

# RAD GUIDE

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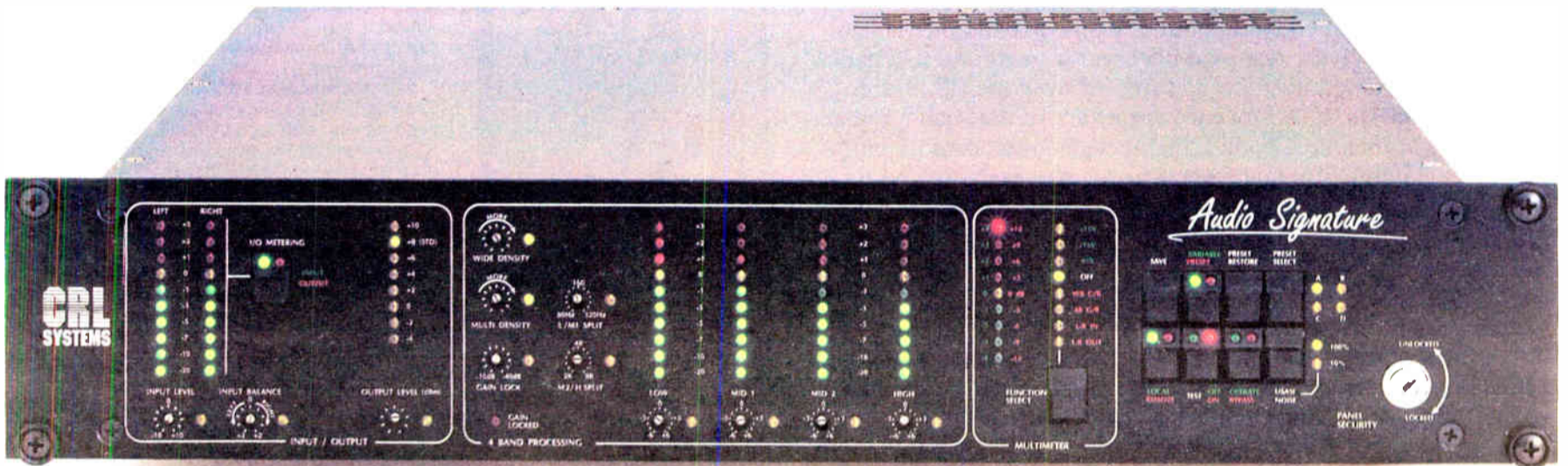
*A Forum for Radio Broadcast Engineers*

Ray Topp - Editor/Publisher

(507) 280-9668

April 1990

Volume 3 - Issue 4



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## The Real Reason

With other broadcast publications offering money for tech tips and technical articles, I feel that we should set the record straight. Radio Guide pays for all tech tips and technical articles upon receipt -- even before they are published. What's more, we pay for articles even if they are not published! Sound crazy? It's not.

You know how much I've badgered readers, over the months, to write for Radio Guide. When you take the time to send your technical information to Radio Guide, you've done your part. It's only fair that you should be compensated for that time you've spent -- regardless of whether or not your particular article actually gets used. From time to time, certain articles (much less than 1%) don't fit into Radio Guide's format. Yet, I feel it's only fair to reward the effort, if not the results.

Articles are then placed in chronological order with all of the others received, and published when they reach the top of the pile. It's a simple, yet equitable, system for allowing a varied and orderly flow of information among engineers.

Because it can take a couple of months to get an article published, I didn't feel it was fair to ask the author to wonder about, or wait for, payment. Our pay schedule is certainly not as lofty as some of the other publications -- but then what is the real incentive for sharing your technical information with your peers? That's something you'll have to sort out for yourself -- before you decide where your technical articles will be sent.

Ask yourself where they will do the most good, and in which publication your articles will have a virtual 100% chance of publication. You know the track record of Radio Guide. The only way we can keep it on track, is to keep those "cards & letters" coming in. The Radio is a forum and, in this forum, all participants are heard from!

## Letters & Help Needed

### Old Technical Books - A Source

From Benjamin F. Dawson III PE  
Hatfield & Dawson  
Consulting Electrical Engineers  
Seattle Washington

I noted that in your February/March issue, Jeff Glass requested the name and address of a bookstore that deals in used and out-of-print books on radio engineering matters. It's unfortunate that many very valuable books have not been reprinted, and the copies in public libraries (for those lucky enough to have access to a good public or university library) have become lost, stolen or damaged over the years.

Our firm has been collecting out of print, useful and classic books on this subject, for our own library, for years. As a consequence, we have visited used bookstores all over the US and in Europe and Asia. The only store we are aware of that has a reasonable inventory of technical books, including books on radio engineering and related mathematics and physics, is:

**Ptak Bookseller**  
1531 33rd St. NW  
Washington (Georgetown), DC  
(202) 337-2878

Mr. Ptak's store is not large, but he has a very good collection of technical and scientific books, and is very knowledgeable about where one might find things he doesn't have in stock.

### Go-Cart Timing Disk Help

From F.E. Fess II  
WLRB/WKAI Radio  
Macomb, IL 61455  
(309) 833-5561

I need to know if any of you have found a way to clean and polish the timing disk on IGM Go-Carts. I have tried a number of things, with no luck.

*Give him a call if you have some answers - - well' also publish them in Radio Guide . . . editor*

### Continental Cap Failure Update

From Jack Parker, WUBE  
Cincinnati, Ohio  
(513) 621-6960

*Jack sent us this update to his article on the Continental 816R-1A capacitor failure, found in the February/March issue of Radio Guide . . . editor*

I have found that the cause of the failure of the IPA plate tuning capacitor in the 816-R1A was *not* due to arcing (which is the most reasonable conclusion one can reach, based on the external indicators). Unfortunately, reasonable conclusions aren't always the right conclusions -- which is the case here.

The actual reason for the failure, based upon inspection of the failed vacuum-variables,




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seems to be high circulating currents in the IPA plate tank circuit. Presumably these high circulating currents cause excessive temperature increase in the vacuum variable which, in turn, causes the elements of the capacitor to sag slightly, taking the PA grid to ground.

This failure is not a one-time occurrence, but gets progressively worse over a period of weeks, until the capacitor fails for good. The additional capacitors which one places in parallel with the vacuum-variable simply redistributes the circulating current in the IPA plate circuit through two legs, which reduces the current through the vacuum capacitor to roughly half of its original value. This modification obviously works, since I've noted no additional incidents of PA plate/screen overloads since the doorknob capacitors were installed in my 816-R1A several months ago.

*Our apologies to Jack. This update was misplaced and did not appear in the February/March issue, as it should have . . . editor*



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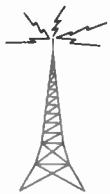
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### Radio Guide

Volume 3, Issue 4  
April 1990

Editor-Publisher: Ray Topp



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# Content or Color

## A Few Words on a Few Changes

Radio Guide is fast approaching its third year of publication. At these times, it's traditional to take a look back and see where we've been and what the next step should be.

It's no secret that I've always felt that Radio Guide's purpose is quite different from the other trade publications. Radio Guide is, obviously, not a news oriented publication. Neither does it strive to be product oriented. The lack of news, press releases, and product information has not hurt Radio Guide or hindered your acceptance of it. You have my appreciation for that.

As an advertiser supported publication, Radio Guide has always fought an uphill battle to overcome its perceived image as nothing but the last band-aid for tired old equipment. Ask yourself this: If you can't fix your old transmitter, which will get replaced first -- you, or the transmitter. Enough said! Your job is to keep things working (new and old) until such time as station management, with your guidance, sees fit to purchase new gear. Radio Guide's purpose is to help you fulfill that task.

Can Radio Guide grow and yet continue to meet your needs? I've been listening to all you've been telling me, and giving it a lot of thought. I feel the time is right to make some of these changes now.

A tabloid is difficult to store, the pages turn yellow, and it's hard to photo-copy articles. The solution to all of this is a magazine-sized publication. This decision is not as easy as it sounds. I know quite a few of you have expressed concern that Radio Guide should not become "glossy." I understand that concern and offer my promise that, as long as you see my name on the cover, you will still get the technical articles you need.

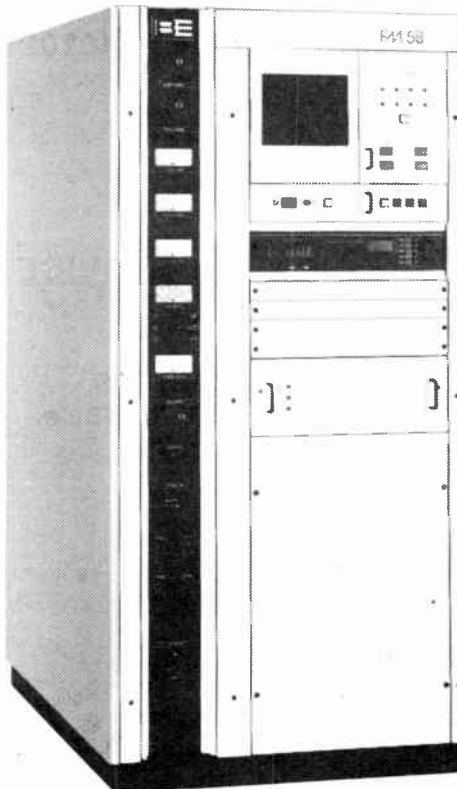
Color is no substitute for content. Yet, to be able to offer you more technical information, means more pages. More pages means . . . you get the point. Radio Guide has to be able to offer all advertisers exactly what they feel they need to deliver their message to you. This doesn't mean that you will be greeted by a slew of traditional "press releases." What we will do is present new product information with a technical slant. We'll describe what it can do for you and how it will accomplish that -- in hard technical terms. Not how pretty the blinking lights are.

Last, but certainly not least, is that as long as Radio Guide remains the same size as other world-famous publications, it will always have somewhat of an identity problem. A change in size and look should help overcome that. There's no magic in new clothes, but we'll try this suit on for size, and see if it fits. It's up to you to let me know . . . *editor*

Watch for the "new" Radio Guide  
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# CRL SPOTLIGHT

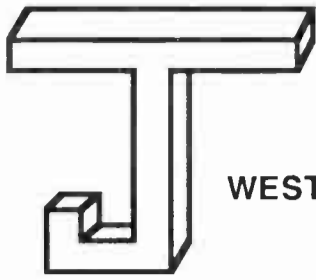
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## Checking RF Ammeters

By Bob Schnieder - Broadcast Technical Services  
Lubbock, Texas  
(806) 798-2601

Have you ever taken over a station and found a number of RF  
ammeters on the shelf? You wonder if they are good and if they are  
accurate. You may get lucky and find some with the meter move-  
ment pegged and stuck to the right, and you will pitch it in the  
trash. The others -- you would like to know if they work or not. You  
could insert each in the line and check them out, but there is an  
easier way.

What you will need is a Variac, digital voltmeter that will  
measure to 10 amps, and a large wattage resistor or resistor net-  
work. (More about the resistor network later.)

Your RF ammeter is designed to measure AC current thru a  
thermocouple. The movement of AC through the thermocouple  
creates the current that moves the meter needle to read the RF  
current. The RF ammeter will measure 60 Hz currents as well as  
those in the Broadcast Band.

The hook-up to check out the meter is a simple series circuit.  
One end of the secondary of your Variac is connected to one end of  
the resistor. Connect one lead of your DVM to the other end of the  
resistor, and connect the other lead of your DVM to one terminal of  
the RF meter being checked. The other terminal of the RF meter  
goes to the other secondary lead of the Variac.

Depending on the amount of current you want to measure, you  
can design your own resistor network. The popular DVMs have a  
10 ampere limit on AC current measurement. Many stations, de-  
pending on their power, will have meters rated at 0-5, 0-8, or 0-10  
amperes. The purpose of this test is not to calibrate the meter, but  
to see if it functions properly.

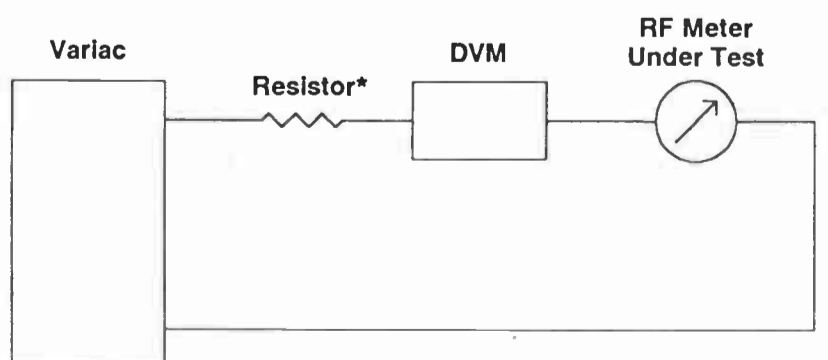
Now for the resistor network. You will need to use Ohm's Law  
to make your resistance and wattage calculations. Your Variac will  
allow you to increase the voltage from 0 to 135 VAC. Let's assume  
that at 50 VAC from your Variac, you want a current of 10 amps.  
Using Ohm's Law, you find that your resistance will need to be 5  
ohms. The wattage of the resistor will need to be 500 watts. A 5  
ohm, 500 watt resistor is not something every parts house has, so  
you may have to use a combination of resistors in series and paral-  
lel configuration in order to get the correct resistance and wattage.  
You may also use other voltages to calculate your resistor network,  
but remember that you don't want the voltage so low that you lose  
the control feature of your Variac.

In our shop we have a nichrome wirewound resistor that is on  
a ceramic core. It was picked up at a Hamfest some years ago and  
will dissipate the heat.

Now that you have everything hooked up properly, you will  
start your Variac at its minimum voltage level. Increasing your  
voltage slowly, you will be able to compare the AC current reading  
on your DVM with what you are reading on your RF ammeter. The  
readings should be very close. You may want to check a number of  
RF ammeters at the same time. Just add the other meters in series,  
and now you can check meter against meter.

Remember that you cannot use this as a calibration standard,  
but it will prove if your meter needs to be re-calibrated.

Figure-1



\* see text for resistor value

# Mighty Mean Machines Made for Modest Money! Just ask Maynard Meyer of Madison Minnesota...

**Q92**  
KLQP-FM

P.O. BOX 70  
MADISON, MINNESOTA 56256

January 5, 1990

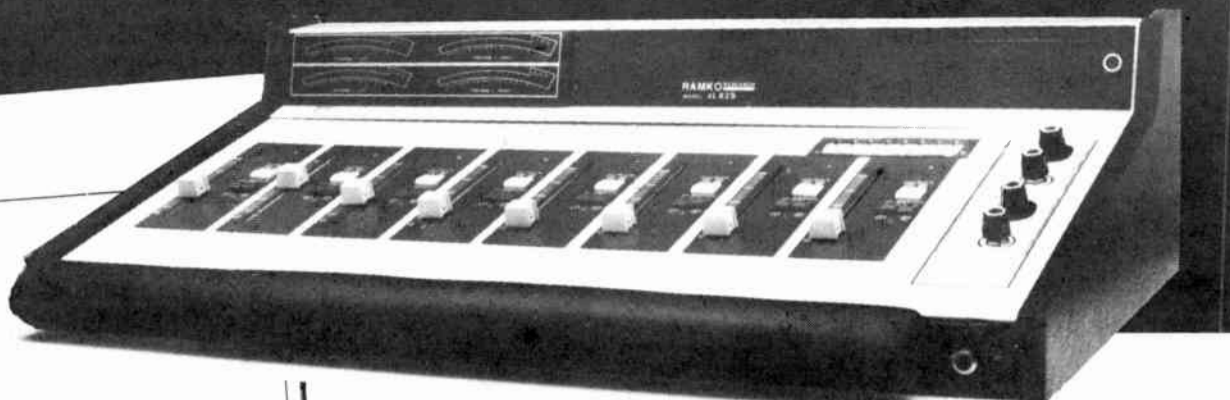
Dear Sirs:

Just a note to let you know how much we like the Ramko xL62S stereo console we installed in our FM broadcast operation a few months ago. The audio quality is excellent and our announcers like the ease of operation. It's amazing that you can offer a console of that quality for the low price tag that was on it.

I had one occasion to call your service department for an answer to a question I had on a minor problem and I received some friendly and accurate advice. Incidentally, the minor problem resulted from a severe lightning strike at our studios, the Ramko board survived it nicely! I would recommend the xL SERIES audio consoles to anyone with a small budget who is looking for "big" quality.

Very Truly Yours

*Maynard R. Meyer*  
Maynard R. Meyer  
General Mgr./Chief Engineer



## THANK YOU KLQP-FM!

We could not have said it better. Ultimately there is no higher authority than you, the broadcaster, on how well we've done our job. How the equipment performs, stands up to every day use or abuse, looks & feels to the operator, plus delivering the features needed for the dollar spent. No less important is how we respond if a problem should ever occur.

## OUR DIRECTOR OF ENGINEERING DIDN'T HAVE JUST A HAND IN THE DESIGN, HE HAD HIS WHOLE ARM IN IT.

Before one PC board was laid out or pencil put to paper for any part of the metal structure, our Engineering Manager sat down and measured the most critical parts of the console's operation. The arm, the hand and fingers, & the operator's line of sight. The arm had to rest comfortably when at the controls; the input & output select switches had to be reachable while simultaneously controlling the faders; the selectors had to be illuminated and clearly discernable at any angle; and the meters had to be properly angled for normal seated operation and clearly show the levels, even across the room. What he finally designed in was a layout that is exceptionally easy to control without operator strain or unusual manipulations. Science calls this ergonomics; we call it just good common sense and a concern about you, the user.

## IT GETS EVEN BETTER AS YOU GO ALONG.

Dramatic new developments in IC technology have taken place that allowed us to design a console with fewer components, less manufacturing labor and higher performance than previously

possible. The end results are significant price reductions for the features provided and a quality of sound reproduction unsurpassed by units costing thousands of dollars more. Huge expanded scale -40dB to +3dB, multi-color VU meters - Four individual meters on dual channel units - Nine input selects on the last channel - Mono sum output - Plug-in modules for ease of service - Optional switch programmable remote start/stops Double shielding for total RF protection - Optional mix/minus buss with balanced out and much, much, more.

## YOU'RE INVESTING IN A CONSOLE...NOT PLAYING THE LOTTERY.

As you are reading this, the xL SERIES is proving itself in numerous installations across the country. "No RF problems of any kind"...."Our sound has noticeably improved since installing your boards"...."Our people really enjoy the ease of operation" ..."Our console actually tested out better than your spec's".

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## COMMON FEATURES:

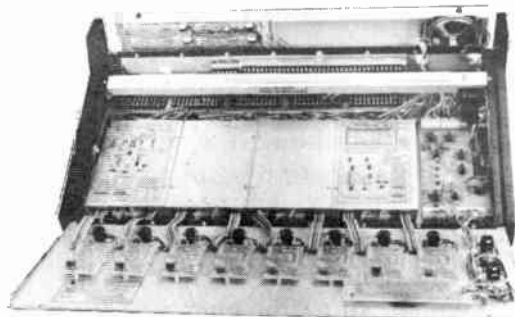
- Mic/line select jumpers on each channel
- Mono/stereo feed selects on each channel
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- Unique internal decals & labels for complete installation without referring to the manual.

## PARTIAL SPECIFICATIONS

**INPUTS:** 2 per channel except last channel which has nine. Balanced bridging 1 kohms in mic mode & 150k ohms high level. Input A of each mixer programmable mic thru high level & strappable for mono or stereo feed. Input B is programmable for low thru high levels. **OUTPUTS:** Balanced low impedance, +24 dBm max into 600 ohms. Additional stereo sum balanced out. Main channel outputs factory set for +8dBm @ 0 VU. **METERING:** Expanded scale, multi color, solid state. 2 each on single channel models & 4 each on dual channel models. **MONITOR:** Stereo, muted monitor outputs @ +4dBm. External 20 watt stereo amp. included. S/N: Mic level in @ -50dBm & +8dBm out; -68db. High level @ 0 dBm in; -75dB. **DIST:** Below noise floor. Typically 0.009%. **RESP:** 10Hz-20kHz, +0.00, -1.5dB. **FINISH:** Polyurethane Carbide black, Linear white & RAMKO grey.

## STEREO CONSOLES: Models & accessories

xL41S	4 mixer, single channel	\$1395
xL42S	4 mixer, dual channel	1650
xL61S	6 mixer, single channel	1975
xL62S	6 mixer, dual channel	2375
xL81S	8 mixer, single channel	2650
xL82S	8 mixer, dual channel	2950
xL12/1S	12 mixer, single channel	3850
xL12/2S	12 mixer, dual channel	4150
RSS2	2 mixer, 4 machine start/stop	225
RSS4	4 mixer, 8 machine start/stop	295
MMB 1/9	9 input mix/minus buss, bal. out	175
SLF	Super long life linear faders(per chnl)	75



Interior view of the xL82S

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## Wet Noodle Antenna

By Edward C. Dulaney - KJAC 92.7 FM  
Lubbock, Texas  
(806) 745-6677

How many times have you been guilty of "overlooking the obvious?" Well, I've been caught a couple of times, mostly in the area of remote broadcasts. I'm a bit smarter now. Not because I attended MIT, but rather because I decided to use some of my amateur radio know-how in the broadcast field.

For instance, our Marti had antenna problems. The little magnetic-mount antenna had been screwed and unscrewed a few too many times and decided to take a much deserved retirement. The station purchased a broadband antenna from a manufacturer who shall remain nameless, which didn't work. This created a problem, as the remote was at an important basketball game, and the station could end up "eating it" if the game couldn't be broadcast.

Fortunately, a few months earlier, I'd decided to make an emergency antenna. Using the formula below, I created a 1/4 wave Marconi antenna using the center conductor of some RG-58/U coaxial line (who said the stuff wasn't useful on UHF frequencies) and a PL-259 connector (see Figure-1). Even though the commercial antenna couldn't get a strong signal into our repeater, this little 1/4 wave "wet noodle" did a bang-up job!

### WAVELENGTH CALCULATIONS:

#### Full Wave

Length (in meters) = 300/frequency (in MHz)

#### 3/4 Wave

Length (in meters) = 225/frequency (in MHz)

#### 1/2 Wave

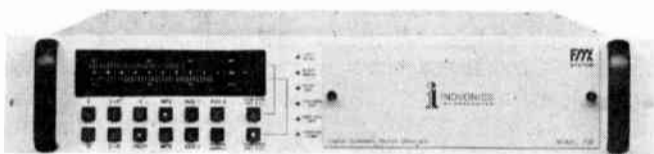
Length (in meters) = 150/frequency (in MHz)

#### 1/4 Wave

Length (in meters) = 75/frequency (in MHz)

## Audible Improvement!

### FM



Our 706 FM Stereo Generator maintains 16kHz response and 75dB separation through *digital synthesis* of pilot and subcarrier. This assures **full modulation** with an *inherent* low residual above 54kHz, though an adjustable pre-pilot composite clipper is included.

The 706 also features internal combining and metering of up to 3 SCA/RDS channels, and has two independent composite outputs. It is 100% - compatible with *your choice* of audio processing, and the FMX™ System is a plug-in option.

### AM



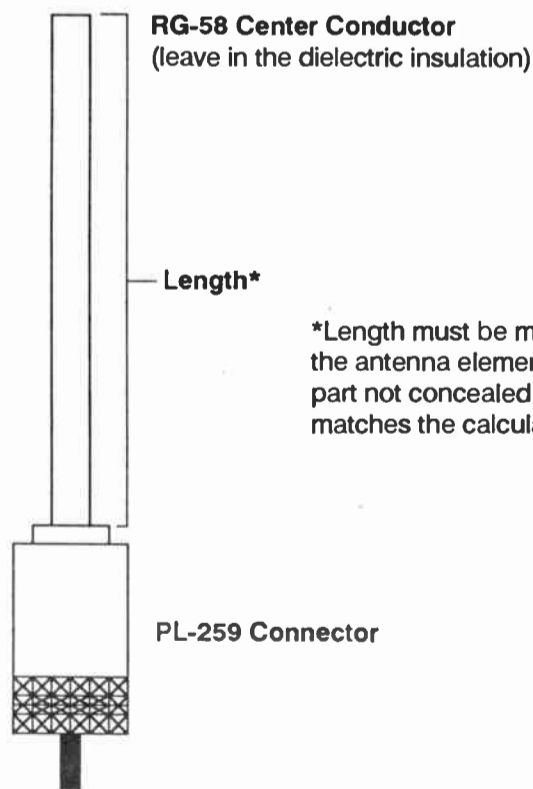
Inovonics' 222 is the simple, effective and affordable path to NRSC compliance. Its built-in peak control, adaptive preemphasis and no-overshoot 10kHz filter make you *sound better* too!

## Inovonics Inc.

1305 Fair Ave., Santa Cruz, CA 95060  
CALL: 1-800-733-0552 - FAX: (408) 458-0554



Figure-1



Other lengths could work as well. On the UHF frequencies, you could make a 3/4 wave antenna out of a length of copper brazing rod. Or how about a simple 2 or 3 element Yagi (directional) antenna out of PVC pipe and a couple of coat hangers? I've tried them all, and each one works fairly well. Considering the amount of money invested, it could be well worth your time checking it out.

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# RCA BTF-20E Harmonic Filter Position

By Russ Erickson - Manager RF Products  
Broadcast Electronics  
Quincy, Illinois  
(217) 224-9607

In regard to Meryl Valne's article in Radio Guide (September 1989 - Page 9), the positioning of the harmonic filter is critical, especially if it is reactive (not absorptive) type filter. The length of the line between the cavity output and the input to the low pass filter is usually a half wavelength. This mechanical positioning insures that the harmonics are arriving at the filter at the right time so as to be attenuated. This also minimizes the amount of harmonics reflected back to the PA cavity, adding to the stability of the amplifier. The second harmonic is the strongest and sees a DC short at the stub (on the RCA filter). The RCA 20E is now probably performing the way it should.

The finger stock deteriorating on the loading adjustment was probably not solely caused by heat, as much as a combination of heat and extremely high RF currents. In a 1/4 wave PA cavity, the current node is at the point where the fingerstock is located, after adjustment to optimum loading/tuning.

Also, when you change out the finger stock, do not sand down the arc marks on the PA wall as you will be removing the silver plating. Instead try silver polish. It takes more time, but it does not add to the deterioration of the transmitter.

Another thing to watch out for on some 1/4 wave cavities is the extremely sharp tuning of the PA loading. Some manufactures use a locking mechanism on the control, but the stability and durability of the lock deteriorates over time.

One of the reasons I recommended the purchase the purchase of a BE transmitter in the past (before I came to work here), was the relative non-interaction between the final PA tuning and loading. This is inherent to the folded half-wave cavity design. I was also impressed long ago by the simplified design with no sliding contacts and no plate blocking cap.

The VSWR issue brought up by Joe Puma and Alan Roycroft can be fixed easily by installing a Bird Wattcher, and completely disabling the RCA's internal VSWR protection by the front panel selector.

On another issue, referencing the original BE FM-30, vintage 1980. One of the things that can get you frustrated fast is trying to align five solid-state IPA amplifiers, if you don't have the right test equipment. If the IPA is performing correctly, DON'T TUNE IT! When I was in Field Service, we would occasionally get a call from somebody who "tweaks 'em up every couple of months." We're always here to help, but if it's not broke, don't fix it.

## FM Exciter Problem

By Earl W. Hocker - KTAN/KFFN  
Sierra Vista, Arizona  
(602) 458-4313

KFFN uses a Wilkinson Model X exciter with its Gates FM-2.5H transmitter. This is an excellent exciter, but all equipment will develop troubles. Our first problem occurred a few months ago when the FM on-air audio started to cut in and out, but the transmitter remained on the air. A call to TTC-Wilkinson Customer Service resulted in a suggestion that I replace the coaxial cable between J611 of the Audio Mixer Board and J501 of the Modulator-Oscillator. This cable was replaced, and the on-air signal returned to normal.

Recently, the FM audio went completely out, but the carrier remained on the air. The coaxial cable was checked and found to be satisfactory. Audio was present at the output of the Audio Mixer Board. Another call to TTC-Wilkinson resulted in a new Modulator Oscillator Board that corrected the problem.

Page 8 April 1990

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## RF Proof DVM

By Jim Wenstrom - KFLS/KKRB  
Klamath Falls, Oregon

It is frustrating enough to have to trouble-shoot a dead transmitter at 2:00 a.m. in the morning, or fine tune it after Sunday night (Monday morning) sign-off. In either case, you finally get enough power to the tower, and you start to take a voltage measurement to compare with the spec sheet. You grab your "Simpson" or DVM, and you see that, even without connecting it to anything, it is reading 137 volts! What do you do now?

I have been known, in the past, to re-wire the transmitter's voltmeter to the points I need to read, but that is very time consuming. What's a person to do? Your choices are limited, and they all cost. You can try to find a surplus RF voltmeter, and try to pack it around, or you can pay the big bucks for a fancy meter to do the job.

In the past 2 years, I have purchased several pieces of test gear from Sencore, and it all worked out better than I would have ever hoped. So, I called my Sencore sales rep, and he said he would send me a meter to try. When he told me that the price tag was about \$400, I wasn't too sure that I wanted to even look at it. But what the heck, it wasn't going to cost anything to try.

It arrived just in time to make my weekly trip to the FM site for some "tweaking and peeking." I couldn't wait to get to the building to see what the meter would read with open leads -- the first test. When I got into the building, even before I poured my first cup of coffee, I turned the meter on and set it to its most sensitive voltage scale. I was amazed when I looked at the display, and it read 00.2 volts.

My first thought was that the board-op had already turned the transmitter off. But the output meter was resting on 95% (19 kW) into 5 bays less than 75 feet away. This little meter was not showing any effect of being in an RF field of over 50,000 watts! I was not surprised, the next night, when it also performed well at my AM site.

I sent my check off to Sencore the next day, because I had found that the Sencore DVM37 is a compact, rugged, and RF proof multi-meter that (they say) can be swung around my the leads. I found that it works when and where you need it.

## Sat Dish Drop-Off

By Pat Cerone - WXRA/WEZG  
Clay, New York  
(315) 699-8200

Here is one for the books. We have a satellite dish for receiving our programming from SMN, and on various occasions we would get nothing but white noise indicating loss of signal. After a while (and the time would vary greatly), it would come back -- very intermittent.

I called my grandson, who is real big in the satellite business in this area, and gave him the particulars of the problem. The meter on the receiver would go to zero, so we suspected either the LNA or the downconverter. The first thing he checked was to see if we had 18 volts on the end of the line to the LNA, and we did.

When we connected the downconverter and the LNA, the voltage dropped to 3 volts. The next step was to find out where the other 15 volts went. We brought the LNA and downconverter in on the bench and checked them on our power supply. We found that they were drawing the normal amount of current.

The next suspect was perhaps a high resistance in the 18 volt output at the receiver; so we took a short piece of co-ax and tried it with that. The voltage was 18 volts! So there was our answer. A bad co-ax line -- about 160 feet buried in the ceiling. We installed a new piece of RG-6, and the receiver loves it. The "S" meter reading is better than ever, about 4 dB better.

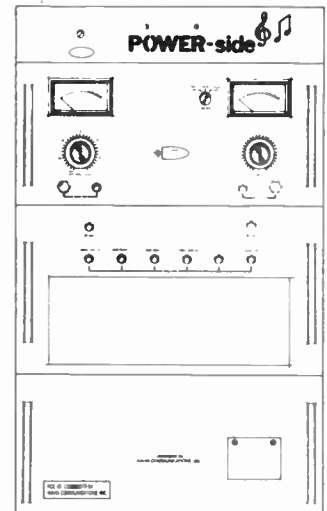
That finally ended our search, and we learned never to trust a piece of cable, no matter how good it looks.

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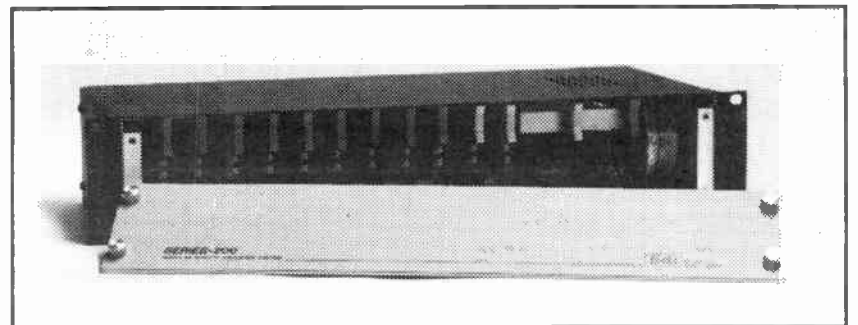
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# Care & Feeding of a CCA Transmitter

By John T. Winqvist - WFPS  
Freeport, Illinois  
(815) 235-7191



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It was about a year ago that I first sent an article (actually a plea for help) on my abused CCA-3000D. Over two hundred various engineers came to my rescue. Since then, I've learned a lot about this transmitter. I cut my engineering teeth working on Collins, Continental, and Gates boxes -- the CCA was a whole new experience. The design was straight forward with triode amps, military looks and, overall, is pretty stable.

My story starts with an interlock system that was bypassed, a radio station located in a trailer, and no earth ground (not even on the tower - the copper ground strap was never unrolled from the shipping position). Needless to say, there had been numerous repairs in the box to correct lightning damage. Nothing on the floor of the transmitter had ever been mounted after installation; the transformers, chokes, and caps were just sitting there. Because of someone's modifications to the interlock system, there was a bad intermittent problem, where any sharp jolt to the transmitter room floor would take us off the air. After curing all of the above problems, along with a baptism of fire regarding IPA grid ring capacitors, all is well again.

What I write about today, is where to get better parts for less money and, if your class A has just doubled their power, all the facts on how to take your 3000D to 5 kW.

My box is three-phase, with four-wire incoming (thank God). For those of you new to this, and find yourselves asking "What is he talking about," there have been numerous articles in past issues of the Radio Guide about different types of three-phase circuits (a good reason to save each issue).

For those of you who have a plate supply transformer with two secondaries, you are halfway there right now. The usual tap that is used is the 1750, which gives you a plate voltage of near 3900 to 4000 volts, depending on your incoming AC line voltage. One Amp of current gets you somewhere in the ballpark of 3000 watts (those of you lucky types that have tall towers or hills to put your tower on, probably haven't seen this figure for awhile).

The first step is to prepare the power supply to take you to 5000 plate volts. Check your rectifier stacks; on these black epoxy bricks, there is a number indicating the peak inverse voltage (PIV) rating of the stack. To my knowledge, there are only two different types: an 11 kV and a 16 kV. You will need to have all 16 kV stacks in the supply in order to make this work.

For those of you who need some stack rectifiers, I have the ultimate solution. There is a company called Peter W. Dahl, that makes mainly replacement transformers for transmitters. They are currently in the process of making replacement stacks for CCA products. Original equipment stacks were in limited supply, and costly. Also, when a bunch of diodes are sealed in an epoxy brick, you can start to build a heat problem which can eventually ruin the "brick." That usually occurs during AM drive time.

After talking to a few engineers with ideas regarding this problem, I called Peter Dahl and told him of the dilemma. His number is (915) 751-2300. After agreeing on specs, he is now producing a 16 kV, 6 amp replacement stack kit for CCA boxes (without the epoxy brick) that will mount in place of the original equipment. The original CCA bricks are rated at something like 1.5 amps, so these replacements should run cooler. Best of all, they are very inexpensive.

Next, the two choke coils L1 and L2 have to be changed; their current rating is too low. Peter Dahl has these as well, at an attractive price. The replacement part number for L1 is CCA-924-033. The replacement for L2 is a 15 henry, 1A choke. The prices (as of this writing) are \$425 for L1 and \$250 for L2.

For those of you how have held out to replace your PCB-laden capacitors on the floor of the box, now is the time. CCA used three 4uF/5kV caps, with one on the IPA plate supply and the other two

(continued on page-11)

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## Care & Feeding of CCA . . . (continued)

in parallel on the PA supply. A recommendation from a friend of mine turned the best price, from the Plastic Capacitor Company in Chicago, IL. Werner Ullrich, of WKST in Newcastle, PA (the most experienced CCA operator I've ever spoken with), uses these capacitors in his CCA, but I took his idea one step further.

The Plastic Capacitor part number for the direct replacement capacitor is LK-50-405; the price is \$85.20, from Newark Electronics (Newark's part number is 18-F-2994). Now, since your PA will be at 5 kV (and sometimes more), my idea was to use an 8uF/6kV cap for the PA, in place of the two parallel 4uF caps. Plastic's part number for this is LK-60-805, and the price is \$292.17. Newark does not stock this, so you will have to deal with Plastic Capacitor Co. directly. Their phone number is 312-489-2229. Talk to Tom Brown; he knows the story and what it takes.

Now, to get to 5000 watts, you will have to use the 2200 volt taps (the common is still the IPA B+ line as before). There is one more step -- get rid of the 8122 IPA stage, and replace it with an 8874. This tube is more expensive but, if you like triodes, less AM synchronous noise, and hate replacing IPA grid ring capacitors, the triode is the only way to go (you can also eliminate the screen supply).

The conversion kit is available from CCA, and their part number for the kit is 380026. This includes socket, mounts, anode

plate, and filament transformer. It also includes all resistors, capacitors, and everything you will need to fit it into your box (all except the tube). The price for the kit is \$364.55. CCA's number is (404) 964-3530. You will also have to change the plate voltage meter resistor to twice its original value, and change the meter scale to read 10 kV full-scale instead of 5 kV.

One more thing, and not just for CCA operators. If your transmitter uses a 3CX3000 triode, and you have just burned your grid ring after a nasty lightning strike, you don't need to order the whole socket. Call QEI Corporation. Their 5 kW transmitter uses a 3CX3000, and they have a grid ring that can mount to almost anything. It costs \$130 and is well constructed. The number at QEI is 800-334-9154. You'll have to keep all the clearance around the tube the same as before, which means (in the case of a CCA) you will need to have the socket mounting plate machined where the old grid ring was, to eliminate the ridge where the grid ring was soldered to; then mount it from the underside of the plate. Each transmitter will be different. Use your head because the spacings are critical. This only works on the 3CX3000A7 tube.

If you are attempting any of these modifications or repairs and run into a snag, please feel free to call me at work anytime. The number at WFPS radio is (815) 235-7191. I keep armed with spare parts. So, if you're in my area (even if you're not, I may know a CCA chief near you), give me a call and we can work together.

The Following is a Paid Advertisement From Kahn Communications Inc.

### Why is the Motorola AM Stereo System a Failure?

Certainly not for lack of trying or marketing expertise. No radio broadcasting system ever enjoyed a larger advertising budget, cleverer promotion or a more powerful group of co-sponsors... Motorola, General Motors and Chrysler. The problem is its technical characteristics... fatal stereo flaws; platform motion, rain noise, excessive bandwidth. And crucial for small and medium sized stations (and even "clears" serving listeners more than 25 miles away), reduced mono coverage to the typical narrow IF bandwidth receiver.

That is the mono coverage problem that will limit a station's "bottom line". It is *THE technical problem no AM broadcaster can ignore or compromise.*

Smart broadcasters will give any new technology a fair try, but they will never stay with technology that degrades such coverage because that means loss of "bottom line" profits.

### MOTOROLA LOST, BUT WE HAVEN'T WON...YET

Motorola has lost the marketplace competition, but to be frank, *that does not mean we have won it...* how could we win when there are no mass produced AM stereo receivers available for the Kahn/Hazeltine system. Motorola heaped scorn on these high quality multi-system AM Stereo receivers, and threatened at least one of their manufacturers. I wonder why Motorola so feared high quality multi-system receivers.

Not only were these great stereo radios, but do you remember their superb mono sound... some with notch filters and frequency response out to 12 kHz. Do you know there were some 20 models of multi-system AM stereo receivers manufactured by Sony, Sansui, and Sanyo.

Never fear, quality AM stereo radios will be back. There is still one way to cure this problem... *through the Federal Court system*, and that is where we are right now in Kahn vs General Motors. When we succeed in the Federal Courts, you have my assurance that not only will you have AM Stereo receivers for the Kahn/Hazeltine system (the system that will survive in the free marketplace), *but there will be quality AM receivers that will help you to compete with FM stereo.*

General Motors, Chrysler and other manufacturers of 3 kHz AM radios are the real reason for AM broadcasting's sorry state. This pitiful situation has been going on for a quarter of a century, and your ratings dropped accordingly. (Can you imagine, some people actually blame AM stereo competition for this old problem. And some Americans actually have the nerve to suggest to other Americans that are competing too vigorously. **Competition and innovation made our country strong and the sooner GM, Chrysler and Motorola stop whimping about competition, the sooner we will be back where we belong, leading the world industrially.**)

From an engineering standpoint, AM Stereo, in the car, can significantly outperform FM stereo because of its greater coverage and lack of multipath. But it requires *quality AM receivers and the AM stereo system that does not lose coverage.*

### Whose Fault is Motorola's "Marketplace" Failure?

Can you believe it, some people actually blame our small firm. Can anybody seriously believe that Kahn Communications could block Motorola + General Motors + Chrysler + the largest media blitz ever targeted at radio broadcasting.

(Even where Motorola somehow convinced a government to protect it from Kahn competition, Motorola failed. A Nov. 1989 report states that Australia's AM radio industry "has reached such a perilous state that strong rumors suggest several [Melbourne] stations may be forced to surrender their licenses within a year", and points out that the [Motorola] AM stereo has not helped, and that music on AM "has had its day". Seems like AMers in Australia are paying dearly for their Government's lack of faith in free enterprise.)



The most powerful companies even with "big brother" governments are no match for the marketplace and the laws of physics. Nobody killed Motorola stereo-it died of natural causes.

### GOOD NEWS POWER-side... ...POWER-side...POWER-side

There is new Single-Sideband technology off and running that can immediately improve your "bottom line" by increasing your coverage. This new technology will allow AMers to compete more vigorously by reaching more of the same type of audience they presently cover. *You don't have to wait for new receivers, nor the years it will take to convince young listeners to accept AM radio.*

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Engineering information is available so that you can see why 5 of the 16 New York City AM stations have installed POWER-side.

### More Good News

*Speaking of the POWER of free market competition and POWER-side, the POWER of the Federal Judiciary will solve the AM Stereo standoff; caused by the lack of mass produced sideband AM stereo receivers.*

*In April of 1988 litigation was initiated; i.e., Kahn vs General Motors.*

*General Motors, and its indemnifier Motorola, attempted to block the litigation. Motorola filed a suit in the Federal Court in Chicago seeking to have my patent declared invalid, or if not invalid, not infringed, or if not infringed at least I waited too long to sue etc. etc.*

*In June of 1988, GM was temporarily successful in staying the New York suit while Motorola attempted to invalidate my patent in Chicago. While Motorola/GM succeeded in delaying matters, the result finally came in October of 1989 when a Federal Judge in Chicago dismissed the Motorola suit stating:*

*"...the court is of the opinion that this suit does not serve a useful purpose and may serve to harass an individual [Kahn]."*

*Then, more good news, on November 17, 1989 a three judge panel of the Court of Appeals for the Federal Circuit in Washington (for all practical purposes, "the court of last resort" in patent matters) unanimously reversed the New York Court in the Kahn vs. General Motors suit, concluding that:*

*"...the district Court exceeded its discretionary authority in creating the stay. The stay is vacated, and the case is remanded to the District Court for proceedings on the merits. Costs in favor of Mr. Kahn."*

*Thus, after 22 months of delay and harassment by GM/Motorola the matter is back in New York. The patent is valid, literally and willfully infringed and, according to patent law, not only am I entitled to substantial damages, but also to have GM enjoined from manufacturing and selling the type of AM Stereo radios that have so interfered with the AM Stereo marketplace.*

*Even General Motors is subject to the laws of this country, as was Kodak in the Polaroid/Kodak instant film case.*

*Stay tuned, while it is once again proven that the free market competition really does work.*

KAHN COMMUNICATIONS, INC. 222 WESTBURY AVE., CARLE PLACE, NY 11514 • (516) 222-2221

# Remote Monitor Control

By Hal Schardin - WCCO  
Minneapolis, Minnesota

When WCCO went stereo a few years back, I realized the problems of studio monitor pots would be doubled.

In WCCO's case, studio-muted audio is run to a power amp. The power amps for all studios are located in a back room. The output of the power amp had been run to an 8-ohm L-pad. These wire-wound controls start out scratchy, and deteriorate from there. In stereo, these problems would be doubled.

Well to start out, I chose the most reliable pot element I know of -- conductive plastic. I know the power dissipation of the pot dictates we will be varying the input rather than the output of the power amps. This project would now require multiple runs of shielded-pair wire to each studio to work, and dual-section audio taper conductive plastic pots.

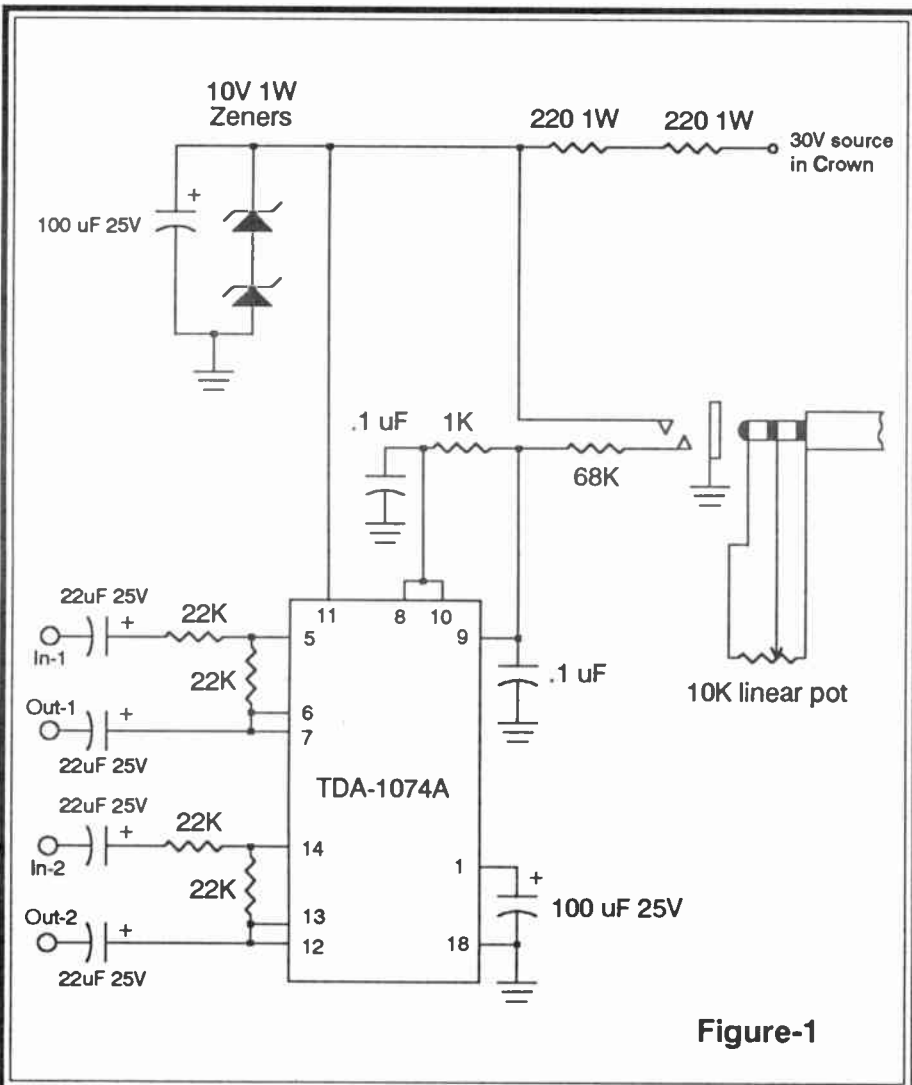
I wondered if there wasn't a simpler way to do this project. While looking at the Digi-Key catalog, under the Signetics category, I spied the TDA-1074A dual tandem electronic potentiometer integrated circuit.

After playing with the chip for a while, I came up with the circuit in Figure 1.

This circuit has been added to Crown D-60 and D-75 power amplifiers. A single linear conductive plastic pot provides a pseudo audio taper, as configured. Further, since you are varying a control voltage, you can get by without shielded cables.

To begin, I built the circuit in Figure 1 on a small perfboard. The two power resistors between the Crown's supply and the circuit's zeners are added later, outboard. Next, I attached pigtailed for input, output and control. Then I covered the circuit board with insulation, such as layers of black tape.

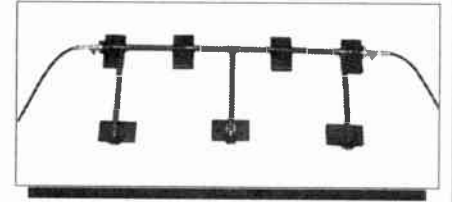
To start the installation into the Crown power amps, I drilled out the rivets holding the stereo-mono switch on the amps back panel. Then I soldered together the two wires that need to be connected together for stereo. This is most easily accomplished by removing the screws that hold the circuit board, and putting a jumper wire in place of the "stereo" connections. I then slipped the circuit package under the Crown's printed circuit board.



(continued on page-13)

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## Remote Monitor Control . . . (continued)

While the Crown circuit board is up, you can trace back to where the supply voltage can be gotten, and you can disconnect the wires that run between the 1/4 inch input jacks and the level pots. Run the jack outputs to the input of the circuit. The circuit's output then hooks to the level pots.

The control wires are attached to a 3-conductor mini-jack, like those used for stereo headsets (available at Radio Shack). Be sure to put the + wire on the tip, so you don't short it out when you install the plug. The ring is control, the sleeve is ground. This jack is mounted in the hole of the vacated stereo-mono switch.

The two series 220 ohm resistors run between the tip of the jack and the +30 volt source of the power supply.

Now you can run wires between the control point, and wherever the amp is located. Put a 10k linear pot on the control point end, and a stereo mini plug on the other.

### Fix Something?

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## Omega Cart Deck Motor Fix

By Earl W. Hocker - KTAN/KFFN  
Sierra Vista, Arizona  
(602) 458-4313

One morning the DJ at KFFN tried to play a cart on our ITC Omega reproducer. The solenoid activated and the pressure roller snapped to its correct position, but the motor shaft did not turn. A call to the friendly folks at ITC indicated that the trouble could be due to a failure of the Omega Motor Control PAL (programmable array logic) devices. They stated that a Technical Service Information Sheet had been issued covering this failure. A check of our instruction manual file showed that we had received this sheet, but had taken no action.

ITC had received notification from one of its component suppliers that certain PAL devices manufactured between January 1987 and May 1988 had been found to have an abnormally high rate of premature wear out or failure, due to electron migration.

ITC uses the PL8155 PAL at two locations on the Omega Motor Control Board -- U103 and U106. They recommend that users check these PAL devices, and if any parts are found with a date code of 8701 through 8805, they should be replaced with new parts from ITC. We checked our devices and found that both parts were between these date codes. A call to ITC resulted in prompt shipment of two replacement parts. They were installed, and the Omega was back to normal.

The moral of this story could be that we should check all Technical Service Information Sheets and comply with their recommendations before we have the troubles.

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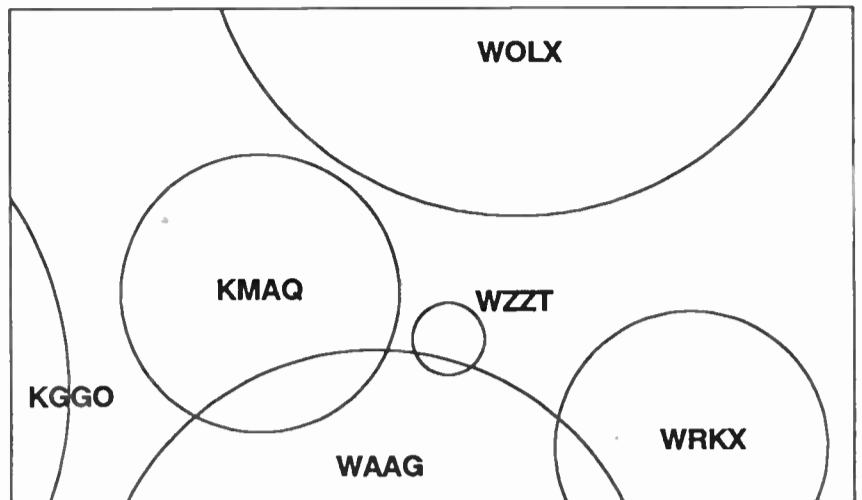
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# Audiofile Power Supply Fix

By Steve Tunwall - KMA-AM/FM  
Shenadoah, Iowa  
(712) 246-5270

I appreciated the Audiofile article written recently by Paul Moder at KATO/KXKQ, concerning 12 volt power supply ripple in his ten year old system. We have two Audiofiles of comparable age that had a similar problem, but ours was hum in the audio output of the system rather than tray selection trouble.

Our system (7000GLS) was purchased used for the "new" FM studio that we recently added to our facility. There was obvious evidence that other engineers had tried to solve this problem by adding or subtracting grounds and adding filter capacitance. I wasted lots of time doing the same kind of things before I got the scope out and looked at the regulated power supplies. The +12 volt terminals showed ripple at 60 Hz, plus random higher frequency noise. There was also an oscillation at 900 kHz (really) as well. This was when I found that the 7812 voltage regulators in the circuit were unbelievable hot. New 7812 regulators did no good.

Mr. Moder found that taking the back off provided enough cooling to solve his problem. His article appeared at the time I was working on our problem, but the backs were already off our units. I decided that the 7812 (1.5 amp) was not able to handle the current the Audiofiles needed. I looked in a few parts catalogs and found the SK9337, a 3A regulator in a TO-3 case. I mounted these in sockets in the sheet metal below where the power supply doors were. Since we have no RF field problems at this studio, I left the doors off to help cool the other regulators. Although the case of this device is ground, I used insulated sockets and insulators with heat-sink grease under the cases, to avoid ground loops. Both Audiofiles now have the larger regulators, and the hum is gone.

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## Cheap & Dirty Off Air Alert

By Jim Bremer - KARZ/KHTE  
Redding, California  
(916) 222-2222

For those of you without the funds to purchase a store-bought silence alert unit, this idea may be of help. With many smaller market stations using one operator for AM/FM combos on nights and weekends, there's a need to alert the operator in the event of a transmitter failure. If your FM is automated or on a satellite service, and doesn't have an operator on the spot to detect this problem, you might try this idea using an inexpensive FM receiver. Just about any radio will work, as long as it has a "stereo" indicator. Be sure that the indicator goes off when an FM stereo signal is not being received.

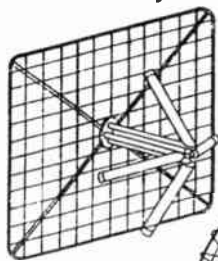
Use a small low voltage relay wired to the stereo indicator (or in place of it) so that the relay is activated when a stereo signal is being received. Then connect a power supply and bell, whistle, or other noise maker to the relay contacts. Tune in your station, and you're set. As long as the transmitter is on, and the receiver is detecting the stereo pilot, all is well. In the event that the signal is lost (or your stereo generator quits working), your noisemaker lets everyone within hearing distance know about it. It's up to you whether you tell anyone how to defeat the device in the event of a prolonged off-air situation that the operator on duty can't correct. If you're always just a phone call away, you may want to keep this secret to yourself.

Keep in mind that this unit is only monitoring the carrier, not the audio. Nothing beats a good silence alert device for overall dead-air monitoring. However, this idea may be of use to you. It could also be used for monitoring an FM translator. It will even work for an AM transmitter if you can find a receiver that has a tuning indicator.



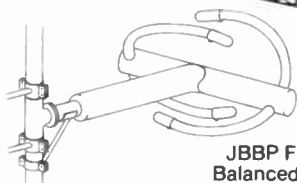
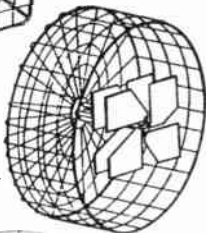
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# Studio Monitor EQ Amplifier

By Frank Berry - WQYK-FM/AM  
St. Petersburg, Florida  
(813) 576-6055

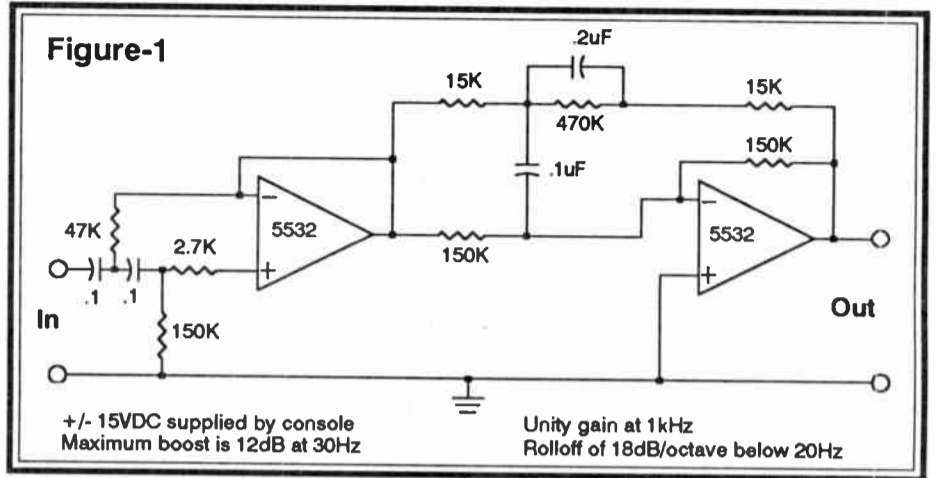
This very simple equalizing amplifier was designed to extend the low frequency response of the JBL 4410 studio monitor speakers as well as many other similar speaker systems.

An inspection of the frequency response curve for the JBL model 4410 speaker system, will show a gradual roll-off beginning at roughly 100 Hz. Though JBL specifies that the response is down 6 dB at 35 Hz, the monitor speakers in our control room, production rooms and news room exhibit a more severe roll-off (probably due to their placement with respect to the cabnetwork and proximity to room walls).

While this roll-off is not normally a problem, it can give you a false sense of security when dubbing material which contains low frequency hum and other garbage (such as can happen on dubs made on high speed duplicators).

This circuit will provide a boost of about 12 dB at 30 Hz and a roll-off below that frequency. We derive the operating voltage for this amplifier from our BMX ABX consoles.

The amplifiers (one for left and one for right) are inserted between the monitor output on the console and the inputs to the monitor power amplifiers.



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# Turntable Remote Control

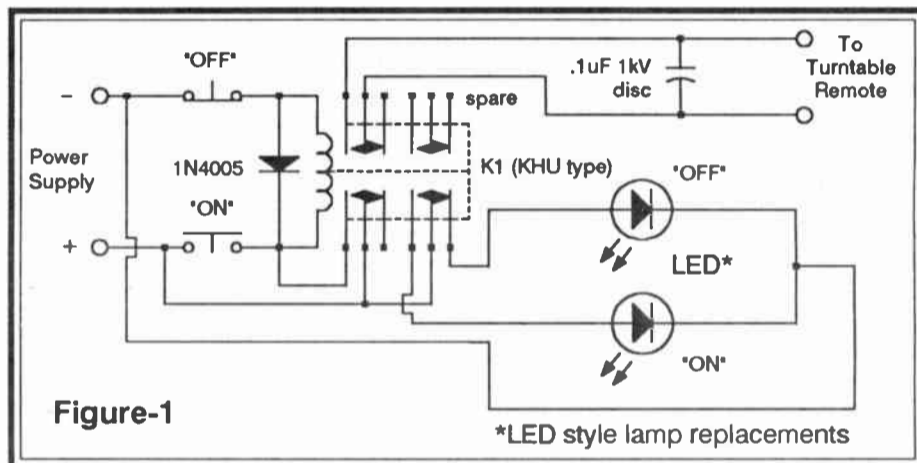
By Philip J. Hess  
Pittsburgh, Pennsylvania  
(412) 366-1249

Often, it's said, necessity is the mother of invention. Being an engineer at a college radio station with a limited budget means that I must be inventive in solving requests for little black boxes. Such was the case after some remodeling in the air studio. I'd recently raised the console to install remote control facilities for the various pieces of equipment in the studio.

One problem remained, however -- the rim drive QRK turntables. In the past, we'd been keying a relay from the PGM/AUD switches on the console. Since the "B" inputs were used for long form sports programming, the turntables would run during an entire basketball game. Clearly something better was needed.

I purchased two Dialco switches from Hall Electronics in Virginia and used them for this project. The switches fit into a 7/8" square cutout (a Greenlee hole punch does a nice job here). The equipment end of the control cable was terminated in a 12-pin Molex plug to ease installation problems and to make future modifications easy.

When I built the remote control center, I put in two Dialco switches for each input, similar to those in the ITC SP series cart machines. After some thought, the old system in use was removed, and the circuit shown in Figure-1 was installed. This circuit provides the required 2-button start/stop operation desired and duplicates that of the cart machines.



Construction of the circuit is easy. The negative side of the power supply goes to one side of the relay by means of the normally-closed switch contacts on the OFF button. The positive side is connected to the other side of the relay by way of the normally-open switch contacts on the ON button. Additionally, the ON button is paralleled on one set of the relay's four sets of contacts. It is this connection that makes an ordinary KHU relay latch at the push of the start button.

Once we get the relay to latch, unlatching is easy. By pressing the OFF button, we break the negative supply to the relay and it resets to the unlatched (off) state. Pulling the plug on the power supply will also cause the connection to break, which may be an advantage in some applications. The diode across the relay coil rids us of the "popping" sound when the relay opens.

One of the other sets of contacts on the relay controls the tally lights, if desired. The third set of contacts controls the motor on the QRK turntable. Look carefully at the barrier strip in the center near the back of the turntable. Frequently, but not always, the center two terminals will cause the turntable to run. Of five turntables in use at the station, one will not work with this method.

The fourth and final set of contacts is available for timer resets, additional tally lights or other purposes. All the connections can be made on the relay socket. I'd suggest wiring the socket outside the box you plan to mount it in. You'll save yourself lots of frustration this way.

After this circuit was built, I've discovered other uses for it. For example, switching a telco line between a hybrid and desk phone, placing the production room on air without using patch cords, remote control of the station's transmitters and switching remote lines to a news room console with limited inputs.

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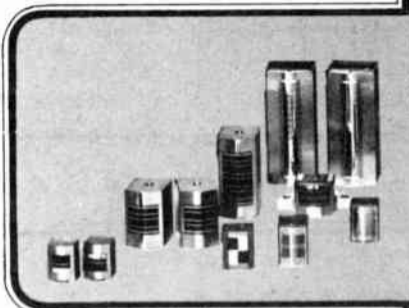
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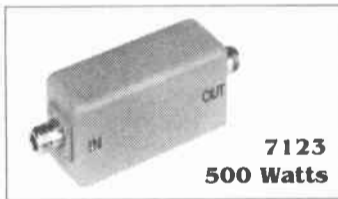
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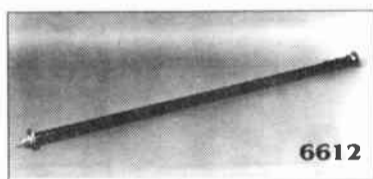
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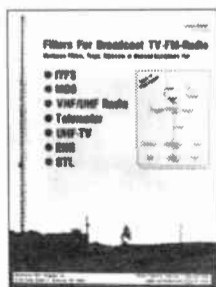


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## Moseley Tech Tip

### Simple Cure for the "Phase Jitters"

During the SBE Convention 1989, we heard reports that our PCL-606 customers had low end overshoot. Moseley also received word from a west coast engineer whose corporate chief had complained about "phase jitter."

Based on these reports, we did some testing of the PCL-606. The low end frequency response is specified as 30 Hz and the actual response extends far below that. However, if a 10 Hz square wave (an extreme example of highly processed audio) is sent through the radio, there is a droop in the output square wave caused by the AC coupling in the radio. Along with this, is a corresponding rise in the peak amplitude. The only real impact this has is that it can fool the modulation monitor peak detector. This is only noticeable if highly processed audio is passed through the radio. Clean audio in, produces clean audio out.

For those who have this situation, there is an easy change to the radio which lowers the low end frequency response to below one Hertz. This extremely low frequency cutoff allows passage of even 10 Hertz square waves with negligible droop. The one component involved is the coupling capacitor in the FMO module on the transmitter. On the spectrum efficient model (required in the 1985 STL rule changes), this capacitor, C37, is 10 microfarads. Replacing this with a 100 microfarad/25 volt tantalum capacitor is all that is required. The initial change appears to have been the result of a typographical error when the new module was produced. Even with the smaller capacitor, the low end response was still far lower than our specification.

Note that only the SEC versions of the PCL-606 can use this change since the earlier model used the 100 microfarad capacitor. All of the 6010 transmitters also use the larger capacitor.

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## Autogram RTV-20 Front Panel Reset

By Rick Walsh - WHCN  
Hartford, Connecticut  
(203) 247-1060

Our production studio is equipped with an Autogram RTV-20 console that is used by many different staff members in a variety of configurations. With 20 channels and a mix of program and audition feeds assigned, it can take quite a while to set all switches back to "normal" when one first sits down to use the board.

Knowing that the internal power supply chassis has a master reset button that will turn off all channels and clear all audition and program assignments, all that is needed is to extend this to a front panel switch. This can be done without altering the front panel.

The front panel monitor input select switch bank (pgm/ext/air) has an "off" position that has no connections to its switch contacts; its purpose is to de-select the other positions. A switched ground can be obtained from the normally-open contact of the "off" switch, to ground the master reset line. A ground must be extended from the monitor select board to the wiper (com) terminal of the "off" switch.

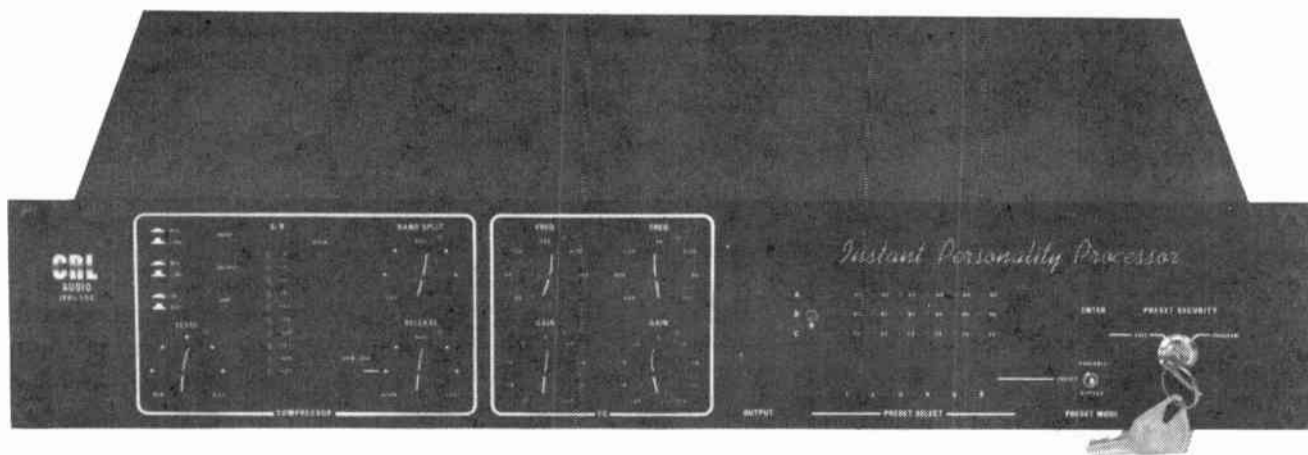
Extend the switched ground lead via a shielded cable to the middle of the motherboard card frame to the slot for the optional micro-processor card. Just to the right of the edge connector socket are wire leads connecting it to the mother board on the right. This can be seen in the RTV-20 manual on drawing MB2 (motherboard 2).

At grid location C-1, connect to lead #6, "MRST" (master reset). Pressing the monitor "off" button will "clear" the console. All of our production people have found this button very useful. However, I would advise against providing this feature on an air-studio located RTV-20 console.

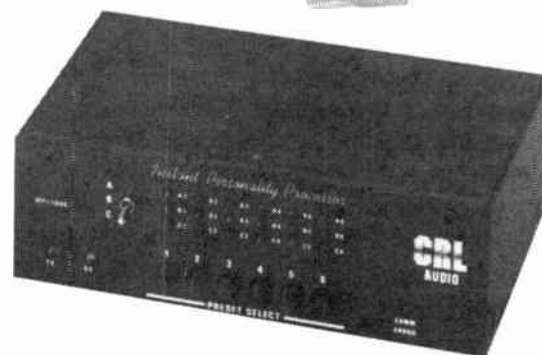
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# Tips From the Field

By Chuck Gennaro - Roberts Broadcasting  
Merril, Wisconsin  
(715) 536-6262

## FM Transmitter

Here are a few items that may make life a little easier. If your transmitter uses current sensing overload relays in its protective circuits, as does our CCA FM-20000E, check those shunt resistors across the relay coils occasionally. If one of them changes value, it can cause an overload shutdown where no overload really exists.

I found this out the hard way when the CCA went down with an "IPA OVERLOAD." After pulling out what's left of my hair trying to find the cause, the shunt resistor across the IPA overload relay was found to be open. It looked just fine but, upon removal and measurement, we found the trouble.

It also pays to occasionally remove and clean the sliding shorts used for tuning and loading in the CCA. A dirty connection here shows up as unstable tuning, or "twitchy" tuning/loading controls. If you are tired of sudden failures of the 5CX1500A tube used in the IPA section, try changing to a 5CX1500B. No changes need to be made to the transmitter, except for tuning readjustment. (We also changed over a Collins 831D 2-1/2 kW FM to the "B" version of this tube and have been much happier with the tube life.)

## Automation

Moving to the automation department, we had one of our Otari ARS-1000 playback decks decide that it wanted to occasionally go into fast-forward instead of play, when the automation called it up. The deck was actually going into "play," but the pinch roller would not come down. There is an "L" shaped bracket attached to the solenoid that operates the pinch roller assembly. Loosening the 2 screws holding the bracket and sliding the bracket up slightly, solved the problem. The pinch roller solenoid plunger sits up higher in the core now and snaps into action with more authority.

I have since been told that some of the Otari ARS-1000 decks were shipped with an improperly assembled pinch roller assembly (ours was OK). It might pay to check yours against the drawing in the service manual.

## Transmitters Again

Back to transmitters for a minute. Walter Bolinger (KJCR) wrote some time ago about a "transmitter with a heart." It had made low frequency thumping noises on the air, traceable to the exciter. Our Collins 310-Z also did this, and it sounded like someone playing low frequency tones behind all of the programming. Pulling out all of the cards in the exciter cage, and cleaning them and applying Cramolin (red) to the edge-connectors, has rid us of the trouble for 7 months and counting.

## AM Transmitter

Never run an AM transmitter from an OPEN-DELTA 3-phase supply. If you've only seen 2 transformers on the pole, instead of 3, you probably have an OPEN-DELTA supply. Our trouble was with a Gates BC-5H that would drop its step-start relay on modulation peaks over 80% (this relay takes the soft-start resistors out of the primary supply after the transmitter has come up to power).

Replacing those resistors got tiresome, as they would overheat and open up from the constant in-out-in of the circuit caused by the relay dropping in and out. It turned out that the relay coil was connected to the "wild leg" of the

AC supply. That wild leg would bounce up and down about 80 volts from its normal value when the modulation was applied. Perhaps this also explains the shorted transistors we had in the audio and RF driver sections of the transmitter.

If you have any RF contactors in the AM line ("Johnson relays"), keep the contacts clean and replace the clips if they look burned. Replacing a few of the relay clips that were burned and missing a finger or two, solved a wandering base current problem that had apparently gone on for a few years. The best thing that I've found to clean and lubricate these relays is the Rawn Cleaner-Lube (the red can). It keeps them from hanging up when the weather turns cold.

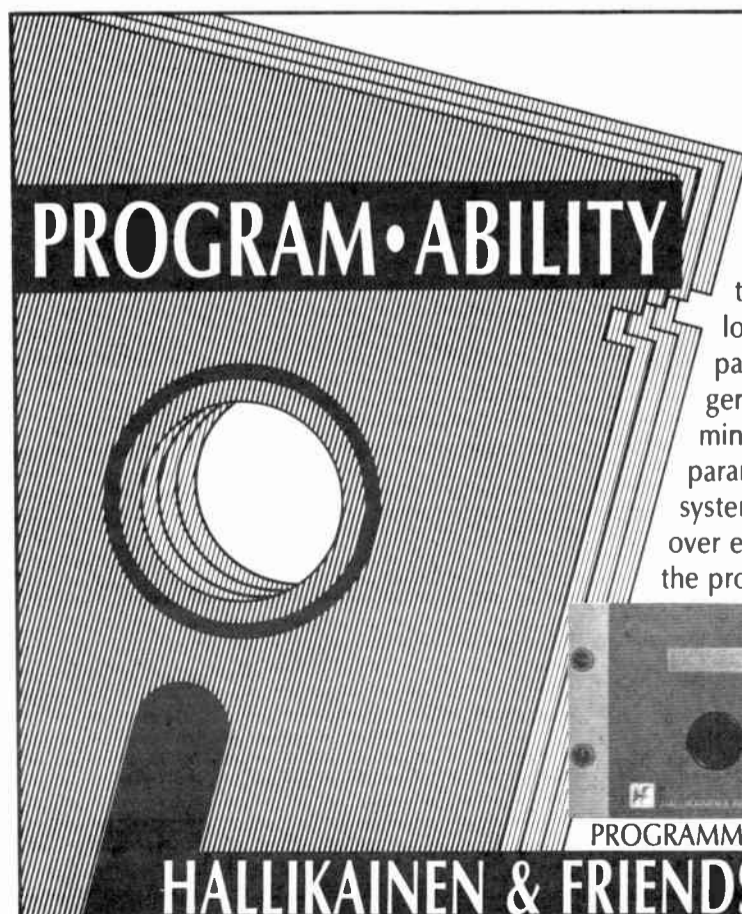
Finally, keep those transmission lines pressurized! One of our AM stations, that runs a 3-tower directional array, has been plagued with wandering antenna monitor readings, while the base current and monitor-point readings stood still. This system was installed in 1947, by the "Andrew Consulting Engineers" (the folks who make transmission line today). There were hand-wound coils on ceramic forms and all.

The transmission and sampling lines are ridged line that looks suspiciously like copper water pipe, and nobody remembered the last time that the dehydrator had worked. Running a few tanks of nitrogen through the lines, purged enough of the accumulated moisture and crud to return the lines to a somewhat normal condition. The sampling system is much more accurate now, and the whole directional array seems less sensitive to changes in the weather.

Keep moisture away from any isolation coils that are present; for the sampling lines as well as the AC feeds to the tower lights. Moisture in the the AC feed isolation coils made the phase of our towers change with the flashing of the beacon!

If anyone out there has the fun of maintaining one of these old Andrew directional arrays, I would be interested in hearing about their experiences.

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# Killer Contacts

By Vince Edward - WBGW 99FM  
Tallahassee, Florida  
(904) 385-1156

Once upon a time there was a transmitter that would, every once in a while, come down with a case of "trip-itis." One Monday morning, at 12:00 a.m., surgery was scheduled for a routing plate blocker-ectomy in the final of the CCA 25000D. After a 30 minute procedure, I was ready to revive the patient. Plate on . . . so far, so good. High power . . . oops! After the smoke had cleared, I found a group of wires that had melted together and adhered themselves to the side of the PA box.

After a quick call to our contract/backup engineer Ray Chamberlain (who I know was extremely happy to hear from me at 3:00 a.m.), I prepped the 25000D for major surgery.

Upon Ray's arrival we rewired the final and replaced the tube socket. (We had lots of fun; you should have been there.) Time to revive the patient again. Filaments on . . . wait 2 minutes for the ready light . . . plate on . . . #&!#. Now what?

Power output was well below normal for low power. We tried high power, with a very slight change. Nothing else had blown up at this point, so we decide to kick the 3000DS driver into high gear to see what would happen -- there was no increase in power from the driver at all! A quick power calculation of the final showed that we had been successful in turning a class C1 radio station into a class A (not bad for 6 hours work).

Numerous attempts were made to pinpoint the problem in the 3000DS, including replacing a suspect high/low power switch, and pulling out all of our hair. It was now 10:30 a.m. (so much for drive time), and so far, we were servicing the parking lot with our exciter output. Ray said it was time to "divide and conquer" and war was declared!

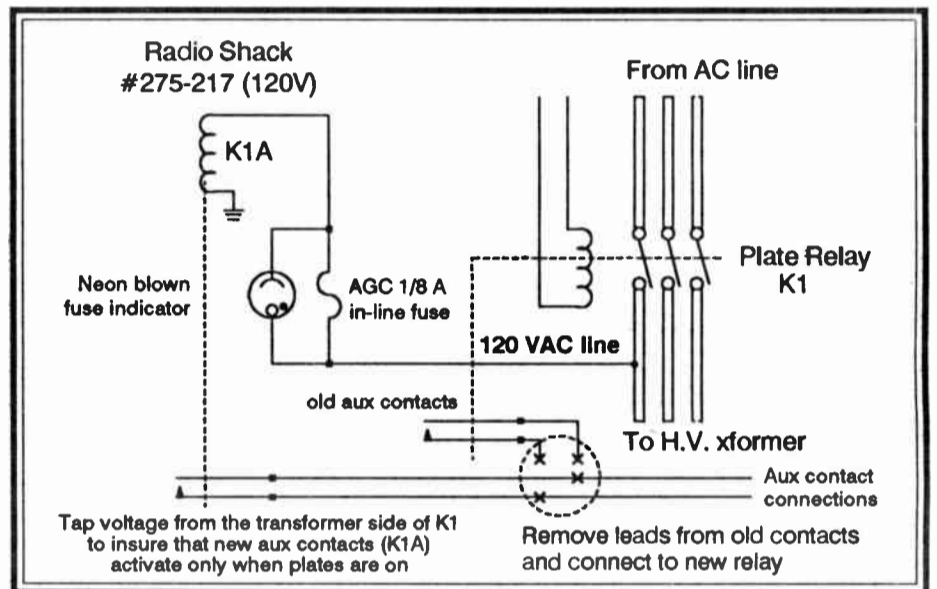
We looked over the schematic for the 200th time, polished off our 25th pot of coffee, and cracked open the 6th carton of ciga-

rettes for the day. Just then, Ray got up, looked at the transmitter and calmly walked to the front of it. He knelt down and started to remove one of the front cover plates. "He's gone insane," I thought. "He's going to take it apart piece by piece and bury it in the field." This wasn't the case. What he was doing, was hooking up the meter to check the voltage at the AUXILIARY CONTACTS that were screwed to the side of the PLATE RELAY (K1).

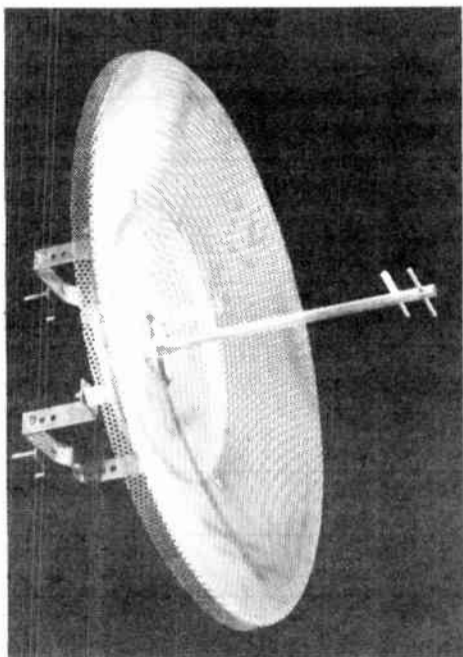
We threw the switch and looked at the reading -- 45 volts. This was wrong; normal voltage to the IPA SG at this point (at low power) should be 85 volts, and at high power it should be 345 volts. To make a long story a little shorter, I installed a new set of auxiliary contacts (these contacts are mechanically activated by K1).

The transmitter ran fine for a few days until the local power company decided to surge us a few times and cause K1 to pound down on and bend the actuating tab on the new set of auxiliary contacts. I was now looking at the same problem that Ray and I went through when we passed through the twilight zone the other night. I pulled K1, bent the tab back into position, and we were back on the air again.

Retro-fit circuit to eliminate "Killer Contacts"



# Cut your STL costs \$1000\* with the PA-48 from MARTI



The PA-48, 4' full parabolic antenna, gives you more value for your antenna dollar. Unlike half-dish antennas the excellent narrow beam-width of the PA-48 keeps your signal going exactly where you want it.

## Specifications

Frequency, 940/960 MHz; Bandwidth, 20 MHz; Gain at 950 MHz, 19.0 dBi; Impedance, 50 ohm; VSWR, 1.3:1; 1/2 power beam-width 16 degrees; F/B ratio 23 dB; Termination, "N" female; FCC Category B; Wt. Net 52 lbs., shipping 69 lbs.

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\* Based on STL path requiring two 4' antennas when bought with a complete Marti STL system.



# Equipment Guide



*The Radio Industry's Most Effective Classified Ad Section  
If You Want To Buy And Sell - This Is The Place!*

**Here's What To Do:**

**1** - Describe your used equipment, for sale or wanted, in as many words as you feel it takes to do the job.

**2** - Describe your help wanted or position wanted, again, in as many words as you feel you need.

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**Address:** \_\_\_\_\_

**City:** \_\_\_\_\_

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**Ad Copy Below:  
(Use Extra Sheet of Paper if Needed)**

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RF meters, used and tested  
Sangamo mica transmitting capaci-  
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Dan's Discount Radlo Parts  
Cavendish, VT  
802-226-7582

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1) 34B deluxe attendant console with  
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Purchased for expansion, but never  
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manual included. \$1550

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WISC-TV  
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608-271-4321 Mon-Thur, 8 a.m. to 5  
p.m. CST

RCA 77-DX microphone in excellent  
shape. \$800

Call Jim Kingsland  
914-638-2748

(2) Lightning protectors. Dale Power  
Arrestor SPA-200. Brand new, never  
been installed. Make offer.

C. Phillips  
WXVO-FM  
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Clinton, TN 37717  
615-457-2697 or 615-435-0987

Martl Model RR-50/450 receiver.  
Needs work, looks good. \$450 or best  
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3.7 meter satellite dish. Dual LNAs  
and feed horn. "SMATV" with A2-EI T-  
bar mount. Instructions included.  
Make and offer.

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75 feet Cablewave HCC-158 1-5/8" air  
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Rich Blever  
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Rane ME-1S 2/3 octave stereo equal-  
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BE Control 16 Automaton System  
Computer brain, switcher and pro-  
grammer  
4) Otari reels  
2) Fixed carts  
Network join  
3) Carousels and racks  
Remote control unit  
System in good condition, station  
gone to live programming. \$12,000 or  
best offer.

Art Sutton  
WMGA  
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Moultrie, GA 31776  
912-985-0580

2) Broadcast Electronics 8BEM100  
consoles. Dual channel mono, eight  
mixers, good condition. Never used in  
a radio station. Some updated 3600  
series electronics. \$850 each.  
RCA BC-6B console. Early 60s tube-  
type workhorse. Appears to be in mint  
condition. Paint not even worn around  
faders. Used in educational TV station  
and in storage last 15 years. \$500 firm.

Barry Hayes  
WNCA  
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Siler City, North Carolina 27344  
(days) 919-742-2135  
(nights) 919-742-4242

ITC RA record amplifier (for use with  
3D) with cable, 1kHz tone. \$450  
ITC RA with 3 tones. \$500

Michael Brown  
3740 SW Comus St.  
Portland, OR 97219  
503-245-4889

GR 1606A bridge  
GR 1932A distortion bridge  
RCA WX-1A FI meter  
GR 1651-A bridge  
HP 415A meter  
Standard signal generator Mod. 847V  
GR 874-LB slotted line  
Clarke 108-E  
Andrew 40C  
RCA WO-91A scope  
BC-221C frequency meter  
3) Sonar model FM-40 business  
radios  
Best offer for one or all

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La Grange, IL 60525  
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ERI 402 Isocoupler. 10 kW 1-5/8" with  
adapters for 7/8" line.  
300 feet Phelps Dodge 7/8" air die-  
lectric line, Good condition.  
3) ERO sample loops for AM direc-  
tional monitoring. With isolation coils  
for sample lines, Unused, stored  
indoors.  
IGM time announce controller.  
Rust remote control metering sys-  
tem. Appears complete.  
Many parts for old AM transmitters.  
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CBS 710 auto loudness controller.

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1980	Harris FM-20K	20 kW FM
1976	RCA BTF-20E1	20 kW FM
1978	Collins 828E1	5 kW AM
1984	McMartin 3.5K	3.5kW FM
1976	CCA AM-50,000D	50 kW AM
1974	RCA BTA-5L	5kW AM
1972	Harris BC10-H	10Kw AM

201 Old York Rd.  
York Plaza Suite 207  
Jenkintown, PA 19046  
215-884-0888

Telex No. 910-240-3856 (TRANSCOM CORP. UQ)  
Fax No.. 215-884-0738

2) Magnecord PT6A transports. Good  
condition.  
Kahn Symmetra-peak  
Gates SA50 dual AM/FM console. 9  
pots, with all tubes, heavy cast iron  
case, looks complete.  
Most items with manuals and spares.  
Make offer or trade?

Chick Gennaro  
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Ampex AG350-2 playback automation  
deck with Ampex tube-type electron-  
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McMartin 1 kW transformer for 4-  
500A tubes. New, will sacrifice.  
4) 4-500A tubes. Only a few hours on  
them.

Todd Noordyk  
WSHN Radio  
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Fremont, MI 49412  
616-924-4700 Fax 616-924-4535

Complete satellite automaton.  
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Absolute Broadcast Automation Mod.  
100 metal tape Dolby B-C cassette  
automation system with matching

TRS-80 Model-4 computer for brain.  
Includes spot processor and 6 Naka-  
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manuals. Electronics in new condition.  
Was using system for Transtar AC-II  
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Great for station just making switch to  
satellite programming. \$25,000 for  
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Ampex AG500 full-track mono reel  
deck in portable carrying case.  
Average to good condition. \$250  
Shure M67 4-channel mixer, good  
condition. \$200  
Shure M64 stereo pre-amp, like new.  
\$50  
2) Shure A68P phono pre-amps, like  
new. \$20 each.

Warren Arnett  
WBAT/WCJC  
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317-664-6239

Shively 6810 10-bay high-power  
antenna, tuned to 101.1 MHz. Only 2-  
1/2 years old, very good condition.  
\$10,000 or best offer.  
2) Otari ARS-1000 playback decks.  
used very little, like new condition, 25  
Hz tone sensor. \$1,200 each.

Al Baxa - WAVA  
11800 Tamiami Trall East  
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813-775-9288

**Shafer 900 System Automation:**

901 Brain  
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Audiofile  
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Manuals and spare parts.  
An old system but OK when removed from service. Needs a little work.  
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JBL professional assortment studio monitors and drivers.  
AKG and Shure microphones.  
Rane splitter/mixer/power amp.  
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Call or write for complete list.

**Lonnie Domnitz**  
Techtronics  
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San Francisco, CA 94121  
415-750-0431

4) Shallco Type 2TQ-255-KU stereo attenuators. 20 steps, 2 dB per step, 150/300 ohms with sue position. Unused, with dial plates. \$50 each. 1500 fuses. All sizes from .25A to 5A, regular and slo-blo. All for \$50.  
3) Desk-top open frame equipment racks for 19" panels. 21" vertical space, unused. \$25 each, includes shipping.  
28" x 19" rack. \$30, incld. shipping.  
15) 3M leader and timing tape. 1/4" x 1500' on 7" plastic reels in boxes. All for \$75, including shipping.  
8) 3M paper leader tape. 1000' on metal NAB hubs. All for \$30, including shipping.

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**Potomac Instruments FIM-21** field strength meter. 535 kHz to 1605 kHz. Excellent condition, calibrated April 1985. Manual and certification of calibration included. Asking \$900.

**Ernie Swanson**  
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**STL alignment tape.** 7-1/2 IPS, 1/2" model #C-0005. Never used. Asking \$55.

**Dick Warren**  
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**Phasemaster** and transformer rotary phase converter. Built by Kay Industries. Very low usage. \$1000 plus shipping.  
ITA FM-250B. Good working condition. \$750  
ITA FM-5000B. Needs final. \$800 plus shipping.

**Tim Branson KYCN**  
450 Cole Box 248  
Wheatland, WY 82201  
307-322-5926

2) Sony PCM-601ESD digital audio processors. Never used, like new. \$1,000 each.  
Aphex model 250 aural exciter. Latest model. \$850  
2) dBx 165A compressors. \$350 ea.  
4) Technics SP-15 turntables. \$250 each.  
ITC Delta record amp. \$500  
2) Texar Prisms. Battle-scarred, but working. \$750 each.

**Greg Strickland**  
WPOW  
20295 NW 2nd Ave.  
Miami, FL 33169  
305-653-6796 ext. 144

**Vikron playback heads** for Audi-cord Series E machines. New stereo 3) \$75 each; mono (2) \$35 each; dummy (3) \$5 each.  
3) Nidec NAH-1202F6 motors for Audi-cord cart machines. Removed from service for shaft burnishing. In excellent condition. \$100 ea.  
3) Ruslang reel to reel recorder roll around wood consoles. Used for 6 months to hold Otari 5050 units. \$150 each.  
3) Nortronics 2-track 9202 playback heads. New, in packages. \$35 each.  
Nortronics 2-track 9200 head in mount. New, in package. \$35

**Rick Shroyer**  
KMWX/KFFM  
215 North 4th St.  
Yakima, WA 98907  
509-248-1460

**Moseley 505 STL.** Composite, excellent condition, 949.000 mHz. \$3,900  
**Martl STL-10** (mono). 950 mHz, in excellent condition. \$2,500  
ITC triple-deck. Used 3 years, excellent condition. \$1,350

**Jose Arzuaga**  
WREI-FM  
Box 980  
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809-895-2725 or 809-895-4198

3) Otari ARS-1000 reel to reel players. \$500 each.  
ABC network tone decoder. \$150  
Moseley tolerance alarm unit for Model TAU-2. \$100  
Moseley SCD-2P subcarrier detector. \$75  
Gates Producer 4-channel mono board. \$400  
Scully 280 series 4-track with 1/2" tape. \$1,500

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ROH 192B-16T stereo bridging line switcher. 16-input, new. \$1,995  
ROH 202B 10-slot powered enclosure with internal 205B power supply. 9-slot capacity, new. \$560  
ROH 211B distribution cards (1x6). 9 cards total, new. \$195 each.  
ROH 210C 10-watt power amp modules. 3 cards total, new. \$280 each.  
Symmetrix TI-101 telephone interface. New. \$300  
Shure M67 mike mixer, M675 production master, A67B battery pack. Excellent condition. \$435  
Shure M267 gated mike mixer. Great shape. \$250  
Ramko SMA1000E 100-watt stereo amp. Like new. \$160

**Robert P. Stewart**  
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**Harris Model ME-1** modulation enhancer. Rack mount, good condition. \$125, plus shipping and packing.

**Les LeBlanc**  
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**Shively 6810 10-bay antenna** tuned to 100.3 mHz with radomes, still in crates. (New cost \$34,000) Make offer.  
**12-bay ERI antenna** on 98.5 mHz. Make offer.

**Wilkinson 8090 exciter**, like new. Make offer.

**Jim Stanford**  
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**3CX1500H3 tube.** Brand new, never used. Purchased as a spare, but trader in transmitter before it was necessary to install it. Asking \$2,000 or best offer. (new cost is \$2,670)

**Gary Lewis**  
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**Harris FMC-3A 3-bay antenna.** Tuned to 90.5 mHz. Best offer.

**Ron Dick**  
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**Tektronix Model 1L20** spectrum analyzer plug-in. Covers 10 mHz to 4.2 GHz.  
**Tektronix Model 132** plug-in unit power supply.  
**Singer Model MF-5** spectrum analyzer mainframe.  
**Singer Model UR-3** spectrum analyzer plug-in. Covers 0 to 700 kHz.  
**General Radio UHF** signal generator. Covers 250 mHz to 950 mHz.  
**Sony VP-2260 3/4"** video player.

(continued on page-23)

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Sarasota, FL 34233  
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ITC RP record/playback cart machine.  
2) 47" equipment racks.  
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3) Switchcraft 96-jack patch panels  
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MCI JH-110 reel to reel deck.  
3) Ampex AG600B reel to reel decks.  
5) RCA BFC bays with radomes.  
Heath GC1000 Most Accurate Clock.  
2) Marl RPT1/150K transmitters.  
Scala PR-450U Paraflector.

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**Automation:**

IGM Instacarts. 1 mono and 1 stereo.  
Both 48 trays. \$3,000 for both.  
Schafer 8000 automation controller,  
minicomputer with CRT terminal,  
loggers, 3 rack cabinets, plus com-  
plete extra system for backup. \$1,500  
for both systems plus spare parts  
galore.  
4) SMC Carousels if purchased with  
Schafer 8000. \$500 each.  
Harris 9002 automation. 2 CRT termi-  
nals, racks, 4 Otari ARS-1000 reel  
decks, 2 IGM Go-Cart 24, spare parts,  
fully loaded, super clean. \$7,500  
Otari ARS-1000 reel to reel repro-  
ducer. Near mint condition, with 25 Hz  
sensor. \$1,000  
Schafer blue equipment rack. \$100  
IGM 12-tray Instacart. \$750

ITC RP cart recorder. \$850  
ITC cart machine rack mounts. Will  
work with Premium series cart ma-  
chines such as RP, WP, etc. \$20  
Ampex 440 reel deck with Schafer  
stereo solid state playback electron-  
ics. \$250  
Teac/Tascam Model 2 console. Slide  
pot, 6-channel. \$150  
Autogram AC-6 console. Timer, extra  
outboard phono preamp chassis,  
super clean. \$2,800  
4) Teac/Tascam Model 32-2 2-track  
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factory rack mounts, virtually new  
condition. \$750 each.  
McMartin audio processor and stereo  
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3) 6-foot military spec. standard rack  
cabinets (19" panel). \$75 for all.  
Harris MD-15 exciter. \$2,500  
TTC Model X exciter. New. \$4,500  
TTC FM-3000 solid state 300 watt FM  
transmitter, New. \$7,500  
Sintronic 10-watt solid state FM  
exciter. \$850

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KWHO  
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916-926-5946

General Radio 1931A AM modulation  
monitor.  
General Radio 1931B AM modulation  
monitor.

2) Broadcast Electronics 1070 stereo  
cart players (1 used for parts).  
Broadcast Electronics 1070 stereo  
record/play cart deck.  
CBS Audlmax III mono AGC.  
CBS Volumax FM 410 mono peak  
limiter.  
Harris MSP-90 AGC (stereo) (wide  
band).  
Harris MSP-90 tri-band AGC (stereo).  
Harris dual MSP-90 AM peak limiter  
(2 mono units in one chassis).  
IGM dual 25 Hz tone detector.  
Gates ACC-2 chassis. Less power  
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Gates Criterion I record amplifier.  
Mono rack mount.  
Gates Criterion I record amplifier.  
Stereo, rack mount.  
Heath AR-15  
6) ATC/Gates Criterion I playback cart  
machines with 150 Hz tone detectors.

Hal Kneller  
WKII  
3151 Copper St.  
Suite 56  
Punta Gorda, FL 33950  
813-639-1112

**New Belden Cable:**

8449 9-cond/22ga control cable. 1000  
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8449 9-cond/22ga control cable. 881  
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8447 7-cond/22ga control cable. 97  
feet. \$35  
8790 2-cond/18ga shielded cable. 192  
feet. \$60  
8422 2-cond/22ga mike cable. 850  
feet. \$275  
9750 3-cond/20ga control cable. 247  
feet. \$50  
8448 8-cond/22ga control cable. 362  
feet. \$150  
8663 tinned bonding cable. 250 feet.  
\$90  
8627 4-cond/14ga control cable. 500  
feet. \$500

**Western Electric repeat coils:**

4) type 94N  
1) type 134A  
1) type 120G  
3) type 120C  
3) type 120E

Western Electric 377H transformer.  
\$25  
Western Electric KS-20159-L3 line  
equalizer. \$75  
Western Electric KS-16816-L4 line  
equalizer. \$75  
Telco test set TTS-15B send/rec. \$75  
Telco test meter TTS-28. \$50  
15) Western Electric TRS jack  
panels. Wire wrap or solder. \$35 each.  
Otari ARS-1000 stereo playback deck  
with tone detector. \$800  
Audi-cord A series stereo playback  
cart deck. \$400  
Russco Cue Master 12" turntable with  
arm and stereo preamp. \$250  
Gates (Harris) Part No. 994-5066-001  
115VAC motor with limit switches. For  
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Best offer.  
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115 VAC motor with limit switches.  
Best offer.  
2) New Andrew 78ARF 3-inch Heli-  
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4) Daven T-334-C 600 ohm attenu-  
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Medium transmitters with broadband solid state drivers  
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Higher power transmitter utilizing two grounded grid tri-  
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*A Wise Enterprise*

Shallco AC-29 600 ohm attenuator.  
As is. \$10  
All items are cost plus shipping.

Randy Kerbawy  
WTJN-FM  
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304-877-5592 (fax) 304-877-5289

Phelps Dodge 2-bay CP antenna at  
100.9 mHz. \$1,000  
Executone telephone system with 2  
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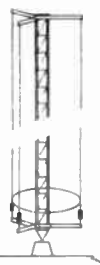
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