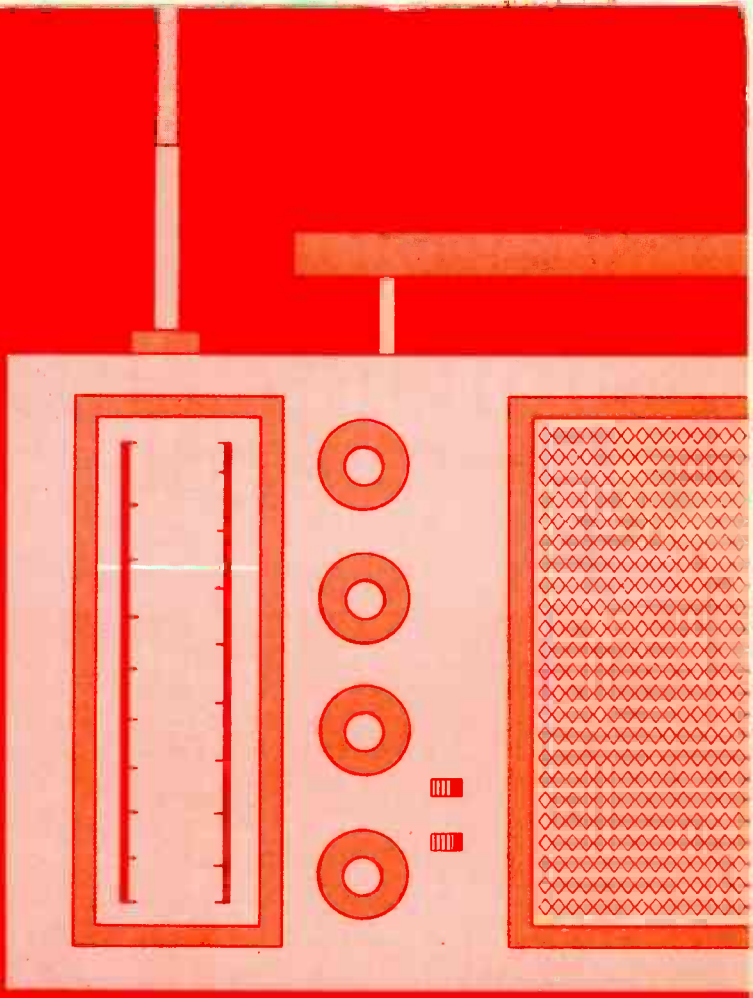

- You Can Still Benefit From Radio Servicing
- More Adventures in TV Servicing

journal

January/February 1977

Last year the thoughts expressed below brought forth an unusually warm response from NRI students and graduates. Since I doubt if I can say it better, I'm again wishing you personal happiness for 1977 in my different kind of New Year's greeting.

—J.F.T.

Your New Year's Message from the President

This is a different kind of New Year's greeting.

Instead of urging you to try harder

For a better job . . .
for increased earnings . . .
for prestige and power . . .

I simply want to wish you
personal happiness during the New Year.

For if a man isn't inwardly happy, if he isn't
at peace with himself,
any other kind of success can be
meaningless and empty.

There is no guarantee that material things—money, success,
friends, and possessions—will make you happy.

But there IS reasonable certainty that anyone who
lives a well-rounded life, keeps his mind attuned to learning,
and who strives for self-improvement,
will not only find a good measure of personal happiness,
but will, in all probability,
enjoy some of the material benefits as well.

They go together . . .
. . . like your enthusiasm,
the close friendships I have had with many of you,
and—your loyalty.

Please continue to visit with us,
to give us your suggestions and ideas . . .
to work with us to make your NRI training the very best
For you.

Then
we'll both be happy.

President
National Radio Institute

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January/February 1977
Volume 35, No. 1

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In this issue, NRI graduate Steven Williams shows us how we can still find profit in radio servicing, and J. B. Straughn, that wily old NRI campaigner, adds yet another saga to his continuing epic of practical on-the-bench television servicing case histories for your amusement and edification.

The NRI Journal is published bimonthly by the National Radio Institute, a division of the McGraw-Hill Continuing Education Center, 3939 Wisconsin Avenue, Washington, D.C. 20016. The subscription price is two dollars yearly or 35 cents per single copy. Second-class postage is paid at Washington, D.C.

It was all Radio in the old days...

...and you can still make money in

Radio Servicing

by Steven L. Williams

The cartoons used to illustrate this article first appeared in the January/February 1927 issue of The NRI News and elsewhere.

Like many other NRI students, I began fixing radios for friends and neighbors shortly after beginning my Radio-TV servicing course. Then, as I progressed through the course, I went on to TV work as well. Shortly after finishing my course, I was hired as a full-time bench technician in the service department of the largest TV retailer in the city. Later I went into other branches of electronics such as test instruments and telephone equipment, and — thanks to NRI's Communications Course — I also qualified for a job as a technical writer for a company that makes communications gear. I now write technical manuals for a manufacturer of sophisticated test instruments for the television broadcasting industry.

Throughout my career in electronics, however, I never lost my original fondness for fixing radios and TV's. I've even had my own part-time TV repair business, operating out of our spare room at home. But as time went by and both my responsibilities and my family kept growing, I finally had to give it up for lack of time and working space.

Of course, in order to operate a TV repair shop properly, you need a certain minimum working area for equipment, spares, and whatever chassis you have lugged home to fix. You also need a reasonable amount of time so you can make house calls fairly soon after your customers phone. (According to a recent study made at MIT, we can expect more and more of our TV repair jobs to be carry-in business, especially as the sale of table and portable models now predominates over console sales. This will naturally demand more shop space.)

At any rate, I had decided to close shop and started selling off my test equipment and parts stock, certain that I'd never go back into business again.

BACK TO RADIOS

Well, as we all know, an old love dies hard. So, after a few years, I started thinking about repairing radios again. Now in my area most TV shops traditionally scorn radio repairing as unprofitable. This is true to an extent: most people just can't understand that a $29 radio could ever cost as much as $10 to repair. On the other hand, most portable radio faults are easy to diagnose and repair; more often than not it's only a broken wire or a cracked printed circuit board. Portables are just naturally prone to faults like that because of the rough handling they get.

With the above in mind, I began encouraging friends and acquaintances to bring their radios to me for repairs. This system has several advantages for me:

1. House calls are extremely rare.
2. People don't mind waiting several days for their radios, until I can fit them into my schedule.
3. Radios don't take up nearly as much room as TV's.

This last point was pretty important because by then our "spare" room was getting pretty well filled up with kids, and the only space I could manage to find was in a tiny corner of our bedroom.

As I mentioned earlier, repairing portables is not as lucrative as TV's. On the other hand, if you do a good job on these

The Office Pup *says—*

little sets, your customers will come back with their more expensive systems. Also, this time they're much more willing to pay a decent price for a professional job. And even the big stereo sets don't take up as much room as a TV set. All things considered, repairing radios alone will hardly bring you the same income as color TV work. But as a sideline, or just to get started, it's particularly well-suited for an NRI student and can often be just as challenging as TV work. This is especially true if you later get into FM stereo and hi-fi equipment, which is also better paying.

BASIC EQUIPMENT AND A WORD ON ALIGNMENT

My first thought was what test equipment to get. I had sold most of my instruments by then, so what would I need to buy in order to get started in the radio trade? Naturally, you don't need as much equipment as you would to start up doing TV repairing. Anyway, the following considerations might serve as a guide for any of you who are thinking about going into receiver servicing yourselves.

The single instrument basic to all electronics work is of course the vtvm or tvom. Your Conar Model 212 tvom will do well by you for a long time to come, until you need to take some special measurements such as current readings or decibels. An ordinary 20-kilohms/volt vom will also do for most transistor measurements, but is less suitable for the older vacuum-tube radios.

My next most used instrument is my trusty signal tracer. Since almost every radio sold in these parts of the woods features AM reception on several bands plus FM, I needed an untuned signal tracer.

With these two instruments and a good portion of cause-to-effect reasoning, you can take on most radio repair jobs. But if you don't live in an area where you can pick up several strong stations spread well across the dial on each waveband, you can't really test the finished job without a signal generator. And I can't tell you just how important it is to thoroughly check the performance of every receiver before you pronounce the job finished. So as soon as your business volume allows, get a signal generator. Even with strong stations to rely on, you'll still be spending anxious moments worrying about whether or not you got the intermediate frequency tuned correctly. You just won't get any peace of mind until you finally do break down and buy an adequate signal generator.

What I have said about alignment is even more true if you do any amount of FM work at all. You'll find that the i-f coils and especially the discriminator will need touching up rather more frequently than you might be used to with AM circuits. This is probably mostly due to the greater expectations we all have for FM reception; we listen more critically to an FM set. And don't forget that a slight misalignment that could go unnoticed in a mono FM receiver might be intolerable in a stereo tuner.

Thus, we come upon the fascinating subject of aligning FM stereo receivers. We won't have room here to go into details, but here are a few words to the wise.

Now you may be quite a pro, able to align AM radios against a few received stations with nothing other than a trimming tool, a meter, and your practiced ear. You may even have done a lot of i-f coil peaking in mono FM receivers using the same method. But don't ever touch a stereo decoder unless you have an accurate stereo generator and a scope. Otherwise, you're just begging for all kinds of trouble. All the things you could do wrong in a stereo decoder would be enough to make an interesting article in itself.

INCREASING YOUR FACILITIES

Now we come to a turning point in our little radio repair business. Should we invest in stereo test equipment (and perhaps a little book-learning) or should we stick to simpler sets? Well, how many TV specialists do you know who can survive on monochrome work alone? If you're going to be an expert in audio systems – and survive – you will have to be prepared to do FM, stereo, and even quadraphonic work, as well.

You can imagine how crowded my bedroom is beginning to look. And, as I tried to explain to my wife, what good is a stereo generator if you don't have a scope to see what you're doing?

After a long, hard look at my bank account I decided on a Heathkit IG-37 FM stereo generator, which I bought in kit form and assembled over a weekend. It gives me a composite stereo signal with every test necessary to align stereo decoders, plus a frequency-modulated rf signal, plus a sweep generator with a 10.7-MHz crystal marker, plus several audio-frequency sine waves, and even the SCA frequencies.

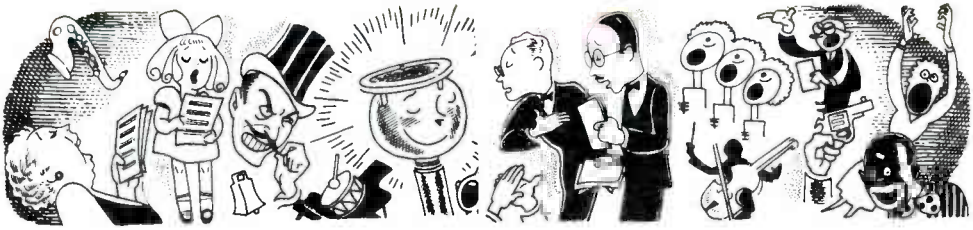
For a scope, I recommend that you get a good one right from the start, like the Conar Model 255 solid-state oscilloscope, for example.

But, to be honest, a scope that will only be used for audio work doesn't have to be nearly as good as the Conar Model 255. The highest frequency signal you will ever have to peek at is normally the 38-kHz subcarrier, and occasionally you might want to adjust the 65-67-kHz SCA trap. For sweep alignment of the i-f stages, or for just poking around in these stages, you'll need a demodulator probe on your scope. However, the demodulated signals that actually reach the input jack of your scope will still only be in the audio range, plus the 19-kHz pilot signal.

Therefore, a simple scope will start you in audio work. However, here are some words of advice. First, keep in mind that stable triggering on composite stereo signals can be a problem with cheap scopes (even on rather good ones it can be hard to judge things like the phase and level of the 19-kHz pilot signal because of trigger jitter). Second, some day you're just bound to do some TV work, so if you can possibly afford it, buy a good scope right from the start.

Really sophisticated (and expensive) instruments, such as those required for doing serious hi-fi servicing, are beyond the range of the present article.

Maybe it would help at this point to summarize the instruments that I feel belong in any technically competent



radio shop. I've listed them in the same order I'd recommend that you acquire them:

1. TVOM or equivalent
2. Signal tracer
3. Signal generator
4. Transistor tester
5. Stereo generator and oscilloscope
6. Variable power supply
7. Test speakers

Some of you may not agree with my priorities, which quite naturally reflect my personal preferences. For instance, I placed a transistor tester fourth on the list, ahead of the stereo generator and scope. Actually, there are several alternate ways of testing transistors, as we learned in our NRI courses. But I have found that after I started to use a transistor tester, I have a lot more confidence in my test results, and a good transistor tester doesn't have to cost much. By the time that you have acquired the first three instruments on the list, your business volume will probably soon enable you to pay for an inexpensive tester, too.

By the same token, some of you older fellows will complain that I didn't include a tube tester in my list, and there are still a lot of tube-type radios in use. To tell the truth, I've never used a tube tester in my life. Everywhere I've worked, we always relied on tube substitution. Most radio chassis use the same tube line-up, so it's always been easier and cheaper for me just to have one of each on my shelf.

The sixth item on my list is a power supply. In the old days, they were called battery eliminators, and that's just what they are. You determine the battery voltage required for the job, remove the batteries, and adjust your power supply output voltage accordingly. The set runs off the power supply while you repair it. You don't waste your own fresh batteries and—most important—you don't introduce any faults due to weak batteries.

Once I repaired a radio for a specific complaint and tested it. It sounded all right at normal volume. At high volume it sounded a little distorted, but I figured that it was only straining its batteries. The set came right back again with a new complaint, which I fixed free of charge. A connection to one side of a push-pull transformer showed up to be open (so this time the call-back only cost me my time). But if I had used a power supply instead of batteries, I would have taken notice of the high-volume distortion right away.

The seventh item, test speakers, is a luxury. That's why it's last. I get by with a couple of 5-ohm resistors and the speaker in my signal tracer. But I always have to complete every stereo job with a critical listening test on my living room speakers. Also, you won't be able to completely eliminate channel crosstalk in most receivers. What looks like the best compromise adjustment on your scope is not necessarily true according to your ear. So I

always try to listen too, when I set the separation pot. This is awkward to do with only one test speaker. One day, when my volume allows, I will have to install a set of speakers over my bench.

(By now you have certainly guessed that I don't make much profit out of my repair business; I plow it all back into test equipment. That, however, is exactly how you build up a service shop.)

SOME HARD CASES

So far, I have told why and how I got started in the radio repair business. Now it is time to tell something about what happened to me once I got going.

Maybe there's something wrong with me, but I seem to be a magnet for two special categories of tough jobs: strange foreign sets with no available service information or diagrams, and sets that other shops have either turned down, given up, or just did a bad job on. Beginners in the business may tend to get more of this kind of work, I think, because after bad repair experiences, people are nearly desperate and figure that they have nothing to lose by bringing their troubles to you.

Let's take the first case. Ask any technician how it feels to tackle an unknown chassis without a diagram. Here is where radios are indisputably friendlier than TV's. Any day! It's a lot easier to find your way around in an unfamiliar radio than a TV, and time lost playing hide-and-seek with components is lost money. Fortunately, most of the faults in my mysterious portables have either been in the audio section where tracing out circuitry is easiest (if you can call that easy), or else they had power supply faults. This applies to sets designed to work on batteries as well as on house current. And most of these troubles have up to now been due to faulty transistors. Now, do you see why I love my little transistor tester?

Don't get me wrong, however. I do not advocate repairing electronic equipment without referring to the appropriate service literature whenever at all possible. That would be a foolish habit to fall into. It wastes your valuable time and there is always the very real danger of overlooking an important point like the correct bias adjustment of output transistors, or the proper setting of a stabilized dc voltage. Nevertheless, sometimes you will be called upon to work on sets where such information is not available. When you have gained enough experience, you should be able to judge just how much you can safely do without a diagram. Anyway, you can always tell your customer that you're willing to look at the radio, but it's not certain that you can get service information, or parts, or both. In any case, don't give up before trying NRI's diagram service.

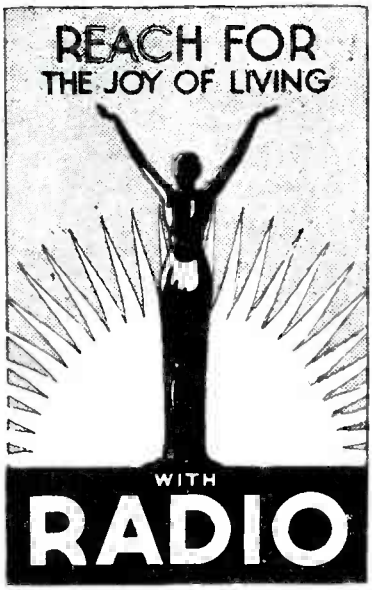
As far as the hand-me-down jobs go, they give good training, but the hard way. They are frequently complicated not only by the difficult nature of the original fault, but may also have acquired the added charm of earlier, devious attempts to repair the fault. Right now, I'd better pass on a tip. Before starting any job,

take the time to ask the customer if there has been any other trouble or if there has been anything else wrong with the set in the past. This way, you get the service history of the set and possibly some good clues to the trouble. You're not as likely to overlook anything, and your customer will be impressed by your thoroughness and concern.

SOME TYPICAL JOBS

The simplest looking jobs can turn out to be the toughest, so watch out when your customer asks for an estimate.

Take a broken telescope antenna, for instance. They're easy to replace, but first you have to find a replacement that fits. Once found, it could be so expensive that your customer will think you are a liar. Always be careful to explain the expense ahead of time so there won't be any hard feelings afterwards. More than once, I have had to pay over $9 for a little telescope antenna wholesale.



I have found most faults causing weak or distorted sound are due to bad transistors or dried-up electrolytic coupling capacitors in the audio stages. Noise is seldom caused by passive components any more since the high voltages and heat that used to break down resistors and capacitors in the old tube sets are not found in transistor radios. Nearly all of my noise troubles are caused by intermittent connections on the PCB. Or else they can be cleared up by spraying a good quality contact cleaner into the volume control. Once in a while, the pivot bearings of the tuning capacitor might need the same treatment, too. But don't splash between the rotor and stator blades!

The i-f section seldom gives much trouble. Most faults in the rf section (aside from cracked PCB's) have turned out to be weak or dead local oscillator transistors or bad diodes in the oscillator circuit. I always try to isolate the faulty stage with my signal tracer before I make any actual voltage measurements. By the way, my signal tracer, although designed for AM, can usually pick off an FM signal well enough for me to judge its quality. It may sound a bit distorted, but now that I have tried it often enough, it gives me a good indication of the performance of the stage under test.

The newest item I am beginning to service is radio recorders. I invested in a test tape that gives a constant sine wave output and also marks 100-second intervals. If I didn't have the test tape, it would be impossible to adjust the tape speed properly. Cassette recorders often require a number of mechanical adjustments. Even though these are simple enough to make, they cannot be guessed at; you will need the correct service information in order to do a professional job.

BUSINESS CONSIDERATIONS

This has been an (incomplete) account of my experiences since making the decision to move into spare-time radio servicing. I have been doing only a low volume of trade, never more than two or three sets in any week, and often none at all for a week or two. For reasons

explained at the beginning of this article, I have not tried for more business. This is about the amount of work you might expect to be doing when you first start part-timing. Unless you affiliate with a retailer, a repair shop based solely on radio work is not likely to grow big very fast. The way I have been consistently reinvesting all my earnings into test gear, my business is so far merely an interesting hobby that just about pays for itself. Of course, once I have all the equipment I need, it will begin to show a profit, and how many people do you know who get paid for enjoying themselves?

With such a small business turnover, you will also find that merely obtaining the spare parts you need seems to take up more time and cause you more headaches than the actual repair work. I'm lucky because during my lunch hour, I can buy almost any component I need near my regular job with no long delays. Whatever your particular situation is, try to arrange your parts shopping as painlessly as possible, otherwise that alone could take all the fun out of the work. Your NRI credentials should be helpful when you contact your local wholesalers.

Others may have had different experiences than what I have related here, especially technicians who do much greater volumes of work. This article was only meant as a suggestion to those who likewise do not have the time or facilities to handle TV repairs, or for new students who are not yet technically capable of it.

Specializing in radio/audio work does present an alternative. Again, according to the MIT study mentioned in the beginning of this article, an increasing demand for technicians in fields other than TV is likely, and servicing audio systems is named as one of those likely fields. Here, too, is a market for your skills. Or a stepping stone on your way to independence.

Helpful Hints 8

No electronics technician's toolbox is complete until it contains a desoldering tool. Two types are shown below. With this tool, you can remove molten solder from circuit boards or terminals. And once you're used it, you'll wonder how you ever did without it. It works on the vacuum principle. The molten solder is sucked away from the connection or terminal through a hole in one end of the tool. Depressing the plunger loads the tool for reuse and discharges the hardened solder which was removed from the connection. For your convenience, the two models shown are available from Conar, and I highly recommend them. I use the deluxe model at work and I carry the standard model in my own toolbox. However, I am sure you can purchase similar versions from your local electronics wholesaler.

James D. Crudup

DeLuxe Model

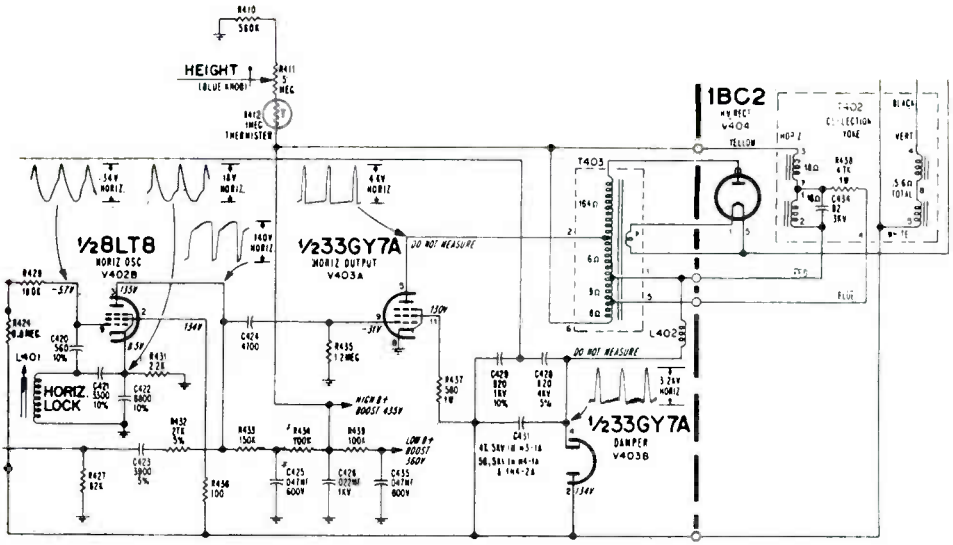
Standard Model

More

Adventures in TV Servicing

J.B. Straughn

This was an Admiral Model H3-1A, an old 19-inch black-and-white portable, and I wish I had $5 for each one I have fixed. It really is an excellent receiver and when working properly gives a fine picture with good sensitivity. This one came in with the complaint of no raster. Generally this trouble is caused by either a defective 33GY7 or a bad horizontal oscillator tube — 8LT8. I replaced both tubes and the raster came on with good sound. I charged the owner $15 as he has hauled cattle to market for me at a reasonable price. Two days later the set was back with the same complaint. Obviously there was an intermittent of



Courtesy Howard W. Sams

FIGURE 1. HORIZONTAL CIRCUIT OF ADMIRAL H3-1A.

some sort. I pulled the chassis and started checking voltages.

The drive voltage on pin 9 of the 33GY7 was about −6 volts instead of the normal −32 volts. This meant that the oscillator was not working properly. I had run into similar trouble before and usually found that it was due to a short in one of the tank circuit capacitors C421 and C422 in Figure 1. I disconnected both capacitors and found them to be okay. Also, the oscillator coil L14 was not open. I checked the resistance from pin 4 of 33GY7 to the chassis. It should have measured around 5 megohms (due to the presence of the vertical height control in the circuit). Instead, it measured around 300,000 ohms. I had also run into this before and had found a partial short to exist from the horizontal to the vertical sections of the yoke. I opened the vertical leads and the low resistance was still present. I decided there might be a breakdown in one of the capacitors in the boost circuit, so I cut one lead of C425, C426, C435, C431, C428, and C429. All leads were cut so they could be easily resoldered. All checked okay with the ohmmeter, so I went over the circuit board looking for a leakage path and rosin joints.

I tried the set and this time it took off and played fine. After a while it began to lose horizontal sync and it became nearly impossible to bring the horizontal back into sync with the sync control. I hit the chassis and the set recovered. I discovered that by rapping the yoke with a screwdriver handle, the trouble would come and go. I concluded that the yoke must be intermittently shorting so I bought a replacement. When I removed the old yoke leads so I could switch them to the new yoke, I still had a reading of 300,000 ohms. Therefore, I knew the trouble was not in the yoke. Luckily, I had not done any lead cutting or unsoldering on the new yoke so I could return it for credit.

I could easily find C425 and found that the resistance from its ungrounded end to the chassis was a little more than from pin 3 of the 8LT8 to the chassis.

This time I looked closely at the schematic and decided that C423 must be leaky. I found this capacitor, of all places, on the underside of the circuit board. I disconnected one lead and found with my ohmmeter that the capacitor was shorted and had evidently been doing so intermittently. Replacing C423 with another 0.0039-μf unit cleared the trouble up for keeps. I looked around for the two tubes I had replaced as I suspected there was nothing wrong with them. They must have been thrown out since I never did find them. Because of this, I didn't feel an additional charge was justified so I made none.

This all goes to show that sometimes experience may be misleading, and if I had not known so much about this particular set I would not have gone off in so many directions at the same time. As they say, a little knowledge is a dangerous thing and this time a lot of knowledge was just as bad.

I had another silly thing happen the other day with an RCA color set in which I had just replaced the horizontal output transformer. Everything was just right and when I fired up the set, I got a raster with some sound but no picture. I checked and messed around until I found out the customer had turned the adjustments on the back of the set. The one at the bottom of my trouble was the service switch. There are two service positions and a normal position. In one service position, the raster is reduced to a thin horizontal line so you can set the red, blue, and green screens to produce a white line. The other position just gives a raster so you can check purity and adjust the green and blue drives for a good white raster. You guessed it – the service switch was in the raster position. Moving the switch to normal restored both the picture and my faith in myself.

I had a bad scare while servicing a Silvertone for poor vertical sync. With the back removed, the circuit board sat on the work bench. While working on the set, I had occasion to lay it on its face. When I sat it upright and turned on the power, there was a flash and the fuse in the receiver blew. I thought that I had put the set down on a screwdriver, but no such thing. There was a pack of cigarettes under the chassis and two projecting points of the chassis had pierced the package and shorted through the foil inside the pack. No real damage done to the set outside of the fuse, but three of the cigarettes had holes burned in them! What I need is a real work bench – a desk top is just not big enough for TV servicing.

TAN AND WHITE 19-INCH ADMIRAL RECEIVERS

It looks like this is my time for the 19-inch Admiral receivers as I just had two more come in within a few days of each other. At the risk of undue set repetition, I am bringing them into this story as I hope you will find my experiences with them (mostly what not to do) of some value.

One set was in a tan cabinet and the other was white, so for simplicity we will call them the tan set and the white set.

Someone had butchered the white set, which was completely dead. When I opened the back, the high-voltage rectifier was lying on top of the plastic flyback housing instead of sitting upright in its own plastic sheath. A bracket which was supposed to mount the antenna terminal strip and the filter choke for the low-voltage power supply was missing from the rear of the vhf tuner. The leads which went to the filter choke were chopped off and sticking up in the air from the printed circuit board. Ordinarily, I wouldn't have touched the set but I had trapped myself, as a few days before, the owner had shown up with the

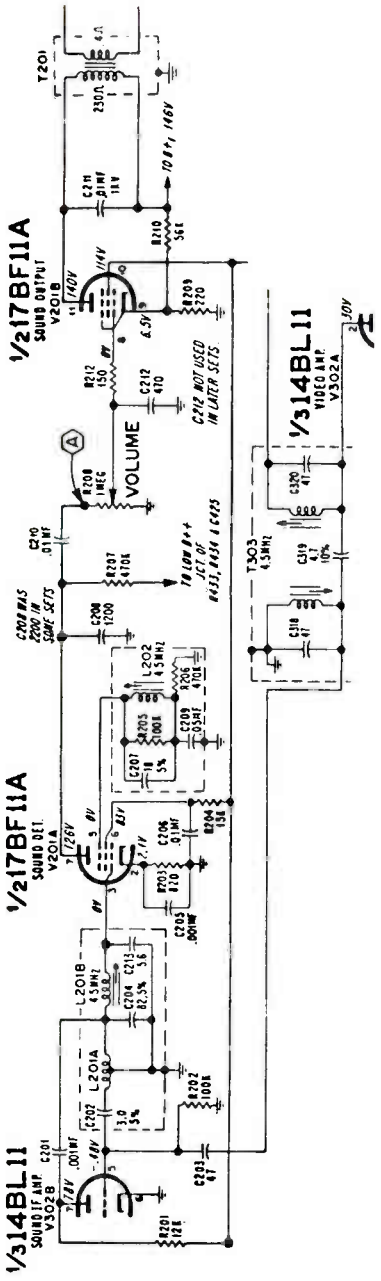


FIGURE 2. SOUND CIRCUITS OF 19-INCH ADMIRAL.

Courtesy Howard W. Sams

high-voltage rectifier and wanted to buy a new one. He said someone was working on the set and that's all he needed. I tested the tube and found it to be okay. I told him if he had brought the set to me I could have fixed it easily. So when he showed up later, what else could I do but make my brag good?

The set was a challenge, but I put it aside for the time being. A few days later, the tan set came in — the complaint was no sound, and it needed a rabbit ear and a uhf loop antenna plus an antenna terminal strip. When I put it on the bench I saw that the picture tube was leaning inward from the top of the cabinet — the set must have fallen from its stand to the floor on its back and in so doing broke the plastic picture-tube mounting tabs inside the cabinet. Since it was about time to buy a new soldering-iron tip anyway, I removed the chassis and picture tube and tacked the broken tabs in place by melting them and the cabinet together at a couple of places with my soldering-iron tip. I then strengthened the joints by melting bare hook-up wire pieces over the breaks and into the tabs and cabinet. This is easy to do and the tabs are then as good as new. I put the picture tube back in, with the original screws through the mounting holes in the outside rim of the picture tube and into the holes in the mounting tabs. I hooked up the set without fastening it into the cabinet. With power applied, the set showed both good picture and sound!

After about half an hour, the sound became an unintelligible roar. I tried adjusting the quadrature coil in the sound detector as I thought it might have drifted in frequency (see Figure 2). The core was frozen in its form and could not be turned. I immediately concluded that the quadrature coil was at fault. I called the distributor in Atlanta and ordered a new coil for the tan set and for the white set a new mounting bracket, a plastic holder for the high-voltage rectifier tube,

a filter choke, and a high-voltage anode lead (also whacked up). I was told there were no brackets of any kind available, so in a moment of pique I canceled the filter choke. When the shipment arrived, it contained only the quadrature coil — the other parts were back-ordered. I should have canceled them then, but I didn't get around to it. Over the next two weeks they came in separately with big UPS shipping and COD charges.

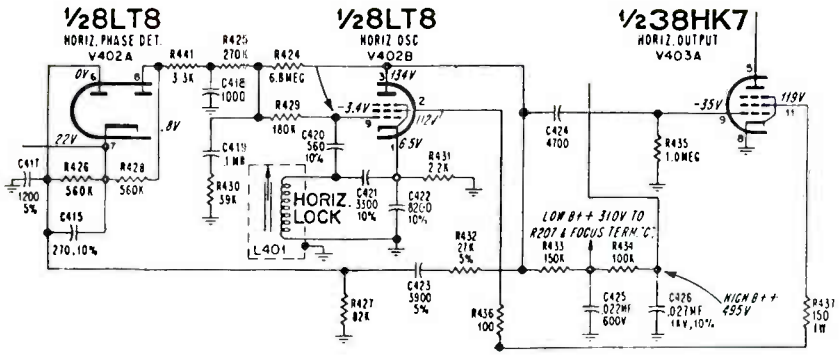
One fine morning, when I had the day off from my regular job, I decided to get with it and kill two birds with one stone. I put the quadrature coil in the tan set (these come prealigned) with the results the same as before. I started checking and found a very high negative voltage on the control grid of the 14BL11, used as the sound i-f amplifier. This is the triode section of the tube and the high negative voltage showed the tube was oscillating. It is supposed to be neutralized by feedback through capacitor C202.

I suspected an open in the feedback network, probably the coil. This proved to be true when the coil was removed. The wire from the center tap of L201 was open, having broken near the coil lug. The wire, after having been scraped bare with my pocket knife, wouldn't reach the lug. However, it did reach the grounded lead of C213 which is mounted on the coil inside the shield can and not outside as shown. Since the broken wire was supposed to go to this grounded lug anyway, I just soldered it to the capacitor lead. I put everything back together and the set now worked okay. There must not have been any play at all in the coil lead and the impact of the set falling to the floor snapped it.

Next, I decided to fix the white set, so I got out the filter choke I had purchased locally and installed it, letting it dangle for the time being. When the set was turned on, there was no supply voltage except for the tube filaments. I checked the fusible resistor and found it was okay and that it was a replacement. I located the diode rectifier and found it to be shorted. I decided to see why the 5.5-ohm fusible resistor hadn't opened due to the excess current drawn by the shorted diode. I found that the printed circuit between the diode and fusible resistor was missing. I repaired this with a piece of bare hook-up wire. Now voltage was present in the B supply and a good picture showed up but the sound was just a howling noise. I tried adjusting the quadrature coil with no luck. Then I tried adjusting the i-f transformers. None of this helped so I went into the circuitry. I found a loose connection at pin 6 of the 17BF11 and then noted that a 5.6-pf capacitor had been wired from pin 3 of the 17BF11 to ground. I knew that this capacitor was mounted on the coil form, inside the coil shield, even if it is shown outside the shield in the schematic.

I suspect the previous technician had installed it as a last resort when there seemed to be no other way to clear up the sound problem. If I had removed the capacitor and fixed the poor connection at pin 6 to start with, I firmly believe the sound would have been okay, or at least adjusted easily. As it was, I had gotten the coils so far out of adjustment that a signal generator would have been required to put them back in proper alignment.

I don't have a signal generator, so what to do? I could order a whole set of new prealigned coils; I could borrow a signal generator; or I could think about it for a while. I chose the latter course and decided that I had a properly aligned set of coils in the tan set so I could switch them one at a time to the white set, adjusting each switched white coil in the tan set to get good audio. With only one coil out of adjustment this would be easy. So, I took the interstage i-f coil I had fixed out of the tan set. In the process, one of its lugs came off the plastic coil form and remained in the printed circuit board! Of course, the coil lead to it broke



Courtesy Howard W. Sams

FIGURE 3. HORIZONTAL OSCILLATOR AND AFC OF 19-INCH ADMIRAL.

off. I got the lug out of the circuit board, and pressed it back into the coil form with the soldering iron. I could then solder the wire back to the lug.

Then I went to get the same coil from the white set and found that it had been removed before and that its lugs had been cut flush with the bottom of the circuit board where they came through. With considerable difficulty, I got the coil installed in the tan set. I was rewarded with a very weak audio signal which after adjusting the coil, became a good sound signal.

About this time, I heard my cow herd bawling for something to eat. It was now 3 p.m. and they should have been fed around 9. My son, Will, had gone deer hunting so I loaded the pickup truck with ten bales of hay (60 pounds each) and was glad it wasn't 15 bales because when it comes to stacking them three high on a truck I give out. Sixty pounds gets heavier every year or so it seems. The cows were highly appreciative. (As *you* should be when they appear as steaks and hamburger on your table!)

I went back to the white set refreshed mentally. I decided I would go over the circuit board with a hot soldering iron to take care of any more loose joints. At this point, I decided that all of this transformer replacement was for the birds and a lot of unnecessary work for a lazy guy like me. I decided instead to measure the depth of each slug in the coil forms of the tan set and adjust the slugs in each coil of the white set to the same depth. I don't know why I didn't think of this before, as all the coils will then be at about the same frequency.

When the set was heating up, it gave a pretty good sound but as soon as the high voltage started to come up (the horizontal oscillator started to work) the good sound went out and was replaced by a horrible throbbing noise. Also, the horizontal was out of sync and couldn't be made to hold. Point-to-point resistance measurements showed around 5 megohms or so from pin 6 of the 8LT8 to ground (see Figure 3). I disconnected one lead of C423 (under the circuit board) to get at the part of the circuit board in question and found that R427 was okay and not open but that the circuit board from it to ground was open. In going over the board to correct bad joints, I made one instead. I installed a wire in place of the damaged foil and turned the set on.

The horizontal sync was better but not usable. The picture slowly drifted from side to side and could not be made to hold – just as though the horizontal afc

were not working.

At this time, I took off to watch the rest of the afternoon football game. Just after a touchdown and a blocked field goal attempt by the Bengals, I remembered C423. Had I or had I not resoldered it? I had not, and with this capacitor back in the circuit, I got a good stable picture and weak undistorted sound. I adjusted each sound coil (except the quadrature) for maximum sound. Then the quadrature coil adjustment brought the sound to normal. The hard part of the job was now done, except for mounting the choke by bolting it to the bottom of the cabinet, installing a new rabbit ear, a new uhf loop, and a new antenna terminal strip.

I decided to mount the strip on the side of the cabinet, near the tuners. I had to poke holes with my soldering iron tip, which by now was ruined, in the side of the cabinet to accommodate the lugs on the back of the strip. I bent these over so they would hold the strip in place. Next, I ran leads from the tuners to the terminal strip lugs and the job was at last finished.

I felt more or less pleased with myself but couldn't charge enough for my labor. I let the tan and white sets go at $35 each. Still, $70 for a day's work isn't so bad when most of it is profit.

RCA CTC 38

I have worked on this color set on several occasions. This time it came in with the complaint of sound and raster but no picture. The sound was not too strong so I decided the trouble must be in the video i-f section. I went to the distributor and ordered new transistors for the video section. He tried to sell me original replacement transistors. I looked them over and there was nothing to identify which leads were the case ground, the base, the emitter, or the collector. The Sam's manual (electronic equipment manuals produced by the Howard Sams Company) neglected to make this identification so instead I bought RCA "SK" type transistors listed in Sams as being suitable replacements and with the leads identified by RCA. I removed the old transistors and found that the leads of the SK transistors did not correspond to those of the old units. It would have been necessary to do a lot of crisscrossing to get them through the proper holes in the circuit board. Instead, I put them under the board, soldering the leads right to the foil.

The results were lousy – poor picture and bad vertical and horizontal sync. I searched and searched to no avail, and finally decided I should have used the exact replacements to start with. I went back to the wholesaler and got the right units. Next, I had the distributor drag out the factory manual so I could carefully copy the pictorials showing the lead arrangements. I cleaned out the tiny holes in the circuit board and inserted the leads through their proper holes in the board so the transistors were on top of the board instead of on the bottom.

The set now worked fine – don't ask me why. Perhaps there were slight differences in the transistors or the change in lead length or positioning was the reason. In any event, when exact transistor replacements are available, use them, and don't take the easy way of putting them on the botton of a circuit board. Live and learn – I guess.

HAM NEWS

By Ted Beach K4MKX

Well, we have lots of interesting letters to go over this time, so I won't spend too much time telling you of my most recent adventures. Just to clear up a few items mentioned previously, I have fixed the Wilson, and it is working fine-business now. Turns out that the final transistor was *not* bad, but the switching diodes were. This problem was ultimately solved by eliminating one of the two diodes (replaced by a short circuit) and replacing the second with the base-emitter junction of a good, high-speed switching transistor. I thought at first this modification might hurt receiver sensitivity, but there is no apparent difference (I haven't run any actual measurements). As an added bonus, I now get 2.25 watts out instead of 2.2 watts with the one diode out of the circuit (whoopee!).

The Genave was repaired and has been sold to NRI's most recent convert to amateur radio, Development Engineer Ken Bigelow, who at the same sitting passed both the Technician exam and the commercial First Class Radiotelephone test. How about that one? Ken had gotten the Second Class license a month earlier, so he didn't have to go through the whole ball of wax, but still, that is quite an accomplishment, and he is to be congratulated. We'll pass along his new call to you just as soon as the FCC gets the new ticket to him. From the looks of the new three-land calls, his will probably be WB3EX-something-or-other.

The FPM 300 has been neglected. In fact, our local radio club (Arlington, Virginia) is trying to get a 10-meter net going to pass along club information and such, and I have had to miss the first two sessions because of the rotten receiver. Right now, however, fixing this rig is low on my list of priorities. I have three other projects in various stages of "doing," and I find all three of these to be infinitely more interesting than repairing a dumb old transceiver.

Two of these projects deal with my KIM-1 microcomputer that I mentioned last time, and the third is the construction of a two-meter synthesizer, using low-power CMOS circuitry. This latter project is well along, and has been breadboarded and debugged already. I have the circuit board about half laid out, and most of the parts on hand or on order. Briefly, the unit will mate with any transceiver having an i-f between 10 MHz and 19 MHz, with no extra crystals to

buy, and has automatic offsets built in for simplex, and high or low repeater splits. The VCO will be directly modulated, and the circuit incorporates its own modulator-clipper-filter for a ceramic microphone. I started out to build the unit on a 2-1/2-by-5-inch circuit board, and even managed to get all the parts stuffed onto the small board. However, I decided to make it easy on myself and went through a re-layout process so now the circuit takes up most of a 5-by-6-inch circuit board. Still pretty small, all things considered.

I also have in the works (but much further down on my list of priorities) an add-on scanner that will scan from 146 MHz to 147 MHz (or 147 MHz to 147.995 MHz) and stop whenever a signal opens the squelch. Pushing a button will display the frequency selected in LEDs so you'll know where you are. Pushing another button will allow the scanning to resume. Also, I will be able to increment (or decrement) the frequency manually from the microphone by simply pressing another button. Like wow! We'll keep you posted on developments. The basic board should be finished by the time of the next Journal and I'll give you some more information on it then.

As I said, the other two projects are involved with my microcomputer, and I am finding both most interesting. The first project is to make the ASCII-speaking computer talk BAUDOT to a Model 15 Teletype® so that I can have hard copy data output. These machines, while old, large, and noisy, have one redeeming virtue – they are cheap (as I am!). I have written the program (subroutine) for the conversion, and have tested it as far as I can without actually having a machine to do the printing, and everything seems to work just fine. I am now in the process of negotiating for a machine (most of which are older than me), so in the very near future I should be able to get printouts from my computer.

The second computer project in the works is a video terminal. This unit of equipment is almost a necessity when working with a microcomputer, as it gives you an instant input from a keyboard and shows your results on an ordinary TV receiver. Again, I have passed up the possibility of buying a video terminal since they cost too much. I have investigated the methods used by several commercial manufacturers of terminals to make the things go, and can really see why they are so expensive. I think the least complex one that I looked at had over 85 integrated circuits!

I intend to take a somewhat different approach, and once again, let the computer do its thing. That is, I intend to build a microcomputer-controlled terminal instead of a hardware-controlled terminal. The computer will take care of such things as keyboard entry and decoding, sending out serial data to the *real* computer, receiving serial data, keeping track of which line is being displayed on the TV screen, controlling the cursor position, and generating sync and blanking signals for the video. By using a single IC (microprocessor) for most of the control, it looks like my proposed terminal will have fewer then 25 ICs in it. How about that? In addition, it will provide many features not usually found on similar machines, such as keyboard-selectable data rates (110 baud to 9600 baud). Software for this project should take quite a while, but I am starting on the hardware part as soon as the other two current projects are completed. We'll keep you posted in the coming months.

Now, let's see who we have heard from since last time. As you can see, there are quite a few. As usual, those listed first are students and graduates of NRI's amateur courses, while those listed last are other students and graduates.

Tom	WN1YRF	G*	Boston MA
Jack	WN1YYK	N	Agwam MA
Arthur	WN1ZMI	N	Willimantic CT
Jose	WN2GPS	N	Bronx NY
John	WN3DDR	N	College Park MD
Ed	WB3DLC	N	Silver Spring MD
James	WN4UGL	N	Great Lakes IL
Allen	WN4UTP	N	Jacksonville FL
Otho	WN4VCI	N	Vienna VA
Willis	WN4VIY	N	Decatur AL
Carl	W4VOX	A	Cullowhee NC
Ronnie	WB5PIW	T	Tyler TX
Neal	WN5SVM	N	Seadrift TX
Mike	WN5UVX	N	Shreveport LA
David	WN6KXH	N	Santa Rosa CA
John	WN6OAA	N	Loma Linda CA
Willice	WB6PWI	A*	San Diego CA
Bob	WB7DQB	—	Mossyrock WA
Mike	WN7WLM	A*	Reno NV
Sam	WD8BJP	N	Jolo WV
Charles	WB8UTC	T	Vandalia OH
Boynton	WN8CAL	N	Cincinnati OH
Bernard	WN8YXA	N	Richland MI
Ronald	WNØRRO	N	APO Seattle WA
Gerald	WNØSIT	N	Virginia MN
Jackie	WNØTMY	N	Braggadocio MO
Wendell	W1MAA	E	Melrose MA
Wayne	WA2UZW/1	T	Woodsville NH
James	WA6OFB	N	Visalia CA
Bill	WA6RUT	T	Chino CA
Dan	WB7BWN	G	Langley WA
Dennis	WB7EXZ	G*	Langley WA
Ralph	WD8CVO	T	Rogers OH

* Just upgraded — congratulations!

As you can see, a very lengthy list this time, and many of the people wrote very interesting notes for me to pass on to you.

WN1YRF is listed as General because Tom successfully passed the exam but so far has not received the new ticket. Tom works 80 and 15 using dipoles and an old Viking Challenger transmitter along with a Realistic (Radio Shack) DX160 receiver. He says that he is quite sure that it was his NRI training that made passing the General exam so "easy," and that he felt confident of his technical knowledge instead of relying on learning by rote from a Q and A manual. Thanks, Tom, it sure is nice to hear such words from you nice people.

I knew that the name Otho sounded familiar when I ran across it in going through my mail the other day. WN4VCI is a student who lives in nearby Vienna,

Virginia, and some weeks ago he called me on the phone to see if I could find a volunteer examiner to give him his Novice exam. I told him that I would be glad to do it for him, but that there was a very active bunch of hams in Vienna (Vienna Wireless Society) who he really should meet and get one of them to help out, just so he could get to know some of the "locals." I gave him a couple of names and then heard no more from him until I got a copy of his new ticket in the mail. Well done, Otho, and I trust that you now know some of the other guys in Vienna.

W4VOX writes that he has his code speed up to between 18 and 25 words per minute, and needs just a little more studying to try for the Extra exam. At present, Carl is busy trying to get a local group together to form a club, and is teaching Novice classes to some of the newcomers. Fine business, Carl, and I know it won't be too long before you go again for that Extra. Good luck.

WN7WLM wrote us back in 1975 that he was one of the "second-time-around" novices, and is now pleased to relate that he has passed the Advanced test and is just itching to get the new call. Mike says "You may now write the final paragraph with a happy ending. Now I'm going to keep on studying until I can pass my Second Class Phone exam." With an attitude like that, Mike, nothing should be able to stop you. Hope you got the new call in time for the Bicentennial year.

WB8UTC is a recent graduate, and had some real nice things to say about the training he got through NRI. Charles did say one puzzling thing, however, that I am at a complete loss to explain. He said, in part, "It seems to me that you folks no longer have an Amateur course, and that's a shame; the ARRL recommended your course to me and they were correct." Well, Charles, I don't know where you got that idea, but rest assured, NRI *does* still have Amateur courses, and we are hard at work trying to keep up with all the rule changes that the FCC keeps making. Stop in some day when you are in Washington and I'll show you our day-to-day list of new enrollments, Charles.

The other day I had a phone call from another Amateur course student in Omaha, Nebraska, who is not at present an amateur (CB only), but is expecting to be licensed very soon. In addition, this particular person just happens to be a dealer in radio equipment (mostly CB, but branching out to Ham gear) and says that if there is enough interest, he would be willing to offer new gear such as Yaesu, Kenwood, Drake, etc., to NRI students at very attractive prices – 10% above his cost in most cases. This sounds quite interesting and if enough of you out there agree, we might just have something real good going. Let me hear from you on this, and we will see what can be done.

Wendell, W1MAA, sent me a nice note and thought perhaps I might publish for your interest a fairly simple derivation of the formula we quite frequently use to determine the characteristic impedance of a transmission line. I might just do that at some other time, but for this column there just is not enough room. Besides, the math involved uses derivatives (which are *not* covered in our texts) which, while being very basic and fundamental to electronics, are sometimes hard for a non-engineer to grasp without a lot of explanation. Thanks anyway, Wendell, and maybe we'll have a go at it another time.

Wayne, WA2UZW/1, writes that he can no longer use his favorite Technician frequencies of six and two meters since his location in the White Mountains effectively shields him from the outside world. He went on to say that he had heard *rumors* that Technicians now have Novice privileges and wonders if this is true. Well, I don't know where you've been hiding, Wayne, but it most certainly is true. In

addition, those of you who took the Tech exam under a volunteer examiner are automatically granted full Tech privileges (no more Restricted notation) and will *not* have to appear for examination before the FCC. Also, as of last November, there is no more requirement for notification of portable operation, and no requirement to sign "portable" or "mobile" (unless, of course, you want to). At any rate, you can now get back on the low bands and practice cw and you will not have to sign "portable one," Wayne.

WA6OFB is a graduate of the Communications course, and got interested in Ham radio while he was studying his lessons. With the help of a friend, James got his Novice ticket and is almost ready to try for General.

Dennis, WB7EXZ, writes that he is career Navy with only two more years 'til he retires and has to go to work. He and Dan, WB7BWN, both went together to take the General test, and both passed with flying colors. The two of them hang out together, mostly on 21.145 MHz doing their rag-chewing. Dennis also operates 80, 40 and 15 using inverted vees which he is in the process of raising another 25 feet. At the same time he is going to stick up a couple of new antennas for 20 and 10 – he says he likes antennas! Fine, Dennis, and perhaps when I get the old Hallicrafters back in working shape I'll hear you on 20.

Last, but not least, we had a note from Bob West in Birmingham, Alabama, telling us that he got bitten by the Ham bug after reading the goings on in the Ham News. For this reason his studies got diverted from color TV to amateur radio and as a result he is impatiently awaiting a Novice ticket from Gettysburg. Bob had a real weird problem with his newly assembled Heath HW101. The largest symptom was that the S meter didn't work when reading ALC, yet everything else checked out perfectly. Consultation with some friends (one a graduate electrical engineer) did not produce any results, so Bob finally called Heath for help. They had it. It seems that they had gotten a shipment of 6AU6 tubes that were really 4AU6's marked incorrectly, and they promptly sent new tubes. This corrected the problem. Just goes to show that sometimes the best way to solve a problem is to put it back in the hands of the manufacturer. Heath has always been very good in this respect.

Anyway, Bob, I hope you have your ticket by now and that you have finally gotten to put the new rig "on the air."

That about wraps it up for this time. I certainly hope that 1977 will be the best year ever for each and every one of you, and *do* write and let us know what you are doing. Until next time, Very 73 –

Ted – K4MKX.

NOTICE

I have received several letters and phone calls since writing about the availability of individual copies of Part 95 (CB) and Part 97 (Amateur) of the FCC Rules and Regulations. Most of the correspondence was negative, since the unhappy purchaser noticed that Part 97 carries a date of March 24, 1976, knowing full well that several significant changes had taken place in the rules as recently as November 1976.

Well, I'm afraid I have bad news for you. After quite a bit of investigation and numerous phone calls to the FCC and the Government Printing Office, we have discovered that Volume VI (Part 95, Part 97, and Part 99) is no longer being published with periodic update transmittal sheets. The individual booklets are it, and I quote you the disclaimer printed in the Part 97 booklet:

"This copy of Part 97 of the Commission's Rules and Regulations governing AMATEUR RADIO SERVICE is current as of March 24, 1976. The Commission will issue revised editions annually or as required. In the interim, all Rule Amendments will be published in the Federal Register."

No one seems to know if the next-to-last sentence means that a purchaser will automatically receive the revised editions when they are released, or if his $1.50 has bought an "obsolete" copy of the rules. In the meantime, we will try to publish any changes or proposed changes here in the Journal.

NRI HONORS PROGRAM AWARDS

For outstanding grades throughout their NRI courses of study, the following September and October graduates were given Certificates of Distinction with their NRI Electronics Diplomas.

WITH HIGHEST HONORS

John Doucet, CFB Borden ON, Canada
William C. Hofecker, Bolivar, PA
Raymond K. Kwan, Edmonton, AB Canada
Robert L. Mains, Dearborn, MI
Arthur R. Rand, Luzerne, PA
Sigthor Skaftason, Toronto, ON Canada
James R. Tomlin, Milwaukee, WI

WITH HIGH HONORS

Danny L. Axtell, Sun City, AZ
Debbie Baker, Clinton, TN
Joseph Blackmore, Grand Falls, NF Canada
J. W. Bowles, San Antonio, TX
John R. Brown, Aberdeen, SD
R. Burge, Slemon Park, PE Canada
Mark M. Cohen, Moraga, CA
George F. Dougherty III, New Castle, DE
John J. Ellis, Fallston, PA
Bruce E. Farrington, Trevose, PA
Gilbert D. Giles, FPO New York
Gerald M. Griswold, Lorton, VA
Charles K. Hartman, Rantoul, IL
Charles R. Hauf, Jr., Ellicott City, MD
Billy J. Hood, Concord, CA
James E. Jackson, Rochester, NY
James C. Jones, FPO Seattle
Richard P. Kolassa, Dunkirk, NY
Philippe Larmet, Atlanta, GA
Vernon W. Micklin, Huntington Beach, CA
Harry I Muus, Jr., Kailua, HI
Chris C. Owens, Altha, FL
D. W. Panoushek, Fairfield, OH
Gustave C. Reichl, Whitehall, PA
Charles E. Rochester, Port Charlotte, FL
Wayne M. Rogers, Warrenton, VA
Robert L. Russell, Findlay, OH
Henry A. Salyards, Jr., Eagle Rock, VA
Paul Sayka, Montgomery, AL
Arthur C. Stephens, Vallejo, CA
William D. Wallace, Lansing, MI
Don Wise, Ottawa, ON Canada
Laurance W. Westcott, Newport News, VA
Joe L. Wilson, Johnson City, TN
Jerry A. Wright, Minneapolis, MN
John W. Wulf, Kalispell, MT

WITH HONORS

Frederick G. Arthur, Bossier City, LA
Irving T. Atwood, Jr., Concord, NH
Gary G. Barnett, Rodessa, LA
Albert J. Berwick, Richmond, VA
Gene L. Bigelow, Iowa City, IA
Bruce A. Brandt, Milwaukee, WI
Edward Calhoun, Rio Rancho, NM
Maurice G. Carriere, Willowdale, ON Canada
Wah Kin Chew, Brooklyn, NY
Lenard L. Chittenden, Marissa, IL
Tommy C. Coalson, La Grange, GA
C. D. Cowfer, Pittsburgh, PA
Richard L. Clubb, APO San Francisco
Kenneth R. Creamer, Lemoore, CA
Larry Creech, Clarksville, VA
Solomon D. Dantzler, APO New York
Richard B. Dodson, Marysville, CA
Thomas R. Flanagan, Bricktown, NJ
Steve Flinchum, Annville, KY
Hosie Franklin, Jr., Washington, DC
Murray Furman, Chapel Hill, NC
Richard R. Gaca, Chicago, IL
Leonard J. George, Junction City, OR
Hiram Hanson, St Augustine, FL
David J. Hardy, Grosse Pointe, MI
Carl A. Hoff, Lynnwood, WA
John J. Jamack, Philadelphia, PA
Darrell R. Johnson, Duluth, MN
Lawrence M. Johnson, Swisher, IA
Ronald P. Kedzierski, Columbia, MD
Harold C. Kuenn, Ridgeway, VA
Burt Locke, San Francisco, CA
Charles A. Long, Blytheville, AR
John Martinex, Lompoc, CA
Roy W. Matthews, Sacramento, CA
Thornton Mortimer, Oak Ridge, LA
Peter Moy, Detroit, MI
John W. Murphy, Cresson, PA
Timothy J O'Leary, New Lenox, IL
John R. Olenick, Beltsville, MD
Victor O. Peck, Indianapolis, IN
Phillip A. Peterson, APO New York
Robert A. Purple, APO New York
Francis F. Rickards III, Dagsboro, DE
Richard J. Shell, Apalachin, NY
Steven D. Shell, APO New York
James L. Smith, Springfield, IL
Henry A. Spens, Richmond, MI

Gerhard Stenger, Bayside, NY
Kyle Stevens, Frederick, OK
Richard P. Subbot, Oakland, CA
Maurice L. Swackhammer, Fort Worth, TX
Carl W. Thenemann, Baytown, TX
Constantin Trantzas, Astoria, NY
Tom H. Trisdale, Hendersonville, TN
William T. Vierregger, Fairfax, VA
Randolph P. Vranish, Del Rio, TX
Richard A. Wagstaff, Dover, TN
Larry S. Wakeman, Griffiss AFB NY
Norman E. Wescott, Jr. Tilton , NH
Thomas M. Woolfolk, Orange, VA
John M. Zimmerman, Six Mile Run, PA

Job Ops

HELP WANTED: Audio/TV technician. Salary open. Contact Mr. Brown or Mr. Schmidt, Solid-State Electronics, 12335 Parklawn Drive, Rockville, Maryland. Telephone 770-0060.

HELP WANTED: Bench man needed as soon as possible. Magnavox experience preferred, but not necessary. Contact Elmer Stephens, Columbus TV Service Company, 3509 Cusseta Road, Columbus, Georgia 31903.

DIRECTORY OF ALUMNI CHAPTERS

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

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

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

NORTH JERSEY CHAPTER meets at 8 p.m. on the second Friday of each month at the Players Club, located on Washington Square in Kearny, New Jersey. Chairman: Al Mould. Telephone 991-9299 or 384-8112.

PHILADELPHIA-CAMDEN CHAPTER meets on the fourth Monday of each month at 8 p.m. at the home of Chairman Boyd A. Bingaman, 426 Crotzer Avenue, Folcroft, Penna. Telephone LU 3-7165.

PITTSBURGH CHAPTER meets at 8 p.m. on the first Thursday of each month in the basement of the U.P. Church of Verona, Pa., corner of South Ave. and Second Street. Chairman: James Wheeler.

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

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

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

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

DETROIT CHAPTER HEARS TOM NOLAN

Tom Nolan, Executive Secretary of NRIAA, was the guest speaker at the October 13 meeting.

Tom gave a detailed demonstration on circuitry of CB transceivers and how to check their antennas using an SWR meter. He also cautioned about using proper test equipment (by holders of Second Class Commercial licenses only) when working on these units to ensure accuracy in keeping them legal as to frequency and power output.

Refreshments were served and a pleasant evening was enjoyed by all.

SPRINGFIELD CHAPTER SEES TRANSISTOR CHECKER DEMONSTRATION

At the October 9 meeting of the Springfield, Massachusetts Chapter, the Sencore Super Cricket transistor checker was demonstrated. Also, a B&K TV analyst Model 1077B was explained in detail.

Alumni News

FLINT/SAGINAW VALLEY CHAPTER ENJOYS PROJECTS

At the September 29 meeting, Mr. Jobbagy introduced a new projection-type color TV to the students and explained how it works.

The next topic was transistor checkers. The students learned all about the new Cricket transistor checker and how to use it. Mr. Chet Mazur brought in his volt-ohm-milliammeter project that he was having trouble with. Mr. Dale Keys, an advanced student in the same course, straightened him out.

At the October 14 meeting, Mr. Tom Nolan spoke about CB radio transmission and repair. Tom pointed out the kinds of instruments to use and how to use them.

Citizens Band radio servicing is growing fast. If you know the fundamentals of servicing radio and TV, it is not hard to service CB as long as you have a Second Class Radio Operators license.

At the October 28 meeting, members brought in two picture-tube checkers and a rejuvenator. One was a B&K and one was a Sencore. They compared both instruments.

A student, Mr. John Enns, from Midland, Michigan had called to say he would like to come to the meeting with an NRI TV with which he had problems. He did arrive and the members of the Chapter gave him a helping hand and put him on the right track so that he no longer had a problem and he went home happy. He traveled 75 miles to get to the meeting. The next meeting is in November.

Executive Secretary Tom Nolan at a meeting of the Flint/Saginaw Chapter during his recent annual visit.

NORTH JERSEY CHAPTER USES TAPE INSTRUCTION

At the September 10 meeting, Mr. Walter Macieski of Nutley, New Jersey was admitted to membership.

Also at this meeting, the members listened to an RCA prerecorded tape about transistor troubleshooting. The tape was brought to the meeting by our member, Tex Judisic. After the tape, the members went to work on two troublesome GE TV sets. One set was a color chassis with raster only. The trouble turned out to be an open resistor in the tuner B+ circuit.

The second set was a black-and-white set with a keystone condition. This turned out to be caused by an open vertical deflection yoke.

At the October 8 meeting, the membership watched and listened to a Howard Sams audiovisual demonstration about semiconductors. This is the first of a series and the chapter is looking forward to the second section in order to brush up on semiconductor servicing.

NRIAA Election Results

The NRI Alumni Association is pleased to announce the election of J. B. Straughn as its new President for 1977.

J. B. Straughn

Straughn, at one time Chief of the Consultation Service at NRI in Washington and Technical Editor of the NRI Journal, is perhaps best known to students and alumni as the author of the highly popular "Adventures in TV Servicing" in the NRI Journal.

Straughn's "Adventures," an ongoing series of practical TV servicing case histories based on his day-to-day experiences, are uniquely down-to-earth, relieved with the wit and wisdom acquired in a lifetime of servicing experience and a refreshingly forthright conversational style seldom found in technical literature.

Says Straughn, "Frankly, I enjoy writing these articles, and I hope they help students and graduates who are just starting out in the service world. They should figure if a guy who is 69 can do it, I surely can!".

The four Vice Presidents elected for the 1977 term are Eldred M. Breese of Pineville, Ohio; Branko Lebar, who is Chairman of the NRIAA Toronto Chapter; Joseph A. Crusco of Waldwick, New Jersey; and Les Lederna of New York City.

The National Radio Institute wishes the NRIAA's new officers success and the best of luck during their 1977 terms.

Get in on the CB Service BOOM

with the B&K PRECISION CB Service Bench

Even if you've never serviced a CB transceiver, you can be in business practically overnight with the B&K-PRECISION CB Service Bench. Check all operating characteristics of any CB transceiver in minutes—without any instrument reconnection!

(Note: This equipment is intended for the experienced NRI technician with knowledge of CB servicing and the proper FCC license.)

Full details on all the instruments making up the CB Service Bench and an order form are included in this issue of the NRI JOURNAL. For a complete B&K-PRECISION catalog, write:

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CB Servicemaster

The fastest way to check all operating characteristics of any CB transceiver–AM or sideband.

When used with a Signal Generator, Frequency Counter, and an Oscilloscope you can:

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- Measure audio output power
- Measure audio distortion percentage
- Measure receiver sensitivity
- Check AGC
- Measure effectiveness of CB noise limiter or blanker (when used with an impulse noise generator)
- Measure squelch threshold
- Measure adjacent channel rejection
- Measure transmitter AM power output—even mobile!
- Measure SSB power output with TRUE peak-reading RF wattmeter
- Check AM modulation
- Check SSB modulation with a two-tone test—*the only accurate way!*
- Measure antenna SWR—even mobile!
- Check the transceiver in the car to determine if the problem is in the antenna system or the transceiver
- Troubleshoot each stage of CB transceiver

The 1040 eliminates the complicated reconnections and multiple test instruments once needed to perform a thorough service analysis on a CB transceiver. With its built-in audio test tones, audio power/distortion/dB meter, SWR bridge, peak/average RF power wattmeter and ability to accept external antenna loads, the 1040 is the key to assembling a profitable CB test bench.

SPECIFICATIONS: RF Wattmeter—Impedance: 50 ohms. Load: 50-ohm, 50-watt continuous, 100-watt intermittent. Accuracy: ±5%. Metering: Average or peak and SWR. Insertion VSWR: Less than 1.1:1. **Audio Wattmeter**—Impedance: 4, 8 or 16 ohms. 10 watts, continuous. **Distortion Measurement**—Type: THD at 1kHz. Scale: 0-30% direct reading, ±5%. **Audio**—Outputs: Receiver audio. 1kHz test tone. Two-tone test signal. **Scope Output**—Transmit: 1MHz representation of 27MHz carrier for examination of modulation on any low-freq. oscilloscope. **Power**—117VAC, 60Hz: 3 watts. 13.8VDC: 150 milliamperes. Reverse polarity protection. Size (HWD): 10.2 × 34.3 × 27.9 cm (4 × 3.5 × 11"). **Weight:** 2.55 kg (5 lbs.), 10 oz.

(OPTIONAL ACCESSORIES)

CB SERVICEMASTER HOOK-UP CABLES

Model CC-41. 36" RG/58U with a BNC connector on each end. $7.50

Model CC-42. 36" RG/58U with BNC connector and UHF connector (PL-259). $6.50

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Model CC-46. 36" RG/58U with UHF connector (PL-259) on each end. $6.00

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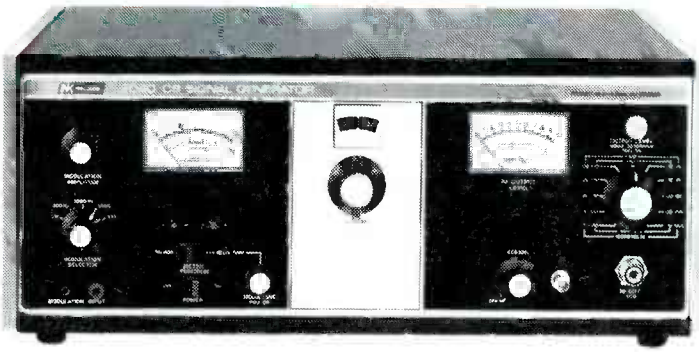
Model CC-49. 36" audio coax with phono plug to dual banana plugs. $4.00

Model CC-50. 36" audio coax with 3.5 mm mini-phone plug to dual banana plug. $4.00

MODEL 1040 **$250**
CB Servicemaster

B+K PRECISION

PLL CB Signal Generator



- Covers all 40 authorized CB channels and ten adjacent unassigned channels.
- 0.1μV to 100mV calibrated output for complete receiver testing.
- Internal 400, 1000, 2500Hz modulating frequencies—can be externally modulated
- 455kHz IF output with adjustable level
- Frequencies generated by ultra-stable programmable crystal-controlled PLL.
- Illuminated Carrier Level and % Modulation/Frequency Offset meters
- Protected against accidental 5W RF input
- EIA standard noise test signal generator

Here is a signal generator specifically designed for citizens band service work—the new Model 2040 from B&K-PRECISION. All 40 authorized CB channels have been provided, plus ten additional unassigned channels. Because generator stability is vital in checking today's sophisticated CB transceivers, the 2040 uses a programmable crystal-controlled phase-locked-loop to generate all frequencies with ±5ppm accuracy. Complete testing of a CB transceiver should include a test of its noise-suppression system, so the 2040 has a built-in EIA Standard noise test signal generator. To make receiver sensitivity tests as quickly and accurately as possible, the 2040's output is selected in 10dB increments from 1μV to 100mV. A +2dB, −10dB vernier permits outputs as low as 0.1μV or any intermediate level.

SPECIFICATIONS: Frequency Coverage and Generation—AM and ΔF: 50 channels, including 40 authorized CB channels. AM and ΔF: Programmable, crystal-controlled phase-locked loop (PLL) and 50-position selector switch; vernier function provides 0-±5kHz channel deviation (ΔF). **Frequency Accuracy and Stability**—AM: Better than ±5 PPM (.0005%). Vernier offset (ΔF) accuracy ±5%. IF: ±.01%, 0-50°C, 455kHz output. **Output Level**—AM and ΔF: 0.1 μV to 100mV, (50-ohm). Output Metering. AM and ΔF: Microvolt and dB. Modulation: AM: 0-100%, calibrated, continuously adjustable. Selectable CW, 400, 1000, 2500Hz or external. ΔF: Simulated single tone SSB modulation. IF: Fixed 30%, ±10%. **Impulse Noise Test**—For receiver noise limiter and blanking tests, an EIA Standard noise test signal generator is provided. **Generator Output Circuit Protection**—Can withstand RF input of 5 watts at 27MHz for 1 minute. **Power:** 105 to 125VAC. **Dimensions:** (HWD) 18 × 27 × 45 cm (7.3 × 10.6 × 17.9"). **Weight:** 7.7 kg. (17 lbs.).

MODEL 2040 **$475**
40 Channel CB Signal Generator

B&K PRECISION

40MHz Autoranging Counter

- Automatic ranging
- 40MHz range *guaranteed;* 60MHz typical upper limit
- 1Hz resolution
- Six-digit solid state readout with discrete reliable TTL logic

The fastest way to determine whether a CB transceiver is exactly on frequency is to check it with the B&K-PRECISION Model 1801 frequency counter. When connected to the Model 1040 CB Servicemaster it automatically displays the carrier frequency when the transmitter is keyed. With the 1801, you can be sure the readings you get are accurate.

The 1801 allows you to tune oscillators quickly and precisely, conduct precision audio frequency analysis tests and, with commercially available prescalers, check frequencies well into the UHF range.

The 1801's bright six-digit display is automatically updated five times per second. Setting the FUNCTION switch to AUTO causes the 1801 to automatically fill all display positions, suppressing least significant digits if necessary and indicating the range in kHz or MHz. Resolution to 1Hz is available in the 1 SEC mode; the readout is displayed in kHz. In this position, inputs of 1MHz or greater will overrange the six-digit display, activating the LED OVERRANGE indicator.

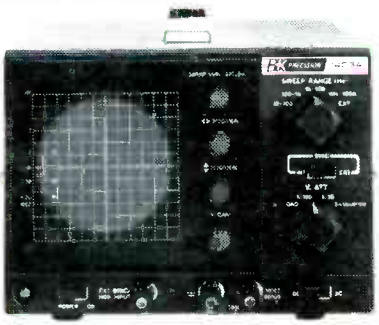
SPECIFICATIONS: FREQUENCY—Range: 20Hz-40MHz guaranteed; 10Hz to over 60MHz typical. **Auto Gate Time:** 10mSEC or 100mSEC (MHz reading) or 1SEC (kHz reading). **Manual Gate Time:** 1SEC. **Overflow:** Flashing light. **Display Refresh Interval:** Fixed; 200mSEC plus gate interval. **INPUT—Impedance:** 1meg/25pF. **Protection:** Diode. **Coupling:** AC. **Sine Wave Sensitivity:** 30mVRMS (guaranteed); 15mVRMS (typical). Maximum Input: (peak AC + DC): 200V to 500Hz; linearly derated to 100V at 1kHz; 100V, 1kHz-5MHz; linearly derated to 50V at 40MHz. **Setability:** ±0.1PPM (±1Hz). Typical Accuracy: Better than ±10PPM. 105-130V, 60Hz, 25W maximum. **Size (HWD):** 3.31 x 8.69 x 10.5". 105-130V, 60Hz. **Weight:** 5.5 lb.

MODEL 1801 — $240

Digital Frequency Counter

B&K PRECISION

3" 5MHz Solid State Oscilloscope



- Compact and lightweight—weighs just 8.5 pounds!
- Check CB modulation
- Allows you to examine CB carrier when used with 1040 CB Servicemaster
- Direct deflection for waveform display of signals up to 450MHz!

The 1403A recurrent-sweep oscilloscope is ideal for use as a CB modulation monitor. Small and lightweight, it takes up very little space on service benches—and it's the perfect size to use as a portable scope. When used with the Model 1040 CB Servicemaster, the 1403A allows you to view the modulation waveform. In general use, the 1403A is ideal for many monitoring applications.

SPECIFICATIONS: Vertical Amplifier—Sensitivity: 10mV/div or better. Response: DC, DC-5MHz (−3dB). AC, 2Hz-5MHz (−3dB). Max Input: 600V peak-to-peak. Input Impedance: 1 meg shunted by 35pF. Attenuator: 1, 1/10, 1/100 multiplier, ±5%. Gain Control Range: greater than 22dB. **Horizontal Amplifier**—Sensitivity: 300mV/division or better. Response: DC-250kHz. Max Input: 100Vp-p. **Sweep System**—Type: Recurrent. Time Base Ranges: 10-100Hz, 100-1000Hz, 1-10kHz, 10-100kHz; continuously variable between ranges. Sweep Linearity: ±5%. Sync: Internal, negative; external. **Direct Deflection Terminals:** 10V/division sensitivity or better. **General**—Intensity Modulation: 25Vp-p. Power: 117/234VAC, 50-60Hz, 10W; three-wire grounded line cord. Acc. incl.: Leads, spare fuse, instructions. Size: (HWD) 13.1 x 18 x 29 cm (5.25 x 7.25 x 11.5"). Weight: 3.8 kg (8.5 lbs.). Probe: (optional) PR-21 required. LC-14 case optional.

MODEL 1403A — $209

3" Recurrent-Sweep Oscilloscope

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Rent or mortgage payments $ _____ per month ( ) Married ( ) Single Wife's name _____

No. dependent children _____ Previous address _____ How long? _____

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B ➔

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Employer's address _____

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Previous employer _____

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Credit account with _____ Address _____

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