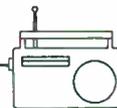


# Radio Guide



**Radio's Technology Forum**

February 1994

## By Popular Demand, The New Radio Guide

Well, not exactly. If anything, the "new" **Radio Guide** will be much more like the original publication that many of you probably remember. We've listened and learned from your calls and letters, and realized that many times, simpler is better.

The **Radio Guide** will now consist of tech tips and nuts-and-bolts technical articles only, with very little advertising and absolutely no press releases, equipment "showcases," puff pieces or radio show coverage.

Since we're asking you to pay for what you get, the very least I can do is promise to deliver solid, educational technical information each month in the **Radio Guide**. More than that, you have my commitment to deliver a real-world publication that will help you solve your day-to-day maintenance and installation problems.

The advertisers you will see in **Radio Guide** are there because they are willing to support our efforts and the educational concept of **Radio Guide**. It is a commitment that has allowed us to re-start the **Radio Guide**, and without them there would have been no **Radio Guide** this time. So, I'm asking you to take the time to call and thank one or two, and let them know that you appreciate their sustaining participation in the **Radio Guide**.

Please take the time to fill out the enclosed form, if you have not already subscribed to the **Radio Guide**. You have my personal guarantee that, if you are not satisfied with what you get, I'll refund your money — no questions asked!

Now, let's get started. We've got a lot of catching up to do, since most of you must have accumulated hundreds of tech tips during the past year. Send them to George and he'll dispatch one of our handy **Radio Guide** solar calculators by return mail. And you won't even have to abscond with batteries from your station to make it work.

*Ray Topp*



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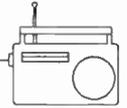
# Radio Guide

February 1994

Volume 6, Number 2

# The Radio Forum

George Whitaker — Editor



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— **Articles should be 750-1000 words** —

— **Tech-Tips should be 200-500 words** —

All "Tech Tipsters" receive a *Radio Guide* calculator.

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## We're Back

As you can see, Ray Topp and I have joined forces to bring you **Radio Guide** in a form more like the original.

The new **Radio Guide** is designed to bring you nuts and bolts information in an easy to read, easy to store, format. As an engineer, and early reader of the original publication, I am glad to see the change back to the early style. Sometimes you can experiment with something and find that, for all your efforts, the original was better. I believe that is the case here. Personally, I am very happy to have been invited to join in making the new **Radio Guide** a magazine that every radio engineer will enjoy and use.

During the hiatus of **Radio Guide**, I have begun publishing a newsletter for beginning radio engineers called Practical Radio Communications. It is designed to teach radio engineering. Also, I have published two books and am working on several others. These projects will continue as I move more out of active engineering and into writing and publishing. Some of you know that I have already semi-retired from KRVA and have turned most of the duties over to my assistant. I still carry the title of Chief Engineer at KRVA but I only go in two days a week. I gave them a year's notice that I was leaving and my year is up in October.

So grab the coffee cup off the workbench and let's toast the new **Radio Guide**, that it may be full of tips and truly be the publication that I think you want it to be.

Remember however, our readers write most of the publication. Share your Tech-Tips with others by sending them to me at the Arlington, Texas address. Each Tech-Tipster will receive a credit card size **Radio Guide** calculator as a token of our appreciation.

*George*

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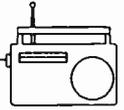
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# SMC 252 Carousel Intermittent Solution

Bob Springer — KFBS/KSAI



*Quite often when reading a Tech-Tip I will find myself admiring the troubleshooting techniques. Troubleshooting is a science and, as with any other scientific project, finding the right experiment to provide proof of what is happening is the real problem.*

*This next tip from Bob Springer with KFBS/KSAI in Saipan, MP contains technique that is transferable to many other situations. As a 30+ year veteran troubleshooter, who teaches this sort of thing, I'll admit that I was impressed.*

*Bob serves as Chief Engineer for the Far East Broadcasting Companies' stations KFBS and KSAI on Saipan. KFBS is FEBC's International shortwave station consisting of four 100kW transmitters broadcasting in 21 different languages and dialects to Asia. KSAI (5kW medium wave) broadcasts in 5 different languages to the residents on the island of Saipan. Saipan is the governmental seat of the United States Commonwealth of the Northern Mariana Islands located in the Western Pacific. Now, Bob tells us about his ...*

## **Carousel Intermittent Solution**

First one and then gradually two other SMC 252 Carousels in our Gates automation system, at KSAI, began advancing the controller very intermittently and at very random times during the playing of a cart. This would cause two sources to be channeled to air simultaneously. Because this would happen maybe only once or twice a week, if that often, it was difficult to track down.

When this problem occurred, the cart was immediately tested for the presence of any false 150 Hz signals. No false signals were ever found. All of the circuit boards were swapped between Carousels, but the problem did not follow any one board, proving it to be the culprit. Connecting an oscilloscope to the output of the cue amplifier and to the output of the power supply, gave no evidence of the presence of any noise or AC ripple present. Nothing in the Carousel or automation controller circuitry could be proven at fault.

It was proposed that, since this system was over twenty years old, the Carousels were just worn out and could not operate properly anymore. But, why did the system operate properly and without this problem until just a few months ago? Something had changed.

When this problem started occurring once every other day or so, I had to make a concerted effort to find the solution to the problem. I began to wonder, since the problem was so intermittent, if it might be caused by something completely external, like transients on the AC power line. I felt maybe there was a component failure such that the Carousels would operate properly except when subjected to power line transients.

Thinking this elusive component might show itself if I varied the AC line voltage, I connected the Carousel to an AC Variac. As I varied the input voltage, the Carousel's automation system advancing relay, which is actuated by the 150 Hz cue signal, clattered like a machine gun. The Variac hadn't been used for sometime so the contacts were dirty and voltage transients were causing just what I had suspected.

I took the Carousel electronics to the bench to find a bad component that I felt sure existed. A couple of hours of testing the cue amplifier board and 150 Hz switching circuit, right down to checking individual components, showed nothing amiss.

That left only the Carousel power supply as a source of the problem. Nothing seemed out-of-the-ordinary there. I connected another Variac to the electronics unit and an oscilloscope to the 24 VDC output of the supply. As I varied the AC input rapidly between 95 and 120 volts, I could see the DC voltage change significantly, and the 150 Hz cue switching relay was energizing with each dip in the DC voltage. The supply seemed to have insufficient filtering to cope with the rapid changes in AC input line voltage.

Then, I thought of creating transients to see if I could simulate the actual condition that was causing the problem. I plugged a heat gun (the kind used with heat shrink tubing) into an outlet several feet away. Each time I switched the gun on, the relay energized. With the Carousel connected in the automation system, this would have caused the controller to advance.

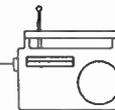
## **Power Supply No Longer Sufficient**

Recently the original two 1100 mFD capacitors in the DC supply (in a Pi type filter with a resistor) had been replaced with two 1000 mFD capacitors. I really didn't think that 200 out of 2200 mFD would make that much of a difference. But to make sure, I paralleled a 220 mFD capacitor across the input section. When I switched the heat gun on, the cue circuit relay would no longer energize. I felt I had found the solution to the problem. Evidently the power supply filtering was no longer sufficient to keep transients from affecting the cue circuitry.

I paralleled the 1000 mFD power supply filter input section, in all three Carousels, with another 1000 mFD capacitor to provide additional filtering capacity and returned them to service. The Carousels have not caused the controller to advance erroneously since. Other Carousel circuits were probably made more stable by the extra filtering as well. If I had not tried varying the AC input voltage or creating similar conditions in which the problem occurred, I doubt if I would ever have found the solution.

# Telephone Hybrid Coupler

Bill Rett — KXBX



*“Necessity is the mother of invention” is an old adage that anyone in radio engineering is very familiar with. Every day there are new challenges to our ingenuity as we are given a \$100 budget to do a \$1000 job. Being a tightwad of the first order, I appreciate guys like Bill Rett at KXBX in Lakeport, CA, who take the bull by the horns and home-brew their own stuff. Bill tells us how to build a ...*

## Telephone Hybrid Coupler

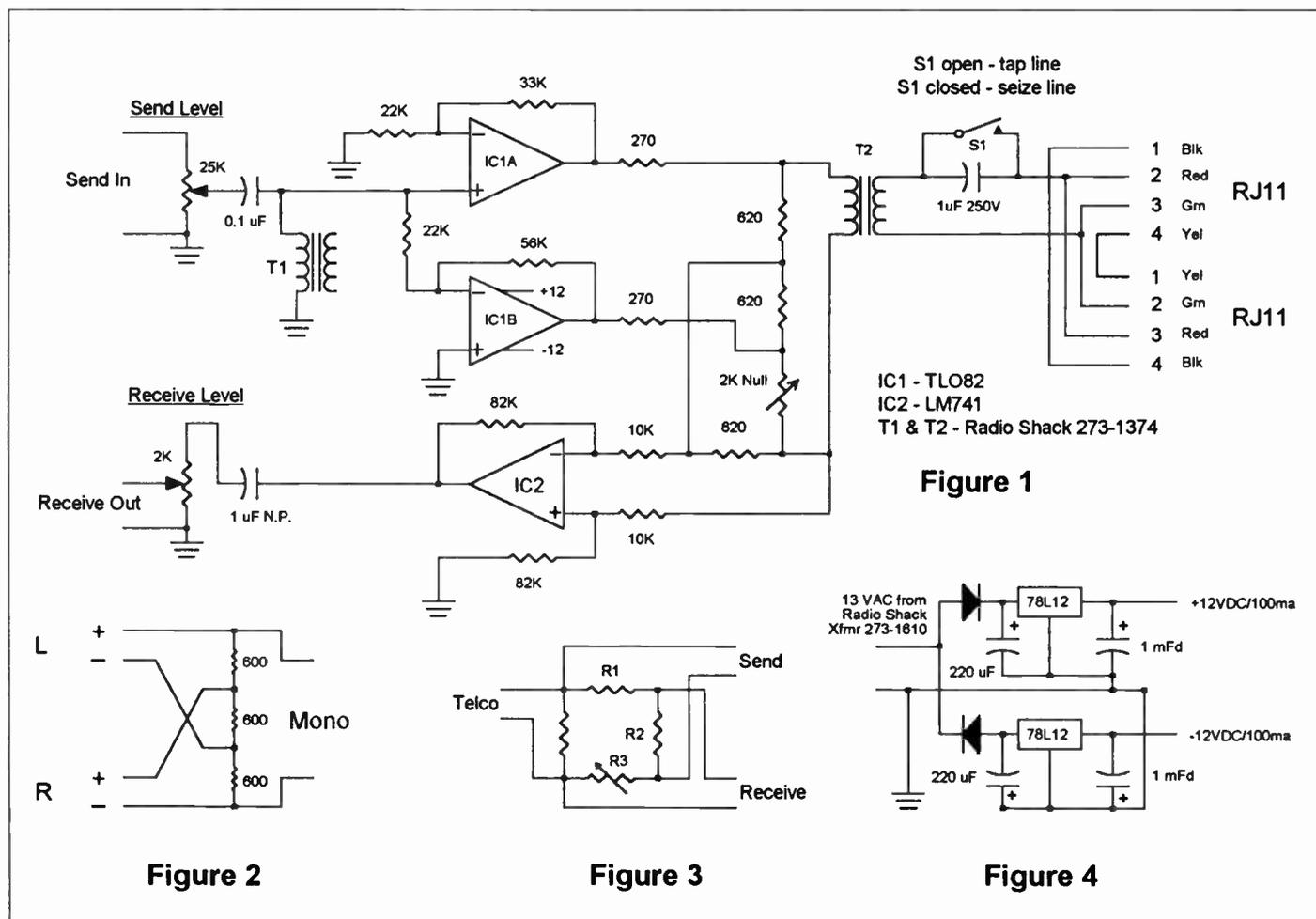
KXBX recently needed a telephone hybrid coupler for use in our E.B.S. remote control system. Unfortunately, the budget wasn't there to just go out and buy whatever I wanted. So, I tried my hand at designing and building my own, (the usual alternative for those of us working in small markets). **Figure 1** is the overall schematic.

This design is based on a circuit that I found years ago in a broadcast maintenance handbook. I have found this circuit to be very useful for getting a mono sum from a stereo console

or any other stereo source (see **figure 2**). It also will work in reverse and split a mono source into two outputs with 40 dB or better isolation between outputs. Note, however, that it only works with balanced audio lines. There is a loss of 6 dB from the mono side to either circuit on the stereo side.

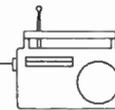
After giving it some thought, it dawned on me that here was the answer to my hybrid coupler design. I just added some gain to make up for the trans-hybrid loss, and also to increase the receive level because our local telco office sometimes provides as little as -20 dB. Since this circuit is based on a balanced bridge (see **figure 3**), it depends on the telco to provide a fairly consistent impedance between incoming calls. The null adjustment can be used to average the changes in line impedance and maintain approximately 20 dB isolation between the send and receive ports.

I also added a high pass filter on the send input in order to reduce any low frequency (below 300 Hz) information from getting into the phone line. **Figure 4** is the schematic of a cheap bipolar supply which I used for power.



# Dielectric Model 600 Compressor-Dehydrator Mod.

Darel Vanderhoof — Central MI Univ. Public Broadcasting



*Many times in my career I have found that experience in the field dictates equipment modifications resulting in performance superior to factory supplied hardware. The engineer actually using a piece of equipment gets a totally different view than the factory engineers designing it. What seems to be a good idea in the controlled environment of a factory sometimes isn't so good out in the field.*

*Darel Vanderhoof, maintenance engineer for the Central Michigan University Public Broadcasting network, headquartered in Mt. Pleasant, has some innovative field modifications as he tells us how to ...*

## Customize Your Dielectric Model 600 Compressor-Dehydrator

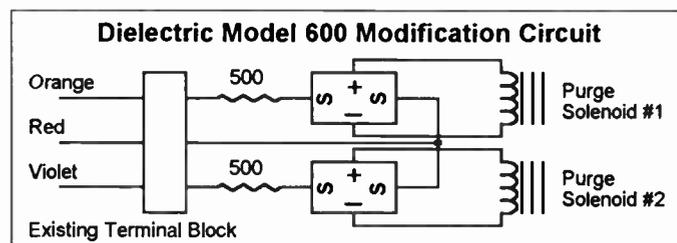
If you are like me, you may have had trouble rebuilding the purge solenoid air valves on your model 600. It seems that, despite best efforts, the valves often want to “buzz” afterward, and will self-destruct if not corrected. My solution has been to convert the AC solenoids to DC operation.

The modification requires two bridge rectifiers and two wire-wound resistors. The rectifiers should have at least a 600 volt PIV rating, and be 1 amp or larger. Use something that you can bolt to the chassis. The last ones I used were part number MB106ND, 10 amp 600 volt, from Digi-Key. The resistors should be approximately 500 ohms, and be rated at 20 watts or more, as they will have to dissipate about 13 watts in circuit. The ceramic hollow core type mount nicely.

The schematic is quite simple, and accurately indicates the wire colors I have found to date. Originally I had planned to add capacitors to the circuit, but found them unnecessary. The 500 ohm resistor values were selected to produce normal amounts of solenoid coil heating, and allow the valves to operate normally over a very wide voltage range.

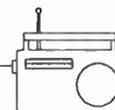
In trying to extend the valve life, I have also found that the solenoid core tends to mushroom at one end, creating an inside lip that catches on the core spring. A 45 degree chamfer with a 1/16 inch face at the entrance to the core spring hole seems to cure the problem.

Before I modified any of my units, I had two that developed faults in the solid state timer. Both times, the last valve “on” failed to turn off when the compressor reached pressure. If you don't want to replace the timer, you can use the spare contact on the compressor's pressure switch to provide the shut-off function. I did this a couple of years ago, when I was out of timer stock, and the unit still works fine. Whether you use the DC modification or not, just loop the red wire common to both valves through the extra contact.



# ITC Premium Machine, Low End Adjustment

Dave Graves — KHYS



*Many of us are still using premium line ITC cart machines. KRVA is still running over 20 decks that are between 10 and 20 years old. Therefore, I know what Dave Graves (Dr. Dave) of KHYS radio in Houston means when he refers to them as “the cart machine that never dies.”*

*Dr. Dave tells us a way to get ...*

## An Adjustable Low End on ITC Premium Machines

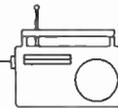
There are many ITC premium series cart machines around, as it seems they were built so “bullet proof” they never seem to die. A couple of companies have made available “wonder boards” for modifying these machines, however, I am still using original equipment cards. But, one of my main complaints was that the low frequency “bump” was

about 3 dB too low. Dave Neal, at ITC, gave me this tip which I would like to share with you all. All you have to do is install a 200-250 ohm pot in the second audio driver emitter circuit! This will increase low end response by 4 or 5 dB.

There are two play amp boards used in the premium series cart machines. If you have the 831-0027 board, replace R107 (left) and R126 (right). On the 831-0094 board, replace R107 (left) and R131 (right). Connect the wiper of the pot to the emitter of the second audio driver, and one end to where the other end of the replaced resistor was connected. You will now be able to adjust the low end at 100 Hz. Start with maximum resistance in the emitter circuit, and adjust so your low end is where you want it to be. I have modified several machines in this way, and believe me, it works. I would recommend a ten turn pot for ease of adjustment. So go out and spend 3 or 4 bucks, the difference is remarkable!

# Testing RS-232 & 422 Wired Circuits

Jerry Brown — WTRG



*I have a "love-hate" relationship with computers. I resist having to learn them and don't care who knows it. And yet, I could not do many of the things I do today without them. Maybe this just shows that I am getting old and crotchety. However, I remember the first time I saw some transistorized gear and said to myself, "Nothing glows, nothing gets hot, you can't see anything happening. I'll never learn to work on this stuff." Of course I wouldn't go back to tube type gear for anything now.*

*In case you missed it, the main thrust of the banquet speaker's talk at the S.B.E. convention in Miami was pointing out to all of us that, like it or not, we would have to learn computers if we are going to be radio engineers.*

*Jerry Brown of WTRG in Raleigh, NC, started off his letter to me with the following: "In the past few months, WTRG has become inundated with technology from several different fronts." Many of us can identify with that situation. Jerry continued with some tips on ...*

## Testing RS-232 & 422 Wired Circuits

WTRG has recently acquired a TM Century Ultimate Digital Studio, a B.E. Audiovault, a 360 Systems Digicart, an Audio Crosspoint Switcher, an AT&T Merlin system with PBX, and many other pieces of gear driven by personal computers. All of these units have one thing in common, they communicate using either RS-232 or RS-422.

### Radio Guide Quick-Tip

**Flashlights are cheap! Keep one hanging in every rack or equipment/wiring area that you may end up working in.**

As a result of this new equipment, the station has acquired enough 25 pair telco cable to make Ma Bell green with envy. Because of the distance between most of the "host" machines and the work stations, a great deal of the wiring terminates in more than one point in our building. During the installation of several of the work stations it became necessary not only to "ring out" several of the pairs, but also to make sure the wiring at both ends was consistent, i.e.: blue/white at the host was also blue/white at the work station, and not vice-versa.

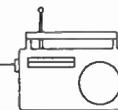
I, like most broadcast engineers of today, am a one person department. So it was very difficult to verify the wiring integrity alone, and I could not justify the purchase of a multipair cable tester that would only be used during the installation phase of the project. Faced with this, I found an inexpensive way to test the data cables. I soldered leads with color coded alligator clips to both a AA and a 9 volt battery. This allows me to test 2 pair at once. With a multimeter I can test for both continuity and polarity at once. I also could not justify an expensive set of break out cables, so I soldered leads with alligator clips to two sub-D connectors and labeled each lead with wire numbers that correspond to the pin number on the sub-D connectors. I also picked up a couple of real cheap gender changers at Radio Shack so I can mate with any machine protocol.

### Radio Guide Quick-Tip

**Keep spare light bulbs and wasp spray in the doghouse. Sooner or later you will need both. A trouble-light with a long cord and extension outlets can also make life easier. Keep one hanging in the doghouse.**

# Revox A-77, Loss of Record

Doug Stromberg — KIFN



*The Revox A-77 has been around a long time as a real nice, inexpensive, workhorse. I used my first ones in 1974 at KFIN in Jonesboro, Arkansas and still have a couple that I am responsible for today.*

*They sort of took the place of the Magnacord PT-6 when we went from mono to stereo operation. If anyone has enough experience with them to write a small book of service tips I would be interested in publishing it.*

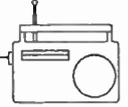
*Doug Stromberg in Wadena, MN has some experience with them and discovered one possible cause if you have ...*

## Loss of Record In The A-77

In recent months I have encountered three Revox A-77 reel-to-reels with the identical problem. No record on one or both channels at the 7.5 IPS tape speed. In each instance the trouble was traced to the bias trimpots on the oscillator card. The carbon strip had cracked under the wiper contact, resulting in intermittent, or no connection. In two of the three cases, both trimpots were defective. They are 50K carbon pots, R-720 and R-722.

# AM Site Tower Fences

Clif Glasgow — KROP/KSIQ



*Sometimes what seems like “old hat” to you may be brand new information to someone else. It all depends on what experiences we have had along the way.*

*A while back I received a call from an AM station where there was a debate going about whether they could replace their wooden fences with metal ones. One staff member said it would make no difference and the other said that it would.*

*Finding that they were directional made my recommendation easy. They should not open the metal fence can of worms.*

*Clif Glasgow of KROP-KSIQ in Brawley, CA, volunteered to help me supply some basic information about this subject as he takes a look at ...*

## Tower Fences at AM Sites

Many stations, with the new RFR rules and tighter FCC security standards, may be replacing tower and/or transmitter site fences. There are very persuasive reasons for replacing tower fences with *wood* to avoid problems with radiation patterns — especially important with directional systems. Redwood or cedar “grape stake” fencing is not that expensive compared to chain link but will require some periodic maintenance (like a coat of linseed oil every year) and are not as secure if you’re in an area likely to be vandalized. Further, you can’t see through them in the event someone does jump the fence. It may also be difficult to have them built six feet

high or so, as may be required by your insurance company or common sense.

If chain link is inevitable, pay the extra to have the perimeter hand dug to find all the radials and run jumpers up to attach to the chain link once its up. Use silver solder and, if you can’t handle a gas rig and brazing tip, get a welder to help.

For both chain link and wood fences, make sure the installers hand dig the post holes; if you let them use an auger, you are going to cut radials and, worse, wind them around the auger and pull them out. In most cases, radials can be pushed aside slightly and the concrete poured right over and through them without degradation of their function.

If the fence is going around transmitter shack and tower, run strap back to the main ground point and bond it at least at the corners. If you have a more unlimited budget, run strap around the perimeter where the jumpers come up from the radials, bond to both strap and fence. If you ever have to put in another ground system, you can run from the strap outward and use screen inside the fence.

Failing to bond chain link fences into your ground system can cause serious signal deficiencies and losses; you create an RC network in shunt to ground which could even unbalance unstable towers like 3/8 to 5/8 wave systems and shunt fed systems.

Just remember that anything metal put in the near field becomes a part of the act.

### Radio Guide Quick-Tip

**3M color coded electrical tape is available in many colors. Keep a few on hand to code your cables, when wiring your studios.**

### Radio Guide Quick-Tip

**Always ground your AM tower when working on it. Battery jumper cables are good for this. Run the leads from the tower frame to a good earth ground.**

# Eraser Finds Wall Studs

Dave Hallow — KRVA



*I have referred to “slappers” and “scratchers” in times past. However, in case you missed the explanation, here it is again.*

*To me, Tech-Tips can sometimes be so simple that you slap your head and say, “Why didn’t I think of that?”, and sometimes they can be such that you scratch your head and mumble to yourself, “How in the world did he ever figure that out?”*

*Anyway, my assistant at KRVA, Dave Hallow, came up with a “slapper” when he told me that ...*

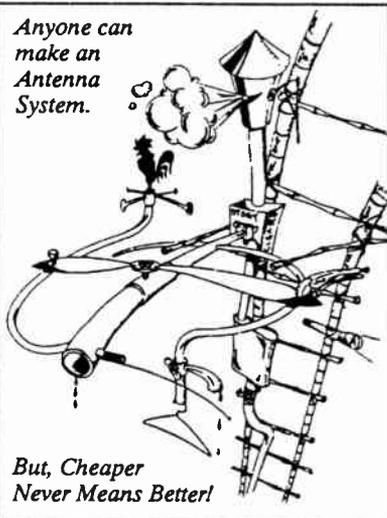
## Finding Wall Studs is Easy

Sometimes you need to hang something heavy on the wall. This necessitates locating the studs. Or, you are trying to route some wiring and want to make sure to miss them. Whether you need to hit them, or miss them, you still need to know where they are. All you have to do is grab the hand-held cartridge eraser and make a pass or two over the wall in question. It will locate the studs for you by pulling down on a metal stud, or on the screws in a wooden stud.

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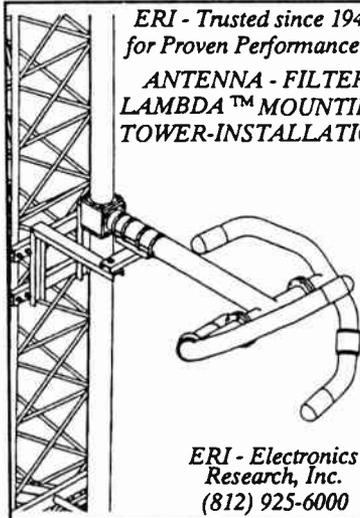
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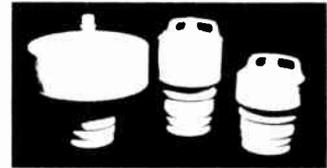
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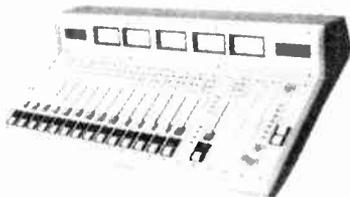
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Fixed and Variable Vacuum Capacitors: Jennings, Dolniko & Wilkins, Mounting brackets and flanges. Vacuum relays.

Oil Filled Filter Capacitors: Plastic Capacitor Corp., 600 to 40 kV, 1 mF to 30 mF with special mounting brackets. Non-PCB of capacitor replacements are available for most transmitters.

Ceramic RF Capacitors: Centralab, Jennings, Sprague, High Energy, 5 kV to 40 kV.

Variable Transmitting Capacitors: E.F. Johnson Co., Cardwell Condenser Co., insulated shaft couplings as used in phasors, variable transmitting capacitors.

Weachler-Weatinghouse: RF ammeters, 0-0.5 amps through 0-50 amps, internal and external thermocouples, expanded and linear or square-law scales. Sizes are 3 & 4 inch, round and square. Special meters are available.

RCA: Transmitter, phasor and antenna tuning unit parts.

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## FCC Rules on Kahn POWER-side

Motorola tried to deny broadcasters the right to increase coverage by using SSB — Kahn POWER-side™ equipment. But the FCC specifically ruled that the "Kahn POWER-side system ... may continue to be operated ..." as a monoimprovement system. So you can now use POWER-side with Kahn independent sideband exciters to immediately increase coverage to listeners using any and all type of AM receivers.

See FCC Order ⇨

## Federal Communications Commission FCC 93-485

21. Kahn "POWER-side" Operation. Several parties express concern over the continued acceptability under our rules of operating using the Kahn POWER-side AM single-sideband system. POWER-side operation, as distinct from Kahn stereo operation, involves an AM transmitter with two independent sidebands, containing identical program material, but with intentional level and frequency response differences. This system is implemented with a Kahn independent sideband stereo exciter and is claimed to have certain advantages for reception with monophonic receivers, particularly in adjacent-channel interference situations. CTI and Furr argue that adoption of the proposed standard would prohibit such an implementation. Motorola maintains that the Kahn POWER-side mode of operation is not stereophonic and questions its legality under the present rules.

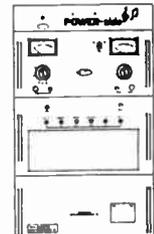
22. Our AM rules do not include a definition of the term "stereophonic." However, generally accepted definitions of stereo service infer two or more channels of audio information designed to produce an audio "image" when demodulated by an appropriate receiver. On this basis, we find that stations employing the Kahn POWER-side system are not subject to the provisions of the stereophonic transmitting standard adopted herein and may continue to be operated, provided that the program material fed to both channels of the exciter is identical in content.

## POWER-side™

### PROBLEMS

- Adjacent Channel Interference
- Antenna Null Distortion
- Co-Channel Interference
- Power-line Re-Radiation
- Building Re-Radiation
- Receiver Tuning
- Low Fidelity Home Radios
- Co-Channel Beat
- Selective Fading

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