

# RADIO GUIDE

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A Forum for Radio Engineers  
Ray Topp Editor/Publisher (507) 280-9668

Oct/Nov 1989

Volume 2 - Issue 10/11

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Rochester, MN 55904

## Radio Guide FAX Machine On-Line Now

**FAX Number - (507) 280-9143**

Radio Guide now has a FAX machine on-line 24 hours a day -- every day. The number is (507) 280-9143. This FAX service was established with one thought in mind; I want to make it as easy as possible for you to submit technical information to Radio Guide for publication.

A large number of stations seem to have FAX machines now, so I felt that this would be an easy way for you to submit articles and technical information to Radio Guide. After you have completed a repair or found a new test procedure -- please, take the time to jot it down and FAX it to us. If I have any questions, I'll let you know via a return FAX.

You know how the Radio Guide helps you to do your job. You can help others by supplying your technical information for publication. By now, I think you've seen what the Radio Guide is all about. I am interested in practical -- save some bucks and time -- real world solutions to real problems.

A problem solver. That really is the definition of a broadcast engineer. Ninety percent of what you do is involved with problem solving, one way or another. Unfortunately, all of our problems are not the same. Radio Guide's purpose is to help reduce your reliance on guesswork to solve some of those problems.

### A Two Way Street

Quite a few of you have requested articles from back issues. The Radio Guide FAX can be an excellent way to provide you with those articles. Just let me know (FAX or phone) what you need, and we'll get it out to you right away.



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## BBS Listing Grows

Check out the Equipment Guide this month. You'll find a sizable listing of broadcast oriented computer bulletin boards. Many thanks to Mark Timpany (WQFM), Wauwatosa, Wisconsin (sysop for the Second Opinion BBS). He provided an extensive list of bulletin board systems to Radio Guide for publication. Our thanks to others who called in to report new boards on-line or changes in existing BBS information.

I'll have to admit, I was amazed at the number of broadcast boards in operation around the country. It can take a great deal of time to set up and maintain one of these boards. Let's make it worth their while and check into these BBS systems once in a while. There are numerous communication computer programs out there (free public domain) as well as cheap modems (less than \$90).

When you consider the low additional costs involved, it just makes sense to get a modem for your computer and to avail yourself of the technical information on these BBS systems. Now if you set up your computer/modem at work -- you'll be able to use the telco lines there, instead of having to do it at home. (Did I say that?) Just tell the GM (when he notices the late-night phone bills) that, unlike the overnight DJs -- you're BBSing, not BSing, on the phone.

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## Corrections - Info & Help

### Otari MX5050 Tip

By Greg Hahn, CE - WRKA  
Louisville, Kentucky  
502-423-9752

One of my Otari MX5050 BII reel to reels developed a problem with the brakes. Rotating the reel turntables in one direction was very difficult regardless of the setting of the tension springs. Rotating in the other direction could be made too easily. It was very hard to cue up a tape this way.

I removed the "brake drums" from the motor shafts and switched sides, putting the one from the supply side onto the take-up side and vice-versa.

I was then able to put the tension springs back in their proper places, and the machine has worked well since.

### RF Filter Tips

By Marvin Fiedler - KCOR  
Antonio, Texas  
(512) 225-2751

AT&T has a modular plug-in telephone RFI filter. It eliminates most RFI problems on single line phones. Check your local AT&T store for availability.

The Radio Shack toroid core is also very effective and easy to use. It may be used with mike, speaker, AC cords, phone lines, coax cables, computer ribbons, etc. It is item #273-104, page-125, in the 1989 catalog.

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### Tube Suppliers

From John P. Frew - WYXC

Cartersville, Georgia (404) 382-8852

John wrote the other day to tell me of a number of tube suppliers he had found. Here is his list:

Daily Electronics 800-346-6667

Temtron 800-645-2300

Thor Electronics 800-526-4052

Davilyn Corp. 800-235-6222

United Page 800-735-7501

I've heard from others that the price and availability of 4CX-250Bs is getting outrageous. If any of you have found other tube suppliers, please keep Radio Guide informed... Editor

## Is Everything OK?

If we're doing alright, let us know. If we're not serving your needs, let us know that too - - and at the same time be sure and tell us what you think needs correction, modification or expansion.

Remember, Radio Guide depends upon your suggestions for its content, direction and its very existence. You've said you've wanted it, so here it is. Please, help to create a useful technical publication.

Call me at (507) 280-9668 and let me know what you think.

Ray Topp -- Editor/Publisher

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# Hand Held Tube Checker

By Andrew Bell - WBIN  
Benton, Tennessee

It was 6 a.m. -- air time. I hit the HV switch and, "Oh Great," no carrier. From all indications, it seemed that there were three possibilities: 1. A blown fuse, 2. A bad resistor, and 3. A bad driver tube. I checked the simplest one first. The fuse was blown. I replaced it and hit the HV switch again -- another blown fuse.

The resistors were OK, so this left the 807 driver tubes. The spare tube boxes were marked "used." Usually we have only one of a pair of 807s blow, so this meant that one was good and one was bad. The question was, which one? I had no way of checking them; then I had an idea. Power is dissipated as heat, and a shorted tube draws heavy current, which results in more power consumption. This will reveal itself inside a shorted tube as heat.

I thought to myself, "Surely the shorted tube will be hotter than the good one." So, I took the two tubes out of the transmitter and held one in each hand. Sure enough, one was hotter than the other. I laid the hot one aside, and put the two used ones in the transmitter. After warm-up, I tried to go on the air, and the fuse blew again. I pulled the tubes out, one in each hand, and again, one was hotter than the other.

So, I replaced the fuse and put the two coolest tubes in the transmitter. I hit the LV switch, and after about two seconds, my driver plate reading went from 0 to 250, which is normal. The corners of my mouth proceeded to touch each ear. I hit the HV switch, and we were off and running for another day. Time elapsed: 12 minutes.

While this method may not work with all tubes, and may even seem a little "off-the-wall," I can say from experience (or luck), that it worked for me.

## Misc. Tips

By Steve Weber - KGRV  
Winston, Oregon

### A Poke in Your Eyeball

Late one evening, while vacuuming the old RCA, a red-hot speck of metal soared out of the oscillator, and crashed into the glass lens protecting my left eye. The AC circuit breakers had all been flipped off, except for the crystal oven breakers. The left lens has a permanent ding in it, but it saved my eye. Closer inspection of the RCA plug-in oscillator unit, showed 110 VAC at all the rivets. A short strip of electrical tape now covers the rivets.

### Tips for Trannys

The RCA Ampliphase transmitter was tripping off for no apparent reason. It would take a dive when the temperature varied a few degrees. Changing one of the 5671 finals made the big difference. Still, a 20 minute filament warm-up is necessary to burn off the gas, while maintaining proper voltages.

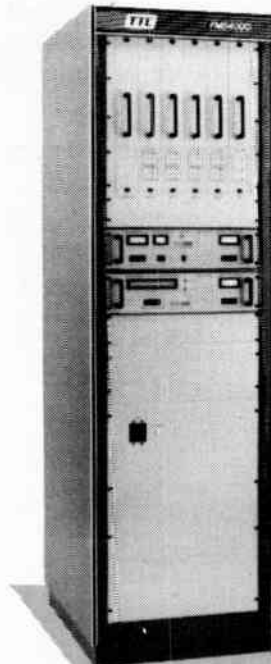
The air interlocks change sensitivity as often as the weather, and a quick check according to the RCA manual, plus tapping on the equipment cabinets lightly, will reveal any problems.

The next dilemma is glitches and loss of excitation, due to faulty oscillator plug-in sockets, and also due to loose crystals within the crystal ovens. Any rust here will obviously be a clue. We haven't discovered the final answer here yet. A glitch will light the Differential PA Overload Light.

Another obstacle on those mornings with a stubborn "plate on," is one of the undervoltage relays was not getting enough voltage to enable plate-on. The bias undervoltage relay, rated at 2.05 volts, requires 2.49 volts, thus the PA bias voltage must be maintained carefully. Times delays set improperly, or broken, were further causes of sluggish sign-ons.

Overload relays had to be turned to their proper settings, including high voltage, low voltage, PA, and driver overloads. The antenna protective unit threshold needs occasional touching up.

Weekly change of the PA air filter, and monthly cleaning, helps keep this good old unit purring happily.



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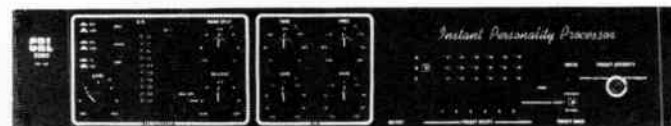
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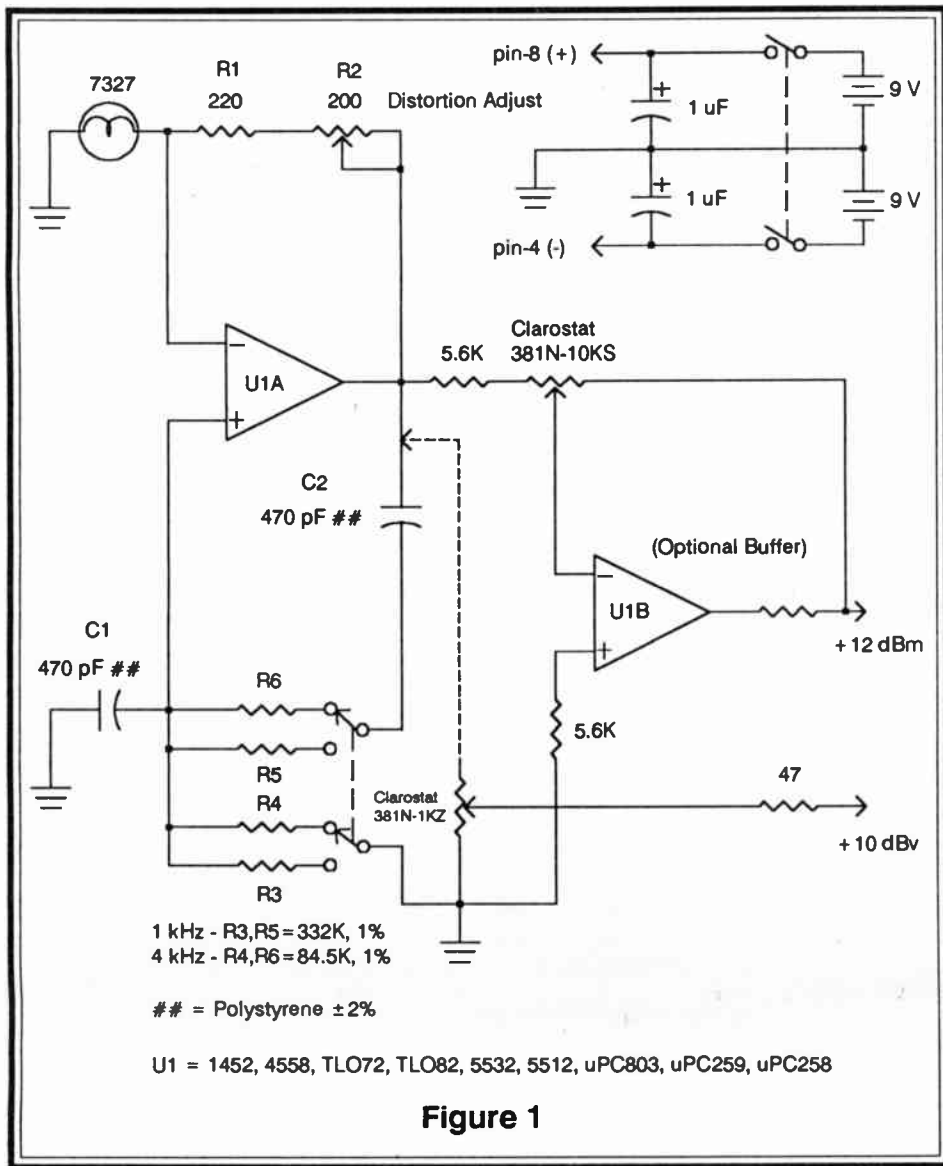
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# Tone Test Oscillator

By Steve Hnat - Hnat Hindes  
Thompson, Connecticut

Many broadcasters today are taking advantage of telephone frequency extenders. Along with these devices, is the necessity for spot frequency checks at 1 kHz and 4 kHz, and for initial set up. An alternative to dragging along a ridiculously large piece of test equipment, is the simple test oscillator in Figure-1.



The circuit may be constructed with or without the line driver stage and will fit neatly into a box slightly larger than a pack of cigarettes. Without the driver, the circuit will deliver +10 dB into a 600 ohm load, at less than 0.1% THD.

C1 and C2 should be either silver mica, polystyrene, or polycarbonate types. R3-R6 should be 1% RN55 types. The circuit will work with 5% resistors, however, chirping may result if tolerances are too erratic.

The components shown will produce frequencies of 1 kHz and 4 kHz ±2%, which is more than adequate for checking frequency extenders. Other frequencies may be selected by plugging into the formula:

$$F = \frac{0.159}{RC}$$

Where F=frequency in Hz, R=(shunt or feedback) resistance in ohms, C=capacitance in uF.

R1 and R2 may be substituted with a fixed 300 ohm resistor, which will provide a fixed level of approximately +10 dB.

### Circuit Specs:

Max Output (with driver) = +12 dBm (600 ohms)

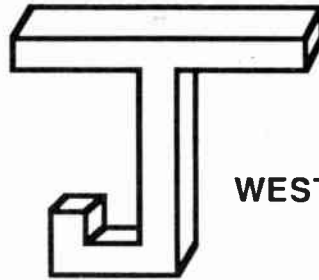
THD @ +12 dBm = 0.05%

Freq. Tolerance = ±1.8% @ 4 kHz or ±1.2% @ 1 kHz

Current Drain = 5 mA

Battery Life = 96 hours (with driver)

The circuit is also well suited for field servicing cart machines and for spot frequency checks on equalized broadcast loops.



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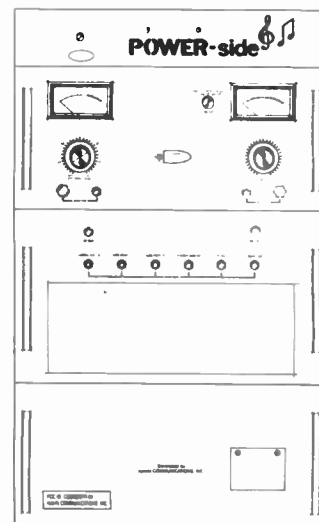
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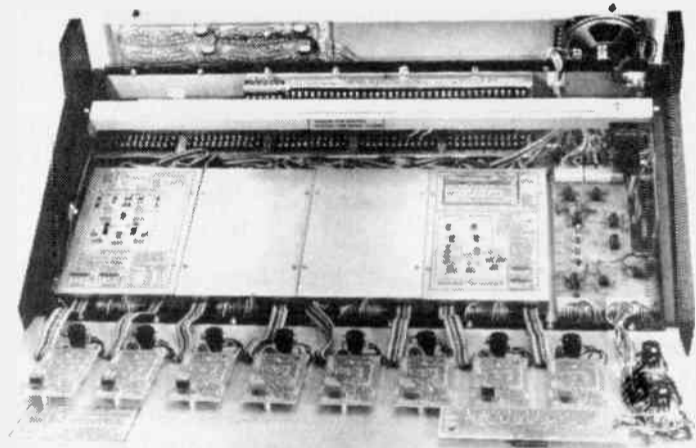
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# CD Player Cleaning Tips

By T. Alan Dickerson, CE - KT99  
Sulphur, Louisiana  
(318) 625-7777

As a lot of stations have experienced, we have also been plagued with CD player problems. A lot of the time the CD player is wrongfully accused. It is also true that one CD player will be more sensitive to errors on a CD than another player. So, is it the player or the CD? I've put a "CD Failure Sheet" up in the control room. I ask for the CD number, the cut on which the problem was found, the type of problem, and the machine that the CD was played in.

The reason that I ask for the type of problem is that the faults are not the same. The CD may have skipped, stopped, or even have frozen on a verse -- making the singer sound like he held that note out a long time. These descriptions help in making a diagnosis of the cause much easier. A typical listing on the failure sheet would look like this:

CD#	Player #	Cut #	Problem
723	2	11	Skipped in middle of song

Now start looking for patterns. If the same player comes up often, then the machine needs to be checked out. On the other hand, if the same CD number comes up often on different machines (and maybe the same cut number), look at the flip side of that disk, and it will probably be scratched and fingerprinted.

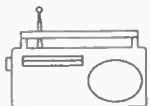
Another thing the sheet will tell you is when the players need cleaning. Although you should set up a regular cleaning schedule, when you see a sheet full of failures, cleaning can't hurt -- regardless of the actual cause. We were using three Technics SL-P720 players, and I was cleaning them once a week. Go to the camera shop and get some lens paper and lens cleaning fluid -- both are very inexpensive. Now depending on your machine, you might need to remove some pieces to get to the laser lens to clean it. **MAKE SURE THE MACHINE IS OFF - - THESE LASERS CAN DAMAGE YOUR EYES.** Very gently, wipe off the lens with a moistened sheet of lens paper. You might have to put the paper on the end of a Q-tip to get down in on the lens (as in my case). The laser is "floating," and it will move in the case when you clean it. Just be very careful not to damage it. This is what I've been told by my manufacturer, but you might want to check with yours before attempting. They may have a cleaning procedure already written up for you.

Now after you clean the lens, take some alcohol and a Q-tip, and clean off the spindle motor top. This is where the motor that spins the disk comes in contact with the disk. Mine have a little rubber gasket that can lose traction if it gets oily from handling. This should be a fairly simple procedure so, if it seems complicated on your machine, it might be for a reason. Remember most of these are home CD players, and they aren't built to be periodically serviced like cart machines. They are very fragile and there is a lot of plastic to break.

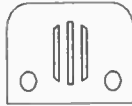
To finish the saga of our CD problems, we have given up on our home-style Technics players, and are currently using three Denon cart CD players. The basis behind these is that they keep the user from touching the disk at all. They perform really well, and stand up to the user's abuse. Time will tell if they will still perform years from now.

Let me say that the cleaning procedures outlined here were successful for me, but do them at your own risk.

## Equipment Guide



The Yellow Pages of Broadcasting



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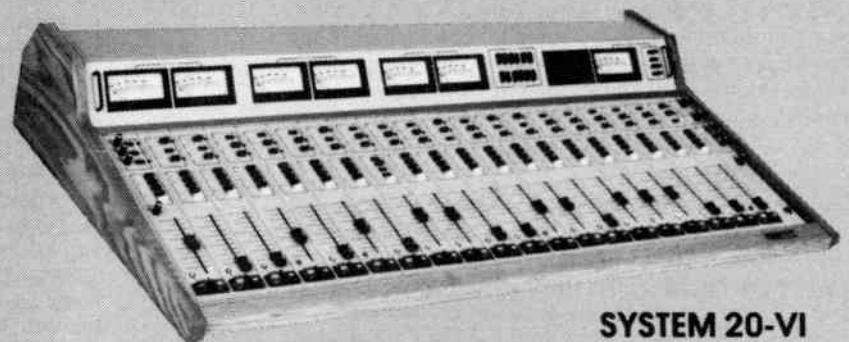
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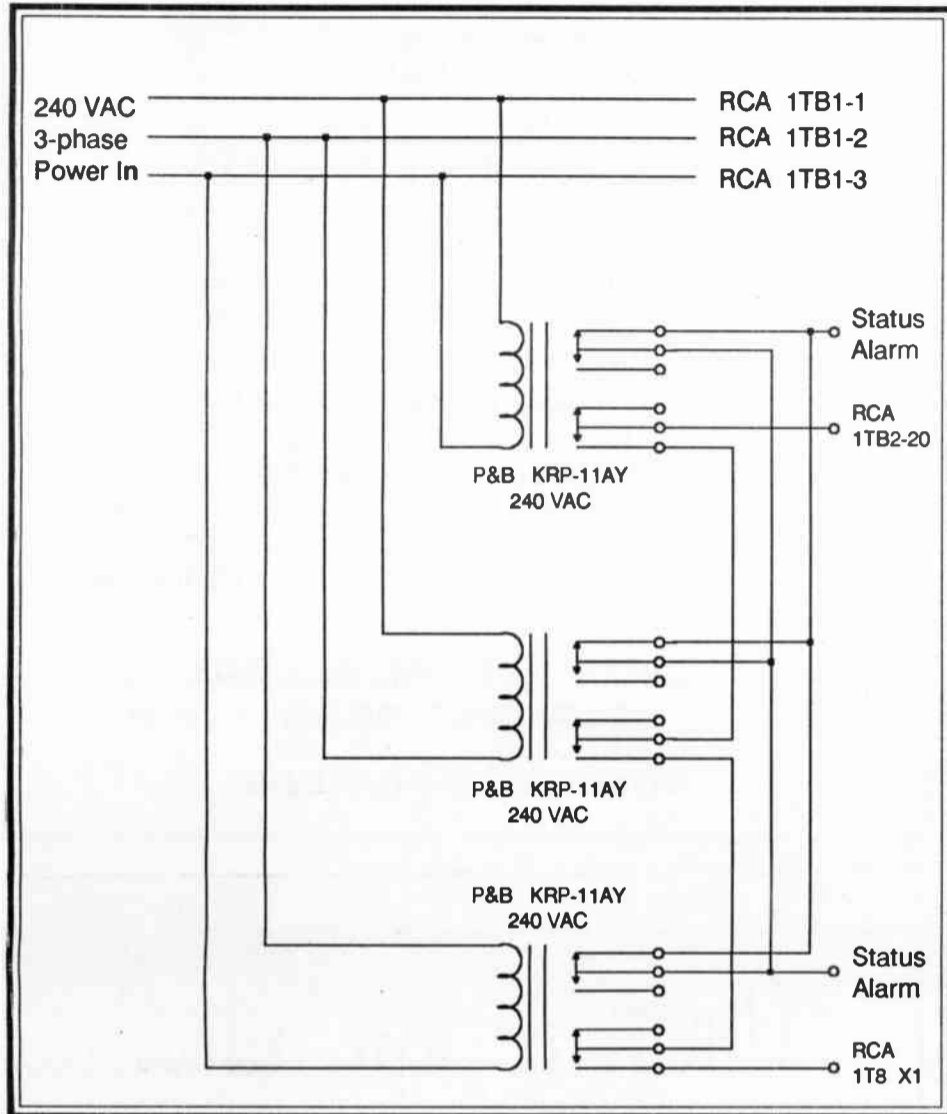
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# Transmitter AC Power Phase Loss Protection

By R.V. "Bud" Stuart  
Susanville, California

Here's a drawing on how I have provided protection and 3-phase status on an RCA BTF-20E. The loss of any one phase will cause a complete shutdown of the control ladder, thereby protecting the blower, etc., and provide a fault alarm.



## Speed Control Problems

By Allen Sherrill, CE - KQKQ-FM/KKAR-AM  
Omaha, Nebraska  
(402) 342-2000

### Tascam 122 Cassette Speed Control

Our news/talk operation uses several Tascam 122 cassette decks. I have had intermittent problems with speed control and head stack contact with the tape.

These problems are usually traceable to the solenoids which control the pinch-roller and head stack positions. Over a period of time, the plungers in these solenoids become magnetized which cuts the pulling torque quite a bit.

The plungers can be removed from the solenoids and "demagnetized" in much the same manner that tape heads are (although getting to the solenoids involves removing about a million screws). The result is a much more reliable cassette deck.

### Technics SP-15 Turntable Speed Control

Recently I repaired a Technics SP-15 turntable with an intermittent speed control problem. When the start button was pressed, the unit would run at what looked to be a thousand RPM. (The service manual calls this symptom running violently.)

The problem was eventually traced to one of the coils in the stator assembly (the stationary part of the direct-drive motor). The "coil" in question (actually a copper trace etched on a ring around the assembly) is soldered to a PC board on the bottom of the assembly, and one of these connections had broken loose. Re-soldering the joint restored normal operation.

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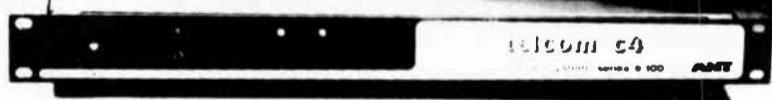
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# Texas Tower Grounding

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

I have found that the biggest help in eliminating power line surges is to have a closed-delta power configuration delivered to the transmitter. So many power companies will give an open-delta configuration, and the "wild leg" seems to give the transmitters more problems.

In addition to a closed-delta configuration, we add the following to all of our contract installations: We use a ferrite toroid core which you can get through Polamar Engineers, and coil at least 3-4 turns around and through it on each AC line. We do this for each leg before it enters the transmitter. Then we use metal-oxide varistors (MOV) of proper size on each leg to ground and leg-to-leg. In addition, we use the same technique, with smaller cores, at each point where the AC splits off and goes to other components such as the exciter or low-voltage power supplies. We even use MOVs of proper size on all our audio inputs and outputs. The 25-volt variety seems to be the best for our audio applications.

A couple of years ago, I was installing a Class-C FM in the middle of a cotton field. The nearly thousand foot stick was the tallest thing in West Texas for hundreds of miles. There isn't much rock in the area, but would you believe that we had to bring out special chisellers in order to put in the base footing? Three feet down we were in solid rock! Great for the tower base, but how do you get a good earth ground?

The first lightning storm hit a few days after the station was on the air, and we lost power supply rectifiers. We had a hole in the Heliac, and experienced other associated problems. The AC system was single-phase, and we used a Phasemaster to power the new Harris FM35. The plant had a three-phase generator installed, and I thought that maybe the studio could switch it on when a storm approached. We would be off the power company, but then we still had the tower to worry about. Also, the studios were twenty-five miles away, and how would they know when a storm approached the transmitter site?

## Where's The Well?

While working at the site one day, the supervisor of the local Rural Electric Coop stopped by to see the "big stick" in the sky. One of his initial questions was, "Where did you put the water well?" I looked in amazement. "Listen," I said, "this Fort Worth Tower building is only 8x24 feet, and with such little floor to clean, I can carry the water I need in a 5-gallon can -- and the local gas station has decent rest-room facilities. Why would I want to put in a well?"

He then told me how his power company protects all their substations in the West Texas area. They drill a well until they hit "sheet water," then they put 4/0 unvarnished copper wire down the hole and use that for their ground. They may drill four holes per substation and tie them all together.

I told the station owner of the conversation, and we decided that it was worth a try. We had a well service drill a well a few feet from the tower base footing. At 125 feet, we hit "sheet water," so I had them drill 25 feet past that point. I had two eight-foot copper grounding rods welded to the end of our 4/0 unvarnished copper wire. Down the hole it went, and then we tied it to our tower. I also ran 4-inch copper strap from our equipment and the AC entrance ground to this point.

The outcome has been that the station has been on the air for two years and has not had a problem with lightning. I have personally observed the tower taking one direct hit from lightning. The overloads of the Harris FM35 shut it down momentarily, and then it came right back up.

I have been in broadcast engineering for over 25 years, and I have attended a number of special sessions on lightning protection. The only thing I can say is that you cannot do enough to protect yourself. I have seen ATUs vaporized by lightning, and I don't think, in that instance, any protection could have worked. I've seen installations that used automobile spark-plugs for lightning gaps that worked. There isn't a miracle cure that I know of -- but then maybe that is what keeps this profession interesting.

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## Soft Tubes & Regulation

By Rich Egan, CE - WIZM AM/FM  
La Crosse, Wisconsin

If you suspect a tube is going soft, try adjusting the filament voltage while monitoring plate current through the tube. A new tube will generate enough emission to allow you to lower the filament voltage without affecting tube performance. An older tube will show a noticeable change in plate current as the filament voltage is adjusted. I also watch modulation peaks for an indication that a tube may be getting soft.

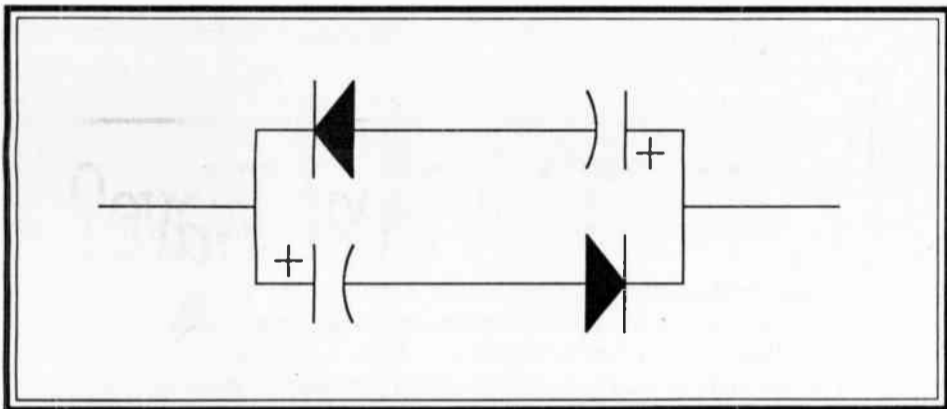
I've found that the key to getting good tube life is good filament voltage regulation. About 18 months ago, I installed a new filament regulator in our Continental 816R-2A. I can now set the filament voltage wherever I want it, and it stays set -- steady as a rock. Previously, we could get about a year from a set of tubes before they would no longer make full power. I'm currently on a set of tubes I installed last April, and with the new filament regulator, I'm still waiting for them to go soft. That represents a 25% increase in life.

## Non-Polarized Cap Substitute

By Michael Mallory - Dromedary Technical Services  
Roopville, Georgia  
(404) 854-8846

I recently went crazy trying to find a non-polarized capacitor for a project. As luck would have it, I found an article in Radio Electronics which detailed the above circuit.

Being out in the sticks, as I am, you have to learn to "cut and fit" to get anything done.



## SMC Data-Cell Tips

From John Wittenmeier  
Corporate DE - May Broadcasting

John called and told me of a fix he had for older SMC gear that uses the old Sigma Data Cells. These Data Cells can be found in old AS-series audio switchers. They have also been used in other SMC gear, such as Carousels and cart decks. The Sigma Data Cells are no longer available, and when they were, they were outrageously expensive.

Each Data Cell has a small lamp inside its metal case, that can be replaced -- if you're careful. The metal case should be removed by bending out the small tabs near the base pins, and then pulling the cover straight off. Most of these cells had a silicon type potting compound inside, but it is quite pliable and should present no problem.

Once open, the old burned out bulb may be replaced with a ML2176 (24V) lamp. They cost around 55¢ each. The photo-sensitive strips in the cells don't go bad, so the life of these Data Cells can be prolonged indefinitely by replacing lamps as needed.

John had another lamp saving tip: Install a voltage regulator to feed less than the normal 24 volts to the common of all the lamps in the AS-series switcher. The cells don't need a full 24 volts to operate, and less than rated voltage will greatly prolong the life of these cells.

Thanks John -- Editor

## The Carts You Can Count On



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# "Monday Morning Check"

Date \_\_\_\_\_

## Building

Outside Lights  
Hall Lights  
Air Lights  
Prod. Lights  
Trans. Lights  
News Lights  
Emergency Lights  
Fire Extinguisher  
Bugs  
Water Softener  
Alarm

## AP

Paper  
Ribbons  
Teletype  
Radio

## Things to Order

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## Production

### Cleaning supplies

Q-tips  
Alcohol  
Distilled water

### Reel, Cart, Cassette

Demagnetize  
Heads cleaned  
Cart cueing  
Face plates clean

### Turntables

Stylus  
Tracking  
Speed

### Console

Air sound  
Face plate clean  
Pots tight

### Clocks Calibrate

### Light Monitor Flash

## Air Control

### Cleaning Supplies

Q-tips  
Alcohol  
Distilled water

### Reel, Cart, Cassette

Demagnetize  
Heads cleaned  
Carts cueing  
Face plates clean

### Turntables

Stylus  
Tracking  
Speed

### Console

Air sound  
Face plate clean  
Pots tight

### Clocks Calibrate

### Light Monitor Flash

### EBS

Receiver  
Tone generator

### Weather

Radio  
Weather station calibrate

### Flashlight Works

### Air Radio Works

One other maintenance idea that I started several years ago, is my "Monday Morning Check." This is an 11x14 sheet of paper with a basic list of things to check at the beginning of the week. The list covers such things as building maintenance, tape deck cleaning and supplies, EBS system, and anything else that needs checking out. I use this checklist to see if I need to order things like AP paper or ribbons. It also has helped me to discover problems with equipment that no one had told me was acting up.

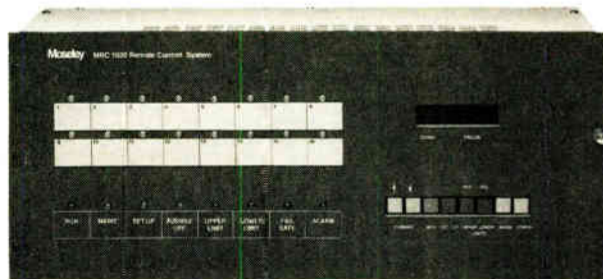
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### Make the Intelligent Choice! The MRC 1620 Remote Control System



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# Solid-State Rectifiers Pass or Fail

By Gary Minker, CE - WIRK-FM/WPBG-AM  
Lake Worth, Florida  
(407) 965-9211

With all of the marvels of solid state technology in today's transmitters, the DC power supply is still the root of all that makes things go. No matter if the voltage is low, like logic, or high, as in B+ plate, the rectifier is where the story starts. Most people associated with repair today have only vague recollections of the mercury-vapor technology which was a true revelation of the time. Though still in very limited use, the vapor rectifier made its mark not only in history but in the trouble shooting procedures of many a long night. Today, typically, the selenium rectifier (old by some standards) and the silicon rectifier need to be understood.

Test or replace, pass or fail -- the big question at 4:32 a.m. when the big box has blown the breaker off the wall. Most typical transmitters of any vintage will have power supplies ranging from 5 to 50,000 volts DC. This range of A+/A- to B+/B- power supplies has an equally impressive assortment of solid state devices in place. Testing of these widely varied devices is not standard across the spectrum. Technology in test meters, from iron vane to digital, has made reliable checking of rectifiers quick and simple (if not cheap and dirty). Low voltage devices are generally tested reliably by any good meter via resistance or the newer "diode check" functions. The problems crop up when testing the big boys from 5 kV on up. Diodes with a PIV (peak inverse voltage) of greater than 20 kV require special test equipment.

Having to keep transmitters afloat in South Florida, where lightning can be frightening, requires some special twists in rectifier testing. Pass or fail -- is it as clear as that? In low voltage, where the devices are typically a single junction, the pass or fail doctrine is true. In higher voltages, where a "stacked" technology is applied (mechanically or potted), the answer becomes very grey.

With the proper simple tools, it is possible, and very advisable, to grade a rectifier. For a pretty conclusive test of a troublesome rectifier, three test devices should be used:

1. A good quality DVM with the "diode check" function.
2. A curve tracer of any variety from table top to the one described in the August Radio Guide on Page-10 from Bob Schieder.
3. A Sencore LC-77 Capacitor Tester.

Testing rectifiers can be done in the low voltage mode, with test devices one and two, with tremendous accuracy. Familiarity with the DUT (device under test) and either a companion unit or a new device to compare against is helpful. The junction voltage drop across low voltage devices gives a good indication of the condition of the device. The curve trace of the Lissajous pattern allows the technician to actually see any anomalies of the junction.

For leakage testing, which can be critical, the LC-77 utilized in the capacitor leakage mode with the desired PIV selected as the test voltage and set up to read out either in ohms or amperes (as appropriate) is conclusive proof of a pass or fail. In high voltage devices, and/or stacked units, the use of the curve or Lissajous trace is a helpful guideline, especially if your test unit is voltage adjustable up to around 50 VDC. This visual assessment of the junction(s) is helpful along with these next tests in the Sencore LC-77.

1. Establish the forward conductivity break-point for conduction in the DUT.
2. Compare this voltage to companion devices in this mode.
3. Grade all similar devices in this mode.
4. While in the capacitor leakage mode, select the proper PIV, up to 1 kV (maximum of the tester), and read the reverse current leakage in either ohms or amperes (as appropriate).
5. Grade all similar devices in this mode.

(continued on page 13)

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## Solid State Rectifier . . . (continued)

6. While observing the DUT in the forward conduction mode, you will notice that a forward current is obtainable within the display parameters of the tester. This voltage that is being applied should be recorded, and the tests be repeated at this voltage for all DUTs. This forward current display is an indication of anomalies within the device or stack (shorts or opens).

With these last tests, you can see that it is possible to actually grade a rectifier against others of a type. This type of testing will actually help technicians to dust off their crystal balls and foretell of possible rectifier failures. Aside from the Sencore LC-77's normal functions, this tester may also be used for hi-pot testing of suspected "leaky" devices such as formed coils, transformers, chokes, or reactors. Hi-pot leakage testing at various temperatures and voltages can not only save a great deal of time, it may also save a life.

## SMC 350 Carousel Tips

By Jon Hartmeyer - WCLT Radio Inc.  
Newark, Ohio

I have discovered some simple ideas that will help in finding and fixing certain problems with 350 series Carousels. I have been working on these style carousels for about 1½ years, and I have compiled these ideas for getting a down Carousel back up again. Where I work, there is one AM station and one FM station. They both are on station automation systems, with nine 350 Carousels and one 450 Carousel.

The first thing I will be talking about is the pinch roller solenoid. We have a Carousel where the solenoid would not operate when the machine was placed into the play mode. All of the electronics associated with the pinch roller checked OK. I moved the solenoid by hand to see if the shaft was burred or bent. After moving the shaft four or five times, the machine would operate okay on its own. I did notice some squealing, so I assumed that the solenoid was going bad. The machine ran fine for 2-3 weeks, then the problem resurfaced. The same thing got the machine going again, and I adjusted the air valve on the rear of the solenoid. It appeared to work fine once again, but within two weeks the problem was back.

This time I used a hand demagnetizer for tape heads on the the solenoid shaft and on the bar that the shaft sits against. The machine has been working fine since then, and the squeak is gone when the solenoid operates.

Another "major" problem also has a simple solution. I have had two machines, that while going to the next tray, have rotated a half a tray space and tried to tray in the cart. This will not occur until it gets to the proper tray -- if you're lucky enough not to get the tray fork and tray pins jammed together. After investigating, I found the tray motor was going past the tray in/out switches. I checked the brakes on the tray motor, and I checked the switches. They both checked okay. Then I adjusted the alignment of the shift lever by loosening the bottom bolt and shifting it slightly up and down until the Carousel operated properly. I have not had this problem with either machine since then.

The last simple fix I have is for the rotate motor. One of the Carousels would rotate fine with only a few carts loaded, but if there were over half the capacity of carts, it would not rotate the full cycle. It would hang up about the same place when it had a far distance to travel. I could hear the motor still running, so I checked the tires; they checked okay. The solution I've found for this problem is to first clean the inside of the drum where the tires ride. If that doesn't work then adjust the rod for the rotate motor adjustment. Usually just the cleaning of the inside of the drum will take care of your problem with the rotate cycle hanging up -- especially if it happens about the same place during the rotate cycle.

These are just a few ideas that I know of. If anyone out there has any different solutions to some different problems with a Carousel, I know I would enjoy reading about them.

### So How Come You Never Write?

If you have any short tech-tips, send them in. Remember, it doesn't do anyone any good if you keep that info to yourself.

## Now Class A's can go First Class!

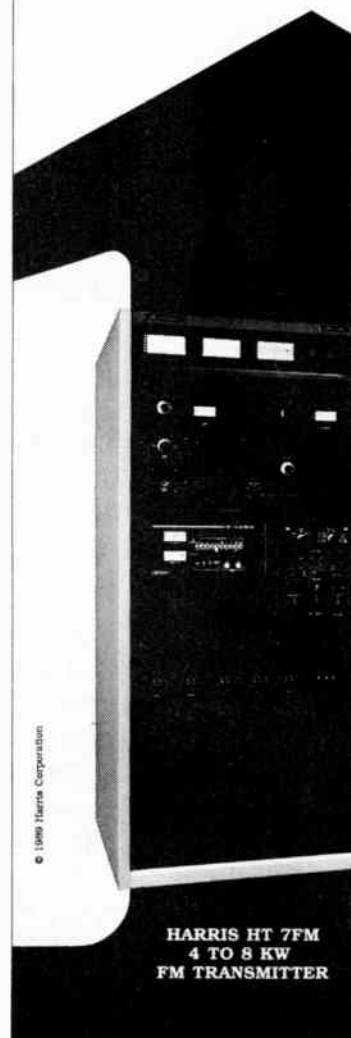
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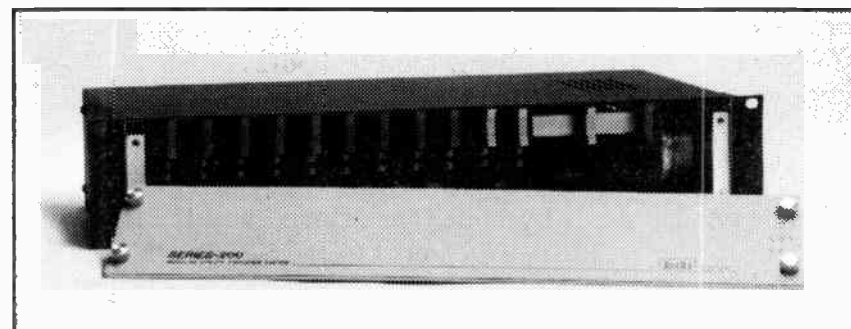


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# Autogram/Collins Console Amps

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

First of all -- a big thanks to all the engineers that came to my rescue with my CCA problems a few issues back. Here's a tip in return. This one is for all you Autogram, Collins, etc. console owners.

There are a few companies making upgrade modules for these consoles. To get the benefit of the transformerless output, it requires you to make some major changes to what is called the "A-2" chassis in the console. The task has all the appeal of a pimple on the backside.

Here's a functional time-saver. Recently (after the usual management battle about cost) I talked my owners into purchasing the Autogram output modules for the mixer and line output amps. After reading the conversion procedures, I decided there was a big oversight in the manufacturer's design. Instead of converting the chassis, why not put a terminal strip on top of the can with the active balanced outputs there?

The reasons are numerous; the cue, headphone, and monitor amps still have input transformers. So you have just installed these modules with the intent of getting the transformers out of your air chain, and now you're going to put more of them on the line in parallel? No reason for it. Let the active balanced outputs drive your processing gear -- and nothing else. The un-balanced high current output will drive your output transformers and all the original circuitry, and there will be a substantial improvement.

This arrangement will allow you to pop the new modules into the board, and have them on-line in a few minutes (not hours), and if an act of God happens, and a module dies, you can go back to your old modules in minutes flat. This will save you hours and a few gray hairs -- and strange looks from management.

The procedure is to remove the orange and orange/white wires from the upgrade circuit board (pins 3 and 4 on the socket). Drill two holes for the wires to come through the top of the can, add a terminal strip and grounding of your own choice, and feed this to your air chain. Plug them in, and you're done.

Also, the ads claim, that to get fullest improvement, you should replace all the modules. We just replaced our program output modules, and had a dramatic improvement. They are worth it just by themselves. Of course someday we will finish the job, but for now everybody in this station is quite impressed (myself included).

## 3-Phase Protector

By Randal Howard  
Tucson, Arizona  
(602) 744-1150

At KFLT, the Family Life Broadcasting station, here in Tucson, there is a Continental 317C-2, 50 kW transmitter, which naturally runs on 3-phase power. Hanging unobtrusively on the front inside wall of that rig, is an deceptively simple device, labeled "Phase Failure Protection" (with little else said about it in the book). It is a 3-phase relay, which will operate upon failure of any phase, and which also detects phase rotation.

The device is made by Time Mark Corp., and the model number for the device is 258B. The contacts are SPDT, and it interrupts the control system.

I hope this helps someone save a blower motor or other device from an untimely death at the hands of the power company. Remember that a 3-phase motor will run backward as well as forward, if phase rotation is wrong (as it could be if the power company lost a transformer and mis-wired it). Tubes without cooling don't last long! Yes, I know about interlocks, but those things die too -- and often without fanfare. You really don't want to find out about it at 3:00 a.m. on a Sunday morning -- do you?



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# Orban Optimod 8100 Fix

By Mark Bohach, DE - WHOK Inc.  
Lancaster, Ohio  
(614) 653-4373

After a recent thunderstorm, I noticed that my FM station (WHOK) didn't sound quite "right." In the studio, right off the modulation monitor, the station sounded distorted and dull. On the monitor, I noticed two symptoms. First, the stereo pilot was wandering plus and minus 0.5% to the beat of the music. This was very unusual since I do not composite clip (or will I ever). The second symptom I noticed was a flat topping of the positive modulation at 90%.

Upon arriving at the transmitter site, I checked for the symptoms on the site's modulation monitor. It showed me identical conditions. I placed my standby processing chain on line, and the problem cleared. I then ran the output of my Optimod 8100 A/1 directly into the stereo monitor. The pilot was rock steady, and the audio was absolutely clean.

I pulled the Optimod and took it back to my shop at the studios. I ran the composite output directly into the oscilloscope. On the scope, I discovered a 600 kHz sawtooth coming out of the Optimod. Riding on this wave, was the composite signal. I then placed the Optimod test switches in the "test" position to isolate the stereo generator from the processing. The sawtooth was still there. I traced back to find IC-704, the output driver chip. I had the sawtooth on the output but not the input. IC-704 is an Analog Devices 518 op-amp which is noted for high slew rate and wide bandwidth. Not having one on hand, I replaced IC-704 with an NE-5534, and the problem cleared.

I then called Orban customer service to order the right part and to find out if there was any problem using the NE-5534 as an emergency substitute. I was told two very interesting things. First, the 518 IC usually simply dies, and that the problem that I encountered was somewhat rare. Second, they had never tried to substitute a 5534 for IC-704, so they couldn't advise me. After re-installing the 8100 A/1 and putting it back on the air, I did not notice any significant degradation in separation or audio quality. I have concluded that the NE-5534 IC is a good emergency substitute for the AD 518.

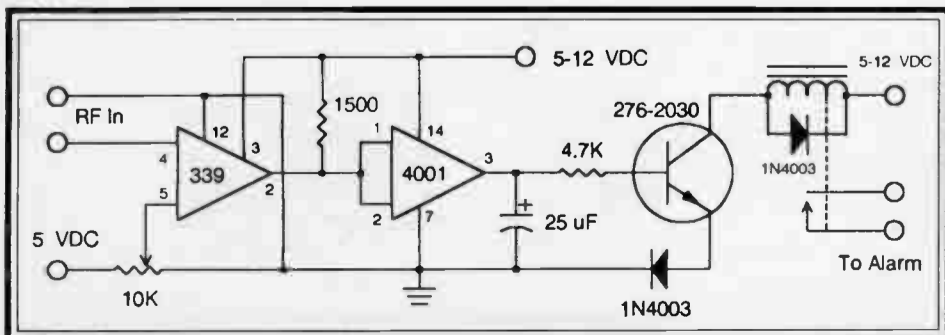
After the phone conversation with Orban, I began to wonder just how rare this problem really is. Could it be that there may be a few frustrated engineers out there that just can't get their processing to sound just right? They tweak and try to fine tune, but something doesn't sound just right . . .

## RF Loss Detector Alarm

By John Graham, CE - WFCJ

I needed a way to let our on-air people know when the transmitter had kicked off. Many times they would monitor the program audio, but not the air signal. So, if the transmitter kicked off, they didn't know until someone called them. My modulation monitor didn't have a sensing circuit to tell if the carrier is lost, so I came up with this circuit that senses the carrier, when present.

If the carrier is removed, the 339 changes to a high, which changes the 4001, which in turn causes Q1 to conduct. This activates the relay that can trigger a visual or audio alarm. The parts are available at Radio Shack. The sensing unit for the RF was simple to construct. I took a three-inch 90-degree elbow, and drilled a hole for a chassis mount BNC connector. I installed the connector with out soldering anything to it. The circuit has been working for some time without any false triggering.





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# A Word About Dial-Up Remote Control Systems

By Alan Roycroft - Hilo, Hawaii

The introduction of remote control systems that require no expensive dedicated phone line, but are accessed from any touch-tone phone pad by authorized station personnel having the secret access code, are God's gift to broadcasters. I have experience with only one make of system, the Gentner, so will confine my comments and ideas to the model VRC-1000. In one installation of synchronous AM transmitters, with sites 100 miles or so from the city of license, it's the o-o-o-nly way to go.

The single unit is basically a computer with many functions that require programming to tailor all the facilities to your special needs. It will take a lot of patience, but the results are worth the effort. There are three sections in the system: metering, commands, and status. The condition of any one of these can be obtained with a clear digitally created announcement or by CRT display and a printer, which can be set up to record readings or conditions automatically at certain intervals.

All of the information is programmable so that an upper or lower limit can be set to activate an alarm condition. If values are below or exceed these limits then, in an alarm condition, any or all five selected phones or pagers are called announcing that such-and-such a transmitter site has a problem. In responding to an alarm call, the authorized personnel will enter the secret access code, obtain the information, correct the condition, and cancel the alarm. If an engineer has to make a call out to the site, he can usually obtain sufficient advance information from the system to even take along some parts. When completing a call with the system, there is a three-digit sign off which is always responded to by the digital voice with a rather peculiar "good-bye."

Under headings of the three main functions of the controller, the following are some ideas I have incorporated or modified:

## STATUS

Your imagination is the only limit to the number of conditions that can be put on alert. For example, an intruder alarm could be a micro-switch in parallel with others mounted on doors and windows; the closure of only one set of contacts is all that is required to create an alarm condition. When I enter a transmitter facility, I am immediately greeted with my pager advising me of an "alarm condition" at that site. Other valuable status sensors are smoke detectors, air conditioning temperature switches, a squelch relay on the STL receiver (to indicate loss of signal), or a normally-closed relay contact connected so that a loss of any phase in the electrical supply will create a warning. Also, a relay on the generator output may be provided to create an "I am running" signal, or by tying in generator alarm circuits, an extension of the "cranked but did not start" or "low oil pressure" and other conditions are valuable.

## COMMANDS

By accessing the system by any telephone, cellular or otherwise, and using the secret security code, the chief operator or engineer can obtain the usual meter readings and make adjustments such as raising or lowering power -- with the immediate announcements of new values such as "Power output is now 98%," or "Antenna current is now 20 amps." All controls are operated through a low voltage DC supply, if your transmitter does not have such a system. The main precaution, as with all other solid state controls, is that a diode must be wired across all relay coils to prevent the inductive spike, created by an opening relay coil, from damaging the collector of the control element.

An automatic generator exerciser can be set up so that once a week, or every few days, the controller will run the generator for a pre-set time, and announce the fact automatically to the selected phones if required. More importantly, it could announce the fact that the generator would not start, as an alarm condition. Similarly, the standby transmitter can be operated on a dummy load with warning of no or poor function.

## METERING

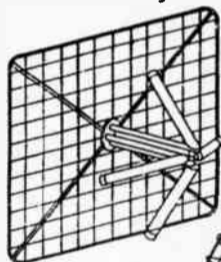
The unit will accept metering samples of either polarity up to ten volts or a balanced  $\pm 5$  volt sample. All other metering is carried out with the same sampling that we have all used for years with one exception. The old analog, and some digital systems, could tolerate RF mixed with the DC sample of tower lighting. (Some systems even simply sampled the supply voltage to the tower circuit and would read light conditions normal even with all the lights burned out.)

Figure #1 is a diagram of the system I am using that provides information if only a side light is out, and will create an alarm condition if only one beacon bulb is out. To sample the current supply to the tower lights, I used an old sampler that, for a primary, uses 1 1/2 turns of the wire used in the load center or breaker cabinet to supply the tower. A secondary winding supplies the rectifier box mounted near the remote control unit. (continued on page 17)



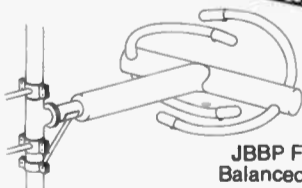
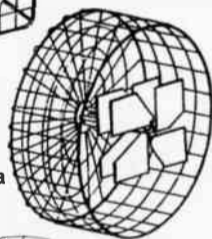
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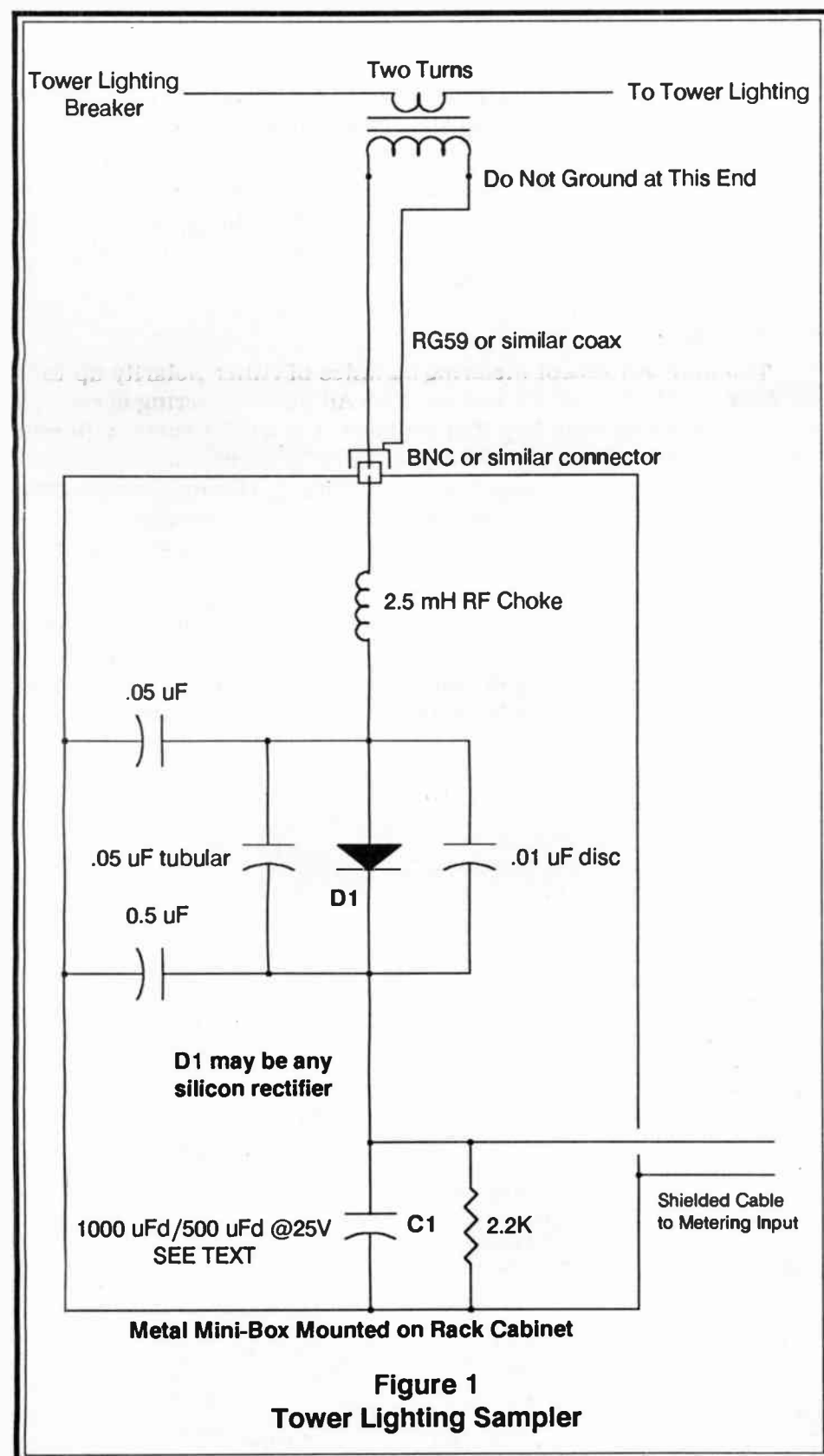
*dorrrough*



## Dial-Up Remotes . . . (continued)

If you do not have an old sampler, one can be made using a Radio Shack low voltage transformer type 273-1512. These are Pi or sectional wound with plastic spools. If you carefully cut the secondary winding off with a small saw, it will not be necessary to dismantle the core. Leave the primary winding intact. Wind about two turns on the old secondary bobbin using the same type and gauge of cable used on the load center; it will be connected in series with the tower lighting breaker and the run out to the tower. Drill holes in the side of the load center cabinet, mount the transformer, and run the original primary winding leads through a shielded cable to the rectifier box as in the diagram.

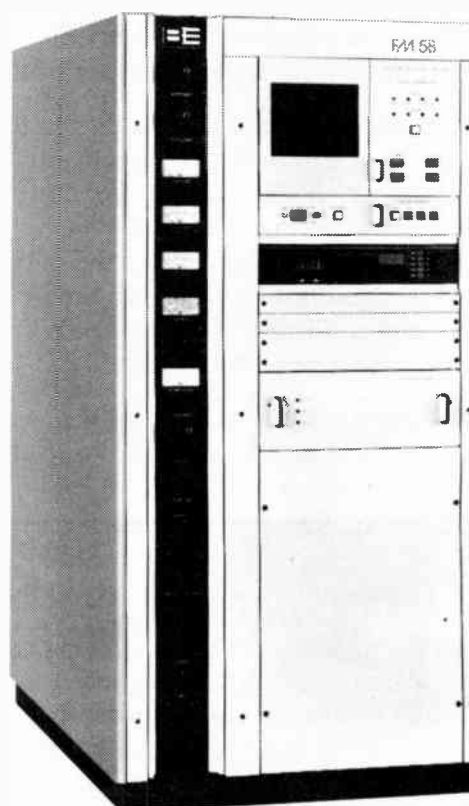
The electrolytic capacitor marked in the diagram as C1, will be 500-1000 uF. It is used to smooth out the beacon pulsing current so that a relatively smooth average voltage is supplied to the controller sample input. Too much capacity will not permit a quick discharge when the lights go out. Program the lighting input for a "100%" reading when all bulbs are working and producing the maximum sample voltage. Set the alarm condition for anything below 70%, which is the maximum for both beacons on and all side lights out. Below this 70%, is when one beacon burns out. Programming will allow the alarm to be inoperative between sunrise and sunset, but the operator can call in at any time for a tower light status. With less than a 100% reading, it is possible to know the condition of all bulbs on the tower -- whether side lights or beacon.



(continued on page 18)

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## Remote Control . . . (continued)

### PROGRAM MONITOR (Figure 2)

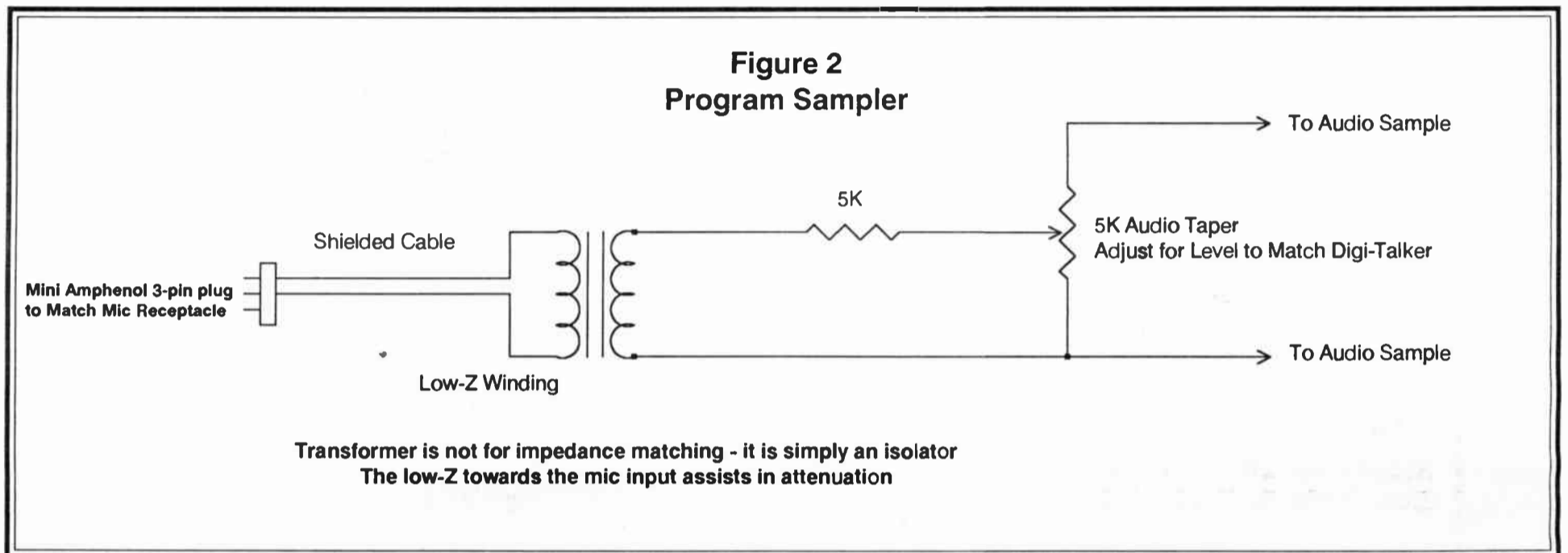
It is essential that a silence sensing unit be installed at the remote transmitter site to warn of loss of programming. It may be a cart stuck in an automation player, loss of satellite music feed, failure of STL feed to the transmitter, or a failure of an audio processor -- whatever. The alarm of silence will call you if you, as chief operator or engineer, are within the range of the transmitter or not.

The only modification that I have done to these controllers is to disconnect the small condenser microphone mounted on the front panel to monitor sounds in the transmitter shack. A good idea, but with exhaust systems and blower motors running in the average installation, the noise picked up tells you very little. A shielded cable and plug can be used from the original microphone jack to a small box containing an audio transformer and a 5K audio level pot to lower the level passed to the mike input to a reasonable level.

The transformer can be an old plate-to-line or a transistor inter-stage (Radio Shack type 273-1374) -- it is not critical. It simply

isolates a grounded audio feed, from the balanced mike input of the controller. The audio feed can be taken from the STL output, the audio sample off the modulation monitor, or from any point in the audio chain. So, if a silence alarm goes out, you will quickly locate the cause. In my case, it is usually the satellite music feed not closely observing the time, and rejoining the program 20 or 30 seconds late -- how I love them!

Finally, there are many sites where a regular telephone service is not possible or is too costly to run. There are several radio telephone links on the market that are FCC approved. One is manufactured by Ritron Inc. of Carmel Indiana. The system consists of two small cabinets, each with a regular telephone RJ11 jack and a small BNC antenna receptacle. The range is about 20 miles with line of site. One end connects to a regular telephone metallic pair, the transmitter site end can use a regular telephone plugged into a double RJ11 adapter so that the Gentner can share the circuit. The Ritron power supply is both 115 VAC and 12 VDC, so that when all power goes out, and when even a metallic phone line would be out also, it is still possible to call up and find out what is happening at that remote site.



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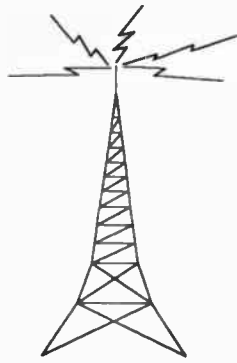
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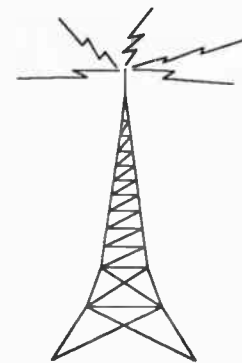


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Ray Topp - Editor

## Here's Why We Do It

The **Equipment Guide** is published as the primary source for all of your used equipment needs - - buying or selling. Here's why **Equipment Guide** works:

- **Equipment Guide** does not have ads that are ancient history.
- **Equipment Guide** does not limit you to a fixed number of words to describe your gear.
- **Equipment Guide** reaches the right people.

The **Equipment Guide** can only help you, if you help it. Use the **Guide** to place your classified ads.

Call me at (507) 280-9668, and let me know what you like (what you don't like), and give me your suggestions. They will be used.

You'll like the results you get in the **Equipment Guide**.

*Ray Topp - - editor*

## Here's Where To Send It:

**Equipment Guide**  
**Box 7001**  
**Rochester, MN 55903**

Name: \_\_\_\_\_

Station: \_\_\_\_\_

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

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

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

State: \_\_\_\_\_

Zip: \_\_\_\_\_

Phone: \_\_\_\_\_

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

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## 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.

3 - Enclose a check for \$3.00, payable to Rochester Radio.

## Equipment For Sale

RF meters, used and tested  
Sangamo mica transmitting capaci-  
tors, assorted sizes, large variety

**Dan's Discount Radio Parts**  
Cavendish, VT  
802-226-7582

**Thousands of Tape Carts**  
Scotch I and Scotch II, Aristocarts,  
Fidelipacs, Capitol AA4 and A2,  
Mastercarts  
50¢ to \$3.00 each, brand new to  
rebuildable condition  
Ampro Console, \$1250

**Pat Martin**  
PMA Marketing Company  
4359 S. Howell Ave. #106  
Milwaukee, WI 53207  
414-482-2638

**CRL Audio Preparation Processor**  
AP300. \$500  
**CRL Spectral Energy Processor SP-**  
400. \$700  
**CRL Peak Modulation Controller**  
PMC-300. \$500

**Dean Aamodt**  
KBMW  
701-642-8747

**Collins twintape spare parts.** Lots of  
PC boards for playback cart deck and  
also for record amplifier, plus spare  
power supply, relays, switches, etc. All  
for \$500 or offer.  
**Gorman Redlich EBS encoder/de-**  
coder. \$250

**Hank Landsberg**  
818-355-3656

**Moseley PCL-303 STL.** 2 receivers  
and transmitters. New crystals on  
950.125 and 949.875. New combiner  
and splitter from Telewave. No anten-  
nas. Asking \$4500

**Dewayne Johnson**  
WAIJ/WLIC  
P.O. Box 540  
Grantsville, MD 21536  
301-895-3292

**CSI T1A transmitter.** Low hours, only  
operated at 500W, with relay panel.  
4-108' 45G towers and Decca-Austin  
insulators.

**Marti RMC15 T/S with RY15 panel.**  
4-Kintronics LTUs.  
1-Kintronics 4-tower phasor.  
1-Potomac 219 4-tower antenna  
monitor.  
Good deal on the package.

**John Alman**  
WIZO  
105 Flintlock Drive  
Franklin, TN 37064  
615-664-6427

**Hughey & Phillips TI-203S 3.5 kVA**  
tower isolation transformer. 120/240  
VAC input, 120 VAC output. With  
instruction book and info. \$1150

**Nick Winter**  
KLAY-AM  
10025 Lakewood Dr. SW #B  
Tacoma, WA 98499  
206-473-3462

**GE Master 2-way base station.** Floor  
mount, high power repeater power  
amplifier (132-174 mHz), 350 watts,  
final tube is 4CX250. Good condition.  
**QRK/Omega audio console.** 10-  
channel digital switching, program-  
mable gain selection on 16 inputs,  
balanced input/transformer output.  
Good condition with complete spares  
on all amplifier and power supply  
boards plus assorted spare parts.  
\$3000

**William J. Brown**  
WPRS/WACF  
P.O. Box 367  
Route 133 West  
Paris, IL 61944  
217-465-3663

**Micro-trac 303A Pro 12" tone-arm.**  
New in box. \$75  
**Micro-trac 306A 16" tone-arm.** New in  
box. \$100  
**12-Audiopak A-2 carts,** new. \$2.00  
each.  
**32-Fidelipac DYN401X lubricated**  
tape, 1800'. \$4.00 each.  
**11-Fidelipac DYN501X lubricated**  
tape, 1800'. \$7.00 each.  
**Stanton 310B phono pre-amp.** Bal-  
anced out, new in box. \$170

**Mike Tyburski**  
Industrial Components Corp.  
2551 Boston Road  
Wilbraham, MA 01095  
800-628-9400

**Altec 1528 automatic mike mixer.** \$75  
**B&W Model 200 audio oscillator.** \$75  
**B&W Model 400 distortion meter.** \$100  
**QEI Model 77775I transmitter interface**  
for remote metering. New. \$100

## TRANSCOM CORP.

Fine used AM & FM Transmitters  
and also New Equipment

For the best deals on Celwave products  
Andrew cable,  
Shively & Comark antennas.

1980	CCA FM-28,500	28.5 kW FM
1980	Harris FM-20K	20 kW FM
1976	RCA BTF-20E1	20 kW FM
1978	Collins 828E1	5 kW AM
1976	Harris MW-5A	5 kW AM
1976	CCA AM-50,000D	50 kW AM
1978	Harris MW50A	50 kW 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

**Phillip Robillard**  
KLVU AM/FM  
1803 N. First East St.  
Haynesville, LA 71038  
318-624-0105

**Multi-user/multi-tasking computer**  
software for sale. Training and set-up  
available. Best offer.

**WKTT Radio**  
P.O. Box 26  
Cleveland, WI 53015  
414-693-3103

**Celwave CFM LP-3 3-bay antenna.**  
300 feet 6" elliptical waveguide.  
**Sparta 680 exciter.** \$1200  
**QEI 675 exciter.**

**Ken Diebel**  
KTJC  
1207 Louisa  
Rayville, LA 71269  
318-728-5852

**ITC RP stereo cart deck.** Excellent  
condition, with all tones and new  
heads. \$1700

**Phil Woods**  
WPEG  
520 Hwy 29 North  
Concord, NC 28025  
704-333-0131

**Berkhalter 300' tower.** 18" face, 4  
years old. Includes 310' of 1-5/8" trans-  
mission line.

**Tom Cooper**  
WGRO-FM  
P.O. Box 689  
King George, VA 22485  
703-775-3744

**Catel Model 2000 stereo generator**  
and FM modulator (for cable systems).  
Best offer.

**Jim Corcoran**  
KWWW  
P.O. Box 638  
Wenatchee, WA 98801  
509-662-7135

**Moseley MRC-1600 with CPU modifi-**  
cation to hold memory during power  
failures. \$2,000 or best offer.

**Bill Glynn**  
KSKA-FM  
4101 University Dr.  
Anchorage, AK 99508  
907-561-1161

**Potomac Instruments AM-19 antenna**  
monitor. Up to 5 towers, use for smaller  
arrays, with load plugs. \$1,950  
**Will accept trade or partial trade**  
toward operating impedance bridge,  
Potomac AM field meter, or RF resis-  
tant distortion analyzer.

Jeff Baker  
Technical Design Services  
P.O. Box 120  
Fairport, NY 14450  
716-258-3380

ITA Model FM-250 transmitter with RCA BTE-10C exciter. All was working when taken off the air and replaced with new equipment. Asking \$1,000

Donald Parsons  
Christian Radio KLUH-FM  
P.O. Box 1313  
1315 South 11th St.  
Poplar Bluff, MO 63901  
341-686-1663 or 314-785-0006

8-Lauderdale Electronics Labs DA-8 distribution amps. 2-channels in/4 channels out, or single channel in/8 channels out. Individual output levels. \$165, postage included.

E. Glynn Walden  
KYW  
5th & Market  
Philadelphia, PA 19106  
215-238-4893

ITC mono RP cart deck. 3 tones, mint condition. \$1,000  
ITC RP with network delay. Excellent condition. \$1,250  
ITC SP. 3 tones, new heads. \$575  
3-ITC RAs. 3 tones. \$550 each.  
ITC RA. 1 kHz tone. \$500  
Bell & Howell oscilloscope. \$75  
Relapped mono cart machine playback heads. \$70  
Stereo playback cards, 3-tone cue cards, rack mounting ears, relays, and other small parts for ITC premium series cart machines.  
Belar AMM-2 mod monitor. \$750

Michael D. Brown  
Radio Broadcast Consultant  
3740 SW Comus St.  
Portland, OR 97219  
503-245-4889

SMC Automation System includes:  
2-racks  
4-250RCS carousels  
1-SSP3060  
1-LA246M  
1-PDC3  
3-RSC50  
1-AS10  
1-power supply  
Will take reasonable offer.

Marvin Sigers  
WJXR  
Route 2, Box 680  
MaClenny, FL 32063  
904-259-2739

CCA Class-A transmitter. We are upgrading to a C-2. 2-1/2 years old, and the price is right. We also have Shively antennas for sale at a bargain.

Larry Torgerson  
WQIC-FM  
P.O. Box 5353  
2711 7th St.  
Meridan, MS 39302  
601-693-4851

Wegner 1601 mainframe includes:  
2-1644 3-function relay cards.  
1-1648 tone decoder with display and 16 functions.  
1-1626 stereo demod board.  
All for \$600

2-Avcom high stability satellite receivers. One wide band unit (factory aligned) for \$1,500. One narrow band unit for \$1,000.

Aaron Hackney  
WBNH  
701 S. 4th St.  
Pekin, IL 61554  
309-347-8850

ERI 8-bay antenna on 101.9 mHz. 1500 square foot building already set up for a radio station. Can be moved, on block and pad foundation, carpeted with central heat & air.

Ray Eller  
KBUS/KPRE  
2775 NE Loop 286  
P.O. Box 1550  
Paris, TX 75460  
214-785-1068

Moseley 505 stereo STL on 949 mHz, with subcarrier on 92 kHz. \$3,500

Ken Lane  
KVRP  
1406 N. First  
Box 1118  
Haskell, TX 79521

Harris Stereo 80 console. Very good condition with manual. \$1,000 or best offer.

Michael Berry  
KFAS  
100 East Florence Blvd.  
Casa Grande, AZ 85222  
602-836-7779

Teac A-550RX cassette deck. Good working condition. \$200  
Sony TC-FX7. Good working condition. \$100

# FM BROADCASTERS!!

## We can meet all your FM transmitter needs!!



### SOLID STATE - LOW POWER

Amplifiers and transmitters are available at the popular levels of 30W, 100W, 300W, 500W, and 1KW. All units are solid state, broadband, and designed for both local and remote operation.



### ONE AND TWO TUBE HIGH POWER

Medium transmitters with broadband solid state drivers and one zero bias grounded grid triode in their PA are available at 1.5KW, 3.5KW, 5.5KW, 7.5KW, and 12KW. Higher power transmitter utilizing two grounded grid triodes (one as a driver) are available at standard outputs of 15KW, 22KW, 25KW, 30KW, 40KW, and 50KW.



## Energy-Onix

752 Warren Street Hudson, New York 12534  
(518) 828-1690 FAX (518) 828-8476

*A Wise Enterprise*

Spotmaster 405-A cart machine.  
Motor bad. \$50  
BE 2000 series. Good working condition, excellent appearance.  
Electro-voice D-056 dynamic mike, Good working condition. \$40  
2-Atlas Sound C3-40, 8-ohm, 40-watt horn type speakers. \$50 for both.

Al Morris  
WZAP  
180 Wallace Pike  
P.O. Box 369  
Bristol, VA 24203  
703-669-6950

BE Control 16 Automation System includes:  
4-Scully reel to reel playback decks.  
2-IGM 42-cart Go-Carts  
1-IGM 24-cart Go-Cart (new).  
2-BE cart decks (PB only).  
1-BE triple-deck (PB only).  
New power supply, new source cards.  
Complete system now in use.  
Asking \$25,000

Roy Mapel  
KAML-FM  
Box 1009  
Gillette, WY 82717  
307-682-4747

4-Otari ARS-1000 playback decks with 25 Hz decoders. Including 6-foot rack and Mark Persons Live Assist Controller. Excellent condition, just removed from service. \$5,000 negotiable, or will trade for 30' pneumatic mast.  
Stereo-Max. Brand new. \$1,500  
Automation Systems 901. Needs work. Very cheap.

Don Price  
WRNS  
P.O. Box 609  
Kinston, NC 28501  
919-522-4141

Excess Belden Cable  
1000' spool #8449, 9-cond 22-ga control cable. \$275  
881' spool #8449, 9-cond 22-ga control cable. \$238  
97' roll #8447, 7-cond 22-ga control cable. \$35  
192' roll #8790, 2-cond 18-ga shielded cable. \$60  
235' roll #8422, 2-cond 22-ga mike cable. \$70  
850' spool #8422, 2-cond 22-ga mike cable. \$275  
152' roll #8459, 25-cond 22-ga control cable. \$175  
247' roll #9750, 3-cond 20-ga control cable. \$50  
362' roll #8448, 8-cond 22-ga control

cable. \$150  
250' spool #8663, tinned bonding  
cable. \$90  
500' spool #8627, 4-cond 14-ga  
control cable. \$300

Randy Kerbaw  
WTNJ-FM  
Box 1127  
Beckly, WV 25802  
304-877-5592 or 255-5221

Schafer 48-cart Audio-File. Excellent  
condition, includes manual.  
50 kW Harris dummy load. New,  
water cooled.  
Tektronix 545 scope.  
Conar Scope.  
Precision Scope  
Collins 900-1 67-kHz SCA monitor.  
Phelps Dodge SPC-5 5-element heavy  
duty FM antenna. New, on 92.3 MHz, in  
crated boxes.  
Best offer accepted on all items.

A.L. Anderson  
KMBR Radio  
Bismarck, ND 58501  
701-255-1234

IGM Insta-Cart. 48-tray mono.  
3-Ampex decks  
2-Shafer stereo PB electronics.  
Inovonics Model 377 stereo PB elec-  
tronics.  
Above equipment was "in working  
condition" when obtained. Most  
manuals available. We need to get it  
out of here so no reasonable offer  
refused. Purchaser pays shipping.

Following equipment was up-graded  
and is in excellent condition.  
ATI M1000 dual mike pre-amp. \$150  
dBx 164 stereo limiter. \$75  
2-Marti CLA-40H limiter/compressors.  
\$350 each.  
LPB S-2 limiter. Fair condition. \$40

Ed Walters  
17-1/2 West 16th St.  
Holland, MI 49423  
616-392-9799

**HARRIS 9000 SERIES AUTOMATION  
SYSTEM INCLUDES:**  
9000 program module.  
Microplus dual disk drive.  
5-Otari ARS-1000-DS reel to reels.  
4-IGM Go-Cart 24-cart carousels.  
2-ITC Delta playback decks.  
Audicord E26 record/play stereo cart  
deck.  
Audicord E26 playback stereo cart  
deck.  
Clear text logging package with TI-  
840 printer and 35' of cable.  
2-TEC CRT terminals with 50' of cable  
for studio use.

Live studio/newsroom remote ctrl.  
4-Harris racks.  
We have lots of spares. This system is  
3 years old, complete, and ready to go.  
All offers are considered. \$35,000

Jeff Twilley  
WOVU  
Route 1 Box 33  
Oceanview, DE 19970  
302-539-2600

Scientific Atlanta 7300/7325 digital  
satellite receiver. 1) 15kHz, 1) 7.5 kHz,  
1) voice cue card. 3) crystals. Like new.  
\$9,000  
HD955 Delay (mono). 6.4 seconds/  
15kHz. \$1,750  
ABC Talk Radio cue demod  
(McCurdy MRP-1) with interface and  
printer cables. \$500

John Katz  
Westcoast Broadcasting  
209-686-2866

Wheatstone Model SP 5A Console  
15-input, 8-track output audio console.  
Never been in service. Brand new 1989  
specifications. All original documenta-  
tion. All inputs are stereo with solo bus.  
3-mike/line input modules. 12-A/B  
selectable line input modules. All input  
modules have equalization. Studio  
muting on Mic inputs. Dual studio  
talkback. Built-in machine remotes.  
Timer controls. List price new: \$18,500.  
Must sell, will sacrifice for \$12,000.

Also available: 1) Denon DN-950F Cart-  
Compact Disc Player. brand new, in  
box - \$1,000. 2) ADC Pro-Patch  
chassis, Model PPA-3-18, Mark II, N.O.,  
brand new - \$500 each. 1) ADC Pro-  
Patch assembly, Model BJB-103-4.  
Mark II, brand new - \$500.

Call Joe Perez  
Santa Rosa, CA  
Days 707-526-5050  
Evenings 707-526-5050

1988 Harris 3.5 kW FM transmitter  
with exciter. Used for 14 months at 800  
watts. Immediate delivery, financing  
available. \$19,500 or best offer.

Brad Fuhr  
WLTO  
616-526-9604

Schafer 800-S solid state 10-channel  
automation system. \$800  
Schafer 902 solid state automation  
system. New cards, 10-channel, 4-  
racks, net join, remote control, 6-250  
model 24-tray carousels, 5-random  
access units. Ready for on-air use.

## When we say we rebuild equipment We mean it!

Fall Special - thru 11/30/89



Model RP-0001  
Recorder/Reproducer

ITC Premium Series  
Mono RP Cart Machine

Regular Price. \$995

**Special \$895**

(add \$95 for 3-tone option)

Our price includes the following:

-and-

*You are protected  
with a full warranty  
and right of return.*

New motor bearings  
New capacitors on PC cards  
New sealed trim-pots  
New pinch roller  
New cartridge springs  
Re-lapped tape heads  
Documented spec. run  
All mating connectors  
Complete manual

# HE HALL Electronics

1712 Allied Street  
Charlottesville, VA 22901

(804) 977-1100  
Fax (804) 979-0978

\$5,878  
2-Racks. \$100 each.

Todd Noordyk  
WSHN AM/FM  
517 N. Beebe St. Box 190  
Fremont, MI 49412  
616-924-4700  
FAX 616-924-4534

3) 100' rolls of RG-8 transmission  
cable. Never used. \$290 per roll.

Jim McMahan  
WAMD  
P.O. Box 970  
Aberdeen, MD 21001  
301-272-4400

Sola 1.5 kV uninterruptable power  
supply (UPS) in mint condition, with  
status lights and battery packs. \$2,000

Paul Christensen  
904-721-9111

HP330B Distortion Analyzer. \$100  
HP206A Audio Generator. \$100  
General Radio 916AL RF Bridge. \$700  
General Radio 1650-B Impedance  
Bridge. \$225

Rhode & Schwartz HUZ VHF-FM Field  
Strength Meter. \$650  
All equipment in working condition,  
includes manuals and shipping - COD  
or pre-paid.

Walt Gradzki  
Marionics Inc.  
P.O. Box 4732  
Toms River, NJ 08755  
201-240-3199  
FAX 201-240-3133

Vidifont Mark IV-A character gen.  
2-RCA TR600 2-inch VTR with spare  
heads. Serial number above 6000. With  
AE 600 editor and full documentation.  
RCA TK28 film island complete with  
2) PT 66 16mm projectors, 1) TP-7  
35mm slide projector, 1) TK 15 multi-  
plexer, 1) heavy gauge steel platform.  
Assorted monochrome video monitors.  
Numerous spare parts for all above, all  
in good working condition. Price  
\$15,000 FOB Huntsville, Alabama.

Contact Robert Gay  
WAAY-TV  
205-533-3131

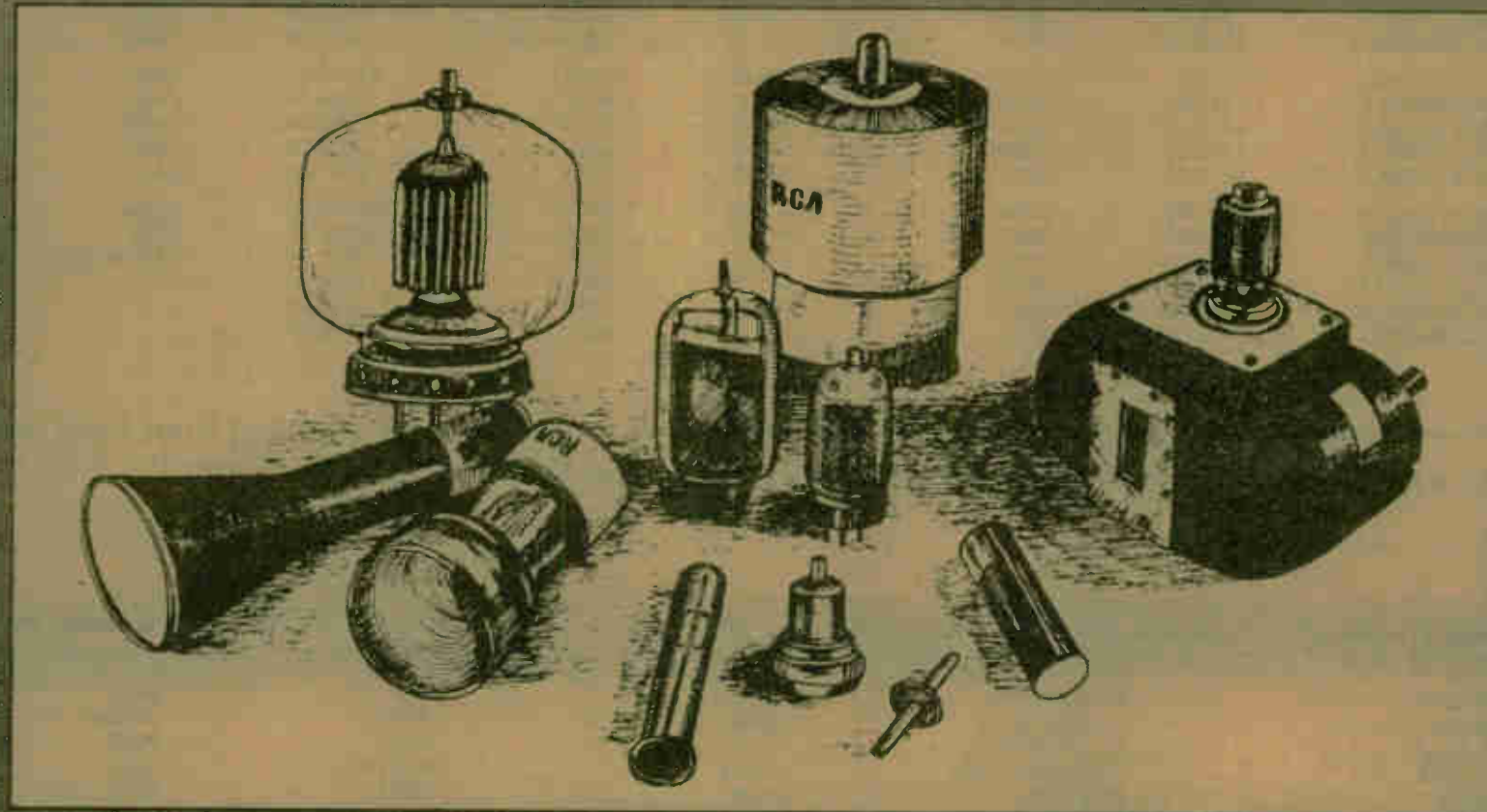
1-Set Marti STL-8 stereo micro-wave  
transmitters/receivers on 948.85/  
949.15 MHz.  
(continued on page 9)



# BROADCAST TUBE CATALOG

Video Camera Tubes • RF Power Tubes

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 TOLL FREE (800) 422 4250  
 (800) 422 4277 (Calif. only)

**Since 1945**  
**Same Day Shipping**

## REBUILT POWER TUBES

3CW20000A7	Call	4CX3000A	\$ 690.00	5736	\$ 515.00	6576	\$3120.00
3CW20000H3	\$1045.00	4CX5000A	785.00	5762	725.00	6696	1925.00
3CX2500A3	400.00	4CX10000D	945.00	5771/356	1400.00	6696A	1925.00
3CX2500F3	415.00	4CX15000A	1090.00	5891	3930.00	6697A	2450.00
3CX2500H3	435.00	4CX20000A/8990	1370.00	5918A	2250.00	6800	750.00
3CX3000A1	\$ 405.00	4CX35000C	\$3985.00	5919	\$2750.00	6800A	\$750.00
3CX3000F1	435.00	5CX1500A/B	590.00	5936	2480.00	6920	3720.00
3CX3000A7	490.00	356/5771	1390.00	5986A	2220.00	7121	1560.00
3CX3000F7	525.00	889RA	2090.00	6076/A	575.00	7255	660.00
3CX5000A3	1050.00	891R	1705.00	6166A/7007 RCA	2420.00	7480A	3630.00
3CX5000H3	\$1160.00	892R	\$1695.00	6420	\$1100.00	7482	\$8360.00
3CX10000A1	1325.00	5604	1760.00	6421	1550.00	7560	7150.00
3CX10000A3	1210.00	5606	910.00	6421F	1550.00	7560V	7275.00
3CX10000H3	1195.00	5606A	910.00	6422	1300.00	7900	Call
3CX10000A7	1210.00	5619	1280.00	6423	1540.00	8461	6600.00
3CX15000A3	\$1325.00	5658	\$1725.00	6423F	\$1450.00	8773A	\$2970.00
3CX15000H3	1215.00	5667	1450.00	6424	1425.00	8795	6930.00
3CX15000A7	1320.00	5668	900.00	6425	1800.00	8990/4CX20000	1375.00
3CX20000A3	1590.00	5669	1400.00	6425F	1775.00		
3CX20000H3	1600.00	5681	5700.00	6426	1590.00		
3CX20000A7	1585.00	5682	5950.00	6427	2300.00		

Prices assume the return of a rebuildable dud. If a dud must be supplied from ARS, an additional 20% of the rebuilding price will be added to the price of the tube.

## NEW POWER TUBES

2C39A	4-400C/6775	6BA6	813	5840	7558
2E26	4-1000A/8166	6BE6	872A	4876A	7580W
3-400Z	4CX250B/7203	6C4	4055	5886	7586
3-500Z	4CX250BC/8957	6CW4	4631S	5894	7587
3B28	4CX300A	6DJ8	4691	5902	7609
3CX1000A7	4CX350A/8321	6L6GC	4847	6005	7645
3CX1500A7/8877	4CX600J	6SN7GTB	5636	6012	7649
3CX2500A3/8161	4CX1000A/8168	6SL7GT	5639	6072A	7650
3CX2500F3/8251	4CX1500A	6V6GTA	5651	6080	7651
3CX2500H3	4CX1500B/8660	6X4	5654	6111	7801
3CX3000A1/8238	4CX3000A/8169	7C24/5762/7459	5670	6112	7895
3CX3000F1/8239	4CX5000A/8170	12AT7	5675	6136	7898
3CX3000A7	4CX10000D	12AU7A	5686	6146B	8106
3CX3000F7/8162	4CX1500A/8281	12AX7	5687	6201	8122
3CX5000A3	4CX20000A/8990	12AY7	5687WA	6205	8156
3CX5000H3	4CX35000C/8349	12BH7A	5702WA	6386	8791
3CX10000A1/8158	4X150A/7034	12BZ6	5702WB	6442	8792
3CX10000A3/8159	4X500A	25L6GT	5703WA	6688	8794
3CX10000H3	5CX1500A	25Z6GT	5703WB	6883B	8806
3CX10000A7/8160	5CX1500B	26C6	5718	6939	8807
3CX15000A3	5CX3000A	VA220 series	5719	7034	8890
3CX15000A7	5R4GB	VA221 series	5721	7059	8891
3CX15000H3	5U4GB	356/5771	5725	7060	8916
3CX20000A3	5Y3GT	Y572BAL	5726	7077	8976
3CX20000H3	6AK5	575A	5727	7167	8977
4-65A/8165	6AN5	673	5749	7289	8984
4-125A/4D21	6AQ5W/6005W	678	5750	7486	8986
4-250A/5D22	6AS7GA	810	5751	7543	8988
4-400A/8438	6AU6A	811A	5763	7551	9007
4-400B/7527	6AZ8	812A	5814A	7554	9011

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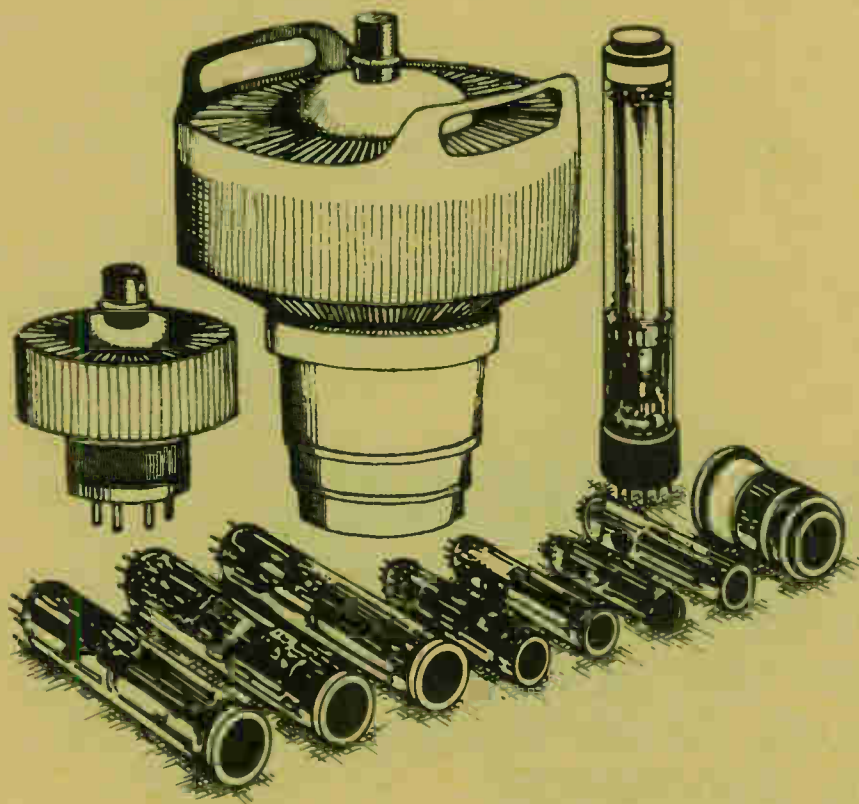
Larger thermal mass of *heavy graphite* anode absorbs high temperatures occur during tune-up or modulation peaks. *Zirconium* coating acts as a *getter* during anode temperature overloads.

\*4-400C is same as 4-400A but mechanically ruggedized.

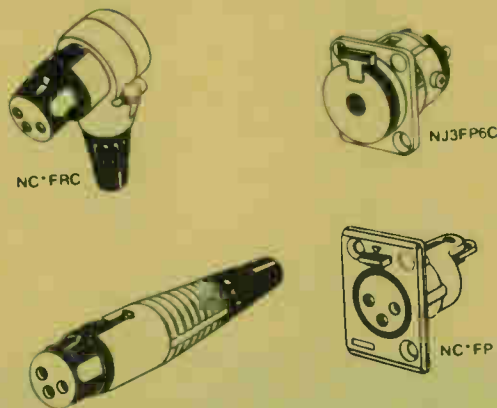
3-400Z	4-125A	5-500A	872A
3-500Z	4-400A	575	6146
4CX250B	4-400C	807	7527A
4CX250BC	4-500A	810	8122
4-65A	4-1000A	833A	2E26

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4380	4911	P8130	P8420	P8491	XQ1085
4837	BC4917	P8131	P8421	P8496	XQ1410
4389	BC4922B,G,R	P8132	P8436	P8497	XQ1413
BC4390B,G,R	BC4923B,G,R	P8133	P8438	P8498	XQ1415
BC4391B,G,R	BC4927B,G,R	P8135	P8452	P8499	XQ1427
BC4396	BC4937B,G,R	P8142	P8453	80XQZ	XQ2170
BC4532U	BC4992B,G,L,R	P8144	P8454	83XQ	XQ2175
BC4592B,G,R	BC4993R	P8146	P8455	XQ1020R,B,G,L	XQ2177
BC4593B,G,R	BC4994G,L,R	P8147	P8456	XQ1023	XQ3070
BC4594B,G,R,L	BC7735	P8148	P8457	XQ1025	XQ3075
BC4809B	BC8134B	P8160	P8460	XQ1070	XQ3077
BC4892B,G,R	BC8480	P8161	P8461	XQ1071	XQ3410
BC4893B,G,R	BC8507	P8199	P8462	XQ1073	XQ3415
BC4894B,G,R	BC8541	P8197	P8463	XQ1075	XQ3427
BC4908B,G,R	P8022	P8400	P8474	XQ1076	XQ4500
BC4909	P8024	P8401	P8490	XQ1080	



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						1N21	Series
B25-12	MRF454A	SD1229FL	2N5070	2N6094	2SC1765		
B30-12	MRF455	3D1229-1	2N5071	2N6134	2SC1946		
B40-12	MRF455A	SD1244	2N5090	2N6166	2SC1966	1N21	"
B70-12	MRF515	SD1479	2N5108	2N6255	2SC1968	1N23	"
BAM120SR	MRF517	2N3632	2N5160	2N6256	2SC1969	1N25	"
BLW-75	MRF604	2N3839	2N5179	2N6304	2SC1970	1N82	"
BM80-12	MRF607	2N3866	2N5583	2N6305	2SC1971	1N358	"
BM70-12	MRF616	2N3866A	2N5589	2N6368	2SC1978	1N415	"
CD5919	MRF626	2N3867	2N5590	2N6370	2SC2097	1N416	"
CM80-28	MRF627	2N3868	2N5591	2N6439	2SC2099	1N446	"
DME150	MRF628	2N3870	2N5641	2N6603	2SC2100	1N630	"
DME375	MRF629	2N3871	2N5642	2N6604	2SC2103A	1N830	"
MPSH-12	MRF641	2N3872	2N5643	2SC710	2SC2237	1N831	"
MRF212	MRF644	2N3873	2N5645	2SC730	2SC2290	1N832	"
MRF215	MRF646	2N3896	2N5646	2SC731	2SC2395	1N833	"
MRF216	MRF648	2N3897	2N5829	2SC908	2SC2420	1N1838	"
MRF221	MRF901	2N3898	2N5835	2SC994	2SC2494	1N3665	"
MRF222	S15-12	2N3899	2N5836	2SC998	2SC2509	1N4294	"
MRF223	S100-12	2N3902	2N5837	2SC1011	2SC2538	1N5719	"
MRF224	S30-28	2N3903	2N5841	2SC1120	2SC2539		
MRF237	S100-28	2N3924	2N5842	2SC1121	2SC2540		
MRF243	SD1013	2N3926	2N5847	2SC1122	2SC2630		
MRF245	SD1015	2N3927	2N5848	2SC1165	2SC2694		
MRF250	SD1019	2N3946	2N5849	2SC1176	2SC2695		
MRF250A	SD1077	2N3947	2N5862	2SC1177	2SC3103		
MRF260	SD1089	2N3948	2N5941	2SC1178	2SC3104		
MRF261	SD1098	2N3959	2N5943	2SC1239			
MRF262	SD1127	2N3960	2N5944	2SC1251			
MRF264	SD1141-1	2N4072	2N5945	2SC1306			
MRF315	SD1143	2N4073	2N5946	2SC1307			
MRF316	SD1144	2N4427	2N6080	2SC1314			
MRF321	SD1200	2N4428	2N6081	2SC1509			
MRF422	SD1201	2N4429	2N6082	2SC1589			
MRF453	SD1202	2N4430	2N6083	2SC1668			
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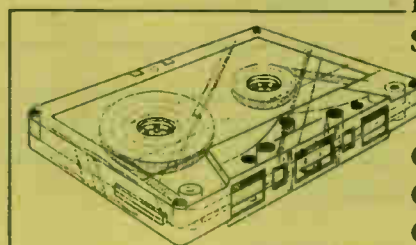
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 tion. Cheap please.  
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John Morton  
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Broadcast Engineering Svc.  
Mouth of Wilson, Virginia  
703-579-4461

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Marandee Broadcast Eng.  
Chatsworth, California  
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Soroca Electronics  
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Dave Wrenn  
Aiken, South Carolina  
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Dean Engineering  
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Sampieri Engineering  
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Don Roden  
Roden Engineering  
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Don Haworth  
Haworth Engineering  
Fargo, North Dakota  
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Jim Taylor  
Jim Taylor Engineering Svc.  
Augusta, Georgia  
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Mike Tosch  
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Jeff Twilley  
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