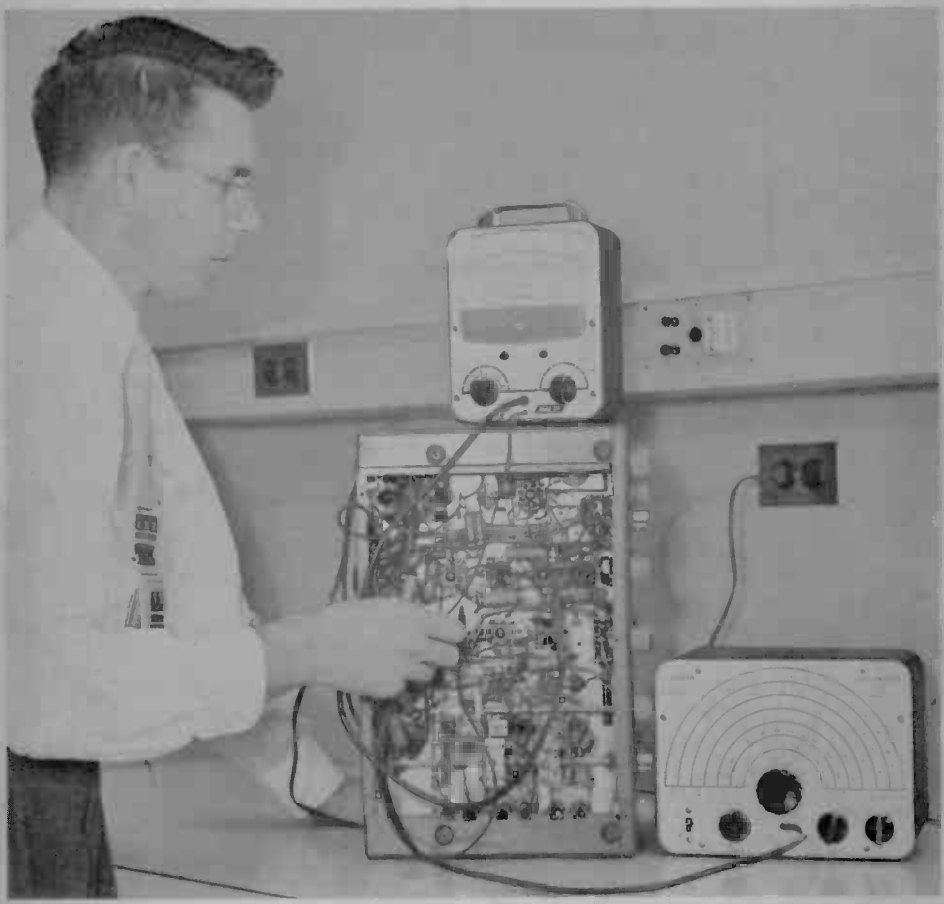
NRI news

December/January 1961-62



BRUCE COURTNEY, A MEMBER OF OUR INSTRUCTION DEPT. STAFF, USES THE NEW CONAR SIGNAL GENERATOR TO ALIGN A COMMUNICATIONS RECEIVER.

ALSO IN THIS ISSUE

NRI NEWS

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Editorial: SEED PLANTING

We have all heard the phrase "Big oaks from tiny acorns grow." Did you ever really stop to consider how very important to you are the seeds of success that can be planted each day?

Consider the part-time radio and TV technician as an example. Much of his service work is done in the customer's home and often during evenings when both husband and wife are present.

This "captive audience" provides a real opportunity for the technician to plant seeds of courtesy, skill, poise, and confidence that can grow and spread into a profitable and respected enterprise.

A polite "Good Evening," a respect for rugs and furniture, cleanliness of one's self, self-discipline, businesslike approach, and a friendly "Good Night" are some of the seeds that quickly take root.

A healthy, deep-rooted tree takes many years to cultivate and grow. And so it is with real success in business.

None of us like to deal with discourteous people. If counter clerks, as one example, are rude or indifferent, we soon take our business to another store. If the plumber leaves a mess after fixing the faucet, we take him off our list and, if we pick up our car from a repair shop and find grease on the seat or wheel, we become poor prospects for future services.

We can profit by avoiding the mistakes of others.

J. M. Smith
President

NRI IS POPULAR . . . . . .

IN POPULAR ELECTRONICS!

Looking through the October issue of Popular Electronics magazine, we discovered:

information about NRI courses appear on pages 17-18;

"Transistor Topics" beginning on page 66 was written by a former NRI staff member - Lou Garner;

"The Restorer" article beginning on page 49 was written by NRI student H. E. Sanders;

an advertisement for NRI's new CONAR DIVISION appears on page 91.

We hope our students and graduates are as proud of this unsurpassed "representation" as we are!

New CONAR Signal Generator

By

Art Widmann

Technical Editor

The Conar Division of NRI adds another new kit to its line of fine test equipment. The Conar Model 280 is a service type rf-af Signal Generator suitable for alignment of Radio and Television Receivers. The kit was devoloped to fill the service technician's need for a dependable signal generator at an attractive price.

KIT DEVELOPMENT

Much thought and study went into selecting the features and circuitry of this kit. First of all, we studied the features of other signal generators on the market - both kit type and factory assembled. Many of these were exhaustively tested and evaluated in our own laboratories. Most of the higher priced ones were very good and would meet the needs of the service technician. Some had expensive features that are definitely not needed in a service type signal generator. Most of the less expensive kits had insufficient provision for proper calibration after construction. Some of the signal generators were loaded with gimmicks that would add little or nothing to the usefulness of the instrument.

The requirements of the signal generator kit that we would produce were clearly laid out. Since the signal generator is one of the basic test instruments, the purchaser has the right to expect years of dependable service from the instrument. The instrument should be able to take some rough usage during the normal course of its service life.

The oscillators should be stable and be as nearly on frequency as possible after assembly. The stable oscillator is easy to attain. Simply select a stable circuit and use high grade components. The accuracy should be sufficient for service use without special calibration. However, it was felt that provision should be made so the technician could adjust the alignment of his instrument should the occasion arise. This meant that preset adjustable coils and preset adjustable trimmers would have to be used in the rf oscillator circuits.

Art Widmann

The amplitude of the output should be adjustable over a wide range. A large healthy signal should be available for troubleshooting. Also, you should be able to attenuate the amplitude to a very low level for certain alignment purposes.

The scales should be large and easy to read. There should be easy correlation between the proper scale and the settings of the frequency band selector.

The kit must be easy to assemble. Since beginners as well as seasoned technicians will be purchasing the signal generator, the construction of the kit should not require specialized skills.

A single output cable permanently attached to the instrument is desirable since it cannot be lost or misplaced. Using the same output cable for the rf signal, modulated rf signal, and audio signal saves operating time for the technician.

The instrument should present a professional appearance. It was felt that this feature is important because the instrument is often visible on the bench where it will be seen by the technician's customers.

Among the instruments we evaluated was our own NRI Professional Model 90 Signal Generator. It stood up very well in comparison with other factory assembled signal generators - some with much higher price tags. Correspondence with thousands of purchasers of the Model 90 had also convinced us that it

meets the needs of service technicians. It was felt that by producing an instrument in kit form with features of the Model 90 we would best serve the interests of the technician.

KIT DESCRIPTION

The Conar Model 280 Signal Generator is housed in an attractive black crackle finish cabinet. The front panel is polished aluminum with black engraved lettering. The large easy-to-read scales cover most of the front panel. The plastic pointer with a fine red hairline accurately indicates the frequency setting. The planetary geared control knob enables the operator to set the desired frequency quickly and smoothly. The other controls are conveniently placed along the lower portion of the front panel.

The instrument generates three types of outputs: unmodulated rf, a 400-cycle audio signal, or the rf signal amplitude modulated by 400 cycles. The rf signals are generated on fundamentals from 170-kc to 60-mc. The frequency is indicated on six scales corresponding to the six overlapping bands of frequencies.

The chassis is made of steel for rugged durability. This provides a firm mounting for the frequency determining parts. An open construction layout was used for easy assembly. About the only close wiring is on the bandswitch which you wire before mounting it on the chassis.

The circuit of the Model 280 is shown in the accompanying figure. The Hartley type oscillator circuit was selected for its stability. Six separate coils and capacitors form the oscillator tank circuits. A different tank circuit is switched to the oscillator tube for each of the six bands of frequencies. A ganged variable tuning capacitor varies the frequency over the selected band. The tuning capacitor has two sections, one section for the four low bands and one section for the two highest bands. This arrangement assures a favorable L-C ratio for the oscillator circuits over all the frequency bands.

The oscillator tube is the rugged and reliable 6BE6 pentagrid converter tube. The tube functions as an electron coupled oscillator. The cathode, the first control grid (pin 1) and the screen grid (pin 6) act as a triode to operate the rf oscillator. The electrons that pass through the grids and reach the plate are the electron coupled output from the oscillator. In this way the load placed on the output of the oscillator does not affect the frequency of oscillation. Grid 3 (pin 7) is used to amplitude modulate the oscillator frequency. A 400-cycle signal is applied to this grid when the function switch is set to the modulated rf position.

The oscillator output from the plate of V_1 is coupled through C_9 to the grid of the cathode follower. The 1-2-3 pin section of the 12AU7, V_2, forms the cathode follower output of the signal generator. The use of a cathode follower provides a low impedance output from the signal generator and acts as an additional guard to prevent the output load from affecting the frequency of the oscillator.

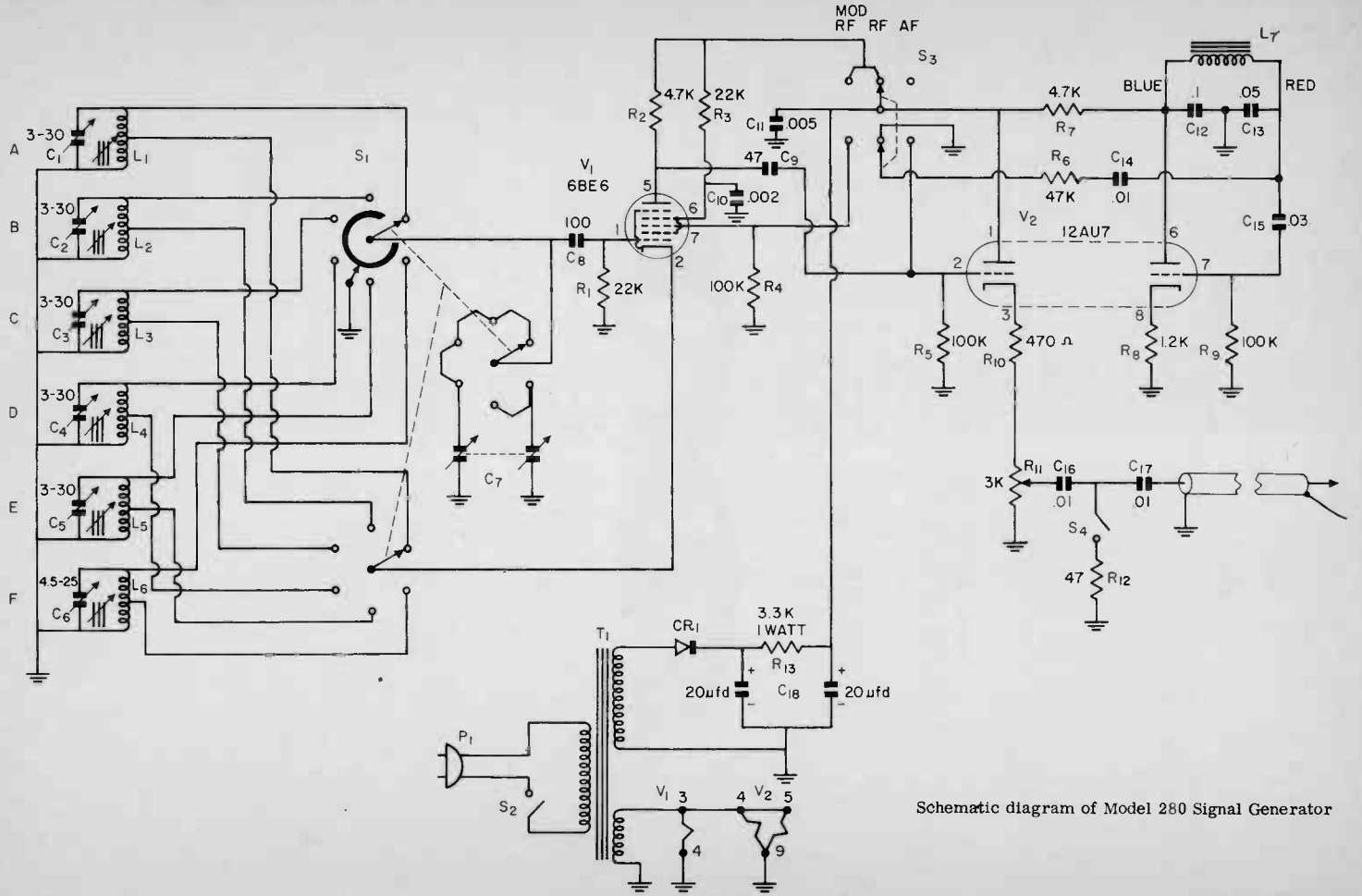
The 6-7-8 pin section of V_2 is used for the audio oscillator. This Colpitts type oscillator and its associated components produce a sine wave at a frequency of approximately 400 c.p.s. In the modulated rf position, this signal is fed to the grid of the oscillator tube. In the audio position, the 400-cycle signal is fed to the grid of the cathode follower. Notice that in the audio position, B+ is removed from the plate and screen of V_1 so there is no rf output.

The output from the cathode follower is fed to the output cable through an attenuator network. The 3K potentiometer, R_{11}, provides a continuous variation of the output. High-Low switch, S_4, provides a large step-change in the output signal. Both the High and the Low output are continuously variable. The output from the attenuator network is coupled through C_{17} to the output cable. This capacitor isolates the signal generator circuitry from the receiver you are working on. THUS IT IS SAFE TO INJECT A SIGNAL TO THE PLATE OF A TUBE IN A RECEIVER EVEN THOUGH THE PLATE HAS B+ VOLTAGE ON IT. The output cable is a low capacitance coaxial cable. The grounded coaxial shield prevents signal radiation from points other than the output clip on the end of the cable.

The power transformer provides isolation of the instrument from the power line. The voltage from the high voltage secondary winding on the transformer is rectified and filtered to provide B+ for the instrument. The low voltage secondary winding provides filament voltage for the tubes.

ACCURACY AND CALIBRATION

Some confusion exists concerning the desired accuracy of a signal generator. In the first place, signal generators are never meant to be frequency standards. Even the most expensive ones make no claim for accuracy that approaches the accuracy of frequency standards. Instead, signal generators provide a convenient signal source that is continuously variable in frequency over the desired band of frequencies. This doesn't mean that ac-



Schematic diagram of Model 280 Signal Generator

curacy is not desirable. Great accuracy runs the cost up and the improved accuracy is not repaid in the usefulness of the instrument. Most service type signal generators fall in the 1% to 3% range of accuracy. Let's see what this means in terms of use.

Suppose you set a signal generator that has 2% accuracy to 600kc. The output may be off frequency as much as .02 × 600kc = 12kc. In other words, while the generator reads 600kc, the actual output frequency might be as low as 588kc or as high as 612kc. This seems like a lot. However, if you set a radio receiver dial using this signal generator output, the dial setting would be off such a small amount that it would be hardly noticeable.

The CONAR Model 280 Signal Generator has preset oscillator coils and preset trimmer capacitors. A carefully constructed instrument will usually fall into the 1% to 3% accuracy range without alignment. This is considered sufficient accuracy for service work. If you want better accuracy, it can easily be obtained by calibrating the instrument according to the instructions in the manual.

Suppose, for example, you wish to improve the accuracy of Band B which covers the broadcast band of frequencies from 550kc to 1600kc. To accurately align this band, you need only an ordinary broadcast receiver. You use the radio receiver and known frequency broadcast stations. In this method of aligning your signal generator, you compare the frequency of your signal generator with the frequency of a broadcast radio station. Since the frequency of radio stations is held to a very close tolerance, you can use these signals as standards for comparison. You feed both the signal from your signal generator and the signal from the radio station into the radio receiver. You compare the frequency of the two signals by listening to the audible difference frequency from the radio receiver.

Select two stations, one whose frequency is near the high end of the B band and one whose frequency is near the low end of the B band. The exact frequency on which the stations broadcast can be learned from the listings in the newspapers or from the station break announcements. Be sure to definitely identify the stations you use. Before performing alignment of your signal generator, perform the following steps: 1. Turn the signal generator on and let it warm up for at least fifteen minutes. 2. Make sure the red line of the dial pointer is lined up with the edge of the scales when the tuning capacitor is fully meshed. If not, loosen the pointer set screw and reset the pointer. Then tighten the set screw. 3. Definitely identify the coil and capacitor adjustment for each band.

Tune the radio to receive the known frequency station near the high end of the B band. Definitely identify the station. Position the output lead of the signal generator near the radio receiver antenna. Set the signal generator function switch to RF and the band selector switch on B. Rotate the signal generator dial to the same frequency as the received radio station. You should hear a high pitched audio signal which decreases in pitch as you approach the frequency. This beat note signal is the difference in frequency between the radio station signal and the generator signal. Zero beat the two signals by carefully adjusting the signal generator dial until the beat note is at minimum or zero frequency and increases if the Signal Generator dial is tuned to either a higher or lower value.

Now the signal generator is producing the same frequency as the radio station. Observe the dial reading of your signal generator. The difference between the dial reading and the known frequency of the radio station is the error of your signal generator at that frequency. Carefully recheck your adjustments to be sure the error exists.

Locate the trimmer adjustment for band B. Set the signal generator dial to read exactly the frequency of the radio station to which the radio is tuned. Rotate the band B trimmer adjustment until you again hear the beat signal. Then carefully set the trimmer adjustment to zero the beat signal. The signal generator is now correctly aligned at this frequency.

Tune the radio to a known frequency station whose frequency is near the low end of the B band. Rotate the dial of the signal generator to indicate about the same frequency as the radio station and zero beat the signals. The difference between the reading on the signal generator and the known frequency of the radio station is the instrument error at this frequency.

Correct the signal generator error at the low end of the B band by adjusting the B band coil slug. Set the signal generator to read the known frequency of the radio station that the radio receiver is tuned to. Rotate the B band coil slug adjustment until you hear the beat note and then carefully adjust the slug to zero beat the signal.

After adjusting the slug at the low end of the band, you will have to readjust the trimmer at the high end of the band. These two adjustments interact so you may have to repeat each adjustment several times. The slug should be adjusted last.

After aligning the B band at the high end and the low end, the instrument should read correctly at all other points on the B band scale. Some small errors may exist at other points on the B band scale. Such errors are usually due to slightly bent plates of the tuning capacitor. The error will usually be considerably LESS than 1%. This size error is unimportant for servicing alignment of radio receivers.

You can check and align points on the A band by using your radio receiver and harmonics of your signal generator output. With your signal generator set at band A and the dial set at 400kc, the fundamental frequency of the generator output signal is 400kc. Harmonics of this fundamental frequency are also present in the output signal. For example, the second harmonic of 400kc is 800kc. This 800kc harmonic signal can be picked up by a radio receiver when the receiver is tuned to 800kc. Suppose you want to use harmonics to align the A band so the frequency indication is exactly correct at the common intermediate frequency of 455kc. You would select a known frequency radio station whose frequency is twice 455kc or 900kc. If you don't have a station at that exact frequency, one near it will do. The check point on band A will be one-half the station frequency. For example, if the frequency of the station is 900kc, the A band check point will be 450kc. Tune the radio to receive the known frequency station at 900kc. Set the generator at band A and the function switch at unmodulated RF. Set the signal generator to read exactly 450kc and radiate the signal to the radio antenna. Move the A band trimmer capacitor until you hear an audible beat note signal. This beat note will be the difference between the 900kc radio station signal and the second harmonic of the 450kc signal generator signal. Continue adjusting the A band trimmer to zero the beat note. The signal generator is now producing exactly 450kc or exactly one-half the frequency of the radio station. This same method can be used to check other points on the A band and points on other bands of your signal generator.

You can check or align the other bands of your signal generator by using a communications receiver. As described for Band B, you select stations of known frequencies at both ends of the band you are checking. Use the proper band trimmer to correct errors at the high end of the band and use the corresponding coil slug adjustment to correct the errors at the low end of the band.

USING THE SIGNAL GENERATOR

Some technicians associate a signal generator only with receiver alignment. While this is the primary purpose of the instrument, the signal generator is also a very valuable troubleshooting tool. In some servicing situations, using the signal generator will pinpoint the defect in a receiver quicker and easier than other methods. Defects such as weak reception and intermittent operation are good candidates for signal injection with a signal generator. Some technicians automatically reach for the signal generator when they encounter a weak receiver. They have learned not to trust the customer's assurance that he "didn't touch anything in the back." The reasoning is that if it turns out to be an alignment problem, you will have to use a signal generator eventually anyway. You will have saved a lot of time spent eliminating other possibilities.

Signal injection with the signal generator can quickly tell you many things about the receiver operation. It can isolate the trouble to either the front end or a later stage by injecting the i-f frequency at the first i-f stage. The audio section can be checked with the 400-cycle audio signal. A little practice will tell you what the normal attenuator setting is for the various injection points in the receiver.

"I can't fix it here - I'll have to take it to the shop!"

The large amplitude output signal available from the Model 280 makes it very useful for troubleshooting. On the low frequency bands, the modulated rf signal will be 4 or 5 volts. While you seldom need this large signal, it is handy if you want to drive a signal through the defective stage or a badly misaligned stage.

Needless to say, the audio signal from the signal generator can be used to check all types of audio equipment. When used with an oscilloscope, the 400-cycle sine-wave signal can be used for checking distortion. Since the signal from the signal generator is a good sine wave, it should pass through the stages of the amplifier under test without becoming distorted. Also, you can check the voltage gain of each audio stage by comparing the amplitude of the input signal with the amplitude of the output signal as it appears on the scope.

RECEIVER ALIGNMENT

Alignment is the process of adjusting tuned circuits to respond to a desired frequency or band of frequencies. In a superheterodyne radio receiver, the tuned circuits consist of the rf stages, the i-f stages, and the local oscillator circuit. The rf stages are aligned to produce maximum response to the band of frequencies covered by the particular receiver. The local oscillator must be adjusted so that it will track. That is, the local oscillator must produce the correct frequency at all settings of the radio tuning dial. The correct frequency is the frequency that, when mixed with the incoming signal from the desired radio station, produces a fixed intermediate frequency. The i-f stages are adjusted to give maximum response to the intermediate frequency (usually 455-kc.)

To align tuned circuits, it is necessary to have a signal source and a response indicator. Your signal generator provides the signal source at the frequency that the tuned circuit is to be aligned. You can use any one of several methods to indicate the response of the tuned circuit to the applied signal. The simplest method is to use the speaker of the receiver. The signal from the signal generator must be modulated to produce an audible tone from the speaker. Then as the circuits are aligned, you judge the response by the loudness of the tone from the speaker. Since it is difficult for the ear to detect large changes in loudness, other methods are considered more accurate. However, using the speaker as a signal level indicator is entirely satisfactory for alignment of radio receivers if the sound output is kept near the threshold of audibility.

Another method of indicating the response of the tuned circuits in a receiver is to connect a scope or ac voltmeter across the voice coil of the receiver speaker. This gives you a visual indication of the signal level as you adjust the tuned circuit.

The most popular method of indicating the signal level is to connect a dc voltmeter to the output of the second detector. The meter is very sensitive to small changes in the circuit response. With this method you can use an unmodulated signal and you do not have to listen to the tone from the loudspeaker. One precaution: If the circuit you are aligning breaks into oscillation, your indicating meter will show an extremely high reading. It will be necessary to find and correct the cause of oscillation (usually feedback) before you can peak the tuned circuit. Otherwise, you will have to align the circuit slightly off resonance where oscillation does not occur. When an oscillation condition is suspected, use a modulated signal and listen to the output. This enables you to detect an oscillating circuit condition because the receiver will produce squeals or motorboating noises. You can still use your dc meter as the response indicator.

Injecting a Signal. It is necessary to inject the proper amount of signal into the tuned circuit without de-tuning the circuit being aligned. This is usually accomplished by injecting the signal into a stage ahead of the stage being aligned. For example, to align the i-f stages, the signal is applied to the control grid of the mixer stage. The mixer tube isolates the tuned i-f stages from the signal generator so there is no loading effect. The amplitude of the signal is then adjusted by attenuating the signal generator output.

Minimum coupling should be used to inject a signal into the rf stages or preselector stages of a receiver. Placing the output clips of the signal generator cable near the loop antenna of a receiver will usually radiate enough signal into the receiver. If the receiver is badly misaligned, you can start alignment by connecting the signal generator output directly to the antenna terminals. This will inject enough signal to drive through even a badly misaligned stage.

When you get the set approximately aligned, remove the clips from the antenna terminal and radiate the signal into the set by shorting the signal generator clips together and bringing the unshielded ground lead of the signal generator close to the antenna. This prevents any loading effect on the tuned circuits by the signal generator during the final alignment.

Using Minimum Signal. Accurate receiver

alignment requires the use of a minimum signal. You want the receiver to produce its maximum sensitivity when receiving weak radio stations. Therefore, final alignment adjustments should be made using a signal strength that is just large enough to give a good indication on your response indicator. In a receiver using avc, the signal strength should be small enough so that avc voltage just begins to appear. An alternate method is to disable the avc voltage by shorting the avc line to B-.

Warm-Up Time. The oscillator in your CONAR Signal Generator is a stable circuit that will show no appreciable frequency drift during warm-up. However, it is good practice to allow the generator and receiver to be aligned to warm up for 10 or 15 minutes before alignment. The circuits in some receivers will drift noticeably during the warm-up. Therefore, the set should be turned on and allowed to warm up for about 15 minutes before starting the alignment procedure.

Disabling the Local Oscillator. When aligning the i-f section of the receiver, it is desirable to disable the local oscillator. This prevents the local oscillator signal from beating with the signal generator signal and producing confusing signals. The local oscillator can be disabled by shorting the oscillator section of the tuning capacitor.

Obtaining Maximum Sensitivity. To obtain maximum sensitivity from certain radio receivers, you can use an alignment procedure known as "rocking." This procedure may produce inaccuracy on the dial readings of the radio. However, the dial markings on most radio broadcast receivers are only a rough indication of the frequency that the radio is tuned to. Therefore, the disadvantage of a small inaccuracy in the dial setting is more than off-set by the improved receiver sensitivity.

The rocking alignment procedure can be used only on a receiver having a padder capacitor or a tuning slug in the local oscillator coil. In most cases the receiver will be a transistor set -- modern tube receivers seldom use a padder. In the following discussion, the word padder refers to the padder capacitor or the tuning slug in the oscillator coil.

First, adjust the oscillator and rf trimmers for maximum output at 1500kc with the receiver dial indicating this frequency (any specific frequency near the high end of the dial may be used.) Thereafter, if an rf stage is used the rf trimmer or trimmers are not to be touched again.

Next, set the signal generator tuning control to 600kc. Tune the receiver to produce maximum output indication regardless of dial setting. Make a note of the exact reading of the dial. Change the setting of the padder slightly. Retune the receiver for maximum output. Make a note of the output. If the output has increased, you are adjusting the padder in the correct direction; if the output has decreased, you are adjusting the padder in the wrong direction.

If you are adjusting the padder in the correct direction, continue adjusting the padder in that direction, retuning the receiver dial for maximum output indication. Of course, you must tune the padder slightly beyond the correct point and then come back to make certain you have the maximum.

If the original padder adjustment was in the wrong direction, turn the padder in the other direction, retune the receiver and note the output. Continue this procedure until maximum output is obtained. Again, you will have to tune slightly beyond the correct point to make certain you have the maximum output.

This "rocking" adjustment increases the receiver sensitivity at the expense of exact dial calibration by effectively adjusting the oscillator to track the preselector. The combination of setting the padder and the receiver dial adjusts the oscillator to track the mixer and the preselector.

After performing the "rocking" adjustment at the low end of the receiver dial, you must adjust only the oscillator trimmer capacitor at the high end of the dial, until the dial calibration is correct at the high end of the dial. Then the padder is readjusted to maximum response at the low end of the dial. Repeat the high and low adjustments until no further improvement is noted. The last adjustment is always to be at the low end of the dial. When you have done this, the receiver will track the dial reasonably well and maximum sensitivity will be obtained over the entire tuning range.

CONCLUSION

The signal generator is one of the basic tools of the electronic service technician. A good signal generator provides the technician with a convenient, reliable source of signal for all kinds of circuit testing. When you consider the many years of service you receive from such an instrument, it is well worth the purchase price. The time saved in knowing instead of guessing on service problems will repay the purchase price many times over.

The NRI Laboratories

by
R. O. Titus

The laboratories at NRI are located on the third floor and have received the same careful attention to design that characterizes the entire Wisconsin Avenue facility. The current laboratory facilities comprise three separate areas adjacent to the Instruction Department. The largest area is devoted to servicing; the others are utilized in development programs. The lab's proximity to the Consultation Service also permits ready access to the reservoir of technical background and experience of its personnel.

The laboratory is headed by Mr. Joseph Schek who is also a technical consultant. Elizabeth Mast, Charles Barton, and R. O. Titus round out the full-time staff. The staff is supplemented by Stephen Bailey, Carl Foster, and Barry Frye as their regular Instruction Department duties permit.

Fig. 1 shows Mr. Charles Barton of our laboratory processing an 8W experimental kit. This processing involves a specific procedure. When the unit is received for servicing, it is first examined for possible shipping damage. It is then identified and tagged. The pertinent correspondence and student report are examined and used in tracking down and correcting the difficulty. The unit is then calibrated and run through specific experimental procedure to insure its normal operation. Then, together with a full laboratory report, it is returned to the student.

A great many course-kit difficulties can be solved through close checking and rechecking by the determined student. Some of the more illusive "bugs" are ironed out by correspondence with our Consultation Service. If, however, the consultant feels that a solution would be speeded by a laboratory examination, he will call in the unit from the student with instructions for shipment. All the specific information and correspondence relating to the unit will be held on file in the laboratory pending its arrival.

The servicing equipment and calibration standards available to the laboratories include the popular and reliable Model W VTVM and range to a complex audio distortion analzer and comprise such names as: Hewlett-Packard, Textronics, General Radio, Hallicrafters, Lampkin, and many others. With this full complement of servicing and calibration equipment, specific information, and familiarity with the units processed, the repair takes on the form of greeting and helping an old friend.

As in any other electronic-related field, development plays an important role in the utilization of the lab. Here, development and modification on both CONAR division and course equipment is carried out. In Fig. 2 we see Mr. Art Widmann, a Technical Editor, conducting a "breadboard" test on a circuit that may appear as an alteration to update or simplify any of the courses offered at the Institute. Development is also carried out on kits to be offered through the CONAR division of NRI.

In order to supply pre-assembled CONAR units, a portion of the laboratory area is devoted to the construction and calibration of various test equipment. Fig. 3 shows Stephen

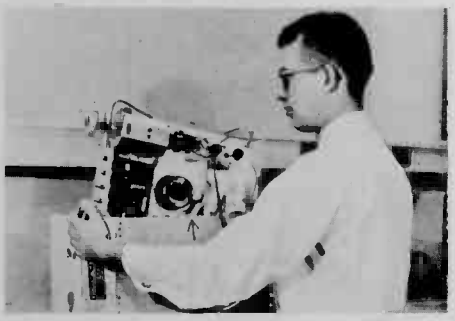


FIG. 1. Working on an experiment in Kit 8W.

FIG. 2. A "breadboard" test.

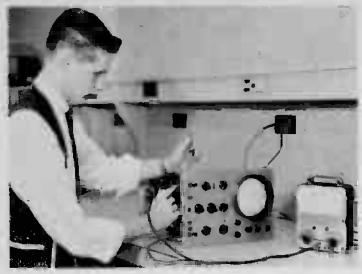


FIG. 3. Conducting a test on the Model 250 Oscilloscope.

Bailey completing final assembly and testing of a Model 250 oscilloscope.

The laboratory is continually involved in a program of quality control. This activity, through sampling, keeps an "eagle eye" on new components to insure their trouble-free installation and function. The occasional sour component that does slip our notice is replaced from pre-tested lab stock and is subjected to a close examination for possible alteration by the manufacturer. The quality control program also extends to pre-assembled units and insures correct calibration and operation before their shipment to the customer.

The laboratory service is operated for students, graduates, and NRI equipment owners. Student service is generally done on a charge-free basis with the exception of student-damaged units and those sent in with missing parts. On graduate and supply items, a charge is made on a parts plus labor basis. Due to the time and expense involved, on the part of both the Institute and the student, NRI does not process equipment other than its own. Questions on such equipment from our students and graduates are referred to our Consultation Department for aid and solution by correspondence.

When you use our laboratory service, keep these suggestions in mind as they will speed repair and return of your equipment:

1. Be certain that you have done your part in tracking down the difficulty.
2. As specifically as possible, detail the difficulty you have encountered in your correspondence.
3. Pack the unit with care to avoid transit damage and include complete identification.
4. Notify the Institute of the date and content of shipment.

We at the Institute are proud of our laboratories and extend an invitation to you to drop by and see them in action when you visit NRI.

WE WANT TO HEAR YOUR STORY

by O. Read
NRI Staff

Perhaps our most rewarding experience is having our students, graduates, and other friends visit NRI. Rarely does a day pass without our having the pleasure of showing visitors the complete and complex operations providing educational facilities to thousands of students who receive their electronics training from NRI.

Nothing pleases us more than the opportunity to talk, face to face, with our graduates and to hear of their special interests, their jobs, and how they have made a niche for themselves in our Electronics industry.

Many of these men tell how they "started from scratch" to build a profitable servicing business. Others found themselves possessing sales ability, in addition to their technical "know-how", and set up dealerships in radio, TV, and appliances. Still others tell of having obtained well-paying positions as electronic technicians.

Several of our most recent visitors are specializing in the "mushrooming" field of communications, including Citizen's Radio Service, utility and marine electronics. And many have set their sights on the sale and maintenance of hi-fi as a livelihood.

Books could be written on "case histories" of successful careers in electronics enjoyed by our graduates. Unfortunately, these would contain too much duplication and repetition of established methods used by the majority to be of real help to those seeking opportunities in specialized fields of electronics.

The staff members of NRI firmly believe in the well-known axiom that "Nothing succeeds like success." We know that many of you have discovered or developed new ways to make money in whatever branch of electronics you have chosen.

You have learned to do things more efficiently, or perhaps you have paid particular attention to little things that are so important in dealing with the public.

We asked one very successful Radio-TV technician what he considered the most important ingredient, besides technical know-how, that contributed to his success. He replied that "cleanliness and showmanship" had paid off handsomely. We asked him to elaborate on "showmanship" and why he considered it so important.

His answer was quite revealing and is typical of the case histories of success we'd like to pass on to other graduates or students as they seek assistance or encouragement in bettering themselves. He said:

"Showmanship is simply setting up my service department in my store window -- instead of hiding it in the back of the store. I'm in a neighborhood where people like to window shop. Most are factory workers and many are skilled craftsmen. Why should I hide my skill and my test equipment when I can do my bench work under the eyes of my customers and prospects? I keep my shop neat too, as well as myself. It's a small town, but I feel I'm now a prosperous businessman and a credit to my community."

There are many such "case histories." The editors of NRI News are compiling the most interesting ones for publication in future issues of the News. We need many more from which we can pick the best to pass on to other NRI men.

So -- what's YOUR story? Please jot down your own ingredients for successful practices and mail your story to Ted Rose here at NRI. We'll appreciate your cooperation and others will profit from your experience. Snapshots are welcome, too. We'd like to see you (in action) performing one of your regular jobs or services.

Understanding Related Circuits: Multiple Trouble

The following is an excerpt from an article appearing in "Service Aids for the Professional Television Man." It is reprinted with the permission of Triad Transformer Corp., A Division of Litton Industries. Mr. Irv Tjomsland is the author and also took the pictures. We feel that the information in this article is exceptionally well presented and should be of great interest to every TV serviceman.

A great many of your daily actions are based on facts "you know for sure." The number of dimes in a dollar, the way you drive a car, and the labor charge you place on a job are all part of accepted knowledge.

A great many of the efforts you extend in your television service work are based on previously worked out procedures or "things you know for sure."

This article has been prepared in the hope that it may present a few additional "for sure" ideas that might help do a job a little faster, easier, and more accurately.

All of the material will be well known to the experienced professional serviceman, but correspondence and field surveys indicate that many would value a brief review of the "standards" the professional takes for granted.

The general subject is "Understanding Related Circuits" with space devoted to a discussion of "Multiple Trouble."

It has been felt that the presentation of useful scope data could help in fixing certain AC requirements which tend to be uniform or "for sure" in certain circuits. See Figs. A-J. of "Patterns you should know for sure."

However, the reader must not assume that the scope data is offered as anything except as a source of ADDITIONAL assistance, because the accepted practice of applying observation, experience, resistance and DC measurements will always provide the foundation of day to day service.

The majority of service jobs that come across the repair bench are of the "single defect" variety. The experienced bench man, with a well developed instinct for circuit responsibility, a good memory, and backed up by a stock of components for substitution rarely has difficulty turning out a steady flow of work. In fact the routine can become somewhat repetitious and arrival of a job with MULTIPLE TROUBLE may come as an unpleasant surprise. Valuable as they are, the CRT inspection, tube testing, DC measurements, and component substitution may lead to nothing better than recognition of the fact that a starting point must be found.

Admittedly the case of MULTIPLE TROUBLE is rare so for the purpose of discussion a completely unlikely job is introduced.

A valued customer requests service on the

receiver in the children's room. Inspection reveals that flame has damaged the flyback, wiring, and capacitors, so you advise that the cost will exceed the value. The customer insists that the receiver has sentimental value and when you recall that his account is good for service on the color set, the portable in the bedroom, the old-timer in the maid's room, as well as the hi-fi in the music room, you agree. To make the situation complete let's also add that the burned out job is an orphan with no schematic data or parts list. No name, no numbers, just trouble.

For the record we will assume that you study the chassis layout, circuit functions, tube socket identification, and select the new components you will require to restore operation.

Your research has indicated that a certain type flyback can supply the high voltage, degree of scan, pulse supply for AGC, AFC, and blanking, at the B plus available, and with the type of driver tube used in the original operation. You note that a separate tapped winding was used to furnish the related circuits so part of your problem is to provide the correct polarity and amplitude pulse to each function to avoid the necessity for dozens of reversals you might otherwise have to make.

The best possible substitute flyback appears to have the same resistance (and inductance values) as the original, but the panel layout and terminal numbers are different. You are therefore faced with these problems: See Fig. F.

The flyback must be adjusted to operate with normal high voltage, width, and boost voltages, and the horizontal output tube at safe cathode current and screen power dissipation.

The AGC circuit can operate only if proper polarity and amplitude pulses are applied to the plate. The AFC system can operate only if a proper sawtooth is applied to the comparison element in the AFC detector. Blanking may interfere with sync and CRT beam current if wrong polarity and amplitude pulses are applied.

The receiver functions interlock in this manner: The AGC keyer may be correctly pulsed, but will not develop AGC bias unless the horizontal system is "locked in" with incoming sync.

Without AGC bias the tuner and IF amplifier will overload causing poor or even reversed sync to be applied to the AFC detector. Under these conditions horizontal hold may not be achieved because the AFC detector cannot function, even with a sawtooth of correct waveshape and amplitude.

Improper blanking amplitude or polarity may cause excessive CRT beam current which may load the flyback to such an extent that AGC and AFC pulses become inadequate.

In other words: If you attempt to restore operation by experimentally connecting and reversing leads to obtain correct polarities and amplitudes you will have to try many combinations (possibly more than twenty) and you may not know when you hit the right combination if any additional malfunction exists in the tuner, IF, video, or sync circuits.

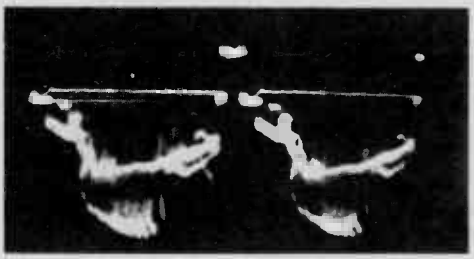


FIG. L. "Wave form presented by commercial grade broadcast scope." Courtesy KHJ-TV.

A BETTER SOLUTION

Instead of trying combination after combination and hopefully checking the image on the CRT for signs of normal operation, PROCEED WITH THE KNOWLEDGE OF "WHAT YOU KNOW FOR SURE" IS REQUIRED TO OPERATE EACH CIRCUIT AND CONNECT THE PULSE OF PROPER POLARITY AND AMPLITUDE TO THE ELEMENT INVOLVED.

Proceed as follows:
Switch on the receiver. Temporarily ground terminal 2 of the flyback. See Fig. F. Measure the amplitude and note the polarity of the pulse at terminal 3 and 1. Terminal 3 shows

500 v peak-to-peak positive going, and terminal 1 50 v peak-to-peak negative going.

AGC requirements:
A pentode keyer tube is used in the original circuit. The screen voltage on the keyer measures 300 volts. Since the keyer pulse should be at least one hundred volts more peak-to-peak than the DC on the screen we can connect the keyer plate to flyback terminal 3.

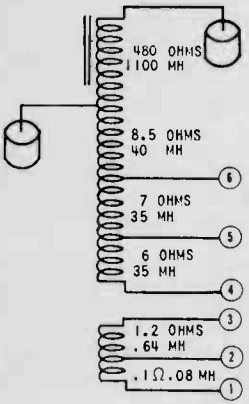


FIG. F.

AFC requirements:
The original AFC wave shaping network incorporated a 27 K 1 watt resistor connected to the flyback. This rather low value suggests a low pulse potential point so, temporarily it can be connected to flyback terminal 1.

Blanking requirements:
An inspection reveals that horizontal blanking was applied to the CRT grid in the original circuit. Since the grid requires negative going pulse for blanking and a rather small resistor (15K) is used to feed the signal the only source of a proper pulse will be flyback terminal 1 provided terminal 2 is grounded. Blanking is connected here.

To sum up: With this arrangement keyer plate amplitude and polarity requirements are fulfilled. Blanking polarity is correct and AFC resistance values seem to indicate that the negative going 50 v pulse is most apt to be suitable.

Now for the Checkout:
It is understandable that one more requirement must be met before operation can be developed to normal. This need is for normal sync to permit adjustment of horizontal hold to make AGC possible.

The most satisfactory method is to apply an independent Bias supply, preferably with two negative outputs, to the tuner and IF amplifier. These should be adjusted to develop a video signal of correct polarity and amplitude at the video detector check point. (See Fig. A, B, C, D, and E.)

Obviously if a normal signal cannot be developed at the video detector, normal video cannot be developed for the CRT and sources for the sync separator circuits will also be unsatisfactory. Repairs as necessary to the tuner and IF amplifier must be performed to develop the correct signal at this point before proceeding with further tests. An important bit of evidence can be had at this point. Voltage required from the Bias supply to develop a normal signal should be similar to AGC voltages listed or actually encountered in other receivers of the same class. If the Bias output is calibrated in VOLTS and the supply itself is of a low impedance type (such as the Bias Supply shown in Fig. 1) it will be less necessary to use a separate voltmeter to make bias adjustments.

With a normal signal established at the video detector check point the following tests should be made:

Video drive to CRT
(refer to Fig. D, E)
Sync input to Keyer
Sync input to AFC Detector

Repair as necessary to provide these key points with correct appearing signal and proceed with adjustments:

With Bias Supply in use adjust AFC system for best possible horizontal hold. If the blanking bar position is normal, but hold appears

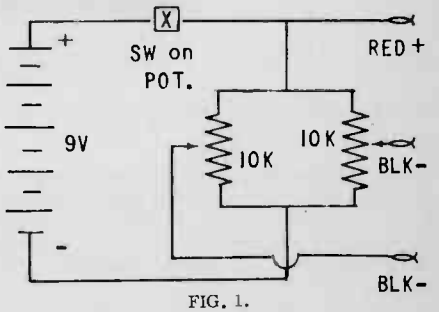


FIG. 1.

to be touchy check all wave shaping components carefully for leakage or off-value characteristics. Wave shaping components that handle substantial power often change in value, altering wave shape and amplitude. In other instances where the pulse source is supplied by the main flyback winding the presence of high boost voltages, plus the pulse riding on it, cause even higher deterioration of elements in this circuit.

With the AFC system "locked in" check the AGC filter network for presence of negative AGC voltage. If AGC bias is not being developed by the keyer, DC checks should be performed on the control grid and cathode of this circuit. (To make sure AGC voltage appearing at the filter network is not "feedback" from the Bias Supply, momentarily switch it off.)

In most AGC keyer circuits the grid will be negative with respect to the cathode by about the same DC value as the peak-to-peak value of the video feed for keying.

AGC grid and cathode voltages are often derived from unexpected portions of the receiver and such odd malfunctions as weak or gassy Audio output tubes can cause poor or even no AGC action, if the grid-cathode voltage difference is derived from an Audio output stage which also acts as a voltage divider for low B plus requirements.

When checking Keyer operation it is sometimes convenient to open the Bias filter circuit but leave the voltmeter connected. Keyer action can be conclusively checked by observing the voltage output of the keyer when the Bias Supply is varied through its range. Keyer voltage may vary from zero to more than a hundred volts so take precautions with the voltmeter range switch.

When Keyer operation is normal remove the Bias Supply and make the necessary threshold or delay adjustments.

Blanking amplitude should now be checked at high and low contrast levels. Amplitude should be reduced, usually by changing the resistor or capacitor dividing networks values, if "telephone poles" appear at the left side of the raster. Amplitude may have to be increased by the same means if blanking is incomplete.

SUMMARY

The difference between the experimental, "cut and try" approach and the procedure outlined above is substantial. It boils down to the comparison that the experimental method is complicated, difficult, and doubtful of result. The method outlined above is objective in that each move is directed toward establishing proper potentials in the individual circuits so that each operate properly as a part of the total.

The ability to divide the whole interlocked circuit into its separate functions and by means of a competent scope "look in" at the test points for the patterns that must be there, has then been added to the other procedures the serviceman has been using for single defect analysis and repair.

SCOPE PRACTICE

If you would take a poll of television servicemen you would find that nearly all servicemen are in favor of scopes, and practically all service shops possess one or more.

If you survey scope application, however, you will find that bench men make almost no use of a scope in four out of five shops!

The reasons may become evident when you answer the following two questions:

1. How good is your scope?

Many scopes in service shops are inadequate to furnish information of a type that will speed up service and improve accuracy.

2. Do you analyze service problems -- from a circuit performance standpoint, or a receiver performance basis?

To clarify the rather ambiguous question consider this example:

You have on your workbench a chassis with the complaint: Poor picture quality, loses vertical, "pulls" horizontally, loses hold on change of channels.

Would you tend to follow procedure No. 1 or No. 2?

Procedure 1

Change tuner, IF, video, sync, and oscillator tubes leaving each tube in place and watch the CRT for evidence that the tube just changed may have been part or all of the trouble? Failing complete success by this method do you start checking DC voltages for schematic variations and evidence of bad resistors and capacitors?

Procedure 2

"Break the receiver problem in half" by scoping the video detector check point. If amplitude, waveshape, or polarity are abnormal, apply a bias supply to the tuner and IF strip to see if a proper video detector output can be established. Completing this do you then check the picture on the CRT to determine if additional trouble exists?

If your service procedure tends to resemble the first example you might find that you would greatly increase your analysis speed and accuracy by adding the use of a competent scope.

Many a potential user of a scope has become discouraged when expected patterns did not

(continued on page 18)

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Chosen for superb sound . . .
outstanding value . . .
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MODEL CO-15 HIGH FIDELITY SPEAKER

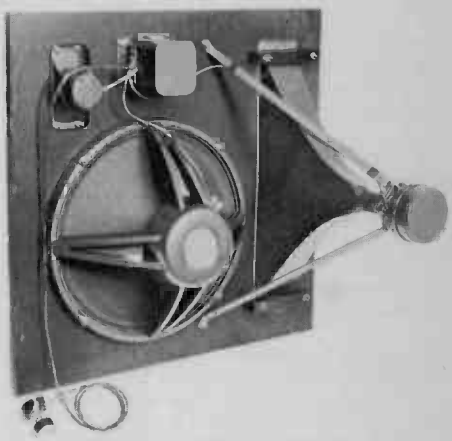
Specially manufactured for CONAR by Electro-Voice, this modestly priced 15" speaker represents an unusually fine investment. Its wide range, crisp response gives needed definition to stereo reproduction. The 15" cone size insures full, rich bass response carefully balanced to the extended high frequency reproduction.

Construction of the CO-15 is identical to the highest-priced components and features the dual-cone Radax design using a small cone for brilliant reproduction of highs plus 15" cone for efficient bass reproduction. Speaker is built on rigid die-cast frame for maximum reliability and perfect alignment of the moving assembly. Voice coil is formed on a rigid, concentric Fiberglas form to eliminate distortion. It is of long-throw design for optimum linearity and the edgewise-wound ribbon coil obtains maximum useful power from the high efficient magnet system.

SPECIFICATIONS

Frequency response 35 to 13,000 cps; free-space cone resonance 50 cps. Power handling capacity 20 watts program, 40 watts peak. Power required for concert level in average living room - 8 watts. Impedance 8 ohms. Mechanical crossover 4500 cps. 2,470,000 ergs total gap energy, 10,500 gauss flux density. 15-1/8" diameter. 6-11/32" deep. 13-7/8" baffle opening. Mounts with four 9/32 inch holes equally spaced on 14-9/16" circle. Net weight: 9 lbs. Shipping Weight: 10 lbs.

Stock No. CO15 SP (parcel post) **$21.95**



MODEL CO-315 3-WAY SPEAKER SYSTEM

CONAR now offers you a complete three-way speaker system, manufactured to our exacting specifications by Electro-Voice. By utilizing three separate speakers for the bass, mid-range and high frequencies, unusual clarity and separation of tonal texture is obtained. Each specialized speaker is designed to operate best over a limited range, thus avoiding the usual compromises of single or two-way designs. A volume control for both the mid and high ranges allows balancing of the system response to exactly fit your personal listening requirements.

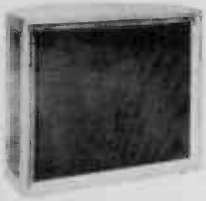
The CO-315 is shipped mounted on a sturdy 3/4-inch baffle board, and can be easily installed in a wall, closet door, or in the cabinet of your choice.

The large 15-inch bass speaker provides outstanding performance with high efficiency and very low distortion. The efficiency of the entire system permits use of the CO-315 with virtually any high fidelity amplifier. The clean, clear "presence" of the CO-315 is the result of the carefully-designed compression driver plus the unique wide-angle diffraction horn that distributes the mid-range smoothly to every corner of the room. This is particularly important for accurate stereo separation. A diffraction horn of advanced design is also an integral part of the super-tweeter for optimum spread of the essential "brilliance" range.

High Fidelity by Electro-Voice

SPECIFICATIONS

Frequency response 35 to 18,000 cps. Power handling capacity 20 watts program, 40 watts peak. Impedance 8 ohms. Electrical crossovers at 600 and 3500 cps. Attenuation rate 6 db per octave. Level control adjusts both mid-range and tweeter. Baffleboard size 23-7/8-inches high, 23-7/8 inches wide, 3/4 inch thick. Depth of system (mounted) 12-1/4 inches. Woofer: Specifications identical to CO-15. Mid-range: Frequency response (in system) 600 to 3500 cps. Flux density 8300 gauss; magnet weight 8 oz. Voice coil 2-inch diameter, edgewise-wound. Dimensions 11-1/2 inches deep, 15 inches high, 4-1/2 inches wide. Tweeter: Frequency response (in system) 3500 to 18,000 cps. Flux density 9000 gauss; magnet weight 3.16 oz. Voice coil 1 inch diameter, edgewise-wound. Dimensions 3 inches deep, 5-1/4 inches high, 2 inches wide (horn mouth). Stock No. 857 SP. Shipping weight 27 lbs - express collect. Price **$85.00**



MODEL KD4 REGENCY KIT ENCLOSURE

Electro-Voice designed the KD4 as an acoustically-correct enclosure for the CO-15 and and the CO-315 or any similar high-efficiency 15" speaker or system. Planned for easy construction, the KD4 requires only ordinary hand tools for assembly; glue, screws and nails are included. All finish surfaces are of clear-grained Korina, and grille cloth is included. All panels are precision pre-cut and easy step-by-step instructions show you how to "do-it-yourself."

The KD4 is a low-boy styled corner horn-loaded enclosure, using the corners of the room as extensions of the built-in-horn. This exclusive E-V design may add as much as a full octave of bass over conventional designs. It may also be used on a flat wall, with a modest reduction in bass efficiency. Size: 29-5/8-inches high, 19-inches wide, 15-3/4-inches deep. Shipping weight 76 pounds - express collect. Price **$73.00**

LEYTON SPEAKER SYSTEM

When space is at a premium it takes unusually careful design to obtain optimum bass response with reasonable efficiency. Laboratory tests at CONAR indicate that the Leyton speaker system by Electro-Voice is outstanding for its smooth well-balanced sound, even with modest power inputs. The 12-inch woofer operates only below 200 cps to provide rich, full-bodied bass without coloration or "boominess." The extremely low 200 cps crossover point also assures minimum distortion in the vital presence and brilliance ranges handled by the specially designed 8-inch coaxial speaker. This 8-inch speaker operates in a cabinet-within-a-cabinet, to eliminate any possibility of interaction with the woofer. A volume control permits matching the treble response to your listening requirements. The Leyton is available completely finished and tested in either Walnut or Mahogany.

Frequency response 40 to 13,000 cps. Power-handling capacity 70 watts instantaneous peak program. Impedance 8 ohms. Magnet weight, 12-inch woofer; 1-pound, 6 ounce ceramic magnet. Size: 14 inches high, 25 inches wide, 12 inches deep. Shipping weight 47 pounds - express collect. Stock No. WNT-SP (walnut) No. MHY SP (mahogany) **$82.81**

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I enclose $_____. (If you live in Wash., D. C.. add 2% sales tax on items marked "plus postage". Use Table on page 22 to compute postage charges. On items marked "express collect," do not remit charges.) Please send me:

- ☐ One Model CO-15 High Fidelity Speaker
- ☐ One Model CO-315 3-Way Speaker System
- ☐ One Model KD4 Regency Kit Enclosure
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- **Eliminates 6-12 V batteries and chargers**
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- **Delivers 6 volts at 10 amps or 12 volts at 6 amps**

Stock #610 WT 22 lbs. (shipped express)
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Specially designed for testing automobile radios - either 6 volt or 12 volt - transistor or vibrator operated.

Ideally suited for use as a power supply for aircraft instruments, relays, motors and other electrical and electronic equipment. For lab use, the ATR can be used to supply various low DC voltages. May also be used as a battery charger.

6 or 12 volt output is obtained by simple terminal switching arrangement with safety lock to prevent accidental movement. Two heavy duty meters provide current and voltage readings.

Put this low cost instrument in your shop and do away with storage batteries for good!

SPECIFICATIONS

Eight Position Voltage Control. Fuse protected against overload. Rated Output: 6 volts at 10 amperes continuous 12 volts at 6 amperes continuous. Equipped with Full-Wave Dry Disc Selenium Rectifier. Noiseless, interference-free operation. Toggle on-off switch. Rubber mounting feet. 6 foot cord. Heavy gauge steel cabinet with attractive greay-hammertone finish. Size: 6-1/2" × 9-1/8" × 8-1/2". Shipping Weight: 22 lbs. Shipped Express, charges collect. 105-125 volts, 50-60 cycle AC only.

Tube Caddies
Choose From 2 Sizes

Junior Tube Caddy. Easy to carry for quick trips. Size 15-3/4" × 12-1/2" × 8". Holds 143 tubes.

Stock No. 2CY (9 lbs. parcel post) list price $18.25

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Argos Tube Caddies make COUNTING and CARRYING tubes easy. Divided sections give INVENTORY at a glance. Missing cartons are easily spotted. Carry a complete assortment as easily as a few - and always have the right tube.

There's space for TOOLS and METERS too. A Tube Caddy pays for itself quickly. Arrive on the job with the tubes you need, saves valuable time - make more calls per day.

Sturdy 5/8" and 1/4" plywood covered with attractive but tough luggage type pyroxilin fabric. Handy center opening gives access to all interior compartments. Stay hinges support top sections when in open position. Durable fasteners keep top sections securely closed when in carrying position.

Carry-All Caddy. Size: 21" × 15" × 8". Holds 262 tubes.

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1 universal loopstick antenna
1 12BA6 tube, (1) 12BE6 tube, (3) 35W4 tubes, (1) 12AT6 tube, (1) 50C5 tube

AND - included FREE - steel tool box with lift-out tray, full-length piano type hinge, carrying handle and snap-lock latch. A $4.50 value.

Standard Kit-includes all parts listed above-retail value approximately $60.00.

Stock No. 24UK (12 lbs. shipped express collect) Yours for **$29.95**

Economy Kit - includes all parts listed above except for volume control-switch assortment, tubes and rectifiers. Retail value approximately $39.00.

Stock No. 25UK (11 lbs. shipped express collect) only **$19.95**

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☐ Carry-all Caddy
(If you live in Washington, D.C., add 2% sales tax.)

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City .....Zone .....State .....

☐ Tell me how I can buy this equipment on terms.

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CONAR Instruments, 3939 Wisconsin Ave., Washington 16, D.C.

Please send me the equipment indicated below. I understand shipment will be by Express, charges collect on delivery.

☐ ATR Battery Eliminator..... $49.95
☐ Standard Kit of Replacement Parts..... 29.95
☐ Economy Kit of Replacement Parts..... 19.95
If you live in Washington, D.C., add 2% sales tax..... _____
Total enclosed _____

Name .....Stu. No .....

Address .....

City .....Zone ..... State .....

Express Office .....

☐ Tell me how I can buy this equipment on terms.

appear. If he further noted that when he attached the scope input the receiver operation changed significantly, his common sense told him he was no longer viewing a true condition.

On the other hand, the consistent scope user will tell you he uses a scope because he can make tests that cannot be duplicated with a volt-ohmmeter or other device.

Most scopers will trace their start in scope usage to some event where the ordinary measurements had failed and a scope showed conclusively reasons for failure. Possibly the instance was the sight of video on one side of a coupling capacitor and not on the other. Or the presence of RF on the cathode of the horizontal output when the electrolytic should have been by-passing the resistor.

A serviceman idly scoped the video input to the CRT on a receiver ready for delivery. What he saw caused him to make a thorough check of peaking coils and one was found to be open, except for the shunting resistor.

SCOPE CHECK CHART

1. When you scope the grid of the horizontal output tube does the long slope of the sawtooth RISE as it crosses from left to right?

2. If you "lock-in" a full vertical picture of horizontal drive, can you reduce vertical amplitude 50% and retain lock without complete sync and frequency readjustment?

3. Can you scope the input to the CRT without losing detail in the picture?

4. Can you set up a half size picture of two cycles of 60 cps sine wave and double the size without changing the proportions?

5. Can you sync negative going pulses as easily as positive going pulses of the same type?

6. Can you calibrate your scope at any one setting and depend on the accuracy of the peak-to-peak readings on all other ranges of the vertical multiplier?

7. If you scope the video input to the CRT at vertical frequency do the horizontal sync pulses appear to be the same amplitude as the vertical sync pulse?

8. If you scope the video detector output at horizontal frequency do the corners of sync and blanking appear to be square? (See Fig. L)

9. If you ground the vertical input test probe and advance the vertical gain does your horizontal line remain straight (not show hum

modulation or grass)?

10. Is your scope easy enough to operate that you can concentrate your attention to the job at hand rather than apply most of your effort to operating scope?

Taking for granted that the obvious factors in a scope, such as focus, brightness, size, and layout, are normal, the answers to Questions 1-10 must be "Yes" if you have a first rate scope. Some "No" answers may not cause too much trouble as the following comment on the questions and their purposes will indicate:

1. If you answer No. 1 "Yes" your scope is arranged for "standard presentation" and your patterns will have the same polarity and time relation as most patterns published with schematic data. If the answer is "No" you may have the beam reversing switches in the wrong position or CRT may be rotated 180 degrees if the socket is floating.

2. If your answer is "Yes" your scope has good sync characteristics, at least with this frequency and type of signal.

3. If the answer to 3 is "Yes" and the same for 7 and 8 your scope has a good low capacity probe because it does not load the circuit under test and is compensated for wide frequency response.

4. Many scopes won't pass the linearity test. Sometimes internal adjustments are provided to compensate or correct linearity.

5. A good place to check this one is at the input to the AFC detector on an older chassis where balanced sync is fed the detector. Who knows, you may improve the receiver as well as test your scope.

6. Probably the greatest shortcoming of most scopes in the field today is a poorly ranged and adjusted gain multiplier. It goes without saying that for most television service the variable gain control must be used to calibrate, and pattern size regulated by the multiplier switch. Unless this is standard practice scope operation becomes about as useful as a voltmeter without a scale. If the gain selector switch changes the ratio much more than three to one per step the operator will have a frustrating time maintaining sync and useful pattern size. It the gain is three to one and you set up a 1 volt peak-to-peak

signal to be one inch high and you switch one position lower in gain the pattern should become one/third of an inch and if you switch to a point higher than starting it should become three inches. If your scope will pass a similar test on all ranges it can be of great assistance to you.

7. If your answer is "No" your scope probe may not have been matched to your scope. This is very apt to be true if your probe is of different manufacture than your scope.

8. This is partly a measurement of the adjustment and quality of your probe, but is also a good indicator of high frequency response. To reproduce a good square wave your scope must have response equal to about ten times the fundamental frequency of the pattern you are viewing. (About 150 KC for the 15.750 KC sync.) See Fig. L.

9. One of the most valuable tests you use a scope for is to trace the source of hum when you have "bends" in the doorways. If your scope input is not well shielded your scope may be introducing the symptom you are tracing.

10. If the answer is "Yes" to 10 your scope may be a big help to you even if it flunks on some of the other questions. A good operator can get a lot out of a poor scope, but sometimes it just isn't worth the effort.

VIDEO DETECTOR PATTERNS

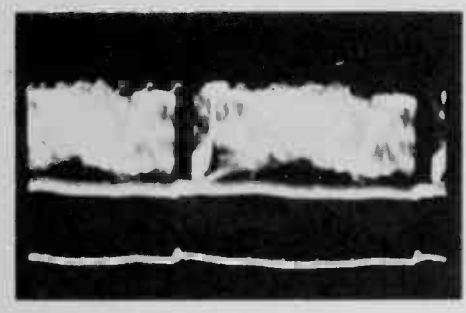


FIG. A. 3 v p-p, vert. freq. video det. normal.

Source:..... Video detector point
Polarity:.... Fig. A negative going sync
Amplitude:.. 3 v peak-to-peak
Frequency:.. 60 cps nominal scoped at 30
Waveform:.. Sync 25-30%, video 70-75%
General:..... Polarity is correct for single video amplifier driving the CRT cathode. Sync to video relationship indicates normal AGC action.

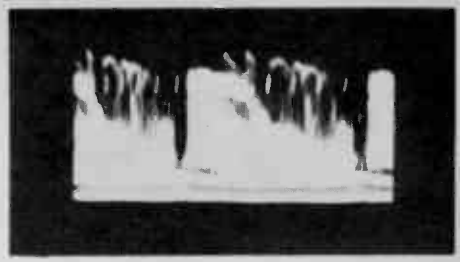


FIG. B. 8 v p-p, vert. freq. video det. excessive.

Source:.....Video detector check point
Polarity:..... Fig. B negative going sync
Amplitude:... 8 v peak-to-peak
Frequency:... 60 cps nominal scoped at 30
Waveform:.... Sync 15% to video 85%
General:..... Expect trouble. Polarity is correct but sync is compressed and amplitude beyond grid swing range of most video amplifiers. Usually caused by gassy IF or tuner tubes or coupler leakage between stages.

FIG. C. 10 v p-p, vert. freq. video det. reversed.

Source:.....Video detector check point
Polarity:..... Sync positive going - (reversed)
Amplitude:.. 10 v peak-to-peak
Frequency:.. 60 cps nominal scoped at 30
Waveform:... Video clipped, sync and blanking rounded and distorted
General:..... CRT will show a negative picture if sweeps can be "stopped" momentarily. Condition results with a strong signal and complete failure of AGC system. Amplitude in IF system so great that detection occurs in late IF stage.

In a Nutshell:
Video detector must develop negative going sync:

With 1 stage video amplifier and cathode driven CRT.

With 2 stage video amplifier and grid driven CRT.

Video detector must develop positive going sync:

With one stage video amplifier and grid driven CRT.

With two stage video amplifier and cathode driven CRT.

Sync should be equal to 25-30% of total pattern with high white content in picture transmission.

Amplitude should correspond to original specifications and must not exceed grid swing of video amplifier.

Amplitude will usually be lower with a two stage video amplifier than with a single stage.

One of the most useful service checks, possible only with a scope, because if provides a positive mid-way test.

VIDEO OUTPUT PATTERNS

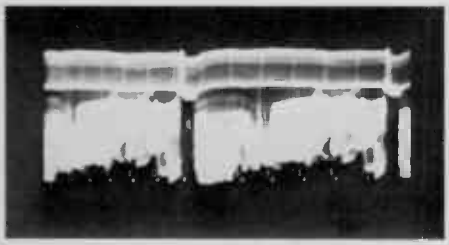


FIG. D. 60 v p-p, vert. freq. CRT input normal.
Source:..... Video input to CRT (cathode)
Polarity:..... Sync positive going
Amplitude:... 65 v peak-to-peak
Frequency:.. 60 cps nominal scoped at 30
Waveform:... Sync to video relation normal
General:..... Polarity correct for cathode driven CRT. Amplitude will produce full contrast picture. Pattern resulted with Video Detector output as in Fig. A.

FIG. E. 100 v p-p, vert. freq. CRT input compressed.
Source:..... Video input to CRT (cathode)
Polarity:..... Sync positive going
Amplitude:.. 140 v peak-to-peak
Frequency:..60 cps nominal scoped at 30
Waveform:.. Sync compressed, white portion of video clipped
General:..... Video amplifier cannot function normally when video detector operates as in Fig. B. Highlight detail degraded, and sync compression may create horizontal "pulling."

In a Nutshell:
A CRT may appear to be malfunctioning when the defect is in the preceding circuitry.

The peak-to-peak value of the video drive can be measured by some peak reading AC voltmeters, but scoping can show sync stretch or compression, video clipping or stretch, can indicate peaking coil, load resistor, and bypass defects, presence of hum and many other undesirable characteristics while measuring amplitude. If the video input to the CRT checks normal, decision on picture tube condition can be arrived at more easily and accurately.

PULSE CONTROL PATTERNS

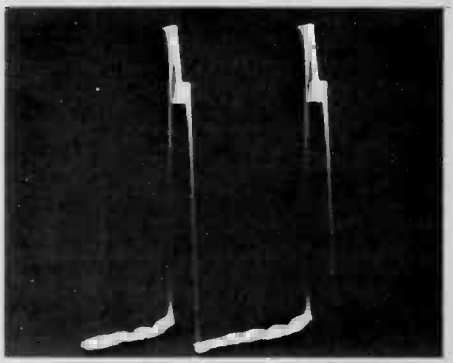


FIG. G. 450 v p-p, horiz. freq. AGC plate retrace spike.
Source: ..... Plate of AGC keyer tube
Polarity:..... Must be positive going
Amplitude: .. Fig. G 450 v peak-to-peak
Frequency: .. 15,750 cps nominal scoped at 7875
Waveform:... Typical horizontal retrace spike
General: ..... To conduct plate current, a vacuum tube must have the plate more positive than the cathode. To produce negative AGC voltage the plate is driven by a positive going spike from the flyback system at the same instant the keyer grid is driven by the incoming positive going horizontal sync. To operate the flyback keyer plate and grid must go positive simultaneously.

In a Nutshell:
Since the keyer requires a positive going spike for operation, and a pentode type keyer has critical minimum amplitude requirements, "for sure" determination of correct AGC pulse supply requires use of a scope. The "locked-in" requirement of the flyback system to the incoming sync makes the keyer circuit a common participant in problems involving MULTIPLE TROUBLE.

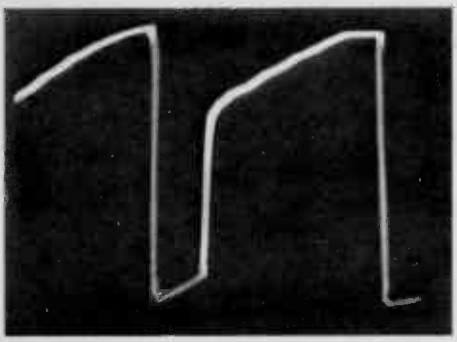


FIG. H. 150 v p-p, horiz. freq. drive.

Source: ..... Control grid: horizontal output tube
Polarity:..... Must be positive going
Amplitude:... 140 v peak-to-peak
Frequency:.. 15,750 cps nominal, scoped at 7875
Waveform:.. Approx. sawtooth, rise to right
General: ..... Scope waveform observation useful to detect component change causing wave shape, amplitude, and frequency malfunctions.

In a Nutshell:
For normal horizontal sweep operation the drive amplitude and waveshape should conform to the original design specifications. This can be determined more accurately by a scope than by reference to the negative grid voltage. Negative voltage on the grid of the horizontal output tube is greatly affected by the gas content of the individual tube, presence of parasitics, hum, and leakage of coupling components. The peak-to-peak value and waveform more clearly indicates the condition of the pulse generating circuit.

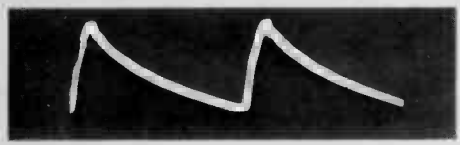


FIG. J. 8 v p-p, horiz. freq. AFC sawtooth.

Source: ..... AFC detector element driven by sawtooth
Polarity:..... Fig. J. positive going
Amplitude: .. 8 v peak-to-peak
Frequency: .. 15,750 cps nominal scoped at 7875
Waveform:... Sawtooth
General: ..... The AFC sawtooth is normally derived from one of two sources:
1. A sawtooth voltage is developed by passing yoke current through a resistor capacitor network. This waveform is normally a sawtooth and no shaping networks are required.
2. A positive or negative going horizontal retrace spike is attenuated and shaped by passing it through a resistive capacitive network to produce a sawtooth of the desired amplitude. Polarity of the original spike can be determined by observing the slope of the sawtooth: If the long slope is in a down direction to the right the retrace spike source is positive going, or vice versa.

In a Nutshell:
Most AFC systems will not operate well if the sawtooth at the detector element varies in amplitude or shape from the original design. A scope is very useful in establishing "for sure" the presence of the proper sawtooth, if original data is available. If no data is available the shaping network should be adjusted to provide a sawtooth with an amplitude equal to from 50 to 100% of the peak-to-peak value of either the positive or negative going reference sync. Polarity may have to be determined by observation of blanking bar position with best lock in: If the blanking bar tends to lock in the center of the raster polarity should be reversed. However, excess amplitude, bad wave shaping, or DC leakage may produce similar results.

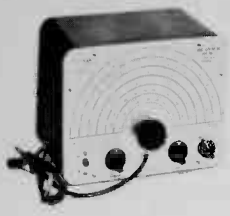
NEW ELECTRONICS OPERATION ESTABLISHED

SAN JOSE, Calif. -- The General Electric Company has established a new electronics operation aimed at the fast-growing nuclear instrumentation and systems market.

The organization has been set up as a product section of the company's Atomic Power Equipment Department (APED) here.

The new section, called Nuclear Electronic Products Section (NEPS), will be an integrated business operation responsible for the development, design, manufacture and marketing of electronic systems and components for the control of nuclear reactors and other specialized instrumentation used in the nuclear field.

CONAR Signal Generator



For AM-FM-TV alignment and troubleshooting
Fundamental Frequency coverage 170 kc to 60mc
Harmonic Frequency coverage over 200 mc
Average accuracy better than ±1% on all bands after easy calibration

Your Choice

Easy-to-Build, Money-Saving Kit

Just $21.50 (Stock No. 280UK)

or

Factory Assembled

$31.50 (Stock No. 280WT)

Designed for rapid, accurate alignment of receivers. High output simplifies signal injection. Aligns weak receivers without difficulty.

Wide frequency coverage for simple AC-DC sets, complex all-wave receivers, transistor portables or hybrid automobile radios. Also covers intermediate i-f frequencies of FM and TV on fundamentals.

Ideal for troubleshooting. Quickly isolates defective stages by the "signal injection" method.

Uses single coaxial cable - no need to shift leads for various outputs. Just flip selector switch for unmodulated rf, modulated rf or 400 cycle audio test signal.

CONAR Instruments, 3939 Wisc. Ave., Wash. 16. D. C.

I enclose $_____, plus_____postage. Please send me:

☐ One CONAR Signal Generator Kit and Manual.....$21.50
☐ One CONAR Signal Generator, Assembled, and Manual.....$31.50
(If you live in Washington, D. C., add 2% sales tax.)

Name.....Stu. No.....

Address.....

City.....Zone.....State.....

☐ Tell me how I can buy this equipment on terms.

SPECIFICATIONS

Frequency Coverage - 170kc to 60mc on six bands. 60mc to over 200mc on harmonics. Tubes: 6BE6 and 12AU7. Solid state power supply. Planetary Drive tuning capacitor with 6:1 ratio eliminates black-lash. Tuned rf coils with highly stable mica trimmers on low bands and ceramic trimmers on high bands. Three types of signal available: Unmodulated rf, Amplitude Modulated rf and 400 cycle af. Coarse and Fine Attenuation. Heavy gauge aluminum panel with black lettering. Cadmium plated steel chassis. Steel cabinet with durable black-wrinkle finish. Actual Weight: 7 lbs. Shipping Weight: 8 lbs. Size: 9-7/8" × 7-1/2" × 6-1/2".

HOW TO ESTIMATE PARCEL POST CHARGES

WEIGHT 1 Lb. and Not Exceeding	Local	1st-2nd Zone, up to 150 mi.	3rd Zone 150 to 300 mi.	4th Zone 300 to 600 mi.	5th Zone 600 to 1000 mi.	6th Zone 1000 to 1400 mi.	7th Zone 1400 to 1800 mi.	8th Zone Over 1800 mi.
2	$0.24	$0.33	$0.35	$0.39	$0.45	$0.51	$0.58	$0.64
3	.26	.38	.41	.47	.55	.64	.74	.83
4	.28	.43	.47	.55	.65	.77	.90	1.02
5	.30	.48	.53	.63	.75	.90	1.06	1.21
6	.32	.53	.59	.70	.85	1.03	1.22	1.40
7	.34	.58	.65	.77	.95	1.16	1.38	1.59
8	.36	.63	.71	.84	1.05	1.29	1.54	1.78
9	.38	.68	.77	.91	1.15	1.42	1.70	1.97
10	.40	.73	.83	.98	1.25	1.55	1.86	2.16
11	.42	.77	.89	1.05	1.35	1.67	2.02	2.34
12	.44	.81	.95	1.12	1.45	1.79	2.18	2.52
13	.46	.85	1.01	1.19	1.55	1.91	2.34	2.70
14	.48	.89	1.07	1.26	1.65	2.03	2.50	2.88
15	.50	.93	1.13	1.33	1.75	2.15	2.66	3.06
16	.52	.97	1.18	1.40	1.85	2.27	2.81	3.24

NRI ALUMNI NEWS

CONGRATULATIONS TO NRIAA PRESIDENT-ELECT FRANK SKOLNIK

One Vice-President Re-Elected; Three New Ones Chosen

There never was much doubt how the voting would go for the Presidency in this election. From the very first, Frank Skolnik of the Pittsburgh Chapter took the lead against his closest opponent, John Berka, of the Minneapolis-St. Paul Chapter. Berka received a sizable vote but never enough to threaten the lead which Skolnik held consistently to the end. So, congratulations to the President-Elect of the NRIAA for 1962, Frank Skolnik!

Our amended Constitution and By-laws adopted September 1, 1960, necessitated the election of three new Vice-Presidents to replace F. Earl Oliver of Detroit, Howard Smith of Springfield, Mass., and John Babcock of Minneapolis. The replacements are Walter Berbee of the Minneapolis-St. Paul Chapter, who received the heaviest vote for a Vice-Presidency; David Spitzer of the New York City Chapter; and James Kelley of the Detroit Chapter. (Note that, although Earl Oliver is no longer a Vice-Pres., the Detroit Chapter still boasts a National Vice-President among its members.) The one incumbent Vice-President who was eligible for re-election, J. Arthur Ragsdale of San Francisco, was returned to office for a second term. Congratulations to these successful candidates for Vice-President!

Born in Pittsburgh in 1908, President-Elect Skolnik attended Saint Paul's Cathedral school, graduating in 1922. He began experimenting with crystal radios at the age of 12 and since then has kept abreast with technical improvements including the most modern TV receivers. He has fond remembrances of the old "cat shisker" galena detectors, the Browning and Drake receivers, Freed Eisemann, and the old Freshman Masterpiece sets.

While doing spare-time Radio servicing, Skolnik went to work at a grocery store as a truck driver and was later employed by a department store where he now is going into his 32nd year of service.

He has always kept his hand in on spare time servicing, operating first a Radio Service shop and later a Radio-TV shop. He enrolled with NRI in 1943 and graduated two years later.

In 1948 he helped organize the Radio and Television Servicemen's Association of Pittsburgh. He has served two terms on their board of directors, and since 1956 to the present time has been their first Vice President.

In 1953 he helped found the local NRIAA Chapter in Pittsburgh and served with distinction as chairman from 1953 to 1958. He is still very active in all Chapter endeavors.

The President-Elect conducts his spare time Radio-TV servicing business from his garage and basement where he has a well equipped shop.

Skolnik's background and experience in Radio-TV are typical of a large percentage of the older members of the NRI Alumni Association. For this reason, and because of his valuable services to the Pittsburgh Chapter and to the NRIAA, he is well fitted for the office of the Presidency, which he will take over from Jules Cohen of the Philadelphia-Camden Chapter on January 1.

Frank Skolnik of Pittsburg, Pa., President-Elect of NRIAA for 1962.

Chapter Chatter

CUMBERLAND VALLEY CHAPTER held its annual banquet at The Nook Restaurant, Hagerstown, Md. Following an excellent dinner, the members enjoyed an informal meeting during which everybody had a chance to present his views and problems about Radio-TV servicing.

The next meeting was held at the home of Chapter Member Reginald Ankeney, Clearspring, Md. Mr. Tom Shea, field sales manager, Eastern Division, Blonder-Tongue Laboratories, was guest speaker at this meeting. Mr. Shea spoke on planning master TV systems. He showed the members his company's line of equipment and demonstrated how to lay out a master antenna system.

DETROIT CHAPTER has admitted three new members. They are Honorary Members Bud Champion and Jim Joseph, and regular member Clyde Perkins. We are glad to number you among the members of the Chapter, gentlemen.

The Chapter held its Annual Stag Party at its regular meeting place. The supper was very good and there was plenty of it; fish and shrimp, potatoes, cole slaw, rolls, pickles, olives, and beer and coffee. Probably most of the members ate entirely too mich. Two visitors were welcomed who came to the party all the way from Ohio. They were Ernest Wisinofsky and Mr. Les Wheeler. A feature of the evening was the excellent stereo music furnished by Ellsworth Umbreit. This was truly enjoyable music and quite a few of the members envied Ellsworth his collection of records.

At the preceding meeting Earl Oliver and Ellsworth Umbreit gave a demonstration on using a signal generator to align a Radio receiver. The Chapter's RCA Radio Panel Board was employed in this demonstration.

A group at Detroit Chapter's Fall Stag Party. The handsome gentleman in the center is Ellsworth Umbreit, who entertained the members and guests with such excellent stereo music.

Leo Blevins has been planning to give a demonstration on building an intercom.

FLINT (SAGINAW VALLEY) CHAPTER is well on its way with a series of lectures for this season. The first one was given by Westinghouse Technical Training at Consumer Power Auditorium. Westinghouse Service Engineer Kenneth Swailes delivered a very informative talk and introduced the 1962 line of Westinghouse Television Receivers, with special attention to transistorized remote control and instant-operating TV picture and sound.

There was an excellent turn-out for this lecture; a total of 167 attended. After the lecture, which lasted three hours, a luncheon was served and Westinghouse presented each guest with a service sheet and schematic pocket-size booklet for the 1962 Westinghouse line.

The Chapter has two new members, Raymond Kitt of Marlette and Leslie Carley of Mt. Morris, who travel 75 miles to attend the Chapter meetings. Our congratulations to these gentlemen!

MINNEAPOLIS-ST. PAUL CHAPTER members have always depended a great deal on John Berka for help and advice on their technical problems. And well they may, for he is a full-time Radio-TV serviceman with a thorough knowledge of and wide experience in servicing. Incidentally, John was a second-choice candidate for the Presidency of the NRI Alumni Association for 1962, as mentioned elsewhere in this issue.

At recent meetings John delivered a talk and lead discussions on vertical oscillators and the hv section of television receivers. Both of these programs were well received.

At the October meeting Mel Lundgren won a door prize of $20 to be used for test equipment. Mel said it was just in time to make a payment on his B and K Analyzer.

NEW YORK CITY CHAPTER, with the arrival of the cool Fall months, buckled down to serious work, with many fine lectures being given by Tom Hull, Chairman Dave Spitzer, Jim Eaddy and many others of the Chapter's expert technicians and experienced speakers. The Chapter's demonstration TV receiver has really been given the works, being used in so many troubleshooting demonstrations.

Ralph Pincus began a series on Radio and started it off with filament circuits and rectifiers, from the old to the new methods. This promises to be a series from which the members can get much-needed information. Tom Hull also described some of the older recti-

fier and filament circuits and explained some of the troubles encountered in them.

Many fine lectures and demonstrations are in store for the members at coming meetings, covering everything from tube and transistor radios to color TV and AM-FM multiplex.

PHILADELPHIA-CAMDEN CHAPTER celebrated its 27th Anniversary on October 7 at the Southwark A. C. Club. It was a tremendous success. Everyone agreed it was the biggest and best social the Chapter has ever staged.

Honored guests were: from the New York City Chapter, Chairman and Mrs. David Spitzer, Mr. and Mrs. Frank Zimmer, Mr. and Mrs. Tom Hull, and Secretary Sam Jacobs; from the Pittsburgh Chapter, Chairman Howard Tate, Secretary Jim Wheeler, Tom Schnader, Jack Fox, Charles Kelley, and National President-elect Frank Skolnik and Mrs. Skolnik; and from National Headquarters in Washington, Ted Rose, Executive Secretary.

The 125 people at the banquet witnessed Jules Cohen, National President for 1961 and Secretary of the Philadelphia-Camden Chapter, present to Charles Fehn a beautifully inscribed plaque in recognition by the Chapter members of his many years of devotion and valuable service to the Chapter.

Many door prizes were won by the lucky ticket-holders. The prizes were donated by the Raymond Rosen Co., the Almo Co., Albert Steinberg and Co., Philadelphia distributors for Motorola, Pierce Phelps Co., for Zenith, Philco Corp., Radio Electric Service Co., Capitol Electric Co., Rose Electric Co., General Electric Co., and Westinghouse Corp. Chapter member Henry Whalen donated a transistor checker and issued ball point pens to all. Chairman Herb Emrich won the most popular prize, a dot and bar color generator donated by the Philco Corp.

After a delicious dinner, a few short speeches by some of the guests and after the door prizes had been awarded, a highly entertaining floor show by professional talent finished off the evening, although some of the members stayed for dancing. It was an evening that will be long remembered by the Chapter members and guests.

PITTSBURGH CHAPTER Chairman Howard Tate and Tom Schnader gave an excellent demonstration on using an oscilloscope for troubleshooting a Television receiver.

A law to regulate the sale of Radio tubes and picture tubes was passed in the legislature at Harrisburg last January. Secretary Jim Wheeler brought in a copy of the law to a meeting and it was discussed at some length for the information and enlightenment of the members. Here is another example of one of the many ways in which membership in a local Chapter of the NRI Alumni Association can be so helpful.

Two new members were recently admitted to membership in the Chapter. They are John Getz and John Lang, both of Pittsburgh. A warm welcome to these gentlemen!

SAN FRANCISCO CHAPTER Chairman Ed Persau, using a signal generator and signal tracer, demonstrated signal tracing on the new mock-up Radio which Chapter members built on a large section of peg board. He showed that signals could be received at every stage, from the antenna to the audio output. Signals from broadcast stations were also received. He then demonstrated localization of defects to one stage by temporarily removing components from the circuit and showing how the signal tracer would not receive the signal at this stage.

At another meeting Chairman Persau demonstrated the appearance of 400-cycle modulated rf waveforms at different points on the mock-up Radio, this time using an oscilloscope and a signal generator.

The members voted to purchase a Kit which can be used to set up 19 different transistor circuits, demonstrating the use of transistors and radios and other electronic devices.

SOUTHEASTERN MASSACHUSETTS CHAPTER at one meeting featured Manuel Sousa, a full-time Radio-TV serviceman, as a speaker. He sopke at considerable length on troubleshooting the horizontal oscillator. There were plenty of questions and comments from the members during this talk. At this same meeting earnest consideration was given to the proposal that the Chapter acquire a projector for showing a schematic diagram on a good-size screen, which would help make the Chapter's programs even more interesting and helpful.

At another meeting the evening was taken up almost entirely by a general discussion among the members on troubleshooting a hybrid auto radio.

SPRINGFIELD (MASS.) CHAPTER members extended their sympathy to Orin Hayden who has been suffering from partial paralysis for some months and who finally underwent a surgical operation for the removal of a spinal disc. According to last reports he was making

great progress toward a good recovery. Our very best wishes and hope for a speedy return to health, Orin.

A highlight of one recent meeting was a lecture and demonstration on transistors by Chairman Norman Charest. This talk and demonstration must have proved interesting to the members, for at the very next meeting he was prevailed upon to give another lecture on transistor theory. It was encouraging to see that most members of the class took part in this lively discussion.

Arnold Wilder has obtained a printed circuit board of a complete transistor radio. This board is broken down into rf, osc, i-f, detector, AMP, speaker, and push-pull power supply. Members will be able to see how the signal is picked up by the antenna, inserted into each stage and finally comes out of the speaker circuit. This should be very interesting and instructive, even to the professional Radio-TV servicemen.

Directory of Local Chapters

Local chapters of the NRI Alumni Association cordially welcome visits from all NRI students and graduates as guests or prospective members. For more information contact the Chairman of the chapter you would like to visit or consider joining.

CHICAGO CHAPTER meets 8:00 P.M., 2nd and 4th Wednesday of each month, 666 Lake Shore Dr., West Entrance, 33rd Floor, Chicago. Chairman: Edwin Wick, 4928 W. Drummond Pl., Chicago, Ill.

DETROIT CHAPTER meets 8:00 P.M., 2nd and 4th Friday of each month, St. Andrews Hall, 431 E. Congress St., Detroit. Chairman: James Kelley, 1140 Livernois, Detroit, Mich.

FLINT (SAGINAW VALLEY) CHAPTER meets 8:00 P. M., 2nd Wednesday of each month, Andrew Jobbagy's Shop, G-5507 S. Saginaw Rd., Flint. Chairman: William R. Jones, 610 Thomson St., Flint, Michigan.

HAGERSTOWN (CUMBERLAND VALLEY) CHAPTER meets 7:30 P.M., 2nd Thursday of each month, at homes or shops of its members. Chairman: Harold J. Rosenberger, R.D. 1, Waynesboro, Pa., 1650R11.

LOS ANGELES CHAPTER meets 8:00 P.M., 2nd and last Saturday of each month, 5938 Sunset Blvd., L.A. Chairman: Eugene DeCaussin, 5870 Franklin Ave., Apt. 203, Hollywood, Calif.

MILWAUKEE CHAPTER meets 8:00 P.M., 3rd Tuesday of each month, Radio-TV Store and Shop of S. J. Petrich, 5901 W. Vliet St., Milwaukee. Chairman: Philip Rinke, RFD 3, Box 356, Pewaukee, Wis.

MINNEAPOLIS-ST. PAUL (TWIN CITIES) CHAPTER meets 8:00 P.M., 2nd Thursday of each month, Walt Berbee's Radio-TV Shop, 915 St. Clair St., St. Paul. Chairman: Kermit Olson, 5705 36th Ave., S., Minneapolis, Minn.

NEW ORLEANS CHAPTER meets 8:00 P.M., 2nd Tuesday of each month, home of Louis Grossman, 2229 Napoleon Ave., New Orleans. Chairman: Herman Blackford, 5301 Tchoupitoulas St., New Orleans, La.

NEW YORK CITY CHAPTER meets 8:30 P.M., 1st and 3rd Thursday of each month, St. Marks Community Center, 12 St. Marks Pl., New York City. Chairman: David Spitzer, 2052 81st St., Brooklyn, N.Y.

PHILADELPHIA-CAMDEN CHAPTER meets 8:00 P. M., 2nd and 4th Monday of each month, K of C Hall, Tulip and Tyson Sts., Philadelphia. Chairman: Herbert Emrich, 2826 Garden Lane, Cornwell Heights, Pa.

PITTSBURGH CHAPTER meets 8:00 P.M., 1st Thursday of each month, 436 Forbes Ave., Pittsburgh. Chairman: Howard Tate, 615 Caryl Dr., Pittsburgh, Pennsylvania.

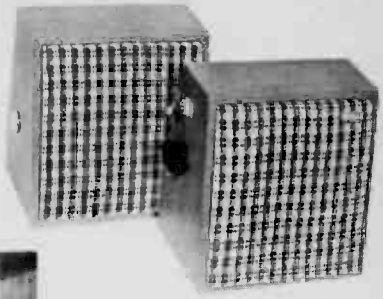
SAN ANTONIO ALAMO CHAPTER meets 7:30 P. M., 2nd and 4th Thursday of each month, National Cash Register Co., 436 S. Main Ave., San Antonio. Chairman: Thomas DuBose, 127 Harcourt, San Antonio.

SAN FRANCISCO CHAPTER meets 8:00 P.M., 1st Wednesday of each month, 147 Albion St., San Francisco. Chairman: E. J. Persau, 1224 Wayland St., San Francisco, Calif.

SOUTHEASTERN MASSACHUSETTS CHAPTER meets 8:00 P.M., last Wednesday of each month, home of John Alves, 57 Allen Blvd., Swansea, Mass. Chairman: Edward Bednarz, 184 Grinnel St., Fall River, Mass.

SPRINGFIELD (MASS.) CHAPTER meets 7:00 P.M., 1st Friday of each month, U.S. Army Hdqts. Building, 50 East St., Springfield, and on Saturday following 3rd Friday of each month at a member's shop. Chairman: Norman Charest, 43 Granville St., Springfield, Mass.

Fully Transistorized Intercom Kit



Save unnecessary steps with this easy-to-build Transistorized Intercom. A complete master station with remote speaker system. Uses 4 inexpensive penlight cells that last about a year with normal home use.

Safe, sensitive, economical - yet ruggedly built. Special circuit eliminates high-impedance hum. Remote speaker "buzzer" signals the master station - generally found only in systems costing much more. Build and install this system in homes, offices - ANYWHERE - for profit! Special 5% discount on all orders of 3 or more systems.

Kit Stock No. 292UK (5 lbs. parcel post)

SPECIFICATIONS

Speakers: 4" PM with 1-1/2 oz. magnet. Cabinets: size 6-1/8" × 6-1/4" × 4". Walnut pyroxylin covering. Master Station has "listen-talk" and "on-off" switch. Remote station buzzer for calling master station. Transistors: (3) 2N407. Push-pull output. Batteries: 4 penlight cells - included with kit. (Cable not included since length varies depending upon installation. Use any type hook-up wire.) All American Made Parts.

Price including batteries **$19.50**

- ORDER BLANK -

CONAR Instruments, 3939 Wisconsin Ave., Washington 16, D.C.

Please send me_____Fully Transistorized Intercom Kits, at $19.50 each.
(5% discount on orders of 3 or more), for which I enclose ..... $_____

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"SOLID STATE" CONVERSION DEVICE

SCHENECTADY, N.Y. -- A laboratory development expected to have important effect upon the application of new sources of electric power was disclosed recently by the General Electric Company.

The Company said its General Engineering Laboratory here was designed and successfully tested the first working model yet announced of a high-capacity "solid state" electronic device for converting direct current to alternating current.

With a rating of 50 KVA, the new inverter has 10 times the power-handling capacity of units of this type announced up to now. The inverter will help solve what has been a difficult problem in development work on new power sources. Electric power generated by such means as fuel cells and solar energy is always in the form of direct current. In most applications, on the other hand, this must be converted -- and at low cost -- into alternating current.

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, JULY 2, 1946 AND JUNE 11, 1960 (74 STAT. 208) SHOWING THE OWNERSHIP, MANAGEMENT AND CIRCULATION OF

NRI News, published bimonthly at Washington, D.C., for October 1, 1961.

1. The names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, National Radio Institute, 3939 Wisconsin Ave., N.W., Washington 16, D. C.

Editor, Theodore E. Rose, 3939 Wisconsin Ave., N. W., Washington 16, D. C.

Managing editor, None.

Business manager, None.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.)

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5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required by the act of June 11, 1960 to be included in all statements regardless of frequency of issue.) 51,322.

NATIONAL RADIO INSTITUTE
H. E. Luber, Ex. Vice-Pres.

Sworn to and subscribed before me this 12th day of September 12, 1961.

Charles Alexander, Notary Public
(My commission expires January 14, 1964.)

"WHAT I NEED MOST IS SOMETHING TO MAKE ME DO WHAT I CAN," the renowned poet and essayist Ralph Waldo Emerson once said. Although he may not have intended it as such, Mr. Emerson was really defining an important function of friendship.

One of the most rewarding experiences you can have is to be that "something" for somebody—to be that motivating force that triggered energy—brought out the best in someone you know.

Thousands of NRI men have found an extremely rewarding method of accomplishing this—a way to help a friend. That is, by *encouraging others* to train for the same success they themselves are enjoying or are working toward. It's not difficult for most of us to recognize the ever-growing need and opportunity for those with technical training—"know-how"—in the fast-moving field of Electronics.

But it's only human nature for many a man to sit back, daydream, *wait* for opportunity to fall in their laps. Often all that's needed is a few words of encouragement, a BOOST from a friend, to snap a fellow back into reality and DO THINGS!

Since you first enrolled with NRI, chances are some of your friends, relatives, or co-workers have expressed some interest in Electronics. It may have been just a passing remark or profound curiosity in watching you tackle a servicing job or kit experiment.

If your friend is not set—satisfied with his present work, perhaps some specific information and a bit of urging from us—*could* be the turning point in his career —a step toward increased income, greater personal contentment, security for himself and his family in the years ahead.

You can do your part—easily—simply. Just send me your friend's name and address. If you don't have one of our regular "Booster" cards, just a short note will do. I'll send him an NRI catalog—won't use your name. But be sure to note your name so you'll get credit for your friend's enrollment.

For each enrollment, you'll earn a cash reward—and equally important—the satisfaction and self-pride in knowing you've helped a friend to help himself. And—you'll have made a big contribution toward NRI's continued growth and leadership as the oldest, largest, "pioneer," Radio-TV home-study school.

J. M. Smith
President

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