retail price of $299.95, and you can make a profit of $49.95 plus the amount you charge for installation. The customer can then take an energy tax credit of $89.99 (30% of $299.95), which makes his cost for the fan only $209.96!

SALE PRICES IN EFFECT UNTIL SEPTEMBER 22, 1979.

nri journal

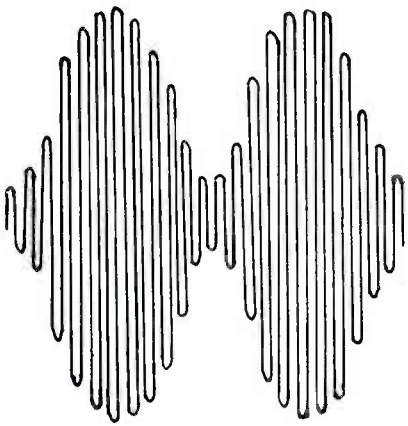
Summer 1979

Volume 37, No. 3

In this issue, Doug Haggis presents CONAR's new Signal Generator. Wayne Brandenburg asks the searching question, "Is there an i-f doctor in the house?" And Mike Taylor explains how electronic ignition diagnosis is a snap!

The NRI Journal (USPS 399340) is published quarterly by the National Radio Institute, a division of the McGraw-Hill Continuing Education Center, 3939 Wisconsin Avenue, Washington, D.C. 20016. The subscription price is two dollars yearly or 50 cents per single copy. Second-class postage is paid at Washington, D.C.

RF Signal Generator



by Doug Haggis

The Model 282 RF Signal Generator is the second in a series of new test instruments from the CONAR division of NRI. This new generator has many features that make it ideal for today's serious service technician.

To begin with, the Model 282 covers the range of 175 kHz to 30 kHz in five, switch-selected bands. Each band overlaps its neighbor so there is continuous coverage over the entire range. For example, the first band covers from 175 kHz to 530 kHz, while the second band covers from 525 kHz to 1610 kHz. This overlapping coverage continues with each band.

You'll never be in doubt as to the exact frequency the generator is set to, thanks to the new digital frequency counter and display built into the Model 282. The exact frequency is displayed on five large 7-segment readouts, letting you adjust the signal generator to within 1 kHz at any frequency.

This frequency counter also makes "calibration" a thing of the past. To "calibrate" the Model 282, you just set the proper coil and capacitor to the low and high band limit frequencies for each of the five bands.

In addition to providing accurate radio frequencies, the Model 282 provides a 1000 Hz audio signal. This signal can be used for testing audio equipment and modulating the rf output of the signal generator. Two types of modulation are available: AM and FM.

The amount of modulation is adjustable with a front panel control. For AM, the control will provide from 0 to 50% amplitude modulation of the rf signal. For FM, the actual amount of deviation will depend on the frequency being modulated. The maximum deviation is less at the lower frequencies and increases as the output frequency increases. At 10.7 MHz the maximum deviation will be at least ± 80 kHz, more than adequate for alignment purposes.

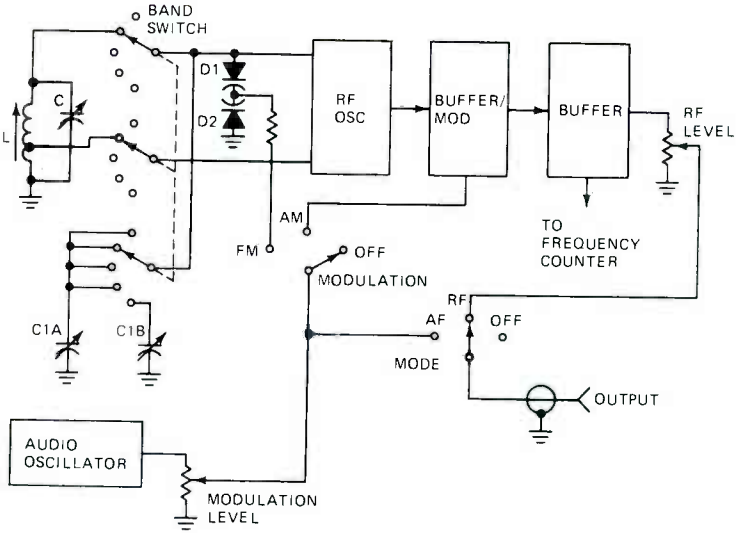


FIGURE 1. MAJOR PARTS OF THE MODEL 282 SIGNAL GENERATOR.

Figure 1 is a diagram showing how the major sections of the Model 282 are arranged. The 3-section, 5-position BAND switch selects one tank circuit (L and C) for each band to connect to the Hartley rf oscillator. This is a very stable circuit using a dual-gate MOSFET transistor. C1 is the main tuning capacitor. C1A tunes all bands except the highest frequency band, which is tuned by C1B. D1 and D2 are varactor diodes that are also across the selected tuned circuit. These diodes provide linear, direct frequency modulation of the oscillator signal.

The output of the rf oscillator is fed to a second dual-gate MOSFET. This stage serves as a buffer or as an AM modulator, depending on the setting of the modulation switch. The 1 kHz modulating signal is applied to one gate of the MOSFET to vary the gain of the stage, thus producing an amplitude-modulated output signal.

The output of this stage goes to a bipolar transistor buffer stage and then to the rf level control. The rf output signal is adjustable from 0 to at least 200,000 microvolts (0.2 V) on the highest frequency band. On the lower frequency bands, a larger signal is available. A portion of the rf output signal is used to actuate the frequency counter.

The frequency counter and display are shown in Fig.2. The frequency counter is contained in the large integrated circuit labeled IC3. IC1 is a divider IC that divides the rf signal by a factor of 10. The signal applied to pin 12 of IC3 is then in the range of 17.5 kHz to 3000 kHz. IC2 is a time-base generator that provides a stable and accurate reference frequency to IC3. In addition, IC2 provides a multiplex clock signal and a gate signal to IC3 to provide rapid scanning (1.6 kHz) of the display digits.

The five display digits themselves each have seven LEDs arranged in such a way that by activating the various segments, the decimal digits 0 through 9 can be formed. Only one digit of the five in the display is on at any given time. Which one is on depends upon the signals at pins 5, 6, 25, 24, and 22 of IC3. Only one pin will be "low" (at

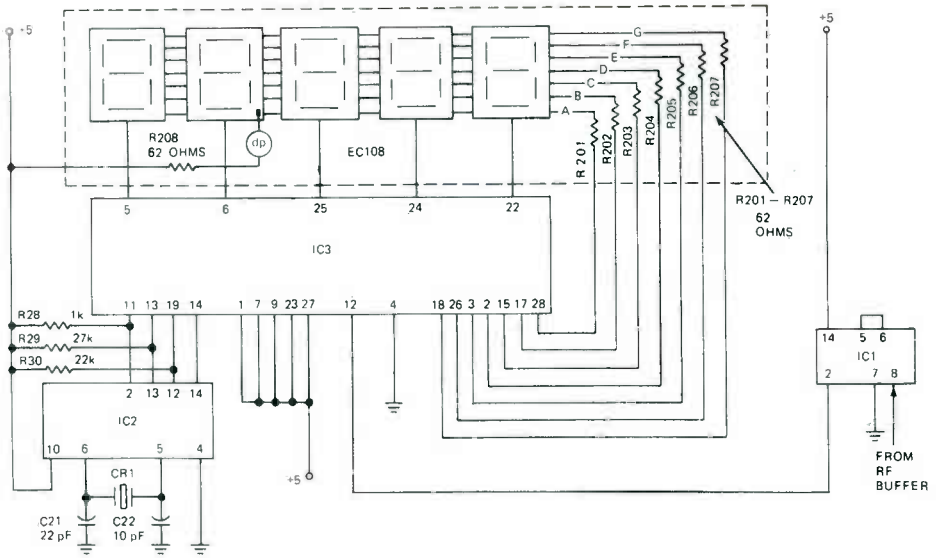


FIGURE 2. THE FREQUENCY COUNTER AND DISPLAY CIRCUIT OF THE MODEL 282.

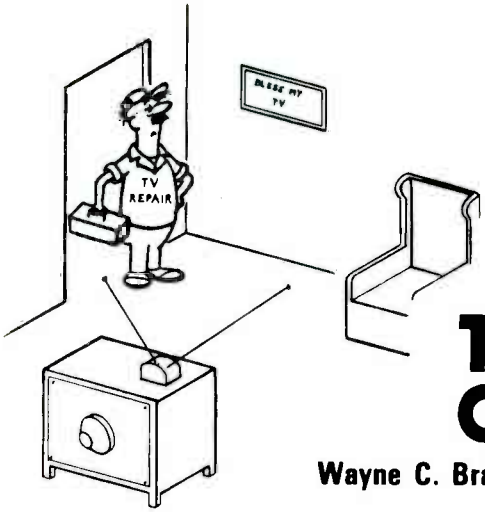
ground potential) at any instant to activate one of the display digits. Circuitry inside IC3 scans these five pins in sequence at the 1.6 kHz rate established by IC2. This rapid scanning of all five digits causes all digits to appear to be "on" at all times.

The Model 282 has most of its circuitry on two printed circuit boards. The main board contains the audio oscillator, the rf oscillator, the buffer/modulator, the buffer, and two regulated power supplies (+5 V and +15 V). This main circuit board also has the circuitry associated with IC1, IC2, and IC3 shown in Fig.2. The second circuit board holds the five display LEDs and eight resistors that are shown in Fig.2.

The main circuit board plugs into the chassis, which holds the power transformer and the operating controls. Assembling the Model 282 is a matter of a few hours' work, made quite simple with clear, step-by-step instructions and helpful assembly drawings. The cabinet is a rugged all-metal type that matches the CONAR Model 231 Signal Tracer and the Model 312 RC Tester in appearance.

The Model 282 is a versatile test instrument designed to meet the needs of the technician in applications where a 175 kHz to 30 MHz signal is needed. It is ideal for AM, FM, CB, and cw receiver alignment. A complete section of the operating manual is devoted entirely to AM-FM receiver alignment. This will help you become proficient at receiver alignment in no time at all.

The signal delivered by the 1 kHz audio oscillator easily handles all of the requirements of audio signal injection testing. The variable output ensures the correct amplitude signal needed to properly troubleshoot preamplifiers, af amplifiers, and output circuits. The performance of the Model 282 is much more than satisfactory. It should prove to be a valuable servicing tool for the hobbyist, as well as the experienced technician.



4. Is There an I-F Doctor in the House?

Television Casebook

Wayne C. Brandenburg, C.E.T.

After thinking about an NRI Journal article written by Harold Kinley, I realized that servicing problems do indeed come in batches. A recent rash of i-f amplifier troubles inspired me to select i-f repairs as the subject of this article.

A FRANTIC FRIEND

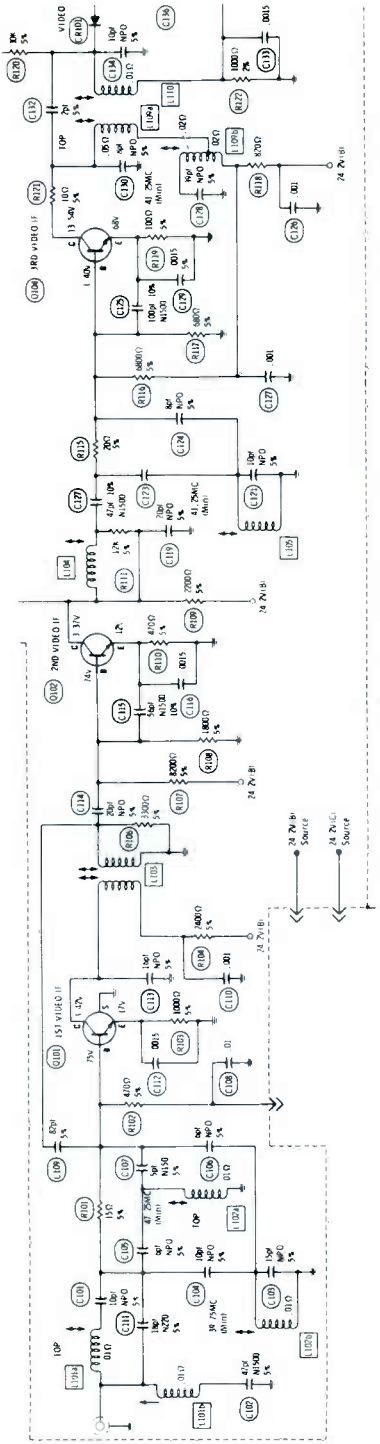
It all started with a phone call from my friend Frank at another shop. He was a little frantic about an agc problem he was having. He (and his boss!) felt that too much time had been spent on the set and he was hoping I could help. I pulled the schematic for the set and reviewed the problem with him. We got absolutely nowhere over the phone, so I told him I would stop by his shop that evening.

When I arrived, I was steered to a modular solid-state Zenith television, a portion of which is shown in Fig.1. The picture on the screen was dark and overloaded with a lot of herringbone pattern on it. It certainly did look like an agc problem to me.

My first test was to adjust the agc control. I found that any setting less than maximum produced no picture at all (a completely blank white screen). Setting the control to maximum produced the overloaded picture. I used the scope to check for the necessary signals in the agc circuit (Frank had already changed the agc module). Both the horizontal pulses and video signal were present, so I turned my attention to the i-f circuitry.

The i-f amplifier in this set is nicely sealed in a metal box. Frank didn't have a replacement, so I popped the top off the box and prepared to do a little signal injection. I set the B & K TV Analyst for an i-f output signal and injected it at the base of Q104, the third video i-f transistor. There was a faint test pattern on the screen, so I moved the probe to the base of Q102. Here I was not able to get any signal through to the picture tube. Moving the probe to the collector, however, did produce the test pattern.

I assumed that the second video i-f transistor was defective and proceeded to prove it with a voltmeter. The collector voltage measured the full 24 volts



Courtesy Howard W. Sams

FIGURE 1. THE I-F AMPLIFIER FROM A ZENITH 25DC56 CHASSIS.

from the power supply instead of the advertised 3.3 volts. As an additional test, I soldered a 0.001 μF capacitor from the base to the collector of Q102. This effectively bypassed the stage and a picture appeared on the screen. I left the job of transistor replacement to Frank.

DOUBLE TROUBLE

The next morning I made a service call that almost ruined my confidence. When I asked the gentleman what the problem was, he showed me an early model RCA color set with no picture.

I removed the back from the set and found a CTC38 chassis. Back when console televisions were in their heyday, this chassis was a very good seller. It's a hybrid chassis with transistors in most of the signal circuits and tubes in the higher power circuits. I have repaired hundreds of these sets, all with the same problem — an open third video i-f transistor.

Figure 2 shows the i-f arrangement in this chassis. Q3 is a rather large epoxy case transistor that hides under a little metal cover. They all go bad sooner or later. It seems as though the collector lead becomes disconnected from the chip inside. I told the customer that I could repair the set in his home.

While my soldering iron was heating, the customer told me an interesting story. "You are the second service company to look at my set," he said. "The first guy fiddled around in the back and said he would have to take it to the shop. He said it would probably cost between $60 and $90." Well, this made me nervous, indeed. If I repaired the set, the previous technician would look like a crook. In this age of consumer awareness, we must avoid adding fuel to the fire. If I didn't repair the set in the home as promised, I would look

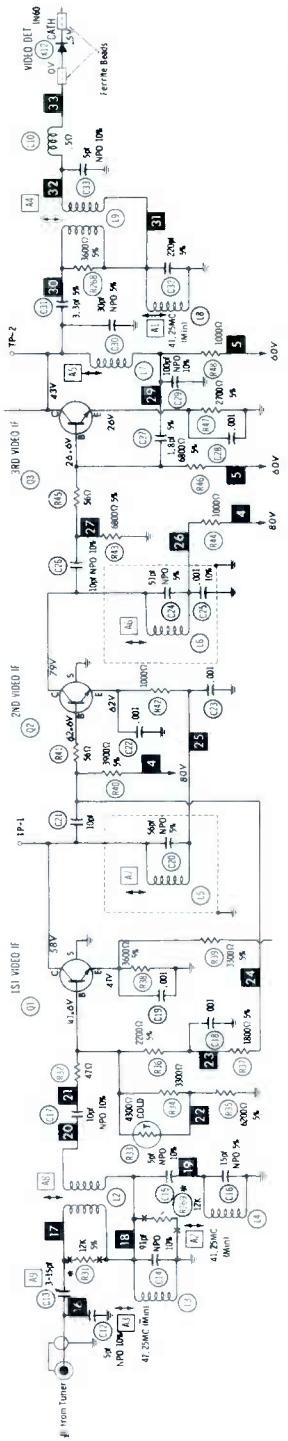
like a klutz. I proceeded to change the third video i-f transistor.

When I turned the set on and the screen lit up, my heart sank. There was a washed-out looking picture that was very badly smeared. I quickly used my VOM to test the transistor that I had removed and luckily found that it was bad. Then I explained to the customer, "Sir, your television appears to have two problems instead of one. This is probably why the previous technician wanted to take it to the shop. I'll see if I can repair the other problem, but I can't make any guarantees." I won't tell you what he was mumbling under his breath as I continued to work!

In my panic, I decided to measure some voltages. This way it would at least *look* like I was doing something. To measure voltages without a schematic, I look for a 0.6 volt difference between the emitter and base voltages (for silicon transistors) and a collector voltage that is somewhat less than the collector supply. (I-F amplifiers are biased class A.) The voltages around the new third video i-f transistor seemed alright. The second video i-f transistor had a collector voltage of zero. More panic!

In Fig.2, you can see that between the collector and its supply is a coil, L6. This is one of those metal cans with an adjustable coil inside. Naturally, I don't carry them with me. I started to loosen the chassis and used a screwdriver to prop the chassis up so I could work under it. The customer became very nervous. He just knew I would grab that chassis and run out the door!

I unsoldered the coil shield can and exposed the coil. I was in luck; the coil wire was broken right where it connects to the coil-form terminals. This is easy to repair – you just scrape the wire a little and add a large drop of solder to make the connection. I breathed a sign of relief when the set worked perfectly.



Courtesy Howard W. Sams

FIGURE 2. THE I-F AMPLIFIER FROM AN RCA CTC38 CHASSIS.

This experience made me think about one of the greatest attributes of a home service technician – acting! You must always show an air of confidence and act like you know what you are doing, even if you are grasping at straws.

A FEW BASICS

The curve shown in Fig.3 represents the gain characteristics of a typical i-f amplifier. As you can see, it is designed to amplify both the color and picture signals while rejecting signals from adjacent channels.

The sound carrier trap in Fig.3 is a little misleading, however. It looks as though the sound is not passed by the i-f amplifier. Remember this – the curve is the overall band-pass response for the complete i-f amplifier. In Fig.2, you can see that the sound is taken off at the collector of Q3 before the sound trap, L8. This is the usual arrangement. The sound is taken off before the final shaping of the curve. In this way, there is a sound signal for the audio circuitry but the trap eliminates any sound that could be passed on to the screen.

Keeping all of this in mind, let's look at some of the symptoms of i-f problems.

I-F SYMPTOMS

There are many symptoms of i-f troubles. Usually these symptoms affect both the sound and picture because they are common in this circuit. Here is a list of four common i-f symptoms and the causes:

Snow. If a part in the beginning of the i-f strip goes bad, there may be snow on the screen. The rest of the i-f amplifier strip will switch to full gain (because the agc circuit sees a low-level signal), and the amplifier noise appears on the screen as snow.

Washed-Out Picture. Sometimes a defect in the i-f amplifier causes a washed-out picture. This is true when one stage goes bad (no longer amplifies) but still passes some signal. In this case the i-f amplifier does not have enough gain to give a picture with good contrast. Instead, the picture has low contrast, and the colors look like pastels instead of having good saturation.

Complete Loss of Picture and Sound. If the signal path is completely broken, through the i-f, all picture and sound are lost. This symptom can also be caused by influences outside the i-f amplifier. For instance, an agc circuit problem

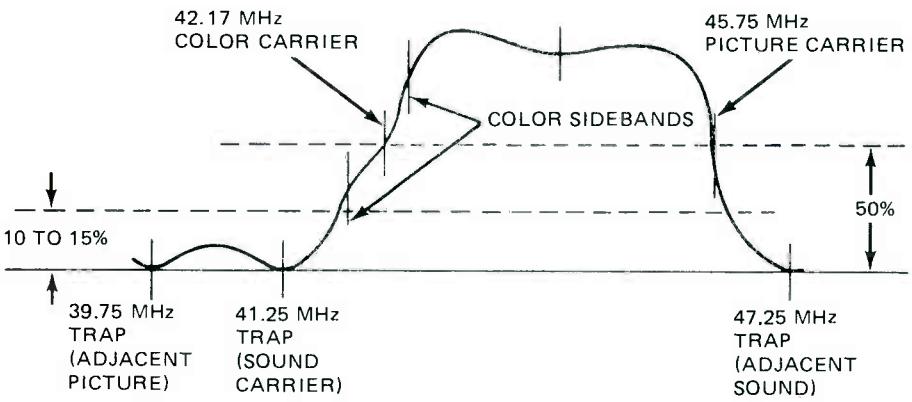


FIGURE 3. COMPLETE I-F BAND-PASS CHARACTERISTIC CURVE.

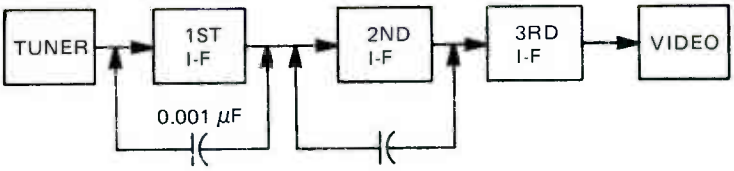


FIGURE 4. JUMPING THE I-F STAGES WITH A CAPACITOR TO FIND THE BAD STAGE.

could completely cut off the i-f transistors. Losing the B+ to the i-f amplifier also results in a complete loss of signals.

Interference. Many defects that can occur in the i-f amplifier cause the curve to become distorted. This can produce virtually any symptom, depending upon the new shape of the curve. Several of these symptoms are: sound in the picture, a light picture from another channel in the background, weak color, blurred color, no fine detail in the picture, and a negative-looking picture.

REPAIR TECHNIQUES

There are many ways to find out which transistors or circuits are bad in the i-f strip. One of the easiest ways is to *measure the voltage* around each transistor. There are usually no more than three or four transistors; locating the defective stage does not take that long. Usually the problem is in the transistor itself, but often a wrong or missing voltage is caused by the surrounding circuit.

If the circuits are easy to get to, the *capacitor test* works well. Hook up the television set for normal viewing, and jump each amplifier stage with a capacitor until a picture appears on the screen. When the picture appears, the stage you are jumping is bad. Figure 4 shows how this is done.

A capacitor (0.001 μF or whatever you have near this) is connected from the input to the output of each amplifier stage. If the picture comes back, you should not expect it to be very good because one stage of amplification and band-pass shaping is missing. Try jumping from base to collector when junction transistors are used. If you suspect a transformer or other part, you can jump it with the capacitor, also. If the picture comes back, you are jumping the spot where the signal stops.

Signal injection is another fast method of troubleshooting. A tuner substitutor or television analyzer injects an i-f signal before each stage. When the picture appears, the problem is in the area right between this point and the previous injection point. Figure 5 shows this process. Starting at the beginning of the i-f strip, the signal is injected between each stage. If the injection of a signal between the first and second i-f produces no picture, but a signal injected after the second i-f does produce a picture, the problem lies between the two places (second i-f). This method makes troubleshooting very fast. Be sure to remember that the farther down the i-f strip toward the video detector you go, the less gain there is. That means that the picture you see will be low in contrast.

If you do not have a tuner substitutor or television analyzer, use the tuner in the set as an injection device. To do this, follow the plan in Fig.6. From the i-f end, disconnect the shielded cable that connects the mixer output to the

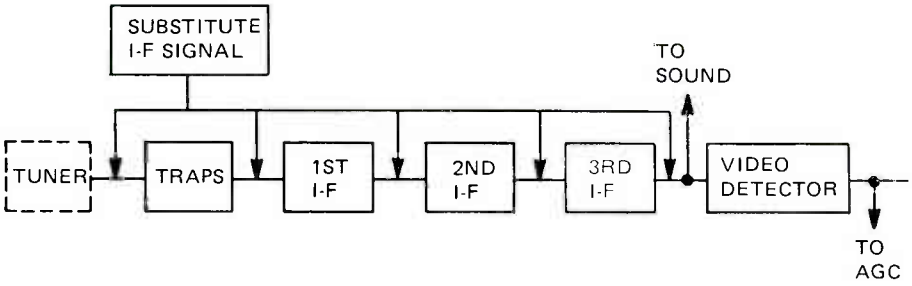


FIGURE 5. SIGNAL INJECTION USED TO LOCATE THE DEFECTIVE STAGE.

i-f input. Usually the connection is a plug, but sometimes it is soldered, so you have to unsolder it. Next, connect a 500 pF or 0.001 μF capacitor (or any small value) to the center lead. This capacitor is the probe you will be using to make your signal injector. Finally, ground the shield of the tuner cable. Now you can use this cable to inject i-f signals. Just hold the capacitor by its body, and touch the loose end to the points shown in Fig.5.

Integrated circuits are checked more like black boxes. All you do is make sure that the voltages are as the manufacturer recommends, and check the input and output signals with an oscilloscope. Fortunately, many ICs are mounted in sockets so that they can be substituted or changed easily.

These methods may seem rather simple, but if you follow them you will be able to respond to the question: *Is there an i-f doctor in the house?*

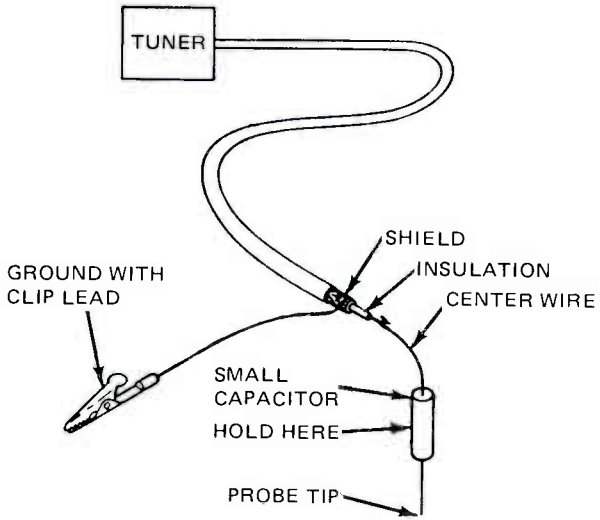
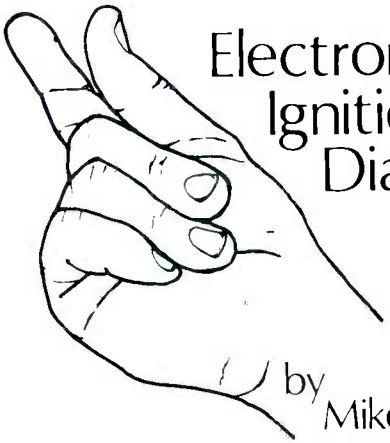


FIGURE 6. USING A TUNER AND SHIELDED COAXIAL WIRE TO INJECT A SIGNAL.



Electronic Ignition Diagnosis:

It's a *snap*!

by Mike Taylor

Troubleshooting and diagnosing electronic ignition problems is really very simple. At first, like many other shadetree mechanics, I thought these "electronic" ignition systems were much too complex for me to attempt a tuneup, much less troubleshoot some type of problem. However, after studying a few service manuals, I found that electronic ignition systems are really much simpler than I expected. After a while, it seemed easier to troubleshoot and service the electronic ignition systems than it did the old conventional ignition systems.

Any part-time mechanic, like myself, can diagnose electronic ignition problems. All you need is a basic knowledge of ignition systems, a few simple hand tools, and maybe one or two pieces of test equipment. If you don't already have a service manual for your car, this should be your first acquisition. Table I is a list of the major automobile manufacturers and where to write to obtain information on the availability and price of service manuals. A service manual is a must if you are going to do any work on your car. The manual includes all of the specifications and details for removal, inspection and repair, and reinstallation of most units. If you are going to be working on a variety of cars, a service manual for each can be quite expensive. Try a more general service manual such as Chilton's Auto Repair Manual or Motor's Auto Repair Manual. These books contain the essential specifications and general instructions for nearly all American cars.

Getting back to the electronic ignition systems – one reason they are easy to service is the standardization of parts between different engines and car models. Each manufacturer has its own ignition system, and that same basic system is probably used on all of that manufacturer's engines and models. Also, as you will soon see, all electronic ignitions operate in much the same way. So if you understand one system, you should be able to understand them all. Now, let's see how these electronic systems operate.

In the electronic ignition system, the contact points and condenser are eliminated. However, the basic setup of the distributor base, distributor cap, rotor, and vacuum and/or centrifugal advance mechanism are retained in the breakerless ignition system. The Chrysler electronic ignition system is typical of the systems used as standard

TABLE I

American Motors – Jeep
American Motors Corp.
Customer Relations Dept.
14250 Plymouth Rd.
Detroit MI 48232

Chevrolet
Helm Inc.
Chevrolet Manual Distr. Dept.
P. O. Box 07130
Detroit MI 48207

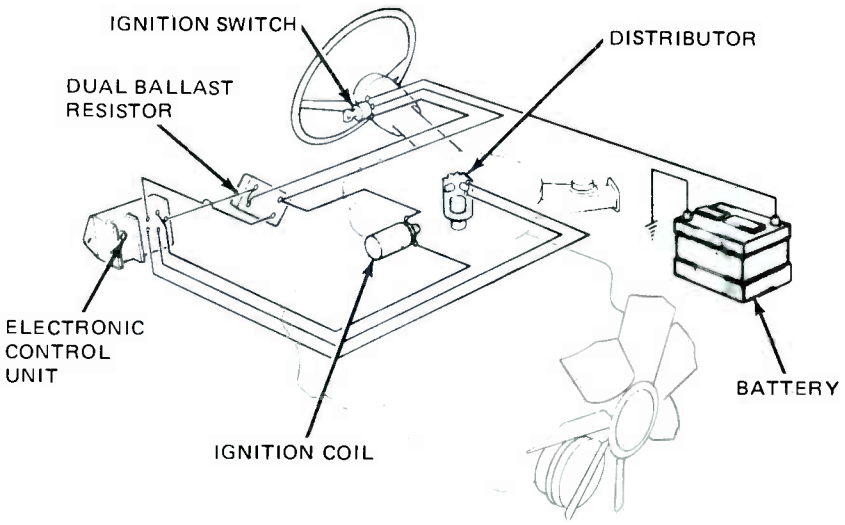
Ford, Lincoln, Mercury, and Edsel
Helm Inc.
Ford Service Publications
P. O. Box 07150
Detroit MI 48207

Pontiac
Drake Printing Co.
Pontiac Repair Manuals
2000 West 8-Mile Rd.
Ferndale MI 48220

Chrysler-Imperial, Plymouth, and Dodge
Chrysler Corp.
P. O. Box 857
Detroit MI 48231

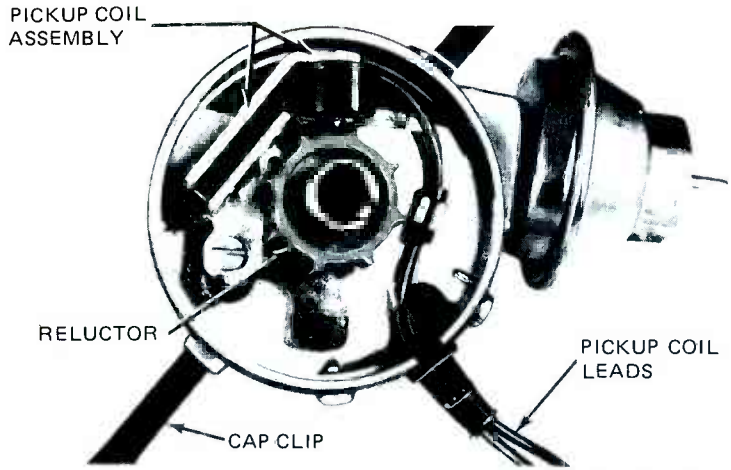
Motor's Auto Repair Manual (Current Year)
Motor's Book Dept.
250 West 55th St.
New York NY 10010

Chilton's Auto Repair Manual (Current Year)
Chilton Book Co.
Customer Service Dept.
Radnor PA 19089



Courtesy Chrysler Corp.

FIGURE 1. THE CHRYSLER ELECTRONIC IGNITION SYSTEM.



Courtesy Chrysler Corp.

FIGURE 2. THE CHRYSLER ELECTRONIC DISTRIBUTOR.

equipment on almost all passenger cars. A wiring diagram of the Chrysler electronic ignition system is shown in Fig.1. Inside the distributor, the distributor cam and breaker points are replaced by a reluctor and a pickup unit, as shown in Fig.2. The reluctor is a gear-like rotor that replaces the cam on the distributor shaft. The number of teeth on the reluctor corresponds to the number of spark plugs.

The pickup unit is stationary, and is mounted in place of the breaker arm. It consists of a permanent magnet and a small coil of wire wound around a tiny pole piece. Then, when a tooth on the reluctor approaches the pole piece, the magnetic field in the pickup unit changes and is strengthened. This causes a positive voltage to be induced in the pickup coil. As the reluctor tooth passes the pole piece and moves away, the strength of the magnetic field decreases and a negative voltage is induced in the pickup coil. Thus, without any mechanical contact, a signal is generated by the changing magnetic field. This signal is very accurately timed and is strong enough to trigger the electronic circuitry in the electronic control unit.

The electronic control unit supplies the primary current to the ignition coil. The ignition coil generates the high voltage necessary to fire the spark plug via the distributor rotor and distributor cap terminals, just as in the conventional ignition system. When a signal is generated by the pickup coil, the electronic control unit then cuts off the flow of primary current to the ignition coil. The magnetic field built up in the ignition coil then collapses and induces the high voltage necessary to fire the spark plug.

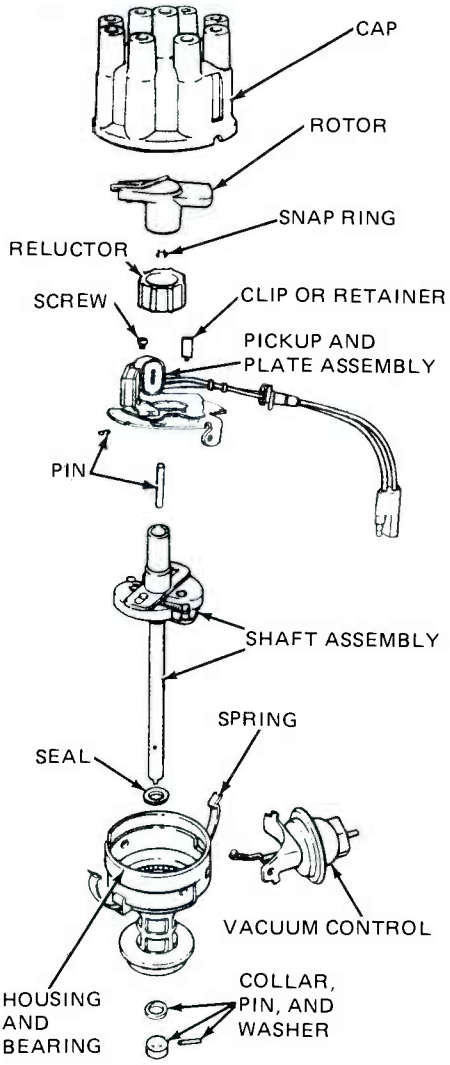
As you can see, the electronic ignition system is very similar to the conventional ignition system. The only real difference is that the distributor cam, breaker plate, points, and condenser of the conventional ignition system have been replaced by a trigger wheel (reluctor), a pickup coil, and an electronic control module. Also, the ignition coil itself cannot be interchanged with the coil used in a conventional ignition. This is because the electronic ignition system coil has been redesigned to produce a higher secondary voltage to take advantage of the improved action of the electronic

control circuitry. The length of time that primary current flows in the ignition coil is also controlled by the electronic control unit. This is "dwell," and because dwell in the electronic ignition system is not adjustable, it remains fixed.

One thing that confuses many people when servicing electronic ignition systems is the different terminology used by the various manufacturers. For example, Figs.3, 4, and 5 show exploded views of three different distributors from three different manufacturers. The three distributors are very similar in appearance and they all operate in much the same way. In the Chrysler unit, the distributor cam is replaced by a "reluctor." In the General Motors unit, the distributor cam is replaced by a timer core and pole piece referred to as a "magnetic pulse generator." In the Ford distributor, the distributor cam is replaced by an "armature." The reluctor, the timer core, and the armature all function identically. Each serves to induce a signal in the pickup assembly to activate the electronic control unit. Another difference, as you can readily see, is that in the General Motors distributor the ignition coil is built into the distributor cap. This does not mean that operation of the distributor is different, only that the lengths of the primary and secondary leads between the ignition coil and distributor are greatly reduced. This results in improved reliability. The American Motors electronic ignition system, although not shown here, operates in much the same manner.

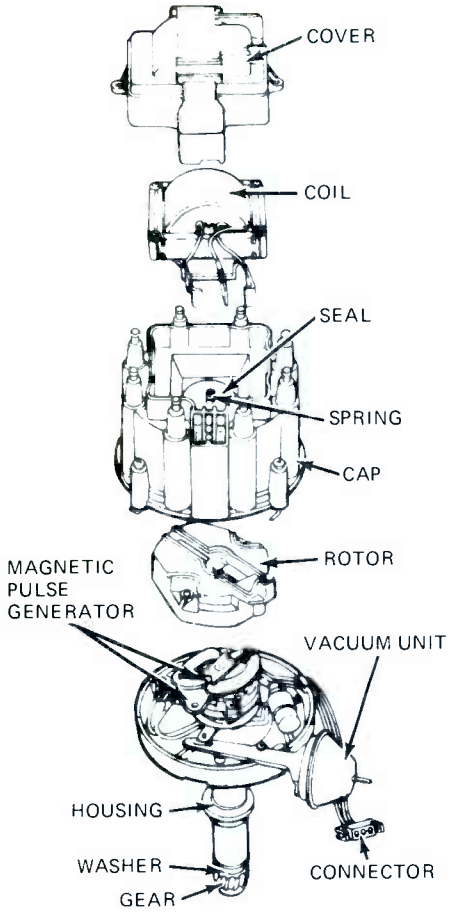
Now that you have some idea of how electronic ignition systems work, let's go through some troubleshooting procedures. Keep in mind, however, that you should never use the conventional under-the-hood shortcuts, such as the use of jumper wires and grounding devices, except those specifically described in your service manual. The use of these conventional diagnostic methods can damage the electronics.

Faulty ignition performance will usually be evidenced by engine miss,



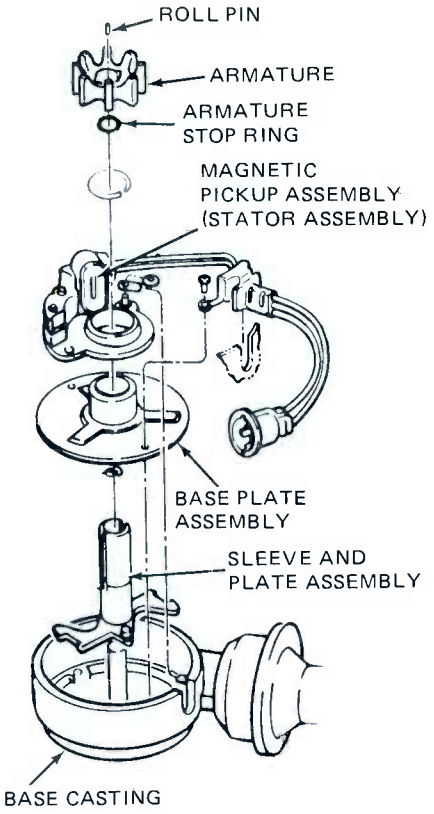
Courtesy Chrysler Corp.

FIGURE 3. AN EXPLODED VIEW OF A DISTRIBUTOR FROM CHRYSLER CORP.



Courtesy General Motors Corp.

FIGURE 4. AN EXPLODED VIEW OF A DISTRIBUTOR FROM GENERAL MOTORS CORP.



Courtesy Ford Motor Co.

FIGURE 5. AN EXPLODED VIEW OF A DISTRIBUTOR FROM FORD MOTOR CO.

engine surge, or failure of the engine to run at all. The following checks will help you when troubleshooting the ignition system.

Engine Miss. If the problem is engine miss, first check to see if it could be due to carburetion, improper timing, or poor spark plug condition. Check all of the wiring for brittle or cracked insulation, broken strands, and loose or corroded connections. The high-tension leads in the coil and distributor cap should be checked to make sure they are pressed all the way down in their inserts. If rubber boots are used, they should be tightly in place over the connections. Also, the outside of the distributor cap and coil cover should be inspected for carbonized paths that will conduct the high voltage to ground. Remove the distributor cap so that the rotor and the inside of the cap can also be checked for cracks and carbonized paths. A carbonized path will appear as a black powdery substance forming a path from the high-voltage source to engine ground.

The pickup coil in the distributor can be checked by using an ohmmeter or an electronic ignition analyzer like the one shown in Fig.6. When checking with an ohmmeter, disconnect the wiring harness from the pickup coil and measure the resistance of the coil. For a Delco-Remy pickup coil the resistance should be 300 to 400 ohms. For the American Motors Prestolite pickup coil, the resistance is much lower – about 1.8 ohms. Check your service manual for the exact resistance measurement.

If the ohmmeter reading is infinite, the coil is open-circuited and must be replaced. Likewise, if the reading is very low, the coil is shorted and must then be replaced.

The pickup coil should also be checked for grounds by connecting the ohmmeter from either coil lead to the distributor housing. Do not use an engine ground. The reading should be very high. If there is a resistance reading, the coil may be grounded and should be replaced.

Likewise, the ignition coil primary and secondary windings can be checked with an ohmmeter. To check the secondary winding, connect an ohmmeter from the high-tension center tower to either primary terminal. The resistance will be above 20,000 ohms, but should not be infinite. If the resistance is substantially less than 20,000 ohms, the secondary is probably shorted and should be replaced. The resistance of the primary winding will vary between different manufacturers. Check the manufacturer's specifications. An infinite reading indicates that the primary is open. However, if at times the engine misses, the primary circuit open may be of the intermittent type. This can be difficult to locate.

FIGURE 6. AN ELECTRONIC IGNITION ANALYZER.

If all of the previous checks appear satisfactory, the electronic control unit is probably at fault. Replacement of the control unit will determine if the original unit is defective.

Engine Surge. An engine surge condition is sometimes caused by a lean air/fuel mixture in the carburetor. However, if the condition is due to an ignition problem, check the distributor wiring for broken or intermittent connections. An intermittent open in the pickup coil can also cause this type of problem.

The surge condition may result from the vacuum unit causing a break in the distributor pickup coil wiring to open and close intermittently. To check this, disconnect the vacuum line and observe engine behavior at idle speed.

The next step is to make an ohmmeter reading of the pickup coil. Again, if the reading is infinite the coil is open. If the resistance reading is low, the coil is shorted. In either case, the coil must be replaced.

Engine Will Not Run. If the engine will not start or will not run, first determine whether or not there is a spark. This is done by disconnecting the coil-to-distributor high-tension wire from the center terminal of the distributor cap. Turn on the ignition and hold the loose end of the wire about one-quarter inch away from a good ground. Crank the engine. A good strong spark, as judged by conventional standards, indicates satisfactory ignition operation. Reconnect the high-tension lead and test for spark at the spark

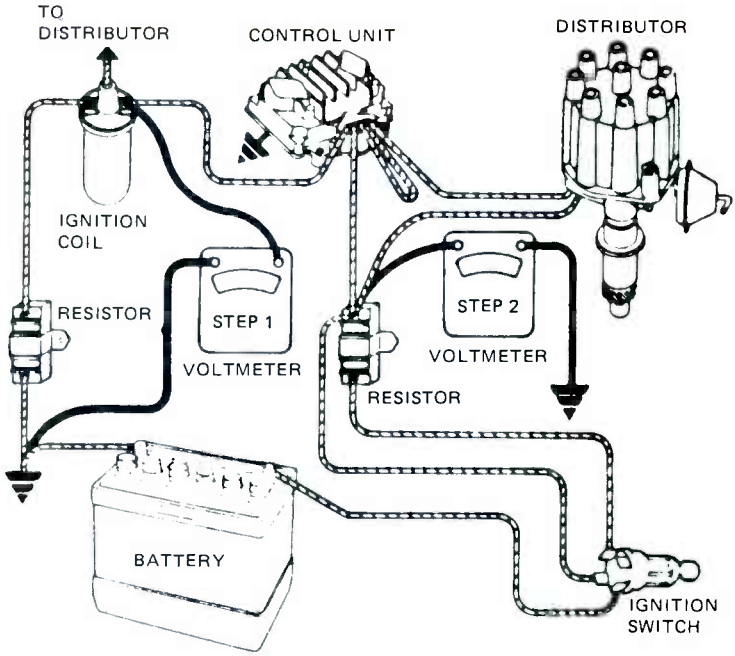


FIGURE 7. CHECKING THE PRIMARY CIRCUIT CONTINUITY WITH A VOLTMETER.

plugs. A good spark at the plugs indicates the trouble to be other than an ignition problem. If the spark is weak or nonexistent, check the distributor, wiring, and ignition coil as previously described.

If the above checks appear okay, the next step is to check circuit continuity. You can do this with a voltmeter, as shown in Fig.7. With the voltmeter connected, as shown in Step 1 of Fig.7, the reading should be slightly less (about 1 volt less) than the battery voltage. Compare this reading to the reading directly across the battery. If the reading is equal to the battery voltage, there is an open circuit between this point and ground. This means that the coil primary winding, the ballast resistor, or the wiring is open.

If the reading is zero, there is an open in the circuit between this point and the positive terminal of the battery. Here, connect the voltmeter, as shown in Step 2 of Fig.7. If the reading is again zero, the resistor, ignition switch, or the wiring to the positive terminal of the battery is probably open.

If the reading is equal to the battery voltage, there is an open in the circuit between this point and the ignition coil. The problem could be a defective electronic ignition unit or an open in the wiring. If the wiring appears okay, try replacing the control unit.

You have now covered the theory and operation of the more common electronic ignition systems. Electronic ignition systems provide the optimum ignition timing necessary to satisfy the new emission control laws, as well as providing maximum fuel economy. Servicing electronic ignition systems should not be any more difficult than servicing conventional ignition systems. Once you understand how each system operates, troubleshooting and servicing should be just a step-by-step procedure.

Honors Program Awards

For outstanding grades throughout their NRI courses, these February, March, and April graduates were given Certificates of Distinction with their NRI diplomas.

WITH HIGHEST HONORS

Sidney S. Allen, Albany GA
George J. Bagnall, Springfield VA
Sally A. Barton, Fort Wayne IN
Harold A. Bennett, West Springfield MA
Wilbur George Bliss, York PA
Russell Parker Boates, Oakland CA
Henry W. Butler, Mililani Town HI
Larry W. Coker, Madisonville KY
Leonard S. Cowles, East Granby CT
Kenneth Alvin Crane, Thornton CO
Lloyd D. Daugherty, Marshfield MO
Steve R. DeYoung, Farmington MI
Gerald M. Dison, Killen AL
O. P. Dixon, Anderson IN
Jeremiah James Donovan, Lackawanna NY
John Dooley, Cambridge City IN
Morris L. Durden, Holloman AFB NM
Brad L. Ellinger, Tippecanoe IN
Walter Kent Fosberg, Oakland CA
Steven F. D. Genovese, Tallahassee FL
James B. Gibson, Jr., Mountain Home AR
Charles Delbert Hall, Killbuck OH
Robert D. Harrington, Clifton Park NY
Harold E. Hauge, Osage IA
Wilbur A. Heath, Dunnellon FL
David C. Hendel, East Stroudsburg PA
Lester Hoke, Jr., Wellsville PA
Ronald S. Inouye, Kaneohe HI
William M. Inso, Davie FL
Marsden G. Kelly, Shalimar FL
Grace A. Lallave, Moca PR
Frank William Larson, Niceville FL
Michael David Lieber, Denver CO
Tony E. Long, Barco NC
Michael E. MacMartin, Keene NH
Federico Marroquin, Lake Village AR
Edward C. Morgan, Burlington NJ
Charles M. Morrett, Huntington IN
Arthur S. Myers, Boonsboro MD
Gerald J. Nindorf, Brookfield CT
Arthur J. Patridge, Mount Vernon WA
William M. Pease, Jr., Upper Arlington OH
Robert L. Perch, Charleston SC
Lawrence W. Peternith, Clifton NJ
Salvatore Polletta, Wolcott CT
Charles Preimesberger, Glendive MT
Teddy Proffer, Jr., Benton Harbor MI
John W. Reeder, Neptune City NJ
Jerry D. Remer, Sturgis SD
Charles W. Rhoades, Claremont CA
Spencer Roberts, Chesapeake VA
Ruben Santini, Brooklyn NY
Michael R. Schroeder, Webster City IA
Louis S. Seale, Sr., Trenton NJ
Ralph John Sexton, Jacksonville FL
John Marshall Short, Plattsburgh NY
Gary A. Shumay, Leverett MA
Ralph F. Skinner, Owaneco IL
Kirby Malcolm Smith, Clearwater FL
Richard B. Spencer, Monterey IN
Kenneth Stidham, Viola KS
Lloyd M. Stinson, Virginia Beach VA
Gerard Majella Sturm, Lorton VA
John Van Meerten, Miami FL
Edward Allen Weaverling, Hampton VA
Harold Geis Weigand, Alexandria VA
Gerald R. Westhoff, Greenwood MO
Thomas C. Wildrick, Waukesha WI
Thomas P. Wilhelm, Flat Rock MI
Chester A. Wilson, Jr., Murray NE
John Edward Wolf, Colonial Heights VA
Millard Wilmot Wood, Wolftown VA
Charles Michael Zearfoss, Lebanon PA

WITH HIGH HONORS

John D. Adams, Yulee FL
William G. Adams, Oakdale CT
David W. Aldridge, New Castle DE
George W. Allen, Cranbury NJ
Richard M. Almberg, Tarpon Springs FL
William A. Anderson, Alton NH
Stanley S. Antczak, Blaine MN
Alan Wayne Arrington, Aberdeen NC
Aaron J. Auchmoody, Groton CT
Frank G. Babos, Morris Plains NJ
Joseph P. Baka, Loring AFB ME
Joseph S. Balaker, Killeen TX
Donald A. Bard, Harrisburg PA
Harry R. Barker, Tuscaloosa AL
Steven J. Barlow, North Arlington NJ
Michael P. Barnes, Atwater CA
Robert A. Barrett, Alma NB Canada
Robert E. Barrow, Washington DC
Russell E. Batten, Jr., Fort Knox KY
Gary Gene Bedford, Fort Worth TX
Peterson Benally, Shiprock NM
Robert D. Benfer, Bellevue OH
Walter Bennett, Rockville CT
Clifford L. Bertoncini, Napa CA
Steven Craig Bevan, FPO New York
Fred E. Bierer, Morgantown WV
Keith Robert Bills, Gloversville NY
Robert Larry Boggess, Sandyville WV
Dennis George Bohl, Mandan ND
Paul Douglas Bond, Weston WV
Wilbur Duane Boots, Jr., Cedar Rapids IA
Clarence F. Borchardt, San Antonio TX
Jerry Boschert, Cincinnati OH
George J. Bouchard, APO NY
Richard Lee Boyles, East Palestine OH
Edward W. Bradford, Greenville NC
Jacques F. Breton, West Springfield MA
Donald Bridges, Midwest City OK
John C. Brown III, Carlisle PA
Ronald W. Brown, St. Petersburg FL
William C. Brownlee, Lockhart TX
William T. Bruederlein, Yonkers NY
Charles Odis Burden, Lewisville TX
Raymond S. Burk, Valencia PA
Ralph E. Cabeceiras, South Prairie WA
David J. Campbell, West Hyattsville MD
Barr M. Canario, Hilo HI
Samuel C. Carpenter, Roanoke VA
Gerald Chamberlain, Yakima WA
John Chamness, Hacienda Heights CA
James F. Chandler, Linn Creek MO
Duane A. Charter, Jr., Biloxi MS
Robert D. Clark, Nantucket Island MA
Mark David Clement, Fort Steward GA
Mylo William Cock, Jr., Lancaster CA
Randall W. Coe, Golden CO
Wendell L. Collins, Ames IA
Victor W. Compitello, Oakland MD
Marvin Cook, Minneapolis MN
Lynn Owen Cozart, Enon Valley PA
William D. Csincsak, Jr., Dayton OH
Philip Cucinotta, Jr., Delmar DE
Donald R. Cunningham, Frankfort IN
Thomas Joseph Curry, East Elmhurst NY
Saul A. Dauksa, Montreal PQ Canada
Lester L. Deaton, La Place LA
John C. DeForest, Brockport NY
Ernest V. DeSantis, Staten Island NY
Donald B. Diehl, Jr., Wrightstown NJ
Harold D. Diehlmann, Portsmouth OH
Michael J. Dixon, Seattle WA
John E. Domin, West Hazleton PA
William S. Dudek, West Warwick RI
Normand F. Dumas, Central Falls RI
Robert James Duncan, Channahon IL
Thomas Edward Duncan, Oxon Hill MD
David Bruce Dycus, Biloxi MS
Joseph Endre, Jr., Windsor ON Canada
Steve Allen Edwards, Rushville IL
Ernest V. Eurek, Elkhorn NE
Stephen Robert Evanko, Anaheim CA
Leonard E. Fagg, Duncanville TX
Randall Adelan Fairhurst, Winona TX
James T. Faulkner, Easton MD
John E. Fauntleroy, Hammond LA
William J. Faust, Kanawha IA
Robert Primo Fernandez, Grand Rapids MN
Fred Fernandez-Coll, Blacksburg VA
Jerome Alan Ferris, Adel IA
Steven A. Fink, Bethlehem PA
Alanson R. Fitchett, Stuart IA
Wilson E. Fitzgerald, Chesapeake VA
Kenneth C. Frederick, Altoona PA
James Velmore Frion, Great Lakes IL
Delmer Eugene Fry, Watseka IL
Walter Clyde Garrett, Cowpens SC
Michael Patrick Garrity, Albuquerque NM
Raymond Joseph Gasher, Scenery Hill PA

Henry Ronald Gaude, Natchez MS
Malcolm A. Gilbert, Porter TX
Frank Benton Gill, Jr., Huntington NY
John B. Gillespie, Regina SK Canada
Earl William Gipp, Great Cacapon WV
John T. Gleaves, St. Charles MO
Joseph M. Glodenis, Chesterland OH
Antonio Mojica Gloriani, Long Beach CA
Kenneth R. Goins, Seffner FL
Dave Gossett, McComb MS
Garry Edward Grabins, Leaf River IL
Glenn J. Grachis, Pittsfield MA
Frederick D. Gribbin, Erie PA
Laurence R. Griffiths, Warren OH
Richard R. Grondahl, Lake Park MN
James C. Grover, Pensacola FL
John J. Grzelka, Cheektowaga NY
Felix G. Gutowski, Grand Junction CO
Brad E. Hall, Baxter Springs KS
John R. Hall, Gretna NE
Ryland L. Hall, King George VA
John J. Halloran, Minneapolis MN
James R. Halvorson, Haughton LA
Steven B. Hamilton, Dayton OH
Soren L. Hanson, Arleta CA
Harry C. Harless, Jr., Goldsboro NC
Richard W. Harr III, Norfolk VA
Billy M. Harris, Jr., Odessa TX
Donald S. Harris, Memphis TN
James Ernest Harris, Cincinnati OH
Harry Don Hasch, Bryan OH
Dennis G. Hatcher, Ranson WV
Jan J. Hattingh, Transvaal South Africa
Larry R. Hayes, Gainesville FL
Loren F. Hazelwood, Cuyahoga Falls OH
Ralf A. Helvey, Phoenix AZ
P. J. Henderson, Jr., Los Angeles CA
Edward Hendrickson, Turtle Creek PA
David S. Hennessee, Morganton NC
Richard Lester Hensley, Warner Robins GA
William A. Herring, Alexandria VA
Arthur W. Hesterman, Napoleon OH
Russell M. Hickey, Greer SC
Melvin Hill, Boynton Beach FL
Rudolph Hines, Jr., Chicago IL
Scott Alan Hirschfield, Mindoro WI
Kendall Hocker III, Alamogordo NM
Carl Austin Hoff, Lynnwood WA
Lee A. Holleway, Temple TX
Terry Lee Hollingsworth, Troy TN
Kenneth E. Holloway, Cadiz KY
Rollen I. Holsey, Langley AFB VA
Harold T. Horton, New Bern NC
Dan Mason Houts, Martin MI
John Ashley Howard, Ledyard CT
Robert S. Howard, Charlotte NC
William R. Hronek, Eagle Rock MO
Preston Huddleson, Califon NJ
Curtis W. Hudspeth, Eogalusa LA
Larry Frank Humes, NAS Lemoore CA
Colin H. Hurst, Masset BC Canada
James E. Hurst, Amarillo TX
Louis Jean Hus, Wilton CT
Steve Huska, Sacramento CA
George Neal Iken, Midland TX
Edwin Q. Inman, Cranston RI
Billy Ivy, Mobile AL
Donald J. Janecek, Arvada CO
Gerald Newell Jenkins, Arcata CA
Thomas L. Jerome, Sauk Rapids MN
David C. Jockisch, Beardstown IL
Lee Joe, Greenwood MS
Robert Johaneman, Livingston Manor NY
David Lee Johnson, Descanso CA
Robert B. Johnson, Ferndale MI
Danny Robert Jones, Clarksville TN
Richard A. Jones, Eatontown NJ
Thomas Jones, FPO San Francisco
James K. Kaloustian, Detroit MI
Brian Joseph Kandibo, APO New York
Gerald John Kearns, Scottsville NY
Joseph Kiba, Seville OH
Sung S. Kim, Gardena CA
D. E. Kinkel, Suisun CA
Walter John Klink, Woodruff WI
Keith C. Knox, Napa CA
James F. Knutson, Waterville PQ Canada
Adrian M. Kozuki, Kailua HI
James Irvin Krebs, Flagstaff AZ
William Daniel Kresge, Auburn WA
Richard F. Krumm, Brooklyn NY
Steven D. Krumpe, Landover MD
Charles H. Kuhlman, Sidney OH
Gregory R. Kusic, Bremerton WA
Edward G. Lakin, Livermore Falls ME
Thomas S. Landon, Norfolk VA
Robert M. Lang, San Diego CA
Frank R. Lann, East Amherst NY
George J. Lappan, Penfield NY
Paul Elliott Lathbury, Frankford DE
Michael E. Lazzaroni, Riverview FL
Matt W. Leach, Correctionville IA
Kevin Scott Lee, Silver Spring MD
Lowell E. Leonard, Alamogordo NM
Walter A. Lesniak, South Holland IL
Kenneth Liesener, Joliet IL
Charles M. Logston, Sacramento CA
Bruce D. Luedke, Camp Springs MD
John Edward Lynch, Fabens TX
George P. Macatee II, Dallas TX
Carl E. Mack, Coulterville CA
Donald A. Mailhot, Brooklyn CT
William A. Mains, McKinney TX
Frank E. Malec, Wilkes Barre PA
Marc Marceau, St. Jean PQ Canada
John Thompson Matthews, Dallas TX
Roger Ernest Maves, Boulder CO
Joseph Mazzara, APO New York
Jerry Lee McArtor, Jacksonville IL
James L. McCarty, Concord CA
H. Weldon McCormick, Levelland TX
Robert W. McCullough, Parkersburg WV
Patrick T. McDonnell, Hicksville NY
Lawrence Roger McFaul, Norfolk VA
Linnaeus R. McGee, Ozark MO
Jack W. McGuire, Blackwell OK
Harold G. McKelvey, Rock Island PQ Canada
Fredrick W. McNeil, Wenatchee WA
David S. McNeill, Skandia MI
Donald Lee Medford, Bryson City NC
Michael J. Meehan, Forked River NJ
Roger Douglas Michael, Andrews TX
Dennis E. Miller, Johnstown PA
John O. Miller, Zanesville OH
Allen S. Mirocha, Chicago IL
Laraine G. Mitchell, Atwater CA
Robert A. Molstad, APO San Francisco
Amos Monroe Moore, East Millstone NJ
Vernon L. Moore, Decatur AL
Joseph T. Morris, Lynchburg VA
Donald F. Morrison, Union Grove WI
Kenneth L. Morrison, Cabot AR
Timothy John Mott, Portville NY
Vaughn W. Murphie, Yakima WA
Dennis Michael Murray, South St. Paul MN
Alec Dean Newbauer, Hibbing MN
Daniel G. Newlun, Homestead FL
Skyles M. Neyhard, Trucksville PA
Milton Ray Nichols, Call TX
Willard C. Nicolaisen, Jacksonville Beach FL
Ralph Thomas Nisbet, Whittier CA
Thomas George Norman, Flagstaff AZ
Rodney W. Oberton, Grand Rapids MN
Tony C. Ogle, Gatlinburg TN
Thomas S. Olson, Burbank SD
Zdenek R. Ondracek, Park Ridge NJ
Pablo Ortega, Elma WA
Danny Abel Oseguera, Bennion UT
Giau Minh Quan, Bristow OK
Weldon K. Park, Kingston OK
Carroll W. Peabody, Maryville TN
Don Perrier, Leaf Rapids MB Canada
Ronald E. Peters, Chula Vista CA
John E. Pettebone, Jr., Annapolis MD
Paul J. Pitts, Jr., Macon GA
David Lynn Plante, Stockton KS
James F. Plowman, Chillicothe MO
Bohumil Polata, Los Altos CA
Nigel Stuart Price, Hamilton Bermuda
John Raymond Raade, Ishpeming MI
John Raudman, Twin Falls ID
James Harold Ray, San Diego CA
Robert J. Richie, Jr., Portland ME
Paul M. Riggs, Elmer NJ
Norman A. Rindal, San Jose CA
James J. Ring, Hamburg NY
Benjamin Ritter, Belvidere NJ
Jackie W. Robbins, Equality IL
Roger Ray Robertson, Brooklyn MI
Billy R. Robinson, San Antonio TX
Thomas J. Rockey, Raytown MO
Richard Roohan, Massapequa NY
Wayne F. Rostek, Saint Charles MO
William B. Rowe, Omak WA
Melvin A. Roxburg, Sepulveda CA
William Joel Royal, Stedman NC
Leonard R. Sacco, Portland OR
Calin C. Savescu, Adrian MI
Philip Raymond Saxon, Abington PA
Kenneth H. Schaeffer, Bellefonte PA
Francis W. Schroeder, Antioch CA
Donald Lee Schwanke, Burden KS
Jack E. Scott, Havre De Grace MD
David Marley Scroggins, Lake Havasu City AZ
David Pearson Seaward, Rye NH
Robert Lee Sebring, Athens OH
Daniel B. Seevers, Cambridge OH
Douglas D. Seuferer, APO San Francisco
William U. Shaffer, Puerto Nuevo PR
Richard A. Sharpe, Farmers Branch TX
Steven R. Sheahan, Pocatello ID
Benjamin C. Shields, Jr., Richmond VA
Raymond E. Shuffitt, Georgetown IN
David Frank Shulters, Palmyra NY
John Robert Silva, Wheaton MD
Arnold L. Smith, Battle Creek MI
Foster D. Smith, Vandenberg AFB CA
Michael K. Smith, Angleton TX
Richard David Smith, APO San Francisco
Robert S. Smith, Brunswick ME
Ronald R. Smith, Pottstown PA
Keith A. Snider, Lima OH
George L. Snyder, Fremont NE
Ignacy Sobota, APO New York
Bryan R. Soscia, Coventry RI
Albert E. Southard, Jr., Great Falls MT
Charles J. Spangenberg, Manville NJ
Sam Booth Spears, Jr., Griffin GA
Robert G. Spivey, Oklahoma City OK
Marc Robert Stecker, Netcong NJ
L. W. Steenbakker, Jr., APO New York
Norman Stenstrom, Vernon BC Canada
Russell L. Stephenson, Groton CT
Russell S. Sterling, San Pablo CA
Donald I. Sternberg, East Meadow NY
Richard Frank Stevens, Kenosha WI
John Peter Stumpp, Plainview NY
Roger M. Sudduth, McLean VA
David Lewis Sutton, Pasadena TX
Neil L. Swank, Jr., Groton CT
Ken Szillat, Billings MT
Larry Lynn Taylor, Honolulu HI
Herman J. Theen, Governors Island NY
Gussie J. Thomas, Port Polk LA
Ronald Allen Thomas, Argos IN
Tommie C. Thomas, Honolulu HI
Janet A. Thompson, Buffalo NY
Cecil W. Tobias, Houston TX
Joseph Leo Tritz, Marshfield WI
Donald Hubert Tucker, Clinton MD
Donovan L. Turner, Wheat Ridge CO
John James Turpin, West Bridgewater MA
Ronald Urban, Glendale NY
Tadeusz Urbanowicz, Parthenon AR
Jesse C. Villareal, Jr., APO New York
Richard C. Vota, Rome NY
Darrell Gary Walker, Pound WI
Herbert C. Wallace, Owatonna MN
Thomas A. Walter, Canton OH
James M. Warrell, Boise ID
Robert Richard Wassen, Russellville AL
Richard E. Watts, Alexandria VA
Roger Warren Weaver, Coplay PA
Wayne L. Weaver, Goldsboro NC
David M. Webb, Albuquerque NM
Eugene M. Weber, Jr., Staten Island NY
Larry W. Weibel, Woodburn OR
Richard Allen Wells, St. Joseph MO
Frank A. Wennstrom, Boise ID
Jack William Wentz, Westminster MD
Donald E. West, Boonville MO

Raymond James White, Salem OR
Robert E. Whittenburg, Walkerton IN
Terence Rider Wight, North Branford CT
Margaret H. Williams, Virginia Beach VA
J. Vern Willis, Carson City NV
Gerald Witte, Hunter AFB GA
Harold R. Wofford, San Antonio TX
Charles Edwin Wood, Franklinton LA
Merle W. Worman, Quincy IL
William D. Zencak, Milford DE
Raymond P. Zeringue, Jr., Saint James LA

WITH HONORS

Robert E. Abernethy, Joshua Tree CA
John Franklin Adams, Dallas TX
Thomas C. Adams, Sr., Baltimore MD
Rafael Alcolado, Halifax NS Canada
Michael W. Aldrich, Minneapolis MN
Eddie Carroll Allen, Irving TX
Diana I. Althiser, Seguin TX
Frank H. Altrichter, Owatonna MN
Gerald E. Amick, South Bend IN
David Henry Ammer, Roy UT
Edwin Alfred Amundsen, San Diego CA
Robert B. Anderson, West Arlington VT
William J. Anderson, La Follette TN
Gary Michael Anello, Floral Park NY
Charles Anthony Apa, North Syracuse NY
Luther J. Ash, Woodbridge VA
John Lee Athey, Selinsgrove PA
Larry D. Baggett, Mt. Zion IL
Stephen Ball, Collegeville PA
Michael B. Barnes, Sylva NC
Ronnie Lewis Barron, Statesboro GA
Richard D. Bartlett, Candler NC
Joseph A. Basile, Lakeland FL
Ralph O. Beattie, Tarzana CA
Larry James Beavers, Hopewell VA
James E. Behrens, Mayville WI
Don W. Berryann, Cottekill NY
John Albert Best, Poway CA
Vernon Ray Bice, South Point OH
Robert F. Bliss, Wenonah NJ
David B. Blottenberger, Baltimore MD
Richard T. Bognar, Torrington CT
Paul Bohannon, Jr., Chesapeake VA
David P. Boland, Neenah WI
Kenneth L. Bortner, Norwood PA
Francis W. Bothwell, Harrisburg PA
Joseph Bottai, Hampton NH
James D. Bradford, Guntersville AL
Ronald L. Brady, Cincinnati OH
William M. Brans, Jr., Sturgeon Bay WI
Clifford E. Branson, St. James MO
Russell S. Brashears, Virginia Beach VA
Gregg Joseph Braun, Decatur IN
Kenneth M. Brewer, Santa Fe NM
Harold L. Breyde, FPO New York
Charles Ellis Briggs, Pequannock NJ
David Mason Brodeur, Blountsville AL
Gregg Kenneth Brown, Eatontown NJ
Harry C. Brown III, Malden MA
William Mark Brown, Beaverton OR
Tony Brushett, Burin NF Canada
James R. Buchanan, Zanesville OH
Leon David Buckle, Ridgely MD
Johnny Ross Buckman, Springdale AR
Carmen Buonauro, Osseo WI
James Franklin Burch, Jamestown IN
Ismael Maldonado Burgos, Catano PR
Charles Paul Burlage, Columbia MO
David C. Burnham, Trenton MI
Gregory Alan Busch, San Francisco CA
Daniel V. Bush, Cleveland OH
James Glenn Butzin, Grand Forks ND
Stephen A. Cady, APO New York
Teddy Wayne Cambron, Overbrook KS
Kerry R. Campbell, Beaufort SC
Edward C. Chamberlain, Forestville MD
Julius J. Champagne, Houma LA
Leslie M. Chaney, Shalimar FL
Andrew Cheng, Vancouver BC Canada
Donald Joe Clayton, Barnegat NJ
Peter E. Cleland, Jr., Anacortes WA
Rejean J. Clement, Cornwall ON Canada
Robert E. Clement, Spencer OH
Ross Cleveland, San Francisco CA
Jerry D. Coe, Mount Airy NC
Robert A. Collicutt, Wolfville NS Canada
Aberan R. Conrad, Steubenville OH
Wayne Allen Conrad, Tucson AZ
Charles R. Costelio, Louisville KY
Lewis A. Cotton, Scott AFB IL
Richard Hollis Coulter, Macomb IL
James E. Craft, Warwick RI
John Milton Creamer, MacClenny FL
Joseph A. Crusco, Waldwick NJ
David J. Cruse, Pecatonica IL
Paul Csiszer, Jr., Leland IL
Linn Cunningham, North Little Rock AR
C. Kevin Curry, Taylorville IL
Neal Wray Curtis, Belgrade MT
Richard P. Damron, Del Rio TX
Charles E. Daugherty, Charleston Heights SC
Billy R. Davis, Seattle WA
Dennis Calvin Day, Wyandotte MI
Paul M. Delage, Orange Park FL
R. B. De Lange, New Brighton MN
Robert R. De Lorme, Innerkip ON Canada
Douglas G. Demers, APO New York
Michael Edward Deremo, Sturgeon Bay WI
Edward Ross De Shane, Fort Rucker AL
Forrest L. Dietrich, Oxnard CA
Ronald J. Di Federico, Henderson NE
Arnold E. Dishman, Anderson IN
John N. Dodsworth, Jr., Andrews AFB MD
Rodolfo Giron Dollete, FPO New York
Robert C. Dorris, Jr., Beale AFB CA
Ned Eugene Downer, Atchison KS
Lewis F. Dudgeon, Mililani Town HI
Stephen Martin Dufalo, San Jose CA
James William Duffy, Wooster OH
Matthew L. Duley, Elmwood Park IL
Russell L. Dunnington, Jr., Lewistown MT
Stephen A. Eastman, Anaheim CA
Clark B. Eckman, Avis PA
Larry J. Eden, Nashua IA
Dale Benhart Egeler, Kalamazoo MI
Everett J. Erwin, El Paso TX
John Howard Eustis, La Salle IL
Verne Fairbanks, Joliet MT
Thomas C. Faircloth, Reidsville NC
Joseph Edward Faucher, Rutland VT
Omar Clayton Fender, Mars Hill NC
John J. Ferracci, Jr., Baltimore MD
John C. Fields, Jackson MS
Joseph Finocchio, South Plainfield NJ
Charles P. Fisher, West Point CA
Merle Fitzpatrick, Jr., Fairfield ME
Robert Floyd, Mountain Home AR
Peter Keith Fluitt, Xenia OH
John E. Forbes, New Orleans LA
Leo Karl Fortenbacher, Sea Girt NJ
Charles E. Fortin, FPO New York
Douglas N. Foster, Louisville KY
Dale R. Fox, Columbia SC
Donald Freeman, Bogalusa LA
Donat H. Fregeolle, Cumberland RI
Robert Oliver Frick, Jr., Groton CT
Daniel R. Fricke, Kingsville TX
Donald R. Furgerson, Alexandria VA
John H. Furman, Sr., Chocowinity NC
Milton Gabor, Glendale WI
Joseph E. Gabriel, Glen Burnie MD
William G. Gale, La Ronge SK Canada
Carl Eugene Gambill, Dugger IN
Maurice Eugene Garner, Jr., FPO New York
Lamar Uriel Garza, FPO San Francisco
Howard J. Gatton, Silvis IL
Patrick Henry Geary, Philadelphia PA
Frank Germano, Carbondale PA
Michael Gialanella, Livingston NJ
Ronald K. Gilliam, Sabina OH
Kathryn E. Glenn, Ames IA
Francis E. Gohringer, Rome NY
David R. Goodale, Rensselaer NY
Dallas R. Goodman, Jr., Cleveland OH
Carlos Cruz Gonzalez, Marina CA
William F. Gorton, Clifton NJ
Arthur W. Goulet, Jr., Rockville MD
Michael G. Green, Augusta GA
John Robert Grose, Russiaville IN
Theodore G. Grossholz, Mountain Home ID
Daniel E. Grunstad, Mission Viejo CA
Jeddy James Gullett, Gulfport MS
Donald D. Halbert, Centralia MO
Robert C. Hanlon, Urbana IL
Gerald J. Hargett, McComb MS
Gennie C. Harrell, Jr., Bessemer AL
Christie Ann Harris, Cedar Rapids IA
Grady C. Harris, Jr., Birmingham AL
Earle H. Hartleb, Erie PA
Lester W. Hatton, Jr., Center Harbor NH
James M. Hawkins, San Antonio TX
Ralph R. Hayden, Jr., Kane PA
Jerome Haynes, Lincoln AL
Louis Edward Haynes, Napa CA
Richard E. Hearn, Jr., Rome NY
Alvin Herber, Shattuck OK
Kevin M. Hewitt, Fort Pierce FL
Charles David Hill, Kansas City KS
Eldon D. Hill, Parma OH
Paul L. Hill, Green Bay WI
Leonard L. Hix, Casper WY
Rex A. Hobbs, Wabash IN
Ed Hogan, Suisun CA
Alan Neal Holbrook, Summerville SC
Carl Denzle Holcomb, Port Clinton OH
Donald R. Horak II, Alexandria VA
Thomas J. Horning, Peoria IL
James William Houser, Andrews AFB MD
Lawrence P. Howard, Green River WY
Edward F. Hubler, Akron OH
Michael Byrne Hudak, Brunswick OH
Gerald L. Hughey, Yermo CA
Rodney E. Hull, Ferguson MO
William Humphreys, Jr., Yorktown VA
Marvin L. Hunter, New Bremen OH
Adolfo Y. Ignacio, San Diego CA
Johnny Ray Ingold, Snow Camp NC
George Robert Ireland, North Somers CT
Gaetano J. Irrera, Ewa HI
John Wayne Isenberg, Ogden AR
David N. Jenson, Port Orchard WA
Peter Raymond Jessen, Camp Pendleton CA
James A. Johnson, Kenesaw NE
Robert Allan Johnson, APO New York
Thomas C. Johnson, Sr., Middleburg FL
Donald Eugene Justison, Vega Alta PR
Michael Kaspar, Jr., Winter WI
Michael Patrick Keane, East Meadow NY
K. Stephen Kear, Vancouver BC Canada
John E. Keehner, Youngstown OH
Earl Edward Kelley, Jr., Asheville NC
Donald Jeffrey Kennedy, Niles OH
Donald Hugh Kerr, Mineola NY
James E. Ketchum, Summerville SC
Muhammad Sarwar Khan, Arlington VA
Raymond M. Kinne, Langley AFB VA
John S. Kitzmiller, Dover DE
Donald J. Kleeberger, Perrysburg OH
Michael V. Knowlton, APO San Francisco
Charles M. Koch, Sr., Huey IL
Joe Paul Kramer, Trempealeau WI
Steven Anthony Krapko, Spokane WA
Ralph R. Kratovil, Pearland TX
Gary Lee Kreitz, Hanover PA
August Robert Kriley, Butler PA
Andrew S. Kucipak, Tupper Lake NY
Thomas L. La Guardia, Bellport NY
Thomas A. Lajcak, Ashland WI
Le Verne Lamie, Erin NY
Randal S. Landry, Iowa LA
Jean L. Langelier, Drummondville PQ Canada
Joseph T. Larkin, Virginia Beach VA
Francis H. La Roche, Cocoa Beach FL
Richard Dean Larsen, Norfolk NE
Ronald D. Larson, Tyndall AFB FL
William C. Laughlin, North Olmsted OH
Larry W. Laymon, Douglasville GA
Eugene H. Lebaron, Lenore ID
Edward James Legrow, Merrimac MA
David A. Lemke, Milwaukee WI
Richard John Leote, Piermont NY
Steven A. Lett, Crothersville IN
Martin G. Levens, Sarasota FL
Ronald L. Lindsey, Killen AL
Herman Lee Lloyd, Knoxville TN
Marvin L. Lovenstein, Portsmouth NH

Jack L. Lucas, Quinault WA
Alwin L. MacKintosh, Aruba Neth. Ant.
Melvin O. Magnuson, Enid OK
John Allen Maiani, Marblehead OH
Cyril D. Mailander, Marshalltown IA
Matthew J. Mangiamele, Red Hook NY
Larry E. Mann, Bloomington IL
Kenneth R. Markley, Winchester VA
Bernard C. Marquardt, Ashland PA
Ross Lynn Marshall, Columbia NJ
Rudolph Marshall, APO San Francisco
Donald W. Martin, Jr., Milton FL
Douglas Glen Martin, Bangor ME
Ronald C. Martin, Pomona NY
Thomas Mastro, Elizabeth NJ
Alfred H. O. Mattner, Jr., Woodbridge VA
Kent Burgess Maurer, Kirtland AFB NM
William Douglas Mayo, Leesville LA
Eugene McArdle, Mantua OH
Richard C. McCallum, Mt. Morris MI
Russell F. McClung, Fort Stewart GA
Palmer T. McCormac, Beaverdam VA
Harvey McCullough, Jr., Rumford ME
R. A. McEldowney, Aberdeen Prv. Gnd. MD
John R. H. McIntosh, Oklahoma City OK
Leonard A. McKain, Beecher IL
Alan Richard McWha, Port Huron MI
Edward Meacham, Newark NJ
Danny Lyn Mellott, Goldsboro NC
Ralph S. Messenger, Jr., Groton VT
Mark William Meyer, Hozlet NJ
Kenneth Francis Miles, East Bethel MN
Julius M. Millican, Grand Prairie TX
Michael E. Minott, New Orleans LA
Mickey B. Montgomery, Austin TX
Robert M. Montoya, Montebello CA
Herschel Dean Moore, Jr., Hamilton MT
Samuel F. Moorefield, Jr., Damascus VA
Thomas R. Morrissey, Miami FL
David Paul Mosconi, Tenafly NJ
Roy A. Mosteller, Jr., Pittsburgh PA
Richard John Mueller, Havelock NC
William E. Mullineaux, Goldsboro NC
Fred Louis Muniz, Virginia Beach VA
Terrill W. Muntz, Seattle WA
John Murphy, West Hartford CT
Steven J. Murphy, Fort Ord CA
Gailen Murray, Baldwin KS
Neal A. Myren, Salem SD
Dickie Milton Nash, Houston TX
John Lewis Nauck, Birmingham AL
Trenton Nelson, Madison WI
Frank John Nemeth, Haskell NJ
James Francis Netti, Herkimer NY
Robert Neumann, Grand Rapids MB Canada
Carlton E. Newbern, Cincinnati OH
Ray E. Nix, Clarkston GA
Eddie Nunn, Anderson IN
Horace E. Oakley, Kennett MO
Ronald E. Oldham, Villa Rica GA
Daniel S. Olejownik, Toledo OH
Arnold H. Olsen, Pompano Beach FL
Charles Ervin Olson, North Augusta SC
Dean Charles Ortner, Whittier CA
Wade Outland, Miamisburg OH
Daniel E. Paquette, Redstone Arsenal AL
Barton Frank Pannell, Aiea HI
Dwight D. Paslay, Spokane WA
Kenneth R. Pastotnik, South Weymouth MA
James Lee Patterson, Clovis NM
Bunah J. Pattillo, Romulus NY
Brandon D. Paxton, Aurora IL
John Forest Penrose, Edwardsburg MI
James K. Peterson, Jr., Norwich CT
Richard L. Peterson, Cottage Grove MN
Charles Louis Picard, Voorheesville NY
Daniel Phillip Pilon, Pensacola FL
Timothy H. Pinckard, Cape May NJ
Glenn B. Pleiness, Port Huron MI
Allen Bruce Pleva, Levittown PA
Albert H. Post, Jr., Lake Orion MI
Samuel David Powell, Menlo GA
Lloyd G. Powers, Independence KS
George T. Prickett, Windsor SC
Jimmy Lee Proffer, Chester IL
Bruce A. Pummill, Missoula MT
Richard F. Purgahn, Alexandria VA
Alfred Ernest Quick, Dixon MO
James J. Rahilly, Annandale VA
Felix M. Ramos, Bronx NY
Donald Rawls, Chicago IL
Joseph D. Reid, Salinas CA
William J. Reilly, Teterboro NJ
Michael W. Reynolds, Gaston IN
Jerry L. Rice, Alameda CA
John B. Richards, Springfield IL
James Alfred Richardson, Waycross GA
Kenneth L. Richmond, Sevierville TN
Curtis Lee Rider, Jacksonville FL
Richard R. Riley, Janesville WI
Robert Ritchie, Yulee FL
Leslie Rivera, Rio Piedras PR
Richard Carlton Roath, Greenville CA
John Roy Roberts, Kalispell MT
Richard O. Robinson, Sr., St. Marys OH
William E. Roeske, Carlock IL
Marion G. Rogers, Westmoreland TN
Richard C. Rooney, Vienna VA
Samuel Rodriguez Rosa, Caguas PR
Thomas Rosak, Pittsburgh PA
F. N. Rosenbalm, Greenville TX
Arthur C. Ross, St. Anne IL
Steward Ross, Springfield OH
William Raymond Ross, Lawton OK
Robert Emmet Rossow, West Bend WI
Robert Douglas Rowley, Biloxi MS
Edward E. Ryan, Andover NY
Anthony John Saban, Gloucester NJ
Stephen G. Sager, Lebanon PA
John Richard Salt, Poland OH
Gerald N. Sandifer, Moncks Corner SC
Billie Michael Sansone, Chapmanville WV
Lawrence Savadkin, Annapolis MD
Robert W. Savage, Hopkins MN
Burton A. Sawyer, Brewer ME
Samuel V. Sawyers, Fayetteville NC
Thomas H. Schlager, Fredericksburg VA
Charles T. Schmidt, Mandan ND
William F. Schneck, Groton CT
Gary R. Schultz, Hilton NY
Herbert M. Schwencke, San Antonio TX
Calvin Alvy Scott, Thompsonville MI
Robert L. Scott, Payson IL
Leroy H. Seagroves, Raleigh NC
William N. Search, Berwick PA
Edwin L. Seay, Beaver Dam VA
Robert Bernard Seeber, Milwaukee WI
Alton Guy Shahan, Jr., Morgantown WV
Kingsley M. Shaw, Antioch CA
Ridley K. Shaw, Medicine Hat AB Canada
Larry James Shear, Spring Lake NC
Ronny Sikes, Columbia SC
David Ray Sinclair, Louisville KY
Jack Noel Skene, Decatur GA
L. M. Smith, FMO Halifax NS Canada
Stanley N. Smith, Block Island RI
William D. Smith, Orange NJ
Michael H. Spalding, Green Bay WI
Helton Clark Spangler, FPO New York
Daniel Spry, Newark DE
Thomas Paul Stachowicz, Chicopee MA
Paul Alan Steele, Glendive MT
Bobby L. Stephens, Warrington PA
Elmer Curtis Stephens, De Soto MO
James Carl Stockton, Sturgeon MO
James O. Stricklen, Orange Park FL
Larry J. Stubblefield, Morristown TN
William Eugene Styles, Independence MO
Earl H. Summerfield, Ft. Leonard Wood MO
Charles G. Swager, Fort Worth TX
Gene D. Sweeney, Springfield OH
Chester F. Swosinski, Jr., APO New York
Raymond E. Sylvester, Hamden CT
Lawrence J. Szafranski, N Tonawanda NY
Larry Ray Taff, Cabool MO
Loren E. Tanner, Marion OH
Carroll Taylor, Yates City IL
Louis P. Taylor, Long Beach MS
William Tevault, Huntingburg IN
Johnny A. Thacker, APO New York
Mark Thistlethwaite, Mobile AL
Raymond G. Thomas, Sumner WA
Gary Tibbit, Albuquerque NM
Harry C. Timmerman, Carmel IN
James K. Tinsley, Sr., Nashville TN
Reymundo Tobar, San Bernardino CA
Lloyd Calvin Toney, Jr., Adel IA
David A. Tonsing, Chesapeake VA
Lewis M. Tourtillotte, Brewer ME
Paul E. Toussaint, Latham NY
Roger Arthur Trahan, New Bedford MA
Frank A. Traina, Westbury NY
Edward P. Tremblay, CFB Shilo MB Canada
Melville Clinton Ulery, Castle Rock CO
Ellsworth H. F. Umbreit, Detroit MI
Gerald T. Vachon, Alfred ME
Alvey E. Vallee, Baton Rouge LA
Fred Allen Vance, Raven VA
Paul J. Vetter, New Orleans LA
Daniel E. Vickerman, Warroad MN
James F. Vincent, Jr., North Providence RI
Walter W. Visco, Clifton NJ
David Lee Wondra, Galena IL
Richard J. Vorwald, Dubuque IA
Edward L. Waclawski, Baltimore MD
Arthur D. Walker, Ewing IL
Raymond Eugene Wallen, Greensboro NC
George A. Walley, Millington TN
Gordon T Walsh, Millers Falls MA
Bruce T. Ward, Bristol CT
Arthur Walker Webb, Jacksonville FL
Thad V. Weidmann, North Huntingdon PA
J. T. Weisner, Augusta MT
Gerald H. Welsted, Derby NY
George Elbert White, Lilburn GA
Linwood C. Whitman, Patuxent River MD
John Stephen Wilcox, Millington TN
Stephen K. Wilcox, Montrose PA
Daniel R. Wilda, Schofield Bks HI
James M. Wilhite, Kent OH
Paul R. Wilkerson, Phoenix AZ
Kathleen Iris Wilkes, Vienna VA
Robert S. Willey, Jr., Hudson NH
Oscar L. Williams, Bronx NY
Mark A. Wills, Novato CA
William D. Wilson, Pittsburgh PA
John L. Wilt, Winchester IN
John J. Wojtycka, St. Francis WI
John Robert Wolfe, Marion VA
Ken Wolford, Cobble Hill BC Canada
Richard L. Work, Lake View NY
Dennis Leroy Worley, Mobile AL
A. L. Wright, Sept-Iles PQ Canada
David Jessie Wurl, Lighthouse Point FL
Charles W. Wynn, Malvern PA
Kin Fung Yee, Beltsville MD
Lawrence E. Yoder, Plaza ND
Earl S. Ziegler, Indianapolis IN

Ham News

Ted Beach K4MKX

Well. first things first. With regards to the QSL card minicontest, we received in the neighborhood of 85 entries. As luck would have it, our esteemed judges have not had an opportunity to make a final selection as to the overall winner. There were several very good entries, and we're having a hard time coming up with the one we want to use. This delay will just give you something to look forward to in the next Journal.

Actually, we are planning to base the NRI QSL card on the design selected, but will probably make a few cosmetic changes to fit our requirements. What this means is that when we print the "winning" design in the next issue of the Journal, the winner will probably not recognize his entry! Not really... it's just that not too many people paid close attention to the requirements we set up some time ago, and we'll have to make some changes to suit our printing methods.

The next item is the scheduled NRI net published in the last Journal. Unfortunately, many of you did not get your copies of the Journal until after the first (or perhaps the second) scheduled date. This was due to an unfortunate mailing delay, caused by our having to mail out several hundred thousand copies of a special mailing that had priority over the Journal mailing. I apologize for this, and hope that we don't have the same thing happen again.

Unfortunately, I had my own problems on the three scheduled dates, and also missed the first two due to personal matters. When I tuned up for the 80-meter session on May 1, I heard nothing but garbage and noise in the receiver. From the sound of things, these unpleasant noises seemed to be originating in my receiver and not coming through via the antenna. Such was the case. After having had receiver trouble last year, I found a bad FET in the front end, replaced it, and was back

in business. Now I've got another problem, and haven't had a chance to put the rig on the bench to look for the trouble.

At any rate, my rig was dead on the first of May, and the two people I called to see if I could come over to their place and use their rigs were not at home. So much for me.

However, I did get quite a few notes from people who were successful in making some contacts on one or more of the net nights, and they were most enthusiastic. These will be recapped later on. The thing that became obvious was that it will be virtually impossible to get *everyone* on the air at the same time and on the same frequency.

Most nets (since we don't really have any organization, let's call them "Get Togethers") will be somewhat "local," or at least regional – East Coast, Midwest, West Coast, etc. There might possibly be some DX check-ins on occasion. At any rate, no one complained seriously about the Tuesday dates or the times specified originally.

Now, I've prepared a schedule for the rest of 1979, showing every Tuesday from August 7 to December 18. (We'll skip Christmas on the 25th.) You can consult this chart to see which band to use on which Tuesday, then pick a convenient date and park on frequency calling "CQ NRI" or listening for the same call. I think these Get Togethers should prove very interesting, and we will avoid mailing conflicts of the Journal as far as timing is concerned (except perhaps for this one). If this works out all right, I'll report in the Ham News column anything I hear on the air as well as any reports from you people, and we'll set up a schedule for 1980 as well. Have a go at it, and I'll join you when I can.

Now let's see who we've heard from since last time. As usual, those listed first are students and graduates of NRI's Amateur courses, while those listed last are other NRI students and graduates.

I would like to quote a small piece from K1VKO's letter. Art writes: "I would like to say that I have only completed one third of your Complete Amateur Radio Course, and have already passed the Advanced Class Test with ease. I am going to wait to finish the course and then get my Extra and Third Class Commercial (to start). Your course made the test seem so easy that I could not believe that this was the test so many said was so tough!" Thanks very much, Art. We always like to hear good words like yours. Of course, much of the credit for your success must go to you for being diligent in your studying. Best of luck on getting the other licenses. I'm sure you'll do fine.

I got two nice notes from Jack, WA1YYK. One was back in February, the other in May. Jack had said earlier that he expected to have his General license by age 62, but the old "13 per" seems very elusive. In the May letter, he indicated he finally made it on April 26, only 18 days after hitting 63! Not too bad, I'd say – close enough. Jack participated in the May 1 NRI net and had some success in contacting WD4GAT on cw. He heard WB9NWR and WB8VGS discussing NRI on SSB, but couldn't make his way into the QSO. Seems like an unhealthy SWR of 2.5:1 is keeping the rf in the shack instead putting it into the antenna. Don't give up, Jack. Please try and check out some of the new dates this year.

AF3J is the new call of Gene (ex K3JFV) who was wondering some time ago whether to get one of the "new" calls when he got his Extra or keep his old call. My advice to Gene was to hang on to the old call, because the K3 type will soon be "valuable." Unfortunately, Gene had already applied for a new call, and now everyone thinks that he's some

type of DX! I'm sure that will pass in time, Gene. And most hearty congratulations on making Extra.

KA3CCK writes that he is finally on the air after a layoff of about 25 years. John was a radioman in the Navy. He enjoys rag-chewing the most and is disappointed that more people are not interested in the same. He says he particularly likes to find out things about the people with whom he is chatting. So far he has contacted doctors, secretaries, lawyers, students, and many others in various fields. I know what you mean, John. It makes things lots more interesting to have a nice "fat" QSO rather than the Name-QTH-Rig-Weather nonsense.

Here's another quotable quote: "I took my Novice exam and passed. My call letters are KA4HHD, and without your course and the valuable attention paid to me, I would never have passed at all." Thanks, Joel. We're glad you are pleased and we're sure you will do fine now that you have your first ticket. Joel had a bit of trouble with the CONAR 500 transmitter at first, but apparently everything is working now, and he should soon be on the air. Try to join us some Tuesday on the NRI Get Together, Joel!

WD4KOK got his last Journal the day after the last scheduled net – May 2. Sorry, Ed, we'll try to do better this time.

Lew, WD4LOK, writes that he made WAS in December 1978 and got his General ticket in March of this year. Lew also missed the NRI nets due to late delivery of the Journal, but he was willing and able to get in there with his Kenwood TS520 and Hustler vertical. The antenna is run without radials although he does use 4 foot ground rods in salted ground. Seems to work fine, especially when tuned up with his Dentron Super Tuner and Bird wattmeter. Sounds like a real neat station, Lew.

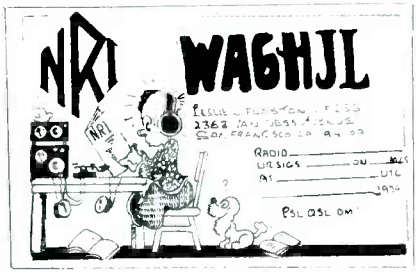
We got a nice note from Jim, WA4ZAU, telling us that as a result of his plea in the Journal to locate a used transmitter, he was able to locate a nice DX60B. John, WB3IMU, (in Jerome PA) wrote Jim, and in short order, Jim had received his new rig. Thanks, John, we are glad there are people out there like you to lend a helping hand when it's needed.

Harold, KA5DVF, writes that he got his Novice license through study of the Heath course, but that he chose NRI to help him on through General, Advanced, and Extra. His shack is equipped with a Kenwood TS820 that he uses with an 80-meter dipole and a Mosley TA33 Jr. Later on, he hopes to put the beam on a 48 foot Rohn tower and twirl it with a Ham III rotator.

WA6HJL does a lot of cartooning, as a hobby, and set us a very well done QSL design for the minicontest. Les has been in amateur radio since 1925 and says he doesn't want you to let that WA call fool you, having spent 30 years as a sea-going brass pounder. He is taking the

Special Notice

Tom Nolan, immediate past executive secretary of the NRI Alumni Association, now has his amateur license. In May, Tom was awarded Novice call KA3DFN. Congratulations, Tom.



NRI "GET TOGETHER" SCHEDULE FOR 1979

	75/80	15	40	75/80	15	40
AUGUST		7	14	21	28	
SEPTEMBER			4	11	18	25
OCTOBER	2	9	16	23	30	
NOVEMBER			6	13	20	27
DECEMBER	4	11	18			

TIMES:

CW 8:30 - 9:00 PM EST

SSB 9:00 - 9:30 PM EST

* +5 kHz in case of QRM or QRN

FREQUENCIES:	CW*	SSB*
15 Meters	21.150	21.400
40 Meters	7.130	7.280
75/80 Meters	3.730	3.980

NRI Amateur course because he says it's never too late to learn more.

WBØQPI writes that he was a Novice from 1975 to 1977, when he got his Technician license. Lloyd has been studying the code very hard and hopes to soon upgrade to General or Advanced, then on to Extra. At the present time, Lloyd's shack has a Heath DX60 transmitter and SB300 receiver, along with a Wilson 2-meter transceiver. He also has an Ameco TX62 that he plans to use on 2 and 6 meters later on, primarily to work OSCAR on 2. Antennas consist of a 40-meter dipole and a Hustler 4BTV vertical. This summer a 40 foot tower and Hornet TB500 tribander will join them.

K1AV writes that he tried to work the April 24 nets, but with little success. He heard KA8BXA calling me and gave him a shout with no results. Later, on SSB, Al heard WB8RZE in QSO with KA2DID and WB3FNJ who did call "CQ NRI" once or twice but didn't leave much room to break in.

KA1BNO, Dan, enrolled in Basic Electronics late last year and plans to transfer to one of the communications courses in order to get an FCC Commercial license. Dan has had his Novice ticket since September, and loves to use the Heath DX60B and keyer he built. He was planning to try for General sometime this spring, and we sure hope he made it. We'll be looking for you on some Tuesday, Dan.

WB1ENK has had her ticket for three years and is planning to upgrade to Advanced or Extra in the very near future. Joline teaches biology in high school and is also into microcomputers. I couldn't tell from the photo she sent just what her low-band rig was, but she also has a Tempo 2020 2-meter transceiver. For antennas she uses 80-and 40-meter dipoles and a Cushcraft ATB-34 beam.

KA2DID (mentioned earlier) wrote us before the first nets, and informed that he was planning to join in. Mike has a Swan 500C transceiver that he uses with either a home brew four-band dipole (80, 40, 20, and 15) or a two-element beam on 10 meters. This combination seems to do well for Mike, as he has no trouble at all working the West Coast and European stations.

N3AJV recently completed our Communications course and says he was more than pleased with eveything he learned from taking the course. Randy particularly likes the 452 transceiver and has married the new Heath Micoder to it quite successfully.

We got KA4EMW's call wrong the first time we put it here in these pages, calling him KA4EMU. Sorry about that,

Bill	KA1BLT	N	South Windham ME	Jim	KA0COW	N	St. Louis MO
Art	K1VKO	A	East Norwalk CT	Lloyd	WB0QPI	T	Denver CO
Jack	WA1YYK	G*	Agawam MA	Al	K1AV	–	Portland ME
Donald	KA2DSA	N	Olean NY	Dan	KA1BNO	N	Cranston RI
Gene	AF3J	E*	Media PA	Joline	WB1ENK	G	Lewiston ME
John	KA3CCK	N	Avonmore PA	Rick	WN1WPR	N	Berwick ME
W.R.	KA4EIG	N	Tavernier FL	Mike	KA2DID	G*	Saratoga Spgs. NY
Joel	KA4HHD	N	Decatur GA	Randy	N3AJV	–	Derry PA
Ed	WD4KOK	N	Finger TN	Ron	KA4EMW	T*	Galax VA
Lew	WD4LOK	G*	Auburn AL	Jim	KA5EMA	N	Portland TX
Margaret	KI4W	E*	Virginia Beach VA	Dave	W5TYL	G	Taos NM
Harold	KA4DVF	N	Columbus MI	Dick	WD6ENL	G*	Oceanside CA
Ken	WA6EBX	N	San Jose CA	Bill	WB7NYL	A	Montesano WA
Les	WA6HJL	E	San Francisco CA	Stu	N8AGV	–	Bethel OH
Bob	KA7CUL	N	Tucson AZ	Joe	WB9NWR	–	Bloomington IL
Harry	WB7VVH	–	Las Vegas NV	Ralph	KA9CTD	N	Galesburg IL
John	N8ATK	G*	Cincinnati	Ken	KA9DIB	T*	Bluffton IN
Peter	N9APB	G	Racine WI	Troy	WD9EDL	N	Lynn IN
				Dave	KH6JST	–	Laie HI

*Just Upgraded – Congratulations!

Ron. Anyway, he now has upgraded to Technician and perhaps to Advanced, since he said he was going to make the try in March. He writes, ". . . we're going to get the code for sure and come back a General anyway. But with my NRI course behind me, the theory is the least of my worries." Thanks Ron, and we hope you made it.

WD4L00 says that he has discovered the fun of QRPp operation since he last wrote. Ed built a Heath HW8 that he uses barefoot into an inverted vee on 40 meters, and into a longwire-tuner on 80 and 20. He loves the reactions he gets when he tells the guy on the other end of the QSO that he is running 4 watts. Ed has made a couple of home brew QRPp rigs as well, but does not have them working just right yet.

It looks as if KA5EMA is another dedicated home brewer. Jim got his Novice ticket recently and hasn't been idle since. First came a commercial kit (Heath 1680 receiver), then a 40/20 meter cw rig (15 watts) from a QST article, a Morse keyboard (also from QST), and a 4 ampere power supply. Next in line is a doubler for the transmitter for operation on 10 meters. Then Jim is going to design and build an SSB transmitter for 20 and 15 meters. He also is interested in radio astronomy and would like very much to hear from any of you out there who share his interests in this and home brewing. Drop him a line at:

Jim Caldwell KA5EMA
217 Llano St.
Portland TX 78374

W5TYL writes that he has been licensed for 21 years but recently started to study communications seriously. Dave plans to get the Advanced or Extra real soon and is looking forward to getting on 2-meter FM with the Model 452 transceiver.

WD6ENL has also been an amateur for quite some time and is looking forward to building the Model 452 transceiver. Dick currently uses a Yaesu FT301D into a Hy-Gain 18AVT, pumping out a good solid 100 watts.

In addition to his Advanced Amateur license, WB7NYL holds a First Phone with Radar endorsement. Code is the

only thing holding Bill back from the Extra ticket. His rig is a Heath HW101 and a Hustler 4BTV roof-mounted vertical.

N8AGV dropped us a line to say that he had a bit of success on the NRI net April 24. He was one of the ones K1AV heard, and carried on a round-table from about 9:15 to 9:50 with WB8RZE, WB3FNJ, WA4GOQ, and KA2DID. Stu says QRM was rough but that it looked as if it might work out in the future.

WB9NWR also had some luck on the May 1 net attempt. Joe got into a QSO with WB9ROE, WB9SGK, and N9ASM on 3.983 MHz. Again, QRN and QRM were pretty rough, but all thought it was a good idea.

Ken, KA9DIB, has found out what so many others have – a newly acquired amateur license can be hazardous to one's lesson study habits! Ken got his Novice license in January and study time went downhill from then. He says he will certainly complete the course, but it just might take a bit more time.

Well, that just about wraps it up for this time. Next time for sure we'll have the winner of the QSL minicontest and a reproduction of the winning design in the column. Also, we will continue to publish the Get Together schedule for the remainder of the year along with the FCC rule changes. Speaking of which, we just received our new (January 1979) edition of Part 97 from the Government Printing Office. Even it does not have all the current regulations in it! I understand that the latest ARRL License Manual (now $4.00) is completely different from previous editions and makes a real nice reference for amateurs. I plan to get a copy and will give you a report next time.

Until then, keep writing and we'll see you on the air.

Very 73—Ted K4MKX

1	Conditional Class License eliminated. Novice power limit upped to 250 W.	June 25, 1976
2	Technicians given Novice privileges.	July 23, 1976
3	No new distinctive Novice call signs, although Novice may sign "/N."	October 1, 1976
4	No requirement to sign "portable" or "mobile" except foreign operators using reciprocal licenses.	November 26, 1976
5	First "comprehensive" CW exam given in Washington, D.C. office. No solid copy for one minute requirement.	January 1, 1977
6	Court case "temporarily" suspends all license fees.	January 1, 1977
7	New interim licenses issued upon upgrade of license class at an FCC office.	March 1, 1977
8	Secondary station license eliminated.	March 3, 1977
9	97.95(a)(2) deleted. No notification of new address required.	March 9, 1977
10	New emission purity standards. All spurious emissions down 40 dB for transmitters operating below 30 MHz, down 60 dB for transmitters of 25 watts or more operating between 30 MHz and 235 MHz (97.73).	April 15, 1977
11	Code sending test deleted from Commission-administrated examination.	August 26, 1977
12	97.95(b)(2) rescinded. Maritime Mobil in Region 2 may use all amateur frequencies. In foreign waters, Maritime Mobil may use only frequencies authorized by regional government.	September 12, 1977
13	Call sign restructured, making special calls available to various class license holders.	March 24, 1978
14	Ban on commercial 10-meter linear amplifiers.	April 28, 1978
15	Novice license term extended to five years, renewable. Technicians given full privileges above 50 MHz.	May 15, 1978

Alumni News

Harry Taylor

PITTSBURGH CHAPTER

The chapter held its annual dinner at the Mr. Steak restaurant on May 3. Harry Taylor, the Executive Secretary, was there. The food was good, the conversation was lively, and we all had a good time.

After dinner, we had our monthly meeting. Harry Taylor showed slides of NRI, some of which brought back memories of the early days of radio. He followed this with a demonstration of new NRI test equipment and a discussion of the new courses currently offered by NRI. The members expressed a lot of interest in the computerized 25 inch color TV set that is included in the new Master Color TV course.

After dinner, we went to work on a color TV assembled by a local NRI student. This gave us an opportunity to share our troubleshooting knowledge.

NORTH JERSEY CHAPTER

Chairman Al Mould demonstrated the new Zenith "SYSTEM 3" modules. The sets these modules are used in are described as "chassis-less," since all interconnecting wiring is in the form of wiring harnesses with edge connectors for the boards. The circuitry

incorporates a master oscillator system, which is divided down to the appropriate frequencies for the vertical and horizontal output stages, and an integral flyback high-voltage multiplier unit. The boards are designed so that individual components are generally accessible for troubleshooting if replacement modules aren't available. Component designations are printed on both sides of the boards to aid in servicing.

We had a good turnout again at this meeting, and four sets to troubleshoot. Sam Britt reported on the Philco G3050B we had been working on at the last two meetings. In addition to replacing a 120k, 1 watt resister in the boost voltage supply, he had a new electron gun put in the black-and-white crt. He also reported a very happy customer.

Ben Nemeckay and Harry Ala worked on a Zenith black-and-white portable, which would get a very snowy picture, and then start to lose vertical sync. This was an intermittent problem, which proved to be caused by a shorted rf tube in the set's tuner. Replacement of the tube was all the set needed.

Bob Morello brought in a Zenith black-and-white portable, a 16F25, which could not be made to lock-in vertically. The trouble proved to be the vertical hold control, a 750k pot used as a rheostat. The wiper was shorted to ground, and so had no effect on the circuit at all.

Bob Schadewald brought in his CONAR Model 315 25 inch color TV. He said he had power supply trouble with his set. We were able to give him a MJ411 from our parts stock. This is Q701, the pass transistor in the 125 volt regulator circuit. Bob also had to replace the 7824, IC402, 24 volt regulator, and the IC503, 746PC chroma demodulator. Al Mould once again demonstrated how quickly an expert can converge a color set on Bob's TV.

DIRECTORY OF ALUMNI CHAPTERS

DETROIT CHAPTER meets at 8 p.m. on the second Friday of each month at St. Andrews Hall, 431 E. Congress Street, Detroit. Chairman: James Kelly, 1140 Livernois, Detroit. Telephone 841-4972.

FLINT/SAGINAW VALLEY CHAPTER meets 7:30 p.m. the second Wednesday of each month at Andy's Radio and TV Shop, G-5507 S. Saginaw Road, Flint. Chairman: Dale Keys. Telephone (313) 639-6688. Shop phone (313) 694-6773.

NEW YORK CITY CHAPTER meets at 8:30 p.m. the first Thursday of each month at 1669 45th Street, Brooklyn. Chairman: Sam Antman, 1669 45th Street, Brooklyn.

NORTH JERSEY CHAPTER meets at 8 p.m. on the second Friday of each month at the Players Club, located on Washington Square in Kearney, N.J. For information, contact Paul Howard, 950 Carteret Avenue, Union, N.J. 07083. Telephone (201) 964-8492.

PHILADELPHIA-CAMDEN CHAPTER meets on the fourth Monday of each month at 8 p.m. at the home of Chairman Boyd A. Bingaman, 426 Crotzer Avenue, Folcroft, Pa. Telephone 583-7165.

PITTSBURGH CHAPTER meets at 8 p.m. on the first Thursday of each month at the home of Jim Wheeler, 1436 Riverview Drive, Verona, Pa. 15147. Chairman: George McElwain, 100 Glenfield Drive, Pittsburgh, Pa. 15235.

SAN ANTONIO CHAPTER meets at 7 p.m. on the fourth Thursday of each month at the Alamo Heights Christian Church Scout House, 350 Primrose St., 6500 block of N. New Braunfels Street, (three blocks north of Austin Hwy.), 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 at 8 p.m. on the last Wednesday of each month at the home of Chairman Daniel DeJesus, 12 Brookview Street, Fairhaven, Mass. 02719.

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

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

This resulted in a fairly good picture, but the color reception was still very touchy. After interchanging i-f boards with another set, Al diagnosed the need for an i-f alignment.

FLINT/SAGINAW VALLEY CHAPTER

We spent one recent meeting working on a Zenith console TV with color problems. First, it was impossible to converge. We could not adjust the color fringing out of the picture. Doug Graham suggested that we check the automatic degaussing circuitry. We found and replaced a bad thermistor, which took care of that problem. With the picture converged, we found a loss of color sync. This was traced to an open bandpass coil in the chroma section.

At the following meeting, we discussed microwave ovens once again. This is a lucrative field for TV technicians because of the electronics involved. In addition to troubleshooting, servicing, or replacing electronic parts, you have to be able to properly care for the cabinet parts. Andy Jobbagy, who is always on the lookout for new service aids, showed us a new fast, effective cabinet cleaner called Wipe Out®. It does a good job without damage to the finish, glass, or oven liner.

Chet Mazure, a current NRI student, brought in a radio with a hum problem. Chet and Andy traced the problem to a bad filter capacitor.

NEW YORK CITY CHAPTER

We were pleased to welcome two vistors, Mr. Furetti and Mr. Donaldson, to our March meeting.

Dick Sheftman submitted a report by Consumer Reports on comb filters used by Magnavox. Although the report stated that the comb filter improves picture resolution, the viewers could not see much improvement.

Chairman Sam Antman then followed up on a hum problem in a radio. After replacing a transistor that checked good out of the set, he noted the set played well for a minute or two and then become very distorted. He noted that this happens primarily in cold weather, which led him to believe that the problem was temperature dependent. By using a cooling spray, we determined that it was an intermittent in one of the leads of the audio driver transformer. For a temporary repair, we twisted the transformer in a way that caused the set to play well.

We then turned to a 9 inch black-and-white TV that had a raster but no picture or sound. We substituted a signal from the tuner of another set, thereby obtaining both picture and sound. This helped localize the trouble to the tuner. After replacing an open rf transistor in the tuner, the set worked, but only on an outside antenna. Sam accidentally shorted the new transistor. We replaced it again – with a cheap universal replacement type. This time, the set worked much better, producing an excellent picture on "rabbit ears."

SPRINGFIELD CHAPTER

Chairman Norman Charest began our April meeting with an interesting talk about TV sets with polarized linecords. On TV receivers without power transformers, the power cord must be properly polarized so that the chassis or circuit ground is at earth ground. If in doubt, check for voltage between the chassis and earth ground.

Preston Atwood and John Park then gave a talk on the repair of Zenith

remote control units. They went through the circuitry of inoperative remote control units S-69876/S-72346. These units are used on Zenith chassis models 23XC36, -38, and -39Z. The defect in this case was electrical rather than electronic. Specifically, it was a broken wire in the field circuit of the TV set's tuning motor.

At the May meeting, Preston Atwood demonstrated various ways of increasing the width of a TV picture. He explained the use of a brass sleeve on the neck of the picture tube and he showed the effect of connecting a high-voltage ceramic capacitor across the deflection yoke winding. He cautioned that discretion must be used in determining which winding can be safely used and in selecting the capacitor. He also stated that any width control should be set to the middle of its range before trying either of the above procedures.

We were very pleased to have Frank Mills, who is an NRI graduate, join our chapter.

The following officers were elected at our May meeting: Chairman – C. M. Vaidya, Secretary – George Lewonchuk, and Treasurer – William Planzo.

DETROIT CHAPTER

At our most recent meeting, Chairman Jim Kelley, Ray Berus, and John Nagy reported on the Society of Automotive Engineers Convention at Cobo Hall in Detroit. As usual, there were many interesting developments in the automotive field.

After the report, John Nagy went through the checkout procedure for locating a mechanical defect in a Sony cassette recorder. It was a stretched drive belt that failed to transmit power to the capstan.

Ray Berus and Jim Kelley worked on an RCA portable TV that had sound, but no raster. We did not locate the trouble, but we gave it a good try. We'll solve that mystery at the next meeting.

SAN ANTONIO (ALAMO) CHAPTER

We had a most enjoyable meeting during Fiesta Week. Fiesta Week in San Antonio is one of the nation's oldest and most festive citywide celebrations. It is described by some as a citywide block party. The meeting was combined with dinner, with our spouses in attendance. Harry Taylor, the executive secretary, was there to join us. Everyone agreed that the food was delicious.

In the meeting that followed dinner, we were shown the modular construction used in the basic electronic kits supplied with the NRI Microcomputer Course. Many of us had taken NRI courses back in the days when all connections were soldered. This new modular construction, with plug-in components, certainly takes the work out of the practical training. We were also shown some of the newer NRI TV test equipment.

Later, Harry showed slides of NRI. Few of us had either visited Washington or NRI. For most of us, this was our first glimpse of what goes on behind the scenes at NRI. We enjoyed the slide show very much.

There were three door prizes given away. The most interesting prize was a whistle switch, which is a remote control switch operated by pressing a squeeze bulb.

CONAR

A Division of NRI
3939 Wisconsin Avenue
Washington, D.C. 20016

☐ Cash Order
☐ COD (20% deposit required)
☐ Credit Card Order
For a Select-A-Plan order, use an order form from the CONAR catalog

PLEASE PRINT

NRI Stud. or Grad. No. _____

Name _____

Address _____

City _____ State _____ Zip _____

Social Security No. _____

Ship to another address? Give directions here:

Name _____

Address _____

City _____ State _____ Zip _____

C/O _____

Moved since last order?

Previous address _____ City _____ State _____ Zip _____

Name of Item	Stock No.	Number	Price Each	Total

SHIPPING AND HANDLING
We automatically ship the best way.

If purchase is	Shipping charge is
Up to $20.00	$2.00
$20.01–$40.00	$4.00
$40.01–$60.00	$5.00
$60.01- $100.00	$6.00
Over $100.00	$7.00

Total cash price for merchandise	
Shipping and handling	
Sales Tax (Washington, D.C. residents add 5%)	
Total amount	

IMPORTANT

Prices in the NRI Journal apply only to residents of the United States. Residents of Canada and foreign countries are responsible for customs charges and additional shipping charges.

CREDIT CARD CUSTOMERS COMPLETE THE FOLLOWING

☐ Master Charge ☐ Visa

Account No. _____

Exp. Date _____ Master Charge Interbank No. _____

Signature _____ Date _____

Please do not write in this space.

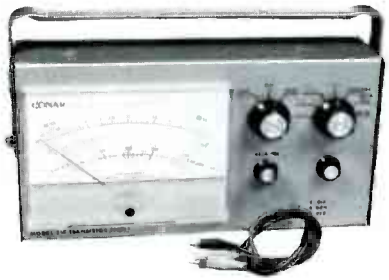
CONAR SUMMER SALE

CONAR Model 224 Tube Tester

Every technician – full or part time – needs the Model 224 for his bench. It helps you make better job estimates and pays for itself quickly in extra profits. It's perfect for experimenters and hobbyists, too. ■ Accomodates all series string and other up-to-date tube types. ■ Open element tests. ■ Independent filament terminal selection. ■ Visible filament continuity tests. ■ Inter-element short tests. ■ Separate winding on power transformer for test voltage. Power requirements – 110-120 VAC only; 50/60 Hz. Weight – 10 lbs. Dimensions – 10-1/2" H X 15-1/4" W X 4-3/4" D. See CONAR Catalog for complete specifications.

$115.00	$75.00
Assembled	**Kit Form**
Stock No. 224WT	Stock No. 224UK

CONAR Model 214 Transistor Tester



Special attention has been given to the development of this transistor test kit. The CONAR 214 is easily constructed, provides accuracy in test results, and usefulness in day-to-day servicing work. Its usefulness is expanded by its ability to test field-effect transistors. Don't buy any transistor tester that does not have this important feature.

$47.50	$35.95
Assembled	**Kit Form**
Stock No. 214WT	Stock No. 214UK

SPECIFICATIONS

Tests – Standard (bipolar) transistors: leakage, 0-200 A; dc current gain (Beta); 2 ranges 0-50, 0-500. Field-effect transistors: bias point; Idss; 0-20 mA; transconductance; GM 0-50,000 μmho. **Accuracy** – ±10%. **Power Requirements** – Built-in battery supply. **Meter Movement** – 200 μA d'Arsonval, fully protected, burnout proof. **Size** – 5-3/4" H X 10-3/4" W X 2-3/4" D, 5 lbs.

Summer Sale Ends September 22, 1979

CONAR Summer Sale

CONAR Model 282

Signal Generator

- Digital readout. ■ AM modulation from 0% to 50%.
- True FM modulation using a dual varactor modulator.

$129.50	$89.50
Assembled	**Kit Form**
Stock No. 282WT	Stock No. 282UK

Summer sale ends September 22, 1979.

SPECIFICATIONS

Accuracy — Better than 1%. **Attentuator** — Continuously variable control provides a minimum attenuation of 40 dB at 30 MHz and below. **Modulating Frequency** — Low-distortion 1000 Hz sine wave. **AM Modulation** — Adjustable from 0% to 50%. **FM Modulation** — True FM using a dual varactor modulator. **Maximum Deviation** — 0 to 40 kHz at 4.5 MHz, 0 to 80 kHz at 10.7 MHz, and 0 to 200 kHz at 21.4 MHz. **Output** — Unmodulated rf, amplitude-modulated rf, frequency-modulated rf, and 1000 Hz audio. **Output Amplitude** — 0 dBm (200,000 microvolts), 3 dB into 50 ohms, 180 kHz through 30 MHz. **Audio Output (1000 Hz)** — 8 volts peak-to-peak into 1 megohm. **RF and Modulated RF** — Continuously variable within 5 bands. Band A:175 kHz to 545 kHz. Band B: 540 kHz to 1.610 MHz. Band C: 1.600 MHz to 4.310 MHz. Band D: 4.300 MHz to 13.510 MHz. Band E: 13.500 MHz to 30.500 MHz.

NRI JOURNAL
3939 Wisconsin Avenue
Washington, D.C. 20016

MR WILLARD F VELLINE 25923 G
1322 S 14 1-2 ST
FARGO ND 58102