TECH TIPS FROM RADIO GUIDE

GEORGE WHITAKER
EDITOR

Rudy Johnson 3-30-94

TECH TIPS
FROM
RADIO GUIDE MAGAZINE

George Whitaker, Editor

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PREFACE

Radio Guide, as a term, has been around a long, long time. As I understand it, the RG on RG-8, RG-58, etc, stands for Radio Guide. Radio Guide, the magazine, however is no longer published.

Radio Guide as a magazine was published from July 1988 until January 1993 when it was superseded by Radio Shopper.

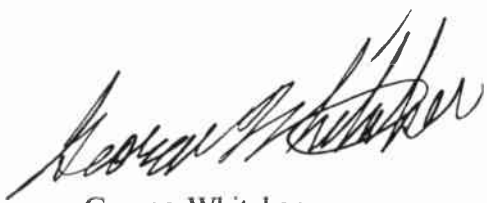
It has been my pleasure to be either a reader, writer, or editor of every Tech Tip that ever appeared in Radio Guide. I learned a lot of very useful information.

Ray Topp and I have joined together to present this information in an easy to use, easy to store format.

All of the Tech Tips in this book are indexed in the back so that you can look up tips on specific equipment or problem areas.

With the exception of a few tips where changes were made to allow better page composition, all of the items in the book are word for word as they appeared over the years in the magazine. This does, however, mean it is possible that some of the products mentioned may no longer be available or that the prices mentioned will no longer be valid.

Many times I have scrabbled through my collection of Radio Guides looking for a particular item because I needed it right then and couldn't remember exactly what it said. Sometimes I would find it, sometimes I would finally give up the search. This book should help all of us.



George Whitaker

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CSI TRANSMITTER RF FIX

David E. Doughty
WTLB Utica, NY

I live in CSI country. There are six CSI FM transmitters operating in this area and I've worked on each one of them at one time or another. The CSI design is simple, stable, and reliable. Some time before his unfortunate passing, however, CSI's Bernie Gelman admitted to me that some of his transmitters had been shipped with a manufacturing defect that can seriously affect their operation.

The defect was found in at least two of the units in this area. Since they were purchased about four years apart from each other, I suspect that there are a good many CSIs out there with the same defect.

Mounted inside the RF final cabinet in conjunction with the output flange, is an aluminum plate with a hole cut in it to allow the output conductor to pass through the "bullet" connector. The hole in this plate should be small enough to support just the edge of the Teflon bullet insulator, BUT NO SMALLER. Some transmitters were shipped with support plates having holes considerably smaller than this.

Problems in operating a CSI transmitter having a support plate with an incorrect hole diameter can manifest themselves in several ways; not necessarily all at once. They include:

Occasional arcing from plate ammeter to cabinet.
Lower than expected output efficiency.
Shorter than expected tube life.
Heating of output tuning components.
Erratic operation of reflectometer.
Unexplained damage, or arcing around the output blocking cap.
Higher than expected incidental AM noise.
Arcing at the twist locks holding the RF cabinet cover.
Premature aging of the RF final tube socket.

I strongly recommend to anyone with a CSI transmitter, especially the higher power units, to check the hole diameter of this support plate and correct it if necessary. You will be rewarded with an ultra-stable, cool running, clean sounding transmitter and you'll hardly ever have to replace the final. (Well -- almost hardly ever)

AM TOWER LIGHTING TIP

Donald J. Larsen
Idaho Falls, ID

I once had a three-tower AM antenna array with a total of twelve side lights and six beacon bulbs. It seemed that the lighting systems ate light bulbs for lunch. One year we replaced fifteen beacon bulbs and nineteen side lights. Evidently, this situation had been going on for some time.

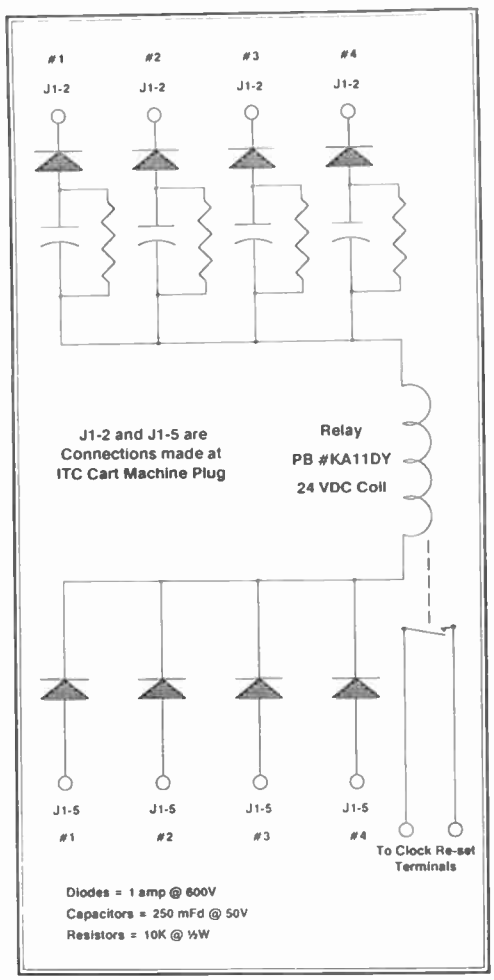
Upon investigation, it was found that (although the towers were shunted to DC ground through the tuning network) the lighting system was completely isolated from the tower structure due to the fact that the lights were fed through Austin transformers.

Bonding the lighting common conductor to the tower cured the problem. Evidently there was a static build-up on the lighting system and periodically it would discharge through the lamps, causing them to burn out.

TEAC SX-3300 TIP

Ralph Messer
WTZE Richland, VA

Ralph called with this tip a couple of weeks ago. He was having problems with a TEAC SX-3300 (10.5 inch reels). It seems that the unit would start and stop all by itself, at random times. Even though the power supply DC showed no ripple, he replaced the power supply capacitors anyway. Problem solved.



CART DECK TIMER INTERFACE

Ken Abernathy - Technical Dir.
WFMX/WSIC Statesville, NC

Since practically all spots are 30 to 60 seconds, the announcers could run a tighter program if they knew exactly when a spot will end.

This timer interface circuit will provide the announcer with that information.

Each time a cart is started, a momentary pulse pulls in the relay and resets the timer to zero. The diodes serve to isolate the different voltages of the cart machines. Current flows only for an instant and the resistor discharges the capacitor.

The control voltage of the run relay is used to start the counter at zero. The timer can be a Lauderdale LEL- 510 or similar unit.

This circuit was designed for ITC SP and WP cart machines but can be used for other cart and recording machines.

HARRIS FM-5C SPURIOUS FIX

James Cunningham
KHKC Atoka OK

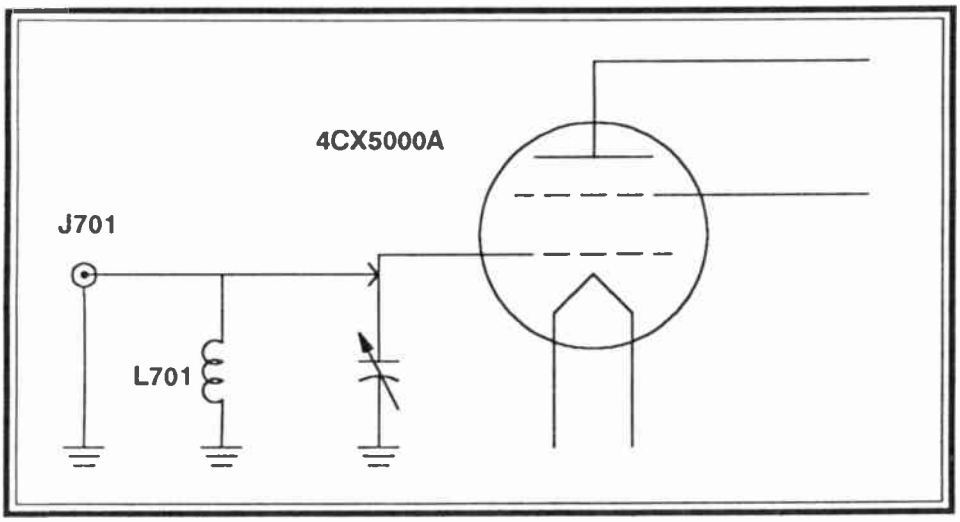
At KHRC-FM, in Atoka, we have a Gates FM-5C transmitter for our 3kW stereo FM service on 103.1mHz. In July of 1985, we received a complaint that our transmitter wasputting out a spurious signal at 106.3 mHz. I was a little puzzled at first, but began my search using my digital DX-400 Realistic receiver. The spurious signal was strong and clear, and I wondered why I hadn't noticed it before.

I removed the exciter output cable from the IPA cavity, fed it into a 50 ohm dummy load and listened with my DX-400 receiver. No Spurious signal. I then re-connected the exciter to the IPA and fed the IPA output into the dummy load. Still no spurious signal. I felt pretty good about that; I was on the right track. I then connected the output of the IPA into the grid of the 4CX5000A PA final. With the PA plate voltage off, the signal appeared. Removal of this cable from the 4CX5000A also removed the spurious signal.

I went straight to the schematic diagram. It showed a grid bias choke (L-701) with a value of 1.8 micro-henries. Instantly, I could see that the choke in the transmitter was much larger than the required value.

I removed the suspected choke coil and, due to a parts shortage, wound one by hand. My Heath Kit inductance checker really came in handy.

I installed the newly wound coil and made the test over. The spurious signal was gone! I double-checked everything, turned on full power, and scanned the dial looking for our spurious signal. It was nowhere to be found. In less than an hour I had cleared up a problem that could have taken an indefinite period of time. This demonstrates how what might have been a major problem, was overcome with simple, logical procedures and inexpensive test gear.



RPU INTERFACE FIX

Conrad Trautman
WSYR Syracuse, NY

When I took over at WSYR/WYYY, it seemed that the most important dilemma to be addressed was the Marti equipment. A beautiful system was in place and it just didn't work. Every time a reporter in the field would try to send something, it would be over-ridden by noise, birds and you name it.

The system was set up, originally, to be a repeater system, where the receive antenna was at our FM site on the hill outside the city. It would repeat to a tall building in the city, located in a valley. Most of our news stories were gathered downtown, so I initially concentrated on the downtown site. It turns out that the receiver downtown was picking up intermod from other transmitters on the roof and whether we used the repeater or did a talk around, the result would be the same.

Marti suggested the installation of bandpass filters, which allow only one frequency to pass, while blocking all others. We needed two in series to finally cure the problem. The insertion loss was about 3dB, but I installed a good antenna in place of a unity gain type, which helped maintain our coverage area. This also cured the repeater problem, since it also transmits to the downtown location.

IC TEMPERATURE SENSORS

David Graves
KMJX-FM/Magic 105 Little Rock, AR.

So you want to measure the stack temperature of your transmitter and the temperature of the building to help keep an eye on transmitter efficiency? But neither of you or the GM wants to spend $100 or so per sensor? Enter the answer to your problems: the National Semiconductor LM-34 CAH.

This nifty little device will solve your temperature monitoring problems at a cost of $8 per sensor. The LM-34 is a linear device which outputs 10mV/degree Fahrenheit, when fed with DC of 5 to 30 volts. Accuracy is + or - 2 degrees or better, over a range of -40 to +230 degrees. Add to this a current drain of only 70 micro-amps, and you have thermo-sensor that will run for over a year on a 9 Volt battery, if no handy source of DC is available.

The LM-35 is the Centigrade version of the device, with a range of -55 to +150 degrees. Accuracy is the same for both products. They come in a TO046 package or the TO-92 epoxy package. The price and info given is for the LM-34/LM-35 CAH, which is the metal TO-46 package. I chose it because I felt the heat transfer characteristics would be better.

Operation is simple -- just put +5 to +30 Volts DC on the +DC lead (denoted by tab), ground the leading opposite, and read 10mV/degree off of the remaining lead. Using a single

supply is necessary in order to read temperatures below zero, but in my application, it wasn't needed.

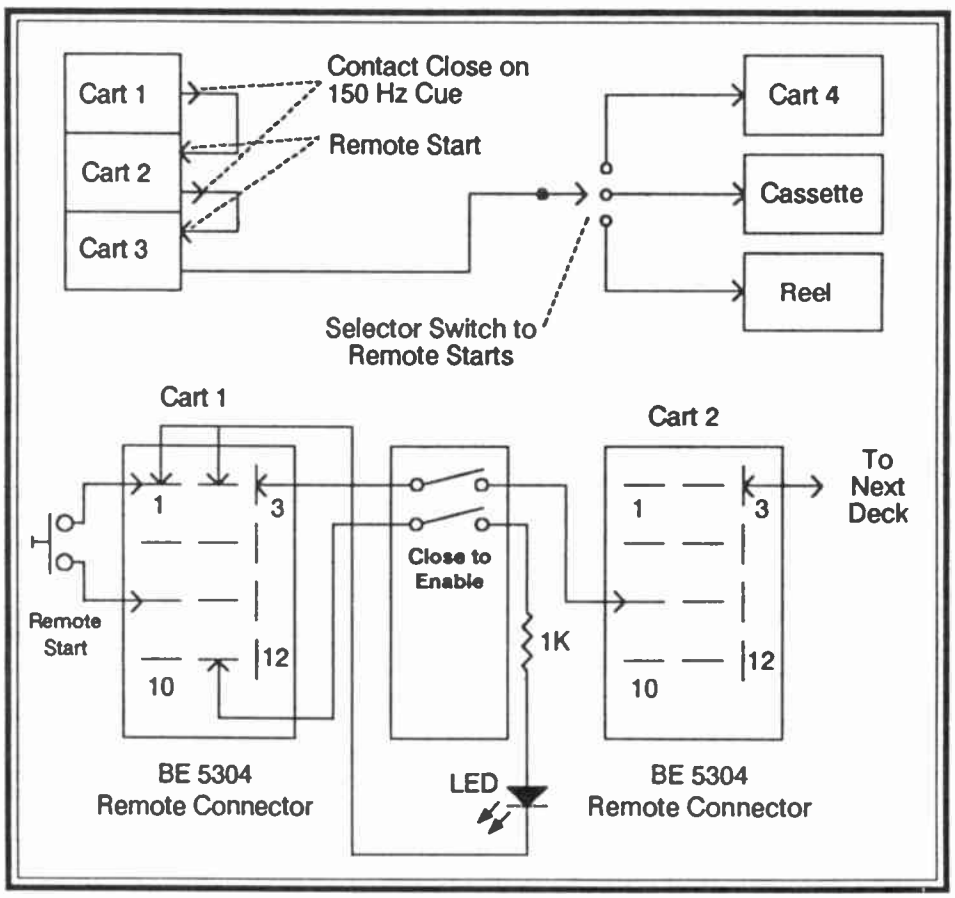
The factory recommends bypassing the device for RF, however I have operated for one year in an extremely hostile RF environment with no bypassing whatsoever, and have had no problems. In fact, my stack sensor consists of an LM- 35 soldered to some Belden cable, insulated with heat-shrink, and inserted into the exhaust duct -- three inches above a 25 kW cavity!

I found it easy to interface with my Gentner VRC-1000 remote control. Just program in a calibration constant of 100, and your temperature is read out to four places. Current price (1989) is $7.90 for the LM-34/LM-35 CAH.

MINI-AUTOMATION

Robin O'Kelly
KORE-AM Springfield OR

Operators like to have occasional extended breaks away from the board, for production work and other "necessities." I designed this set-up for operator fill-in for up to one hour.



The system consists of our BE-5304 triple deck cart machine, a standard cart machine, a reel-to-reel deck and a cassette deck. The system makes use of the 150 Hz cue tone contact closures.

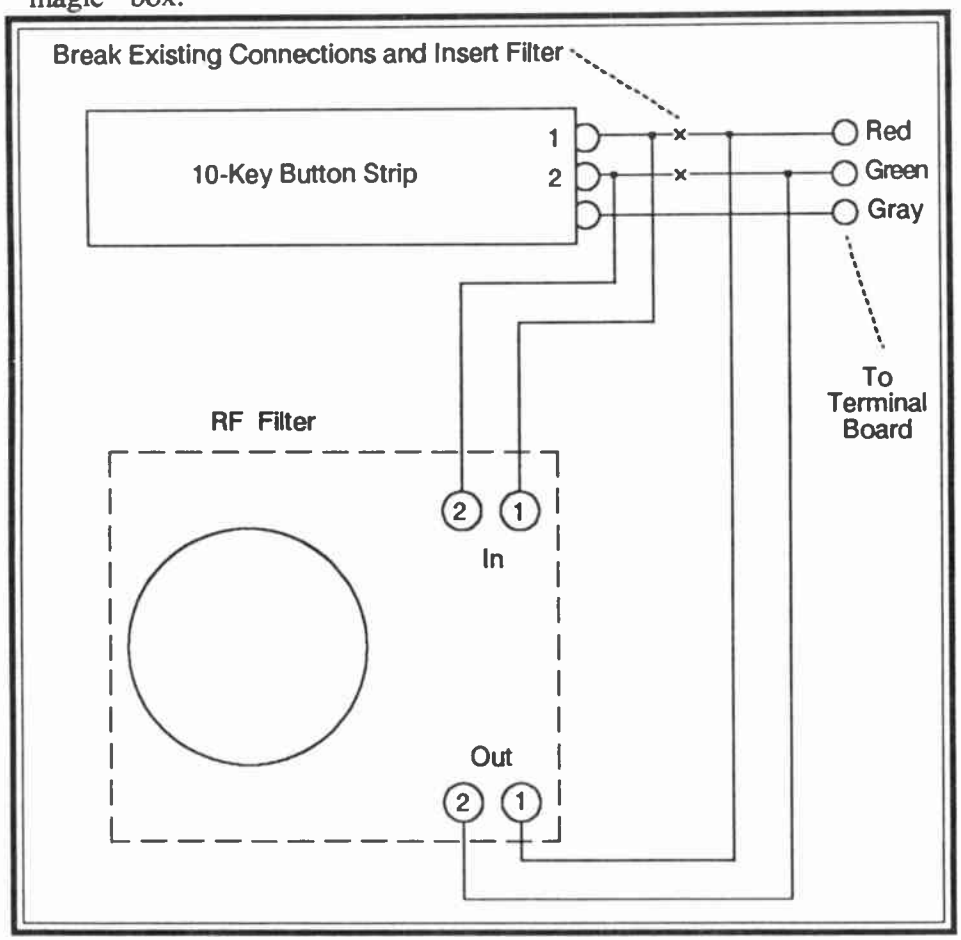
To use the system, a 150 Hz aux cue tone must be placed at the end of each of the carts to be used. Typical use is to load a station ID in cart-1, promo spots in carts 2 and 3, and either music or a program in the cassette, reel, or fourth cart deck. Depending on how long the material in the final deck is, the operator is free for up to one hour, to "take care of business" within the controllable range of the studio.

TELEPHONE RF PROTECTION

Phillip H. Ramsey
KBLG Billings, MT

How often has someone on your staff picked up the phone to record a HOT interview, or maybe the daily stock market report--only to find that when they tried to play it back, the recorded material is overwhelmed by your air signal, or even worse, a signal from the station down the street? It's that old bugaboo, RF! You can hear the newspeople screaming about their lost interviews two blocks away. The salespeople are acting like the world is going to end if they can't record an agency spot over the telephone. Then, to top off your day, the GM is giving you those "looks" that say don't just stand there -- do something!

Here's something to try. I have been using a 10-key ITT telephone, but the principle is the same for all. Pull the cover off, then remove the strip with all the buttons on it. Actually, you'll just need to lift it up and turn it slightly to see the underside. You'll usually see three wires. Leave the gray wire alone. Unsolder the other two, being careful not to break the little tabs off. Be sure to note which wire went where. Add about twelve inches to the wires you just unsoldered. Then add a wire to each of the tabs. Run the wires out the bottom of the case and put the telephone back together again. Here's where we're going to add to our "magic" box.



Suttle Apparatus Corp. makes a nifty little phone filter designated as the SE-1542-A.

To install, just run the two wires you added to the tabs on the key strip, to the input of the filter. Run the other two wires to the output of the filter. I usually screw the filter right to the case of the telephone. It is easier to trim the wires in length this way.

To figure out which is the in and which is the out, hold the filter with the terminals away from your body. The left side is the input and the right side is the output. Be sure to keep your wires running straight. That is, from tab-1 to the filter and back to the terminal block inside the phone, and the same with tab-2.

You may have a strong enough RF field so that this unit won't totally eliminate your problem, but it will cut it down to a level you can live with.

The (1989) cost is $16-$20. It can be ordered from any local telephone repair person or you may contact the company, Suttle Aparatus, Box 28, Lawrence, IL 62429 for the name of your nearest distributor. This may sound like a pitch for Suttle, but it's not. This is just the best thing I've found, in the past 25 years, that really does work to remove the RF from the phone lines.

EDITOR'S NOTE: If you need a filter for a single line with modular plugs, RF SPECIALTIES carries one that is under $10 (1993) and works even at my 5 kw transmitter site.

WHEN IN DOUBT; RE-SOLDER

Dan G. Peluso
KFM Radio Las Vegas, NV

In checking out the Tips From the Field, in the March issue of Radio Guide--Harris TX Tip by Larry Schropp, I was having a grin to myself as I recalled my BC-1T, in 1970 in Kimball NE. The transmitter would, now and again, have its two 833's in the final section, glowing like two red apples. Quickly looking at the drive level, I saw nothing. Switching the crystal selector switch back and forth brought the drive back, and operation returned to normal.

After sign-off, I removed the exciter cage and cleaned up the selector switch and examined all parts and wiring. All seemed OK. I replaced the exciter back into the transmitter, fired it up, and found no problems. All was well.

It wasn't but a few days later that the same thing happened. Rocking the crystal selector back and forth again returned the lost drive signals. Hmmmm.... After sign-off, I pulled the exciter cage again and re-soldered all printed circuit joints and wiring. As far as I know, it's still on the air, without this problem.

The Gates Dualux studio console, about every couple of months, would fade away into the silent zone. When I arrived, and after I got a cup of coffee (this would crack everybody up except the boss), I would open the board and replace the program output tube (a 12AU7 I believe); it seemed cold. The new tube would light up and the program would be back to normal.

The next time it happened I wiggled the tube around in its socket and the program came back. After sign-off, I re-soldered all associated wiring around the tube. There must have been a crack or poor solder joint, as this cured the problem also.

RE-LAPPING TAPE HEADS

Ronald F. Balonis, CE
WILK Wilkes Barre, PA

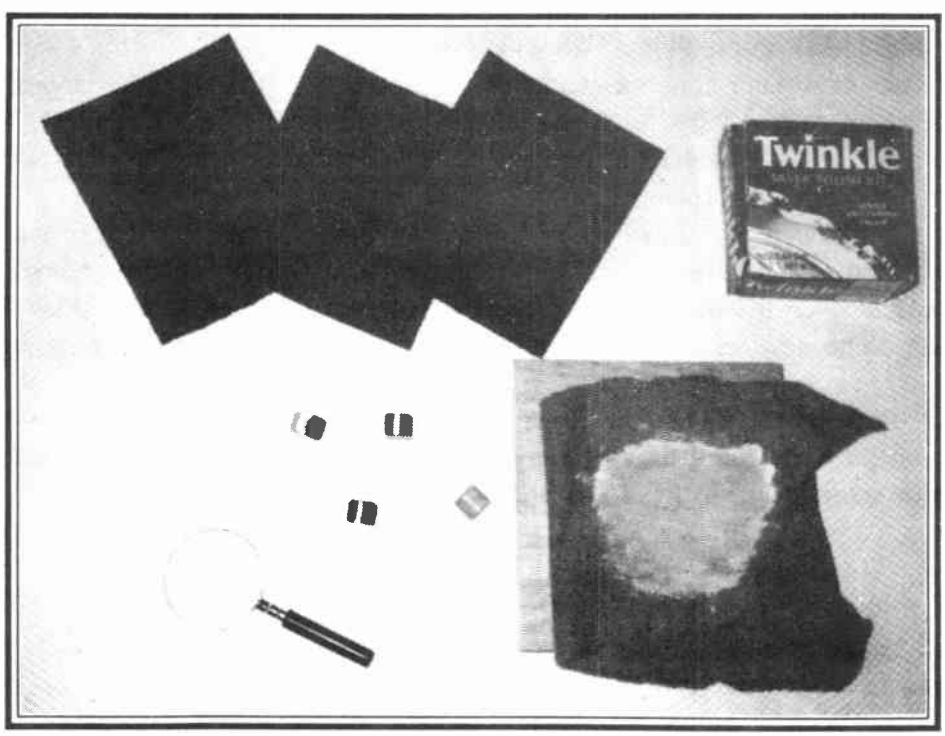
As a business, broadcasting has some of the things going for it that others do not. This is true mainly due to the kind of engineers who work in broadcasting. A station's equipment, with a little tender use and loving care, can be made, or so it seems, to last forever.

A forever that adjusts to the realities of the differing radio markets and stations. Where sometimes it seems that there are as many engineering maintenance philosophies as there are engineers and stations, but no one knows for sure. However, everyone knows that they all have this is common: An innate desire to make things work and to keep them working. A subconscious need to tweak a few extra hours, days, or years out of equipment.

But there comes a time in the life of maintenance of all equipment, including the equipment of radio, when you must stand back and evaluate its worth. To consider if the cost of maintaining it "like new" is really worth it, or if it is even possible. Tape recorders are a good example.

When new, the machines are full of vim and vigor-- they're clean crisp and responsive. However, as they age in time and use, they all become old machines. The bearings in their motors knock a little, sometimes squeak; their response gets sluggish or dull, and even though they can still make technical and mechcanical specs, they do so with a groan or a gasp. And there comes a time when new parts can no longer make a new machine. There comes a time when the machine just isn't worth even a new set of heads.

For an old machine that's still able to work, but not like new anymore, or for a machine that you can't get heads for anymore, an easy and cheap way to keep it sounding as good as it as it can be is to "re-lap" the worn heads you have. It's not too hard to do, all it takes is a couple of things from your local hardware store and some engineer persistence and perseverance.



The things needed to re-lap tape recorder heads are shown in the figure: three sheets of "wettable" emery paper. one of each grit -- 220, 400, and 600. A jar of silver polish, like Twinkle, a handkerchief-size piece of soft flannel cloth, a six inch square of wood for use as a lapping block, a magnifying

glass to inspect the heads to check on your grinding progress and some tape recorder heads with some life left in them. That is, heads with a groove of only 1 or 2 mills deep (thickness of tape) and a reasonably uniform gap showing under the magnifying glass.

The basic how-you-do-it grinding technique is simple: Grinding is done wet by sprinkling a couple of drops of water on the emery paper before starting -- wet grinding produces a smoother result than dry. Grinding is done with a light even pressure of a couple ounces. Grinding is done by holding the head by its sides and pressing its face against the grit. Grinding is done using a rotary. looping or figure-eight-like motion while rocking the head back and forth so that the entire face is exposed to the grinding action. To ensure even grinding turn the head end for end regularly to randomize the grind, frequently examining the head with the magnifying glass to check progress and technique.

The wood block is used as a lapping block for holding the emery paper. The grinding procedure is to start with the coarse grit, then medium, then the fine, ending up with the final polishing. Starting with the 220 paper, grind the head to the point where the wear grooves and traces of the old "polished" surface are nearly gone. Then use the 400 paper to grind out the wear grooves completely. Follow with the 600 paper to grind out any trace of the grinding with the coarser grit papers. Periodically, as you grind, use the magnifying glass and light reflections on the head surface to monitor re-lapping progress. How much grinding effort for each grit depends on the depth of wear, the head material and the skill of the grinder. Typically, it may take 15 minutes to do a moderately worn head -- the best kind to practice on.

The final step is polishing the face to give it a mirror-like finish. Do this: Fold the flannel cloth, moisten it and put a small dab of silver polish on it. Then use the same technique as for grinding with the emery paper. Polishing takes longer and the process will be slower. It takes time to achieve the mirror-like reflection and appearance of a "looks-like-new" re-lapped head.

The re-lapped head will not perform like new but it will work almost as well. Grinding and wear change the shape of a head and the inductance of the head; this changes the optimum bias and the shape of the best equalization curves. Expect that it may be necessary to tweak the bias and equalizations to compensate for the changes in the re-lapped head. Even though its frequency response make be "like" new, it'll probably have more ripple in it than a new one. Consider the costs -- about $5 and some time. Considering the overall condition of an old tape recorder, it's another way to keep it working until it has a major component failure and cannot anymore.

BEARINGS AND SOLDER GUNS

Pete Deets
WFHR/WWRW Wisconsin Rapids, WI

DEMAGNITIZER -- To demagnitize a solenoid core, screwdriver, pliers, or whatever. dig out and dust off that old soldering gun that uses a tip formed from a loop of wire. Plug it in, pull the trigger and pass the item to be degaussed, slowly through the loop. The tip actually forms a one-turn transformer and is very effective.

BEARINGS -- If you have a problem with intermittent flutter in an ITC-750 or 770

reel-to-reel deck, your solution may only be $5 or $10 away. I found that the roller bearings used in the tape path had worn out due to heat and oxide shedding and would induce flutter from time to time. The ten minute fix consists of taking off the bearing assembly, cleaning the oxide off all parts and re-installing it all with a new bearing. Be sure to keep the plastic spacer used between the inner bearing race and the mounting screw. Locally available replacements were MRC bearing number 36FFH401. I took this step after replacing all other motor and pinch roller bearings. The bearings for the capstan motor are NSK bearing number 608ZZ MC2 ERP 5B32S. A good electric motor shop should be able to obtain and replace these for you. Our local shop has done so for me and also does a good job on torque motors.

HOW MUCH CABLE IS LEFT?

Robin O'Kelly - KORE-AM Springfield, OR

Here's a neat way to determine how much cable is left in a Belden Un-reel box or on a spool. If a capacitance meter or Z meter is available, either look up the capacitance per foot of the cable type (available from manufacturer or measure a one foot piece of cable for reference. Measure the capacitance of the entire roll and divide by the capacitance per foot reference figure to find the length of cable.

This works on coaxial cable as well as multi-pair audio cables. It can also be useful in finding hidden breaks in lengths of cable.

A TRUE INTERLOCK

Joel Belik - KIKX Colorado Springs, CO

If you have a main and a back-up transmitter, with a coax switch and a Bird Wattcher, you may want to try this.

In a switch-over, you want to make sure there is no RF on the line when the switch activates. If the plate contactor should stick, the transmitter may say it is off when it isn't. The Bird Wattcher doesn't have interlock for forward power, however it does for reverse power. If you put the high power slug backwards in the reverse power position, it will measure forward power on the reverse power meter. On the Bird Wattcher, the reverse meter has trip points for alarms. Hook one of these up to allow the coax switch to be energized when the power falls below a set level of a few watts. This way you have a real interlock to see if RF is on the line and avoid a confused transmitter control chain.

ITC 770 MOTOR BEARINGS

Roger Bennet - KWMT Fort Dodge, IA

Occasionally, a motor in the 770 will develop a squeal. At first it was thought that the bearings were going bad. The end of the motor shaft only required a drop of lubrication to eliminate the squeak.

OLD SATELLITE DISH FIX

Geo. Schaller - WCOW Sparta, WI

To extend the usefulness of some of the older 4-section Prodelin fiber glass dishes, the performance could be vastly improved by doing two things. First, adjust each of the tri-mount legs individually to "warp" the dish slightly until best noise performance is obtained, by listening and AGC tests. The second and most effective tweak is to adjust the focal length of the LNA. With focal length adjustments of only plus or minus 1/4 inch, it was found that these older dishes will perform well even considering the closer bird spacing.

MISC.TIPS

Dave Stebbins - KZZN Littlefield, TX

Here's a way to verify that the filaments in mercury vapor rectifiers are working. Feel the tube for warmth. It beats using an ohmmeter when pressed for time. BE CAREFUL they can get HOT! Make SURE that the high-voltage has been disabled.

Getting live interviews and halftime entertainment from the field for remote broadcasts is easy with an inexpensive wireless telephone. It's not even necessary to patch it into your remote board, just use a female duplex phone adaptor. Many of these phones have a paging feature that can alert your field man that you are ready to broadcast. You can use it around the station when it's not needed in the field.

WATERING YOUR SATELLITE DISH

Ron Hudson - KKEY Portland, OR

We installed a dish one summer when the weather was dry. Everything was fine until it rained. The static was unbelievable. It took out everything on all transponders and after

the rain, all was again normal. We checked the Tri-Tech and down-converter for leaks and found none. We then grounded everything in sight. Another check with a garden hose resulted in the same static. I got some ribbing on that one - "There's that crazy engineer watering his satellite dish!"

Finally, I noticed that when the transmitter was off the air, the static was gone. OK, the trouble must be RF, as our dish is at the transmitter site about 400 feet from a three tower directional. The coax from the LNA to the down-converter box is about twelve feet long and taped to one of the aluminum spars that supports the LNA away from the dish. With a small can of water, I poured a small amount on the outside of the coax. I got STATIC.

We mounted the coax on stand-off insulators and the static stayed gone. If your dish is located in a high RF field you should try this.

MOSELY TRL-1 SPURIOUS FIX

Steven Crum - WARM Cincinnati, OH

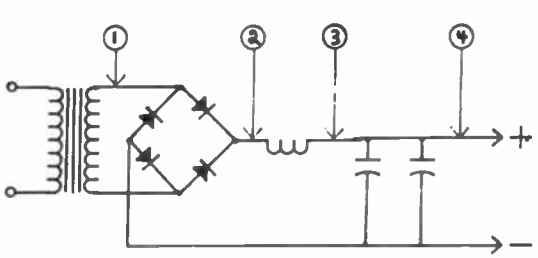
I recently had one of these begin interfering with almost everything on the 450 mHz band. The unit worked fine for four years, then developed spurs 1- mHz wide. I traced the problem to oxidation of the crystal pins.

There are two solutions. Clean the crystal pins and socket with a good contact cleaner (I prefer Cramolin) or solder the crystal in place. The unit has been working fine ever since.

CCA 1000-D AM TRANSMITTER

Dave Stewart - KBNA El Paso, TX

The main transmitter went off the air and couldn't be brought back to life with the studio remote control. The chief was called and he placed the auxiliary transmitter on the air at the transmitter site. The first thing we tried, was to place the main transmitter into the dummy load at low power. It kicked off each time and the overload light lit. The overload relay covers were removed and it was noted that the high voltage supply overload relay was kicking out.



DIVIDE and CONQUER

1. Removed all power and disconnected power transformer from high voltage rectifiers. The plate supply was turned back on and there was no overload indication.

2. Removed all power and connected transformer back to rectifiers. Removed connection from rectifiers to filter choke. The plate supply was turned back on and there was no overload.

3. Removed all power and restored connection between rectifiers and filter choke. Removed connection between filter choke and filter capacitors. Plate supply was energized, transmitter hummed, but did not kick off.

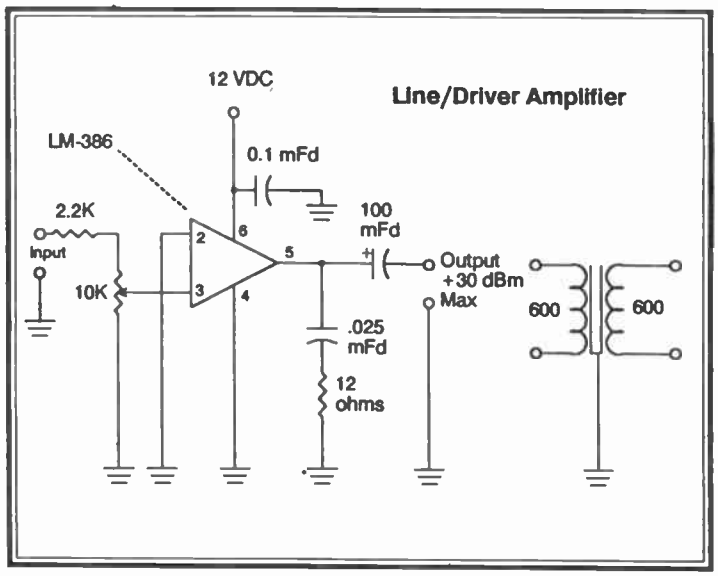
4. Removed all power and restored connection between filter choke and capacitors. Removed high voltage connection from filter capacitors to rest of transmitter. Turned supply back on and found that transmitter was kicked off. The problem had been localized to one or both of the two 8uf filter capacitors. Each capacitor was tested with a Sencore Z-Meter and it was found that the first one read 8.4uf and the second one read 0uf. Both capacitors were replaced due to age and the possibility of PCBs.

Many stations don't have access to a Z-Meter, but any testing of high voltage capacitors should be done with a voltage as near to the capacitor's voltage rating as possible. The couple of volts in DVM won't do the job. That old B+ supply in the attic may be of some use after all. Make sure that you check the noise floor and carrier shift after replacing filters. New capacitors aren't always good capacitors.

LINE DRIVER/AMPLIFIER

Robin O'Kelly-KORE-AM
Springfield, OR

This is a very simple circuit used for several different applications here at KORE-AM radio. It has been installed in a Realistic mixer, to provide sufficient output to drive a phone line coupler for remote broadcasts. The same circuit is used to drive a speaker for remote monitoring of the EBS receiver in our production room.



With the addition of a 600 to 600 transformer on the output, the circuit was added to our TFT-753 mod monitor to provide a balanced output with sufficient drive for our air monitor. Another of these transformer-output driver circuits takes a -10dBm auxiliary program output from our production console, amplifies it to +4 dBm and feeds it to a switcher which allows us to place the production room on the air for certain broadcasts.

CLEANING AND INSPECTING YOUR XMTR

Dana Myers - Sr Field Service Engr Harris Broadcasting Corp.

The old expression that an ounce of prevention is worth a pound of cure is especially true when it comes to transmitter maintenance. A good preventative maintenance program should include periodic inspection and cleaning of the equipment.

DUST REMOVAL

A vacuum cleaner is preferred for dust removal over use of compressed air, since compressed air will blow the dirt into the air to fall on something else. Meter cases should be cleaned with Glass Wax or another non-static cleaner. A paint brush may be used to dislodge dust from delicate circuit boards. Avoid using a nylon bristle brush with a plastic handle, since the static charge may damage C-MOS or other static sensitive components. Instead we use a natural bristle brush with a wooden handle and metal binding.

HIGH VOLTAGE WIRES AND INSULATORS

High voltage wires and insulators must be cleaned with de-natured alcohol or another cleaner, capable of removing dirt without leaving residues.

AIR FILTERS AND BLOWERS

Air filters should be replaced or cleaned as necessary to provide adequate airflow to equipment. If you're using a single transmitter in critical service, a second set of washable filters on hand will save time by enabling you to quickly switch to the clean filters and wash the dirty ones later.

Blowers should be inspected to ensure that the curved fins are not filled with debris, reducing air flow. Motor windings may collect a layer of dirt which could interfere with the cooling of the motor itself. The fins of the high power tubes must be clear of any obstructions which may have gotten past the filters. Monitoring the blower motor current on a routine basis is a good indication that the CFM of air flow. The work or pounds of air moved is a close function of blower current. If the current goes down, then one can assume the blower is doing less work and moving less air. Bearings should be lubricated and checked for excessive noise.

SILVER-PLATED CAVITY PARTS

Silver-plated cavity parts should be inspected for color change-which can be a sign of over-heating and may require the disassembly of the cavity to check for obstructed air passages or loose connections.

A color change in silver-plated parts also can result as a natural reaction of silver to chemicals in the atmosphere. When there is a question of possible over-heating, the part should be cleaned with a chemical silver cleaner such as Tarnex. If it cleans to a silver color, it's normal. If the clean part is blackened or exhibits blue or purple colored areas, the over-heating is suspect. As in any chemical reaction, higher temperatures will cause the silver to react to chemicals in the air at a faster rate. Set screws in the gear and chain drive tuning mechanisms should be checked for tightness. Black silver oxide is a good conductor and need not be removed. Be sure to flush the parts after cleaning to remove residue. Scotch Brite is a good, non-metallic cleaning pad for silver plated parts.

HIGH CURRENT WIRES

High current wires may move during turn-on surges. They can suffer abrasions which eventually may cause an arc if the wires are not properly dressed away from any sharp edges. Wiring on terminal boards may loosen through thermal cycling and vibration. All connections must be checked to ensure they remain tight. If wires need replacing, it is

important to select correct gauge, voltage rating and temperature rating.

EDGE CONNECTORS

Edge connectors on printed circuit boards should be cleaned with Cramolin or a similar cleaner. A small amount is applied to the edge of the connector and removed with lint free cloth. Do not use pencil erasers as this will remove gold or silver plating from the edge of the traces and could degrade the connection or create an intermittent later, as the sulfur in the eraser causes chemical reaction to the edge connector material.

BACK-UP SYSTEM

Any back-up system or emergency mode of operation should be checked periodically. Sometimes relay contacts only need a little exercise to keep their contacts polished and in working order.

TRANSMITTER SITE

Transmitter site cleaning should also include building inspection for such things as leaks in the roof or insects and small animals that can play havoc by wandering into unwanted areas. Intake blowers with filters capable of creating positive pressure in the room can minimize the need for cleaning by keeping much of the dust out.

MAINTAINING RECORDS

A careful log must be kept for future reference. A log should include a description of what was done, when it was done, and the name of the person who performed the work. When people ask, "How often must I clean the transmitter?", the only answer is, "How often does it need cleaning?". Such seasonal events as harvesting, severe weather or construction projects can bring special action, but usually a pattern emerges that allows regular basis maintenance. A complete set of meter readings taken when the equipment is working properly and updated weekly or monthly will greatly assist the engineer when trying to diagnose a problem.

Create a maintenance program spreading weekly, monthly, quarterly, bi-annual and annual tasks evenly through out the year. By choosing when to do what needs to be done and not waiting until any task is so urgently needed that it must be done to keep equipment operating, you can win the war on dirt and stay on the air.

WHEN 115 VOLTS IS NOT

Steve Sandlin - SBE CHAP 99 Bryan, TX

There are times when what you see isn't what you get. I was at my AM transmitter site - a 5 kW directional - when the transmitter went off and the generator cranked. I was surprised because the lights in the building never went out. I checked the status panel and one leg of the three-phase power showed out. I didn't think much about it, but after an hour or so with the generator running, I called the power company. They had no reports of trouble in the area, but they sent a truck.

The possibility of malfunction in the generator control circuitry was looking very real, so I got out my Simpson 260 VOM and checked the power line. The high leg of the three-phase looked good and the low legs showed 115 VAC to ground.

About the time I was measuring the first leg we had a transmitter overload; the line

voltage dropped to zero on the Simpson. As the transmitter came back on, the line voltage returned to normal. I turned the transmitter off and the line voltage disappeared from that leg. Now I didn't trust my meter, so I got a light bulb in a test socket. The lamp did not light on the leg that was going off and on with the transmitter. I finally realized that the Simpson was rectifying the RF and it happened that the meter reading was close to 115 VAC.

I guess that shows you can't blindly trust your test gear. What caused the power failure? The splice at the building weather-head had become disconnected from incoming power.

TELEPHONE SYSTEM INPUT

Jim Turner - TVM Enterprises Kulpmont, PA

If your station is considering the purchase of its own phone system, you, as Chief Engineer, should become involved in the decision making progress. It may give your supervisors some technical insight without a sales pitch. You'll serve as a valued advisor to what some may consider simply a business decision.

If your studio is located at a transmitter site, then the most important consideration is RF immunity. The facts are simple -- the more electronics added to the system, the greater the chance for RF pick-up. Ask questions about the proposed systems usage at other stations and what testing has been done within a strong RF field. If you've ever tried to eliminate RFI in a phone system, you know the headaches involved. So don't borrow trouble. Get it in writing that the new system is guaranteed free from RFI. The same is true of power surges and lightning strikes. Ask to see a complete schematic of the entire system so you can judge for yourself the quality of design.

If your station does talk shows then the ease of conference calls becomes an important consideration. Many talk show guests can only be obtained if they don't leave their home or office. As such, it's very important that the host can easily connect outside callers to the guest. Many systems require a formidable procedure of button pushing to accomplish it. In others you can accomplish conference by just holding down two buttons.

In any event, check it out before the purchase, on an operating system. One of the good features about the old Com-Key system was that you could see the line ringing from any angle. A light bulb inside the line button had its light diffused by the button, thus assuring visibility. That feature is non-existent with a simple LED arrangement. While you may or may not use studio muting for the ringer, many times you can see the line blinking before you are in a position to hear it. You'll appreciate it when you are trying to call after hours. What about recorder or console attachments? Can this be easily done or is the audio circuitry so tricky that you risk unusual imbalance if you try it? Again, have any other stations ever tried it? The same goes for muting the audio and ringer. On the old mechanical style key systems, both operations were simple. With the totally electronic systems you can render the system inoperative or destroy components if you do it wrong. Check out in advance with the schematic. Get all of your requirements guaranteed in writing as well as a complete service manual for the system. Make a complete list of your current requirements to give to salespeople, rather than allowing them to sell you what they think you'll need. Heck, maybe they've never been in a radio station and don't have the foggiest idea what a beeper is or what "remote" means.

POWER-TRANSFORMER TESTING

Lee Eichelberger - Contract Engr Kuna, ID

I have used this procedure for testing transformers for several years. The transformer that's to be tested should have all primary and secondary leads disconnected and the transformer core should be connected to a good ground.

Connect one side of the secondary to the core. Put a trouble light in series with the primary to limit high fault current and to use as a current draw indicator. Connect primary leads, with the trouble light in series, to 120 VAC. If the transformer is good, there will be enough reverse EMF to reduce the brightness of the bulb. If the transformer is bad, the bulb will operate at its full brightness. If the transformer under test is a three-phase unit, it will have to be tested three times, one for each winding.

I would emphasize that one side of the secondary under test needs to be connected to the core, which in turn is grounded. I used this test to find a fault that even a transformer winding shop missed.

HOME BREW PLATE BLOCKER

Alan Roycroft - Broadcast Services Inc. Honolulu, HI

Nothing is more disheartening than to find the transmitter meters all reading "tilt", nothing going out over the air and you don't have the needed part.

A common problem is the plate blocker found on most later FM transmitters. It consists of a metal sleeve or tube swaged around the outside final PA tube mounting, with an insulating cuff made from Teflon tape about six inches wide. This prevents the DC plate voltage from passing on to the Pi network, but does pass the RF signal. I decided to "home brew" a blocker.

First, get a small electrical grinder fitted with a thin flat grinding wheel. Remove the blocker assembly from the transmitter, but do not try to pry the two metal sleeves apart. They are pressure fitted and you'll distort them. Cut a narrow groove down one side of the outer sleeve, ensuring that you do not mark the surface of the inner sleeve which contacts the tube's plate. Remove the insulation and clean up the cut--especially the inside of the cut. Finish off the cut with varying grades of emery paper.

Find some acetate drawing paper somewhere, even if it's used. I ran a 10 kW CCA for some months using paper that had a wonderful drawing of a public toilet. Obtain two hose clamps. Wrap four or five layers of paper around the inner sleeve, being careful not to wrinkle the material. Then wrap the outer sleeve into place, securing it with the clamps. During reassembly of the blocker, arrange screws or tightening nuts on the hose clamp in a position away of the grounded components so there is less chance of flash over. If the clamping bolt extends beyond the nut on the hose clamp, grind it off, and tidy up sharp edges. Do not over tighten the clamps.

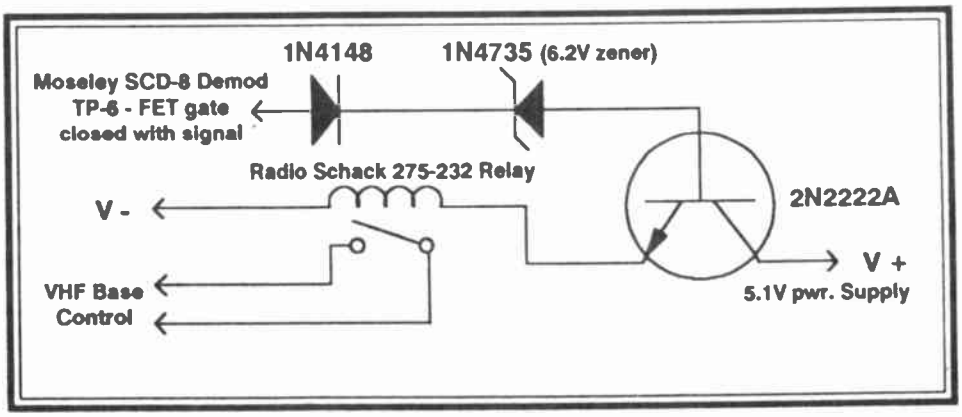
Test the repaired blocker on low power for a few hours and then up to full power, watching out for arcing. If there's arcing, make sure where it occurs. It may be some part was bent out of position and may have nothing to do with the modification. If you have more

than 6kV of plate voltage, you may need extra turns of paper, or you may even find some Teflon paper in some corner of town. At least the acetate paper will get you on the air while the Teflon paper arrives.

RPU TRANSMITTER FEED

John Maples - WMYU-FM Knoxville, TN

Should your SCA no longer be in use, you can use the Mux-2 of your STL to key and modulate a VHF RPU base station located at your main transmitter site, using your subcarrier generator/demod equipment.



Simply add the transistor switching circuit shown here to the demod unit, a mike and amplifier to your generator.

This is a good alternative to using a telephone line as line charges for this purpose can be significant.

COLLINS 820-D-2 AM TX

Ralph Hartwell - KGLA Gretna, LA

In my opinion, the Collins 820d-2 transmitter is one of the best AM transmitters around. They are quiet and relatively trouble free, requiring only clean air filters and an occasional wipe-down with a clean cloth to keep the finish like new. They provide a great sounding signal with little trouble. KGLA has been using one since '72. However, several minor problems have surfaced over the years which caused some new grey hairs to appear before discovering the causes.

INTERMITTENT MODULATION LEVELS

The symptom was an abruptly changing modulation level with no apparent reason. Initially, there was just a slow change in modulation level, which I corrected by adjusting the audio input level to the transmitter.

At first, it was not too noticeable but the problem got worse with time, until after a few weeks, there was an occasional modulation drop off to less than 10%. That was noticeable!! The problem was finally traced to the modulation control relay, K1, which is located on the audio driver A1A1 in the compartment below the modulator tubes. This relay is used to switch a resistive pad in or out of the audio line in order to change the input level to the modulator when the transmitter is switched between high and low power.

Like many daytime stations, KGLA used only high power position. Since K1 does not operate unless you change power levels, the contacts gradually become contaminated over the

years, causing poor contact and varying modulation levels. This condition was aggravated by the intrusion of fine dust forced into the relay by the cooling blower for the modulator and PA tubes. The relay appears sealed, but actually has a slip on cover. Vibration from the cabinet cooling fan and the main power contractor caused the contaminate film between the contacts to break down occasionally, causing abrupt changes in modulation levels. A careful cleaning of the relay contacts restored the modulation level to normal.

If you need to clean the relay, be careful; the relay contacts are quite small and fragile and break easily. Do not file the contacts, since they are gold plated and designed for low level signals. Removing the gold coating will result in rapid deterioration of the contacts and even worse problems later on.

LOW POWER MODULATION ADJUSTMENT

The transmitter modulation level is adjusted by the first setting the proper modulation level in the high power mode, then changing resistors in the resistive pad to reduce the audio drive when the low power mode is selected. This is a rather inconvenient method. The instruction manual gives resistor values for the pad for use at various transmitter power levels. These values assume that the exact power levels are used and that the impedance of the audio source is exactly 600 ohms.

After changing resistors a few times, I decided that adjusting the modulation on lower power would be much easier if I were to install a pot in place of the resistors. Here's how to do it:

1. Turn off the main power circuit breakers to the transmitter.
2. Remove the front panel which covers the RF PA and modulator tubes.
3. Make sure that the high voltage interlock has killed the high voltage.
4. Remove the three audio pad resistors and install a 1000 ohm pot connected between the audio input post E-5 and the ground post E-10. I used the single turn, trimpot style unit with wire leads and a side adjust with a large screwdriver slot.
5. Connect the pot wiper to the modulator input E-9.
6. Restore the transmitter to normal operation and adjust the modulation while in high power operation.
7. Shut down the transmitter and turn off main AC breakers. Remove the cover over the PA and modulator tubes.

CAUTION: THE FOLLOWING ADJUSTMENTS ARE MADE WITH HIGH VOLTAGE ON AND EXPOSED

8. With the main power circuit breakers shut off, block up the high voltage interlock in the modulator tube compartment. This allows the high voltage to be turned on with the front safety cover removed.

WARNING: WHEN THE TRANSMITTER IS TURNED ON, THERE WILL BE NO COOLING AIR SUPPLIED TO THE TUBES BECAUSE THE COVER IS REMOVED. MAKE THE MODULATION ADJUSTMENT RAPIDLY AND THEN SHUT OFF THE TRANSMITTER, INCLUDING THE FILAMENTS, TO AVOID DAMAGE TO THE TUBES. DO NOT OPERATE THE TRANSMITTER WITH THE COVER REMOVED FOR MORE THAN 30 SECONDS AFTER FILAMENT TURN-ON TO AVOID DAMAGE TO TUBES.

9. Turn on the main AC breakers. Press FIL ON. The filaments and fan should come on. NOTE THAT THERE IS NO COOLING AIR TO THE TUBES. WORK QUICKLY BUT CAREFULLY!!

10. Adjust the low power modulation pot you just installed for the proper modulation level.

11. Shut down the transmitter, turn off AC breakers.

12. After the plate voltage meter has fallen to zero, carefully remove whatever you used to block the inter-lock switch.

13. Replace the front panel cover and make a final test of transmitter.

While it might seem easier to drill a small hole to allow a screwdriver to poke in and adjust the pot, being careful to not short anything out in the audio driver assembly, I like to see what my screwdriver is doing. So, I did it as outlined above, even though it requires that you operate the transmitter with the front panel open. Having the pot hidden from view also prevents unauthorized "adjusters" from twiddling with things. You can place the pot wherever it is convenient. Remember that it is carrying audio, so route the leads carefully and twist them about three turns per inch to prevent noise and hum pick up.

INTERMITTENT CHANGE IN RF DRIVE

The final grid drive was reading about half of the usual value. Re-tuning the driver would sometimes increase the drive but the next day or the next week, it would be low again. After a couple of weeks with this routine, I tore the driver stage apart and discovered that the driver transistor Q3 had silicone heat-sink compound on the base and emitter pins. Since this stuff is a pretty effective insulator, it caused poor contact between the pins of the driver transistor and the socket, which resulted in low RF drive to the final PA tubes.

Careful cleaning of the socket and transistor pins restored the grid drive to normal. I also had intermittent loss of RF drive due to a defective switch, S1, on the oscillator assembly A1A2. Cleaning the switch restored proper operation.

TRANSMITTER REFUSES TO STAY ON AIR

There were several occasions when the transmitter would not stay on air. It would operate normally for several hours, then mysteriously drop off the air. All meter readings were normal. It turned out that a defective air vane switch would occasionally trip the interlock and shut the transmitter off. Installing a new switch fixed the problem.

In order to find the problem, I had to run the transmitter with the rear cover off so I could watch the air vane. One day the transmitter would not stay on the air on the high power mode. When the HP ON button was pressed, the transmitter plate relay would go "KLUNK-KLUNK", on and off. I located an intermittently defective remote control relay on the relay assembly board on the A3 panel. Before I discovered this, I was sure the HP ON switch was defective.

FILAMENT VOLTAGE REGULATION

This is not really a problem, but rather something you do in order to improve the life of those tubes. If you do not have a filament voltage regulation transformer installed in the transmitter, you should consider installing one.

According to the tube manufacturer, even a small increase in the filament voltage, above the rated value, causes a drastic reduction in tube life. This is detrimental to your wallet. When the tubes become weak, a small drop in the filament voltage will cause the output to decrease rapidly. This is detrimental to your signal. A voltage regulator will increase tube life and improve your signal at the same time.

A 250 watt Sola constant voltage transformer is just the thing. It will fit on the floor of the transmitter beside the power transformer. In fact, that's what it was designed for! These are sometimes available at various surplus outlets at reasonable prices. There are two types of constant voltage transformers available: the type CVN (usually cheaper) and the CVS. Either will work, but the CVS is the better choice since it has a lower harmonic content in the output waveform.

If you buy a surplus transformer, be sure to get one with no PCBs in the capacitors

used in the transformer. If you've installed a type CVN transformer, you should use a true rms voltmeter to make the final filament adjustment. If you have a type CVS, you can use any AC voltmeter. Measure the filament voltage at the sockets of the modulator and final tubes. DO NOT measure the voltage at the terminals of the filament voltage transformers, as there is a voltage drop through the wires and RF filters in the bottom of the exciter cabinet due to the high current required for the tubes.

Adjust A1R8 for the modulators and A1R7 for the finals. Be very careful when making the adjustments, the filament voltage rheostats are in series with the primary of the transformers, and the rheostats are mounted close to the screen voltage power supply. SAFETY FIRST! DEATH IS PERMANENT! The rheostats have no knobs on them, which makes them difficult to adjust. A trip to Radio Shack will get you a couple of plastic knobs about an inch or so in diameter. Install them and do it the SAFE way.

With the filament breaker on and the plate breaker off, press the FIL ON button and then adjust the voltage measured at the tube sockets to a value of 9.5 VAC plus or minus 0.1 volts. NOTE: When measuring the filament voltage on the finals, be careful that the RF from the driver stage does not cause errors in the meter readings. This is likely to happen if the meter you are using has a rectifier in it. If that does happen, detune the driver tuning capacitor, or carefully pull the crystal out of the oscillator. If you do not have a second crystal installed, you may switch to the unused crystal position.

After making filament voltage adjustment, measure the voltages at the pins of BOTH of the PA and modulator tubes again. The PA tubes should have filament voltages within plus or minus 0.15 volts of each other. The modulator tubes, likewise, should have filament voltages that are close to each other. A larger voltage difference may indicate a defective cathode in the tube with the higher filament voltage, but more than likely the trouble is a poor connection in one of the RF filters in the filament leads. These are screw connections and easy to check.

TUBE LIFE

Tube manufacturers say that the ultimate life of a properly operated tube, such as the 5-500A used in the 820D-2 transmitter is basically limited by the number of hours of available filament life. It does not matter whether the plate supply is on or not. There is no reason to turn the filaments on for an extended period of time before sign on, just to warm up the transmitter; nor is there a reason to leave them on after sign off. The cooling of the 820D-2 is good enough so that about a minute after pressing the PLATE OFF button, the filaments may be shut down also.

ARE THE TUBES STILL GOOD?

It's easy to change the tubes when they quit entirely, but how do you tell if one is a bit weak? The modulator seems to be harder on the tubes than the PA stage is; I have had to replace more tubes in the modulator than the PA stage. It was while trying to figure out if a modulator tube was bad that I discovered how to check them.

The tube to be tested must be placed in one of the modulator positions. There must be a tube in the other modulator socket to prevent the filament voltage from increasing due to the reduced load from a missing tube.

Be careful not to break the cooling chimneys for the tubes. The transmitter can't run without them. If you don't have a spare chimney, order one. They usually get broken when cleaning the transmitter or changing the tube.

1. Turn the modulator bias controls fully CCW. This should reduce the modulator cathode current to a very low level.

NOTE: WHILE THE TEST CAN BE MADE AT EITHER THE 250, 500, OR 1000 WATT LEVEL, THE 500 WATT POSITION IS THE BEST. TESTS MADE AT THE

1000 WATT LEVEL WILL DAMAGE THE TUBES UNLESS COMPLETED RAPIDLY.

2. With the tube to be tested in position, and the transmitter on, observe the modulator cathode current.

3. Rapidly turn the modulator bias pot for the tube to be tested, fully CW. This reduces the bias to a minimum and the tube will draw a lot of current and will overheat rapidly. QUICKLY read the modulator current meter and turn the bias control fully CCW.

4. The tube should show at least 0.5 amperes of current when the bias control is fully CW. If it doesn't show that much current, it will not be capable of full output. The tubes will begin to show increased distortion and the modulation will begin to lose clarity.

THERE'S GOT TO BE A BETTER WAY TO ADJUST THE MODULATOR

Well, there is. You can set the modulator bias adjustments in about 30 seconds. Start by turning both modulator bias pots fully CCW for minimum modulator current. Then adjust modulator bias #1 for a reading of 0.175 Amps (3.5 scale divisions).

Now, adjust modulator bias #2 for a reading of 0.300 Amps (6 scale divisions). If both tubes show the same red-orange color on the plates, you're done. If they don't, one is probably weaker than the other. NOTE: It is normal for the tubes to show uneven heating on the plates, as they age, since the emission of the cathode does not decrease evenly in the modulator stage. This transmitter will work better with weaker tubes in RF final than it will in the modulator.

In an attempt to extend the life of the modulator tubes, some engineers set the bias at a lower level than specified. Tests with a distortion analyzer will quickly show that this results in increased distortion. It also results in increased listener fatigue. Use the values shown in the instruction manual and keep your listeners happy.

The modulator drive adjustment may be set up rapidly with the use of a function generator and an oscilloscope. Feed a 1 kHz triangle waveform into the transmitter at a level for 90% modulation. The oscilloscope should be connected to monitor the RF envelope of the transmitter.

Adjust the modulator drive controls for the straightest sides on the modulation envelope. One control will adjust the slope of the negative modulation and the other control will adjust the slope of the positive modulation. If there is visible distortion in the waveform after attempting adjustment, there's probably a defective modulator tube in the transmitter. Before changing tubes, try adjusting the bias controls slightly to see if it will improve. The waveform should remain uniform for any level of modulation from 0% to 125%, if the tubes are okay.

CLEANLINESS

The transmitter is cooled by a cabinet fan which pulls outside air through a filter in the rear of the cabinet. The filter is out of sight, and therefore often forgotten until it is so dirty that it becomes completely clogged. This can be fatal to the modulator and PA tubes, since the blower for the tubes draws its air for inside the cabinet.

When the filter is clogged, the blower sucks dust and dirt from under the transmitter and deposits it all over the inside. Some of it will get stuck on the squirrel cage in the blower and reduce the airflow to the tubes over a long period of time. Dust and dirt will accumulate in the exciter and modulator driver cabinets. If the filter is clogged, then hot air exhausted from the top of the transmitter will be drawn back down through the output tuning network and re-circulated through the tube cooling blower. This overheats the tubes and reduces their life. Filters should be changed regularly. If you can see dust on the back (outlet) side of the filter, that means that the dust has penetrated all the way through the filter. The filter is "used up", and will allow dust to pass through it, and into the transmitter. Replace it with

good quality filter and keep a spare box available. If you have them on hand, it's easier to remember to replace them.

If you can talk GM into it, buy one of the Newtron brand electrostatic air filters and install it on the transmitter. While you're at it, install one on the studio air conditioner too. It will remove all the cigarette smoke in the air. The Newtron brand filters are the same size as the regular throw away filters, and are a simple drop in replacement. They use no electricity to power them, but use the friction of the passing air to generate static electricity to energize the filter and trap dust. They are expensive, but washable and should last many years if treated correctly. If you cannot locate one of the Newtron filters locally, call the factory at 800-543-9149. You can write them at Newtron Products Inc., 3874 Virginia Ave., Cincinnati, Ohio, 45227.

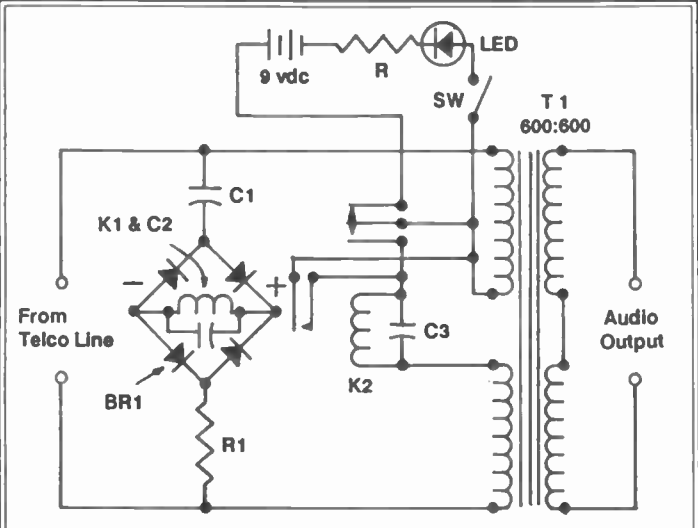
About once a year, you should open up the transmitter and clean it thoroughly. MAKE SURE YOU KILL THE AC POWER AT THE FUSEBOX BEFORE GOING INTO THE TRANSMITTER CABINET. Remove any deceased vermin and insect bodies. Vacuum out dust and lint that collects in corners. Clean cabinet fan blades and check the squirrel cage of the tube cooling blower for dirt. Use a damp rag and wipe off the film of dust adhering to components inside the transmitter.

The inside of the output network enclosure does not get too dirty unless stuff has fallen into it from the top of the transmitter. Check inside and if everything looks okay, leave it alone. If you clean inside be sure not to disturb any connection on the coils.

Replace all rear panel screws when replacing the panel, to ensure correct shielding between sections of the output network for harmonic suppression. If necessary, remove the front control panel to remove the plate current meter and clean the face of the meter. Do this about once a year.

ROBOT REMOTE

Robert Miller - KGWA Enid, OK



C1 - 3.3 uF/50V (non-polarized)
C2 - 1500 uF/25V
C3 - .47 uF/100V
R1 - 1200 ohm, 1/2 W
BR1 - Bridge Rectifier (ECG 5310 or equal)
K1 & K2 - 9 volt, 500 ohm coil (Radio Shack 275-004 or equal)
T1 - 600:600 ohm, split windings transformer (Stancor A4350 or equal)

Need to save the set up, "baby-sit" and tear down times for your scheduled repeat remotes? We had four churches that rotated Sunday's service on a continuing schedule. Economics dictated a change.

We proposed that each church order a dial-up telephone line installed and we would build and install the interface to transfer the audio from their public address system to the telephone line. Church personnel could call their telephone number at any time, other than broadcast Sunday, and check progress of worship service, weddings, funerals, etc. We could save the time and equipment wear and tear of repeated set-ups and

tear-downs. They agreed. We already had a telephone coupler system wired into the board, so ... we just built an interface that would hook up automatically when called.

A 3 X 5 inch PC board was etched to mount all of the components except the transformer. If a Stancor A4350 cannot be found, any 600:600 split winding transformer will do. The components will mount nicely in the Radio Shack utility box. Have the telephone company install their modular jack near the PA system so that the "Robot" can be easily connected between the PA output and the telephone line.

How does it work? The ringing voltage (around 90-100 VAC) appears across C1 BR1 and R1, BR1 rectifies the voltage to DC, which appears across K1 and C2, K1 operates and is held by C2. K1 connects the upper coil to T1 to K2 and C3. The DC telephone line voltage causes K2 to operate. K2 contacts then maintain the DC flowing through K2. The ringing voltage stops because K2 "answered" the call. C2 discharges through K1, and K1 releases. C3 performs the function of audio bypass to insure that K2 remains closed by the telephone DC voltage. C3 also provides low impedance audio path across the secondary coil split of the transformer.

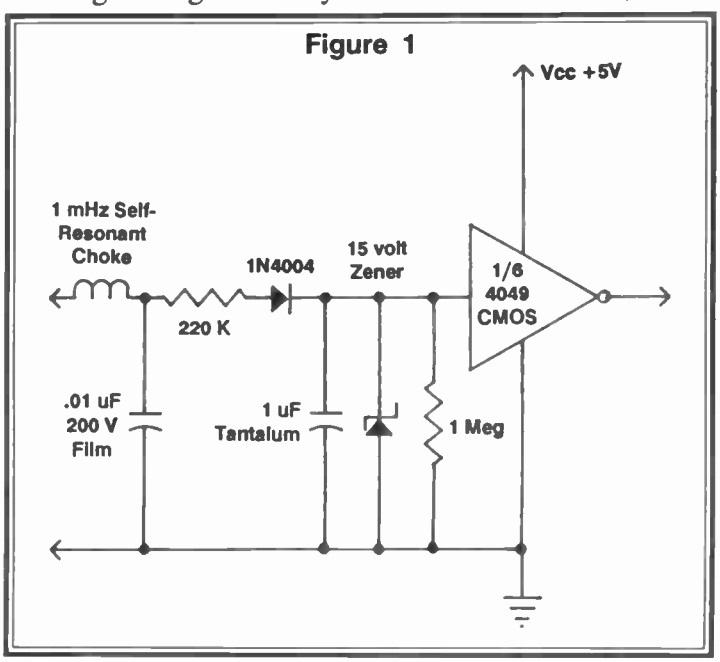
Yep, you got it! You can stick one of these things in your sports package and when the telephone line "glitches", the control studio operator waits 25 seconds and calls the sports crew back. If you want an indicator for your remote crew, hook a 9 volt battery, a current limiting resistor and an LED in series from the normally closed contact of K2 to the armature contact of K2. When K2 operates, the LED goes out and the crew knows that they should be ready.

INTERFACING TRANSMITTER REMOTE STATUS INDICATORS

Micheal D. Brown - Radio Broadcast Consultant Portland, OR

The phone rings ... It's 3:20 a.m. ... The nervous voice on the other end is the new weekender the PD forgot to tell you about, and he's got a problem. "I can't hear myself on the air," he says. "Is the transmitter on?", you mumble, trying gamely not to awaken the bed mate groaning next to you. "How can I tell?", he asks. As you pause to take a deep breath, you realize that you've been here before, more times than you care to admit.

Figure 1



When it comes to transmitter remote control, the KISS (Keep It Simple Stupid) applies in spades. Whatever the system consists of, it must be understandable in ten seconds or less by the entire collection of gorillas, gagglers, and short attention span specialists that your station likely includes. I've found that nothing meets this criteria better than "pretty red lights" status indicators.

Interfacing these at the transmitter site is where the trick begins. The status inputs on most remote control

systems require a dry contact closure to ground, floating at no more than +5 volts when in the "relaxed" mode. The dilemma, of course, is that most transmitters fail to provide external dry contacts for any function, except perhaps, overload conditions. The typical solution is to either ignore the need for status indications, or to install a conglomeration of relays.

FIGURE-1 shows a simple universal circuit providing a "logic-low" output for any voltage input of 4 to 120 volts, AC or DC, that can be referenced to ground. Because the input impedance exceeds 1 meghom for input voltages below about 10 volts, this interface can usually be tied across metering samples without loading problems. Virtually any status indication imaginable can be easily interfaced. NOTE: The 4049 and 4050 family of CMOS buffers and inverters accept inputs of up to 20 volts, with any allowable VCC.

Hookup for most of the indications desired is usually a simple matter. The popular Continental 315R-1 5kW AM transmitter, for example, provides switched +28 V sources on a barrier strip (A7TB1), which were intended for external indicator lamps for filament-on, high and low power plate-on, etc.

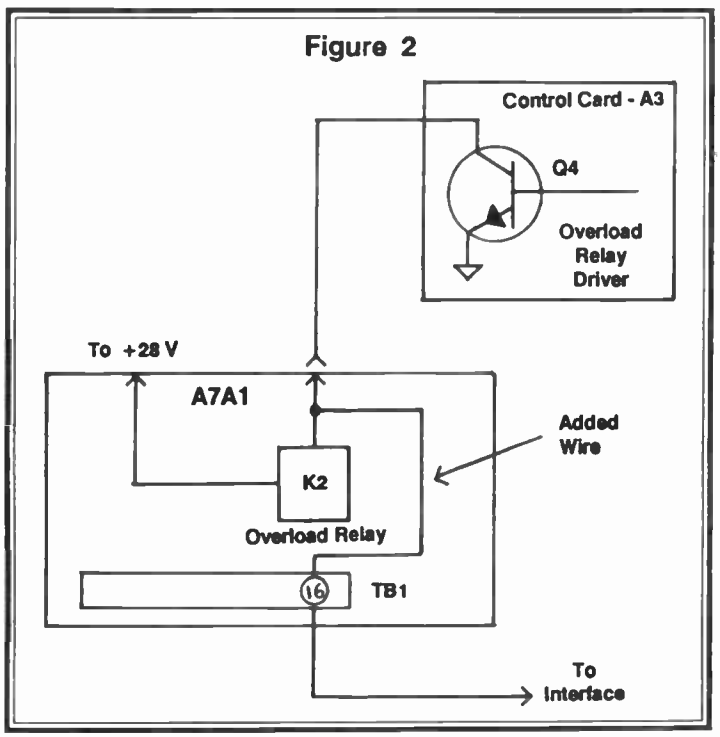


FIGURE-2 illustrates a simple modification to achieve a remote overload indication on the 315R-1. Overload relay driver Q4 is turned on during an overload condition, and floats at +28v during normal conditions. A wire added from the switched side of the K-2's coil to the unused TB1-16 barrier strip point, provides very clean access for this indication.

The sample will be inverted; i.e. the input to the status interface will be high during "normal" non-overload conditions.

The "inverted" programming mode on the Mosely and other remote control units will solve this. Otherwise, another 4049 CMOS section can be added to "re-invert" the indication. With a little thought and minor modifications, most other transmitters can be similarly interfaced.

CART DECK SOLENOID TIP

Ray Thompson - KDKB Mesa, AZ

Many of the older cart decks have high voltage solenoids. Ray found that, when in operation, some of these decks have a higher than normal hum level in the audio output. If there is a large enough ripple component on the DC solenoid supply, the solenoid will induce

hum into the head -- right through the air. Sort of like holding a degausser near a tape head, it seems. A quick check is to disconnect the wires to the solenoid and place the deck into "play". Then manually bring up the solenoid to drive the tape. If the hum is not there, then the solenoid supply bears checking. A ripple above 1.5 VAC or less is okay; if it gets much above 2 VAC, it's audible.

CART DECK TIMER INTERFACE

Kevin Larke - WKYO/WIDL-FM Caro, MI

Here is a timer re-set circuit that works without a remote start button. I've used it on three triple decks (ITC- 3D), so far. It gives a brief contact closure every time a deck is started. The brief closure ensures the exact elapsed time reading every time. I've noticed that many stations use remote push-buttons with multiple contacts, or an SPST button controlling a multiple contact relay for remote starting and timer re-setting. This works okay but requires more parts and, if the jock holds the remote start button in for a second, the timer stays at zero too long a time.

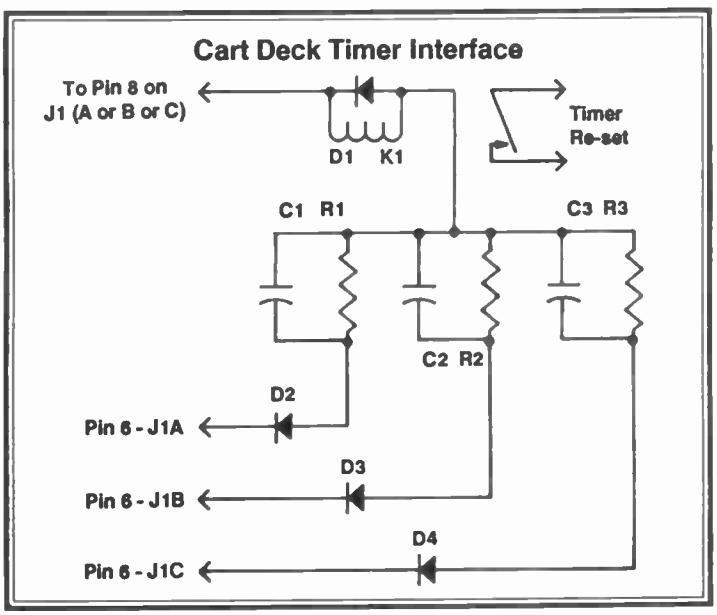


Figure 1 is a drawing of the circuit. K1 is a 12 volt reed type relay available at Radio Shack. Diodes D1-D4 are 1N4002 types (actually 1N4001 to 1N4007 will work). Capacitors C1-C3 are 4.7 uF/35 Volt. Finally, the three resistors R1-R3 are 100K.

It's very simple. When a deck is started, its pin-6 drops to ground, charging the capacitor through the relay coil. The current, at the first instant, is high enough to close the contacts of the relay for a quick blip. When the deck stops, the capacitor discharges through the 100K resistor. The supply is 24 Volts and the relay is rated for 12, but only receives 24 Volts for an instant so the relay won't be damaged.

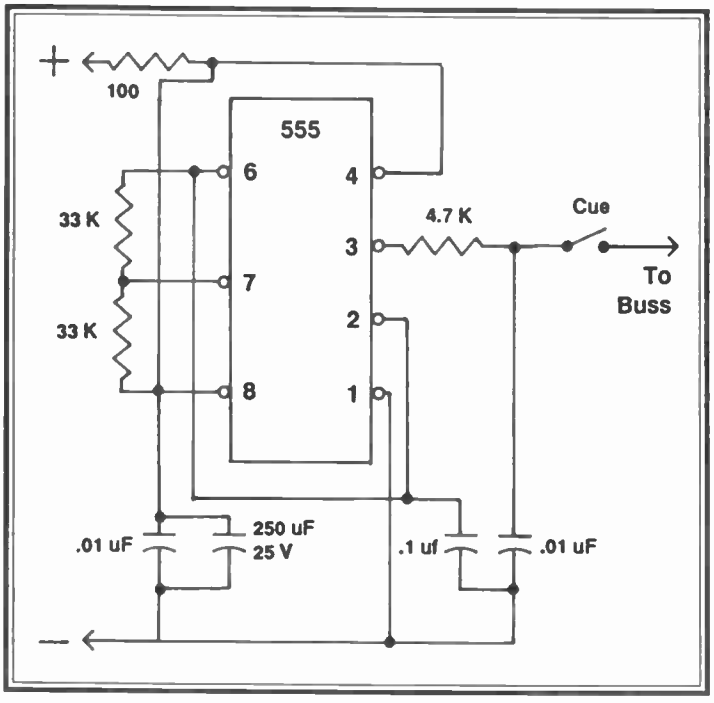
SLATE CUE OSCILLATOR

R.F. BALONIS - WILK
Wilkes-Barre, PA

In today's radio engineering world, sometimes its the little things you do that count the most. It's the things that money can't buy that will let everyone know you were there. This project is like that. Because, for anyone who does audio production, a Slating Cue oscillator built into the production console is worth far more than the cost of its parts.

Slating is a term and practise taken, I think, from the film industry. Before each "take", a slate board with the take number on it is held in front of the camera. In the recording industry , the slating is spoken "take 1" or "take 2" before each cut.

This works well at normal playback speeds, or with a few cuts on a tape. However, at fast forward or re-wind, finding the talk only slate mark can be difficult. A Slate-Cue oscillator lets the announcer add a harmonic rich tone to each aural slate mark. Aural slating with a short tone mark added to it, is heard in a series of high pitched tones marking the beginning of each cut, as the tape is run at fast forward or reverse. Finding a cut is simply a matter of counting the beeps.



Most any low frequency oscillator can work to generate a slate-cue tone. I think a harmonically rich, distorted one, works better; and a built-in one for slate cue at the press of a button, best of all.

At the heart of this project is one of the standard IC building blocks, the ubiquitous 555. It is a common IC now and is most radio station spare parts boxes.

The IC 555 was designed for timer applications and with a minimum parts it can function in either a stable (oscillating) or monostable (one-shot) modes. None of the parts have critical values, just about anything in the ballpark should work. The 33K resistors and the 0.1 mFd capacitor determine the frequency. The 4.7K resistor and the 0.01 mFd capacitor on terminal-3 filter the square wave a little before its output runs through the Slate-Cue pushbutton to tie into the console's mixing buss. 10-15 Volts power is borrowed from some place.

MODULATION PEAK PROBLEM

Carl Fletcher - WAKE/WLJE Valpariso, IN

Recently, I came upon a modulation problem with my AM transmitter; the positive peaks were 5dB greater than the negative peaks. Since all audio stages were push-pull, I

immediately thought something was wrong with the positive half of one of the audio amps, or possibly, the modulation transformer. Actually, everything associated with the audio portion of the transmitter was suspect.

After five hours of changing tubes and coupling capacitors, taking measurements and staring at schematics, I noticed that one the RF final tubes intermittently glowed slightly dimmer than the others. "What now?", I thought, making no connection between this and my modulation problem.

After inspection, a loose filament connection on the tube socket was found and quickly fixed. When the transmitter was put back on the air, the modulation problem had disappeared. The bad filament connection on the RF final caused the problem. This experience taught me two things. First, rock solid pre-conceived notions can lead you a long way down a wrong path. And second, never under-estimate the value of a thorough visual inspection.

FUSE TIP

Jay Mitchell - WENN Birmingham, AL

Our Harris Executive console would not work long without blowing the monitor amp fuse. We replaced the fuse with a light-bulb, at the current voltage rating of the circuit. When the short occurred, the bulb would light and not burn up parts or the PC board. This worked so well you could short out any diode in the bridge rectifiers and the bulb would light (the amplifier would still work, with hum). This allows you time to work on the unit without fanning smoke out of your face. This idea should work with other equipment.

NO AUDIO

Earl Fletcher - KTAN/KATZ Sierra Vista, AZ

The transmitter equipment of KATZ(FM) consists of a Harris FM-2.5H3 FM transmitter and a Wilkinson series 8090 Model X FM Broadcast Exciter. We recently had trouble with intermittent audio.

While the audio cut off, the carrier remained on the air. When the transmitter final was cut off, the audio would reappear at the exciter output. Coordination with the Wilkinson (TTC) customer engineer, suggested replacement of the coaxial cable between the audio mixer module and the modulation oscillator module. The cable was replaced and the audio problem solved. It is assumed that the vibration of the PA blower motor was causing intermittent failure of the exciter cable.

TRANSMITTER WITH A HEART

Walter Bollinger - KJCR Keene, TX

At KJCR we operate a Continental 1 kW FM transmitter in stereo. The studio is a couple of blocks from the transmitter sites and a Marti STL gets the signal to the transmitter. One of the on air operators called me and said there was a funny sound going out over the air. By the time I could get to the station, it was no longer present. Some time later, I was called again. This time I could hear it during the gaps in program audio. They called it a "heart-beat", and it did sound like listening to the heart with a stethoscope. It was a low frequency, repetitive sound and my first thought was that it was motor induced.

I checked the various motor driven equipment in the studio, but no change. I decided the problem would have to be run down when the station was off the air. The next morning at 2:00 a.m., I got up and went to the studio. The sound was there even when the station was off the air. We do keep filaments on all the time, and this keeps the exciter on also (great for frequency stability). The STL operates continuously, so I turned it off and the "heart-beat" was still there. I had noticed that the blower motor on the transmitter had gotten noisier lately, so I began to think it might be related.

I went to the transmitter site and lubricated the motor, no change. I turned the exciter off and the noise stopped. With the exciter back on, I started wiggling the cards in the exciter and shortly, the noise was gone. I turned the exciter off and gave all the contacts on the cards a cleaning. Several weeks later, the "heart-beat" has still not returned. Some of the contacts were dirty and the vibration from the blower was enough to modulate the signal and produce the noise.

WHO IS IN CONTROL?

David Ludwig - KIWR Counsel Bluffs, IA

About 11 p.m. I received a call from the studio that the transmitter wasn't acting right. The transmitter would lower, then raise power, as well as shut down and return to the air on its own.

While I had the operator on the phone, he selected the power position on the remote control and pushed the lower button. The transmitter went "off-air" instead of lowering the power and a few seconds later returned to the air. As he was talking, he gave me a running account of the transmitter's actions, and as he stated, he seemed to have no control of the situation.

I asked him to remove the STL from the air and this allowed the fail-safe at the transmitter to remove high voltage and keep the transmitter down. A check of the remote control output at the studio showed that it was very stable.

With this information, I concluded that the problem was not at the studio. On the way to the transmitter site I tried to piece together the layout of the receiver remote control from the reception of the sub-carrier off the double STL hop, through the filters and finally into the demodulator.

Once at the transmitter site, I took control of the transmitter and had the operator return the STLs to the air. On visual inspection, the indicator lights on the remote did indeed

move in a random fashion from one location to another and on occasion would raise and lower the interface relays. A quick check of the remote control demodulators indicated a reaction to commands being sent to the unit and not the result of a bad component.

The next logical step was to check the STL receiver subcarrier output. The problem became apparent at once. The multiplex channel was extremely noisy and the noise was being interpeted by the remote unit as a command to be carried out. A check of the multiplex metering did show a slight rapid variation from side to side.

The only reasonable place to start seemed to be a the middle hop of the double STL, and hope to cut the problem into one of two possible places to begin. Once at the middle hop, I inspected the STL multiplex channel metering and incoming and outgoing signals were solid. A check of the forward to reflected power showed a slightly higher than normal VSWR but nothing to get excited about now. I decided to increase the 110 kHz injection level to the STL subcarrier from the normal 4% to 15% and returned the transmitter to the air.

We now had solid control and I sat down to figure it out. All I could come up with was the fact that 24 hours earlier we had a very hard rain storm of several inches. I also noticed that the "off-air" signal seemed to be noisy. A check of the signal to noise ratio at the transmitter output verified this.

Now I had a game plan. I called the tower crew and had them inspect the antenna and transmission line of the 320 foot tower at the middle STL hop. The STL did show a good 5 Watts output at the transmitter, but was showing only 100 milliwatts into the antenna. This was clearly not enough power output for the 20 mile hop.

An inspection of the 7/8 inch connector at the antenna end, proved that the rain had deposited a full cup of water into the connector, even though it was sealed. Once the water was removed, a new connector put on and the coax dried out, we returned to normal operation.

I guess the most I learned from this is when the signal gets weak from your STL, the first place it will show up, is in the multiplex channel.

ITC OMEGA SOLENOID FIX

Kevin Rupert - WORT Madison, WI

We recently have had an interesting problem with a 3M (ITC) Omega cart machine. The station which owns the machines is a small non-commercial outfit. We have two Omegas and a couple of old PD-2s. Carts are only run about once an hour for station promos and "underwriting announcements".

A maintenance request came to me that said one of the machines would not start. Checking on this, I found that the green start light would come on, but the solenoid would not pull in on the first try. After pressing "stop", the solenoid would pull in on the second try. Came back to the machine after it had been idle for 20 minutes, and it would again repeat the failure cycle.

The factory suggested that I change the solenoid drive transistor located on the bottom of the deck. These sometimes get leaky. After changing the transistor, the problem continued.

Putting both Omegas on the bench, I compared solenoid drive voltage and the solenoid DC resistance. Both machines were essentially the same. I then swapped the solenoids from one machine to the other. The problem moved with the original solenoid. Even though the solenoid seemed okay, based on resistance and mechanics, I was about to order another one.

At this point, I noticed the solenoid plunger rests against a small rubber bumper when it is in the rest position. I pressed the plunger into the bumper and found it had a tendency to stick. Pressing the start buttons at this point caused a now familiar failure of the solenoid. A close examination of the rubber bumper showed that the adhesive which holds the rubber bumper to the deck had deteriorated. I cleaned the bumper with alcohol and with a rubber conditioner commonly used on consumer tape decks. Since then, the Omega has been working perfectly. We have always been diligent about cleaning tape paths and pinch rollers. Now we'll add solenoid bumpers to our PM list.

MCI TAPE DECK TIPS

Johnny Bridges - WYAY Atlanta, GA

On the newer MCI tape decks, there is a circuit board beneath the tape dancer arm, which attempts to reduce wow and flutter by supplying a signal to the analog torque board, based on dancer arm movement.

The actuator is a magnet, glued to the arm beneath the dancer arm. This magnet was originally fastened with rather poor glue, which sometimes comes loose and allows the magnet to move about erratically when the arm moves. Also, since the arm has some amount of mass, a ham-handed operator can reposition it by slamming the dancer arm against its stops.

Either situation will result in erratic tape tension; in the worst case the machine is unusable due to jerking. The cure is simple: epoxy the magnet to the arm, then position it such that, at its center of travel, it is centered over the inductor on the pickup board.

Another insidious problem concerns the aluminum brake drums on the spooling motors. Since they are only used at power down or a tape break, they tend to be overlooked. They have enough mass, however, to screw up the tension if they become loose enough to rattle on the motor shaft. Again, the result will be jerky tension, but of a very low order. Usually the wow and flutter is slightly out of spec, and often the spooling motor tach generator is blamed. First, try tightening the set screws on the brake drums and see if the wow and flutter doesn't come into spec. Due to the differential expansion of the drums and the motor shafts, these loosen regularly. Tightening semi-annually isn't a bad idea.

WHICH WAY IS UP

Tim McCartney - KBSU Boise, ID

We recently installed a three inch rigid section of transmission line to mate the FM transmitter output to an RF coaxial switcher. Before cutting the 25 foot section, I noticed a warning on one end: "Locate This Side Toward Antenna". This advisory challenged my

engineering theory, since RF will not likely follow these kinds of directions. Looking for an electronic theory, I called around to knowledgeable RF engineers; there was no electronic theory to be found.

However, a plausible explanation appeared: such orientation is a technique which improves the physical strength of multiple sections stacked together. The warning is for mechanical reasons only.

One side of the rigid line section has a catch on it to keep the bullet from falling out. Undoubtedly, this design is for vertical installation, up to a tower to the antenna. In our case, its use was horizontal, so the design consideration was not applicable. The section was soon cut into small pieces with a four inch pipe cutter and hacksaw.

By the way, we never called Cablewave (the manufacturer)--this method has been a lot more fun. And, just to play by the clearly marked rules, the section in question was oriented in the proper direction.

ICE GUARDS

Our transmitter site, at 7000 feet on a mountain top, needs lots of protection. Most stations at this congested RF site near Boise, use ice guards to protect horizontal transmission line runs from falling ice. Usually these are the sections from towers to transmitter buildings. Horizontal metal railings are mounted about six feet above the ground, with vertical ground posts anchored in the earth. The heliax, routed under the horizontal members, is thus protected from falling ice. Since the mountains certainly have no monopoly on ice problems. It seems ice guards would be appropriate for installation in most states.

LATTICE BRIDGE

Chuck Gennaro - WFHR Grand Rapids, MI

Figure A

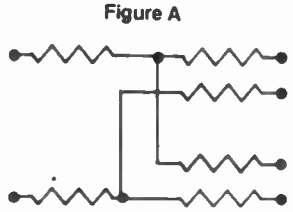
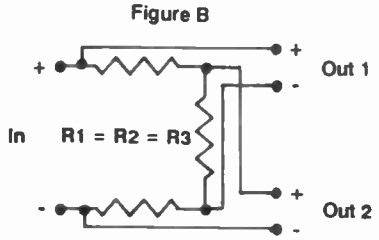


Figure B



Who hasn't, at one time or another, just paralleled feeds from say--a network source or off-air monitor, to several different points around the station, without any isolation between them? A distribution amp would be an elegant solution, but also a pricey one.

Something simpler may be more practical. Enter the resistive splitter pad. A typical splitter pad is shown in Figure A. It's simple and common, but only will provide about 6 dB of isolation between outputs. When someone accidently patches audio into one of the outputs, the other output will get it also--only about 6 dB down. A better solution is shown in Figure B.

Called the "lattice Splitter", it has its origins with the phone company. It has the same 6 dB insertion loss as the simple resistive splitter, but provides much better isolation of about 40 dB between the outputs. If one of

the outputs is shorted, the other output is not terribly affected. A signal mistakenly applied at one of the outputs will still appear at the other output, but will be 40 dB down. Not bad for three, 1 Watt resistors.

The circuit impedance dictates the value of the resistors. With broadcast equipment, that will usually be 600 ohms. Note that a proper impedance match at the splitters terminals is necessary for best isolation.

McMARTIN BA-1K TRANSMITTER

Jim Cassatt Jr. - WADV-FM

According to the NAB Engineering Handbook, 7th Edition, there are nearly 250 stations that operate with a BA-1K. One day when the transmitter was operating at 1000 Watts. the right modulator tube blew. After replacing the tube and back on the air, everything seemed to be ok except for the plate current meter indication. When the transmitter is operating at 1000 Watts, the plate current normally reads about 500 mA. After this incident, the plate current meter read 100 mA. The plate voltage and antenna current meter were reading normal. I even went to the base of the tower to make sure the remote antenna current meter was reading normal.

The next things I checked were the multi-meter readings on the BA-1K. All readings were normal except the Left Modulator Current. The meter was pinning when the reading was taken. After this reading, I realized there was no way the tube could handle that much current. The tube was glowing normally. It was the same as the right modulator tube. After studying the schematics and calling Charlie Goodrich at McMartin Industries, Charlie believed the problem was with the filament transformer. He stated that the filament transformer in the BA-1K has been a common problem.

After re-ordering a new filament transformer from McMartin, we found that the new transformer is shaped differently than the original. It requires drilling new holes in the transmitter and the wiring color code is different in the old one. After the three of us spent the night installing the transformer, the plate current reading and the 1 MOD readings were normal.

If this happens to you, don't wait! About a day after this happens, the transformer's windings kept shorting to the point where the transmitter could not operate on high power.

TOWER BEACON TIP

John Lane - WWVA Wheeling, W VA

What is the problem when the tower beacon works perfectly in the day mode of a three tower DA, but does not work at all in the night DA mode? Yet, the sidelights always work. The AC line to the beacon is shorted to the tower, causing the RF to shut down the beacon flasher.

The problem was traced to a junction box containing a splice that had worked through the electrical tape and shorted to the box. Because of the lighting transformer on the tower, either leg of the 120 VAC could short to the tower without blowing a fuse (although the white neutral wire was shorted in my case).

TAPE TIPS

Morgan Reynolds - WFFX-FM Tuscaloosa, AL

A couple of MX 5050BIIs have appeared with some sort of random noise in the record circuits even when the record gain controls turned all the way down. This noise seemed to be intermittent and, at times, would only appear three or four minutes after a recording session began. This problem was traced to the record relays on the Record and Repro Amp Board, RL 301 and 401. These relays apparently have large contacts for the amount of current they switch, hence some oxide buildup on the contact surface would be likely.

Speaking of relays, have you ever had an ATR 700 jump into record for no reason at all? Even with the Ready/Safe switches on safe? Try replacing Q553 on the Bias Oscillator Board.

OTARI ARS-1000 TIP

Steven Callahan - WFTI-FM St. Petersburg-Tampa FL

I've installed quite a few Otari ARS-1000 units in automation systems over the years. It's a fine playback unit and is relatively easy to troubleshoot and repair. This is a problem discovered on three separately owned units in different places.

The primary symptom was an intermittent play function, which lead me initially to the play button. One would assume the play button would get a lot of operator abuse, especially with the built-in delay going from rewind to fast-forward to play. Close examination and replacement didn't solve the problem or influence its erratic nature of occurrence.

In checking closer, the main power transformer (ET-11- 186) has three secondary windings (26, 28, and 5.5 VAC), and an intermittent in one of those windings was causing erratic play function. Replace the transformer.

CONTINENTAL 816R-4 GATE DRIVE CARD FIX

Mark Goff CE - KVLT-FM Tulsa, OK

My Continental 816R-4 recently had the flu and since it was such a learning experience, I thought I'd share it with you.

The flu was induced by lightning and caused two gate drive cards and one transformer (A9AR1T1) to expire. I was able to identify the bad cards with a procedure from Dave Chenowith at Continental (see below). After replacing the transformer and putting spare gate driver cards in, I threw the juice to it and promptly fried VR1 (blue selenium varactors across L1) Boy do they stink! Greg Stone, at the factory, reassured me they had likely been weakened in the original lightning episode.

After cleaning up the transmitter and myself, I ran the transmitter without Vr1 (per Greg Stone) and still experienced problems getting the transmitter to make full power with the spare gate drive cards; it kept tripping the plate breaker. Jim O'Donahue of Powercon Electronics (who builds gate cards-see below) suspected that the cards, being of different date codes, may have drifted far enough away from the original specs to be a problem. I had Powercon rebuild my gate drive cards and after re-installing them and VR1, everything is just fine.

TEST PROCEDURE FOR GATE DRIVE CARDS

1. Disconnect VR1 (5 blue over-voltage protectors that are across L1 in the rear of the center cabinet).

2. Check one card at a time. Turn transmitter on with no RF drive (mute exciter). Vary manual power control raise and lower. The plate voltage should vary up to 30% maximum, if the card is good. On mine, the voltage varied from 30% to 80% of max.

POWERCON GATE CARDS

Since new gating cards are around $250 each, you might be interested in a place that will rebuild, test, and guarantee cards for one year. They will also overnight them back to you for quick turnaround. They can also repair Control Circuit and Power Monitor cards. Powercon Electronics 9240 Lazy Ln. Bldg. E-3 Dabbs Business Park Tampa, FL 33614 813-932-7722

POOR MAN'S DEVIATION CHECKER

Bob Hawkins - WENS Indianapolis, IN

So your shop doesn't have a service monitor. Well, there's a way to accurately check deviation. All it requires is a scanner, a scope and either a frequency counter or synthesized Handi-talkie. Here's how:

1. Take the cover off the scanner and locate the detector chip (it usually has 18 pins or so and is located away from the microprocessor). Look for a pin with your Voltmeter, which rests around +2 Volts with no signal and varies above or below the 2 Volts as you vary the scanner frequency around a signal. This is the discriminator output (I put a jack on my scanner for easier access).

2. Hook your scope (set for DC input) to the discriminator.

3. The scope will now display the demodulated audio from DC to over 6 kHz. Choose of the calibration procedures below:

A. Frequency counter: adjust Marti Xmtr to licensed frequency. Set base line of scope to center of screen. Adjust Marti frequency 5 kHz high and note new position of the base line. Adjust the Marti frequency 5 kHz low and note the position of base line. These noted lines represent a plus or minus 5 kHz deviation limits.

B. Synthesized HT: Set scanner and HT to same frequency. Transmit and set base line to center of screen. Adjust HT frequency to 5 kHz high and 5 kHz low and note base line positions that represent the plus or minus 5 kHz deviation.

NEUTRALIZATION TIP

Dave Stewart - KBNA El Paso, TX

If there is a bird style wattmeter between your transmitter and the bandpass filter, or combiner, the reflected meter could be a sensitive indicator of the transmitter neutralization.

As the transmitter stages begin to oscillate, out of band signals are generated. The part that is on carrier will pass through the combiner to the antenna. Out of band signals will be reflected toward the transmitter and show up as high reflected power. One transmitter on 94.5 operated with 19.5 kW forward power and 10 Watts reflected power, under normal conditions. On one occasion, we found the transmitter doing 10 kW forward, and 2 kW reflected. After replacing some damaged neutralization components and re-tuning, the reflected power was back down to 10 Watts.

TX POWER TRANSFORMER CAUTION

Ray Topp - Editor, *Radio Guide*

A while back, I was working on a problem in a Harris FM5-H3. From the symptoms I was getting (blown wall breaker and mini-earthquake), it appeared there was a possible short in the high voltage supply circuit. After removing and then restoring the line voltage connections to the power transformer, I placed a wrench on top of the transformer. When I reset the wall breaker and tried to punch up the plate, the wrench flew across the room like a bullet. The short was still in the circuit somewhere and the extremely high current flowing through the transformer in the instant before the breaker tripped again, had created a magnetic field that affected the wrench. The wrench flew with enough force to cause personal injury had I been in the wrong place.

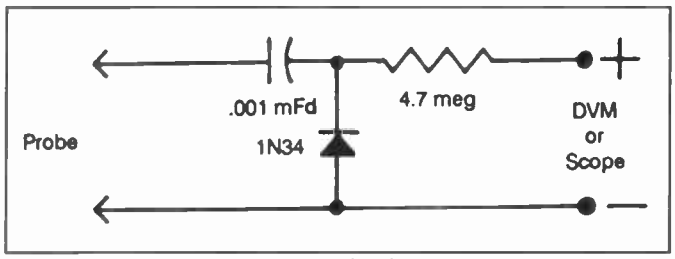
POOR CABLE SHIELDING

J.D. Kimple - WMCO New Concord OH

When installing a new console in our on-air studio, we experienced RFI in one mike channel. When we tried to de-couple the RF from the console, we only dropped the interference level a small amount. After playing around for several days, we tried something: the mike cable that came with the RE20 mike didn't have a solid shield. When we replaced the cable with a solid shield cable, the problem disappeared.

RF DETECTOR PROBE

Roger Blounch - KIYX San Angelo, TX

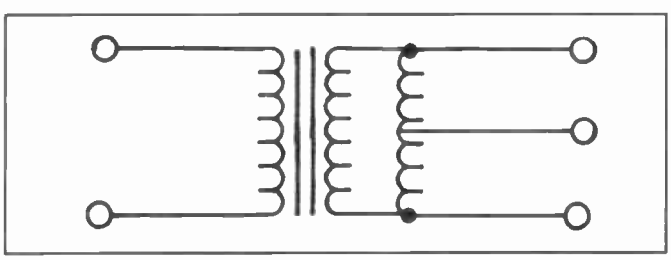


How many times have you had to troubleshoot an exciter or other low level RF stage and not had an RF voltmeter to measure stage gains or to see if that transistor is really amplifying the RF signal? I use this simple circuit built into an old scope probe. This will convert RF to DC and gives you quantitative measurement to troubleshoot with.

MODULATION TRANSFORMER TESTING

Dan Elyea - Family Stations Inc. Okeechobee, FL

Take reference measurements on transformers and reactors while they are in good condition. This will be very beneficial when you are troubleshooting a problem that you think involve these components. Some useful measurements that can be made are resistance, current, inductance, and voltage. Check the resistance of all the windings. One result that can be very confusing here is that you might measure from the center tap to each side and get 4 ohms on each side. You'd expect to get 8 ohms if you measured across the winding, from end to end, but you may get something like 6 ohms. This puzzler comes about because some modulation transformer manufacturers incorporate an extra winding that is paralleled across the center tap winding. I've never seen this extra winding on a schematic, but it sure is there in some transformers. Here is a sketch of what the schematic should look like.



Probably not too many will have access to a simple means of measuring inductance. To get a useful reference on this with simple equipment, energize each winding with 60 Hz at an appropriate reference voltage and measure the current drawn by the winding. This could be with a clamp on ammeter, an inline meter, or by measuring the voltage drop across a reference resistor placed in series with winding under test.

When energizing a transformer winding this way, you can take reference voltage readings on the other windings. You can get a decent profile of a "normal" transformer or reactor by taking all the reference readings such as these and logging them for future reference. Then, if you have reason to suspect the component, you can run some of the measurements again and compare them to the reference readings you logged previously. Another small point -- some transformers by design, have a slightly different resistance reading from the center tap to one side and the center tap to the other side. It has to do with the distance of the winding from the core and maintaining a balance in AC operation, even though the DC resistance readings may not be exactly balanced.

TWO CURES FOR MCI RECORDER GREMLINS

Hank Landsberg - Henry Engineering

While I had the opportunity of maintaining 27 MCI model JH-110A and B recorders, there were two problems that would occur on almost every machine, with some regularity. (1) The low frequency response of the reproduce electronics would disappear and (2) the tape lifters would have difficulty lifting the tape during rewind or fast-forward.

Here are the causes and cures for the 2 MCI gremlins. The LF reproduce difficulty was traced to a dirty CUE RELAY in the reproduce circuit. That's the relay at the rear of the audio electronics drawer that activates when the front panel CUE button is engaged. The relay is wired directly to the reproduce and record tape heads, and is therefore, operating with extremely low levels of audio on its contacts. A very slight amount of contamination on either the relay contacts or the relay socket will cause a "dirt capacitor" to form in series with a reproduce head, which will cause a pronounced loss of low frequency response. Cure: Clean or replace the relay. If the socket is dirty, clean it also with Cramolin or a similar substance.

BE CAREFUL when removing or inserting the Cue relay from its socket! The socket is soldered to the bottom of the circuit-board; its contact pins are very small and easily broken. Many times I've had to remove the motherboard to resolder a broken socket solder joint. If this happens, it's a good idea to re-solder ALL of the Molex connectors to the bottom side of the PCB. They'll break loose eventually.

The weak tape lifter problem seemed to happen to almost every machine about once every year, more often if the machine was used heavily. The lifters just seem to lose their ability to hold the tape away from the heads under the tension of rewind or fast forward. Problem: a magnetized lifter solenoid plunger. After several months of use, the plunger in the lifter solenoid becomes magnetized with the same polarity as the coil windings. This results in lower "pulling ability" when the solenoid is energized. No need to replace the solenoid, just demagnitize the plunger.

Remove any PC boards that block access to the solenoid. Remove the plunger after removing the pin that connects the plunger to the lifter linkage. Now find the strongest tape demagnetizer at the station (a tape head demagnitizer won't work). Turn on the de-mag, and erase the plunger as though it's a wheel of tape. Withdraw it very slowly from the magnetic field before turning off the demagnitizer. Reinstall the plunger into the solenoid and put the machine back together. The lifters should have plenty of pull after the de-mag procedure.

TECH TIPS AND TID-BITS

Stu Engelke, WWDJ, Hackensak NJ

1. To protect three phase blowers and power supplies, install a three phase power monitor. What you do is connect the three incoming AC lines to the monitor and the monitor gives a contact closure if all three phases are there, with correct voltage and phase rotation. Put the contact closure in series with the interlocks or other control to shut things down. This has saved the blower and high voltage rectifiers on an MW-50 since installed.

2. To keep air-conditioner circuit breakers from opening due to compressor lock-up after short power failures (or people constantly changing thermostat settings), install a five minute time-delay gadget in the thermostat circuit. These are available at most HVAC dealers.

3. AT&T Spirit telephone systems work well in high AM RF environments, if you get their "RF" phones. The speakerphone portion also works well for simple on-air talk shows.

4. If you have interlock defeat switches on transmitters or phasors or whatever, use a 60 minute mechanical timer switch. This way you won't forget to "un-defeat" interlocks.

5. If you have a seven second delay unit for talk shows, that's of the solid state variety, hook its bridging input to the program line all the time and switch its output between the transmitter feed when in use, and the input to a cassette deck the rest of the time.

Have the cassette start recording when the announcer's mike is turned on, and stop 14 seconds after the mike is off. You'll get a skimmer that records seven seconds of program before and after the mike gets on and off. Great for air checks. Use a capacitor across a sensitive coil to get the delay.

FM TRANSMITTER-AM NOISE

David Ludwig - KIWR-FM Council Bluffs, IA

Our station operates at a full 100 kW and, like all other stations, we have our share of problems that no one else could possibly have. The following problem caused be a bit of hair pulling that I could ill afford (I have so few left now days).

For a couple of days the announcers began to notice a strange noise during quiet passages of music that could be heard on the "off-air" monitor, but not in the board output monitor. Of course, every time I listened, it was not there.

One evening the announcer called me at home and said the noise was back. He left a few seconds of "dead-air" during selections so I could hear it at home. It sounded like one side of the telephone line had lost connection on a program line and the result was a loud line hum. The noise was at least 30dB down so it was not noticeable during normal programming.

We normally sign off at midnight, so that night I began to isolate the noise by starting at the output of the audio board, through the processing equipment and stereo generator, to the input of the STL transmitter. The noise was still there. By now I had conjured up all the hours that could be spent checking all the power supplies and solid state components that would have to be checked out with scope and meters.

On the scheduled testing night, I began to look for the location of all the power supplies that I would have to check, when I began to get a nagging notion that I was in the wrong ball park. I realized that the noise was more like a ground hum than a 60 cycle hum. I decided to give this new approach only one hour to prove out, then I'd have to go the power supply line of thinking. I fired up the transmitter and found the AM noise was only about 30 dB down; one more indication that it might be a power supply problem.

I put the output of the exciter into a dummy load and with a broad band scope, I looked at the RF. It seemed clean. I disconnected the IPA and fed it into a dummy load and found it clean and free of noise, so I figured that I better get back to the power supplies before the night got away from me.

I restored everything to normal and fired up the transmitter again, only to see that the

AM noise dropped to a -40 dB. Operating on a hunch, I replaced the right angle "N" adaptor and the "N" to "BNC" adaptor on the coax and also cleaned the connectors in the transmitter. When I fired up the transmitter again, the AM noise was now better than -55 dB.

About twice a year I go over to the transmitter site and repeat replacement of the adaptors and cleaning of the connectors in the transmitter because of the returning hum noise.

OLE "MOM" NATURE TRICK

Ray Miller - Tech Dir - KGWA Enid, OK

The chief engineer of one of the stations in Oklahoma contacted me to resolve a radiated pattern variation. He had checked all the capacitors, inductors, and lines in the phasing cabinet and line terminating units. He had found no fault and wanted help.

Upon inspection, the common point and line currents were correct at the phasor and LTUs. No sign of heating or loose connections. No insulators cracked or broken. No indication of faulty lighting system. No fault in static discharge RF chokes. Ball gap on antenna #1 okay--but, ball gap on antenna #2 was welded shut!

Ole Mom Nature had formed a pearlite weld that was exactly the same resistance as the base driving resistance of that antenna! I told him to whip out the hacksaw and file. Problem solved!

A "COOL" DUMMY LOAD

Jack Collinsworth, WFXE, Columbus, GA

Jack called to tell me that a couple of times he had a need for a dummy load of 1 kW AM transmitter. At the time, he could only come up with a 50 ohm, 50 Watt resistor. He reasoned if he could find a way to keep the 50 Watt resistor cool enough, it could handle more than 50 Watts of power.

His solution? Immerse the resistor in a gallon or two of ice-cold distilled water in a plastic jug. He expected the resistor to give up after a short time, but with very cold water, he actually fed a 1 kW transmitter into it for two hours! The jug got warm but the resistor did not burn out.

WIRELESS IS WONDERFUL

How many times have you brought your Marti to a shopping center only to find that it just won't get through the concrete and steel? Jack came up with an alternative. Pick up a wireless intercom set. Feed the output of the mixer into the intercom transmitter unit and take the intercom receiver unit to a suitable location, closer to the outside of the shopping center. Feed the output of the intercom receiver into the Marti audio input and you're on your way. Audio quality may not be perfect but it's better than nothing.

OTARI REEL HOLDER SAVER

Morgan Reynolds - WFFX-FM

I'm the engineer of an AM/FM combo with an automation on the AM. The two stations have owned Otari MX-5050 series and ARS-1000 series machines since 1979. Over the years, we have had to replace several reel retainers because they lose gripping power. When ordering the retainers, no one thought to ask if there was a way to fix the old ones, neither did we receive a product bulletin from Otari. I discovered by putting a drop of oil between two brass pieces located just under the top knurled knob, the retainers once again grip very well. Apparently the brass dries out, or something (don't laugh) and needs a small amount of lubrication to free these pieces. Now the station owns five spare reel retainers and hasn't lost or broken any.

A USE FOR BIKE INNER TUBES

Frederick Fess - WLRB

If you use an Electro-Voice 313A shock mount clamp, the bands that hold the mike away from the support probably have broken or worn out plenty of times. Get an old 1 3/4 inch bike inner tube and cut it into small bands. The inner tube is very strong and will stretch enough to make the shock mount work correctly.

SHORT CUTS FOR SHORTS

Steve Sandlin

It's 3:00 a.m. and you've just gotten a call that your main transmitter just went off the air. Sleepily, you tell the announcer how to re-set the overloads and the transmitter comes back up, with all readings normal. This is the third high-voltage overload you've gotten in the last couple of weeks, but you can't seem to induce a failure when you're looking for it. The next morning you're at the site with the auxiliary transmitter on the air, so you can troubleshoot the main. All the capacitors in the circuit check good, the diode stacks check out, and, being out of other ideas, the spare final is installed. Still with no firm diagnosis, the transmitter is operated into the dummy load with everything operating as it should.

After a few minutes, the transmitter goes down with overloads indicated in the high voltage supply. About the only thing left to check is the power transformer. It checks okay with your VOM, but signs are pointing to it shorting. There's no spare to substitute, and it's too expensive to replace just on a hunch. You get a great idea that might work.

With power off and everything discharged, the transformer is unbolted from the chassis of the transmitter. A piece of plywood is put under the transformer, insulating it from the rest of the transmitter. Finally, locate an inline fuseholder and connect it from the chassis of the transmitter to the frame of the transformer. Then install a 1 amp fuse in the holder and button everything back up. The transmitter ran fine the next week. During your weekly

maintenance, with the standby transmitter on the air, you discover the fuse blown in the temporary fuse holder.

That proves it -- the transformer is shorting to ground intermittently. Until you get a new transformer, keep the plywood in place, and label the transformer as being "hot". A few weeks later the new transformer is installed and no more 3 a.m. calls!

HARRIS FM-25K PA OVERLOADS

R. Lee Wheeler - Wheeler Broadcasting Consultants, Shawnee Mission, KS

MORNING DRIVE OVERLOADS

Having installed and operated four Harris FM-25K's and one FM 25K1 over the last four years, I've encountered a couple of problems which are typical of all the units, at all the power levels I run at various installations.

The problem manifests itself as a sudden and severe plate current overload which generally seems to occur during morning drive. The cause and cure of the problem is in the automatic power control in the transmitter. The Harris design of FM transmitters incorporates a power control scheme which varies the screen voltage of the PA tube, as a means of power adjustment. If it senses a power above or below the 2% or 4% window selected, the transmitter automatically engages a motor driven Variac in the screen circuit, which in turn lowers or raises the screen voltage until the output power returns to a value within the window.

The power control problem occurs when the line voltage to the transmitter falls, which in turn drops the "run what you brung" plate voltage as well as the output power. With all other things being held constant, if the plate voltage drops the transmitter likes to see heavier plate loading.

Over a short period of time, the only reason for the automatic power control to operate is when the line voltage drops and the output power drops. The corrective action of the automatic power control makes this already bad situation worse by raising the screen voltage. The net result is that the screen voltage increases, which leads to an increase in plate current -- but an actual reduction in output power due to the detuning of the final caused by a combination of these actions. The real kicker is that the automatic power control on most of the older versions (pre mid 86 vintage) can only be adjusted during a "plate on" condition. If you have overloaded, the only way to turn the box back on is to go to the transmitter site and back the IPA drive level off to a point where the transmitter will no longer overload, back the screen voltage off of the righthand peg, and adjust your drive back up and retune the final.

SWITCHING TO MANUAL

I've spoken to Harris about the problem and their suggested remedy is to tune the transmitter and set the power controls during a worst case line voltage sag. I have a real problem with this remedy as it results in operation which is 2-5% inefficient most of the time. It's also inconvenient as most transmitter work occurs between midnight and 4 a.m., when the line voltages tend to be higher than average.

The easiest solution is to simply switch to manual power control. At all my installations this has cured all the problems with the transmitter and resulted in very stable operation. At all the sites combined, I have totalled less than two minutes of down time and

no instances of less than 90% or greater than 105% output power.

The down side to this solution is that, on transmitters which were built before the VSWR foldback modification was added, there is no remote control power at all. If you have a site which is subjected to really wild voltage swings, the solution to the overload problem is the screen transformer itself. If you're lucky enough to be running 208V primaries, tap the screen transformer up to a point where the maximum screen voltage is around 1kV.

On some installations I've used the 240V taps and on others I've used the 250V. In most cases this will prevent the box from automatically de-tuning itself off the air.

MCI FLUTTER DANCER BOOGIE

Gary Minker - WPBG/WIRK W Palm Beach, FL

Along the same lines of the recent articles entitled MCI TAPE TIPS, there may be additional problems lurking in a JH- 110 A/B/C. The tape handling problems associated with the play/record mode are usually very different from those of the wind modes. Some of the problems of the play/record mode that resemble phase-lock problems. The can of worms can look like this:

1. The capstan motor exhibits a once per revolution quiver which can be seen while monitoring the DC drive voltage to the motor from the phase lock board. This problem is usually called to your attention by the audible wah-wah-wah sound that emanates from the capstan motor. The noise is usually accentuated when operating the motor at low fixed or variable speed.
2. The flutter dancer arm jitters or wows while running tape at any speed but is accentuated at low speed.
3. The machine runs at maximum tension when running.
4. The machine will not hold a stopped position and winds at an uncontrolled speed over 5000 FPM.

The jitter of once per revolution that is visible on the scope trace while monitoring the DC drive voltage to the capstan and/or the output of the servo tach on the capstan will more than likely not be the lack of concentricity of the tach mylar or the correct phase alignment of the opto-eyes in the tach assembly. The problem is related to the extremely low horsepower of the capstan motor. A bad bearing in the capstan motor which would place micro-inch-ounces of strain at the same position in the rotation will give the motor this jitter, one time per revolution. Removal of the motor and driving it with a variable power supply will show analog variations of the drive current. A stroboscopic study of the capstan will also show this change. This jitter and/or flutter of the capstan is also audible as sort of a wah-wah-wah as it rotates.

If re-building the tach and capstan is not in the game plan (provided the bearing wear is not severe), an updated phase-lock board is available which exhibits resistance to the anomalies of this problem (#PC 2500-1033-XX).

True, the flutter dancer arm is a problem as outlined in the previous articles, and the positioning of the magnet is critical to smooth operation, but glitches that appear in the output of the take-up and supply servo tachs can cause the arm to dance. A non-polarized 25 mfd 'lytic or tantalum across the output of the two tach motors will help to slow down the

tendency to correct nonexistence torque problems which also force the dancer arm to aggravate the analog torque board. Odd combinations of reel size and unusually low reel tensions will also aggravate this dancing. Full or erratic reel tension is often related to dirty molex connectors which connect the reel servos to the mother board. Cleaning and periodic movement of these connectors will clear up this problem which also causes the flutter dance arm to boogie.

The uncontrolled wind from a standing stop or panel command is for the adventurous. When rebuilding the reel servo motors, notice the wind polarity of the DC output. After rebuilding the motors (generators), loosen the rear brush cap and adjust the cap for best output wave form and polarity. Yes, it's true these servos can put out the opposite polarity in a wind situation and cause the machine to run at over five times the normal wind speed with no stopping ability except for the power-down brake clamping.

RCA BTF-20 FILAMENT LEADS

James Eberhart - WQHK/WMEE Ft Wayne, IN

You have PA plate voltage, but no plate current or power output. The drivers are operating normally, although there is no (or well below normal) grid current in the PA tube. All line and filament voltages are normal. I have seen this happen to two different people at two different stations, both operating the 20 kW version of this transmitter, and I might add that they were stumped for a long time.

The problem is that the filament leads from the feed-through capacitors to the tube socket will age over a period of years and the lugs on the ends of the wires will eventually develop a high enough resistance that the tube filament will not light up. This same problem can develop from the filament transformer to the feed-throughs in back of the PA cabinet, but this is usually caught because these are easy to inspect.

Check the insulation on the leads in the PA cabinet and, if the insulation is hard and brittle, that is the sign that overheating has occurred. A good source of replacement leads is your local welding supply shop. They can supply a very flexible cable of the same size as the original and they have the tools to install the large lugs for you. Inspect these leads thoroughly every six months for heating, either by removing them or with a good light and a small mirror. One last hint, ceramic tetrodes DO light up. With only the filaments on, crack the front door and look under the blocking condenser shelf. If you don't see a nice warm orange glow coming out of the ceramic, you know what the problem is.

BROKEN FINGERS AND BLOWERS

James Eberhart - WQHK/WMEE

Check those blower impellers every six months. The curvature of the blades will load

up with dirt and the volume of air delivered by the blower will drop off to the point where the air-flow switch will shut the filaments down. I found one transmitter so dirty, that the air-flow switch had been jumpered across. I was told by the station's engineer that the switch had gone bad a long time ago and was never replaced. We removed the short after cleaning the blower and the switch worked fine.

2. Before you change the final, look around the anode finger stock and count the number of fingers you are missing. After you replace the final, count the finger stock again so see if any additional are missing. Years ago, I had one break off and fall down into the socket without my knowledge, shorting out the bias. The result of that was a ruined brand new tube, when I applied plate voltage.

RCA BTF-5D RECTIFIER STACK

Steve Minshall - KTRB Modesto, CA

Several years ago I had a serious problem with the rectifier stacks of an RCA BTF-5D. The rectifier stacks would fail several times a year until I did some modifications.

The first problem I found was that the voltage dividing resistors were of a value of 22K or 27K at 2 watts. Considering the voltage across them during the non-conducting time of the rectifier stack, they were running in excess of their dissipation rating. The cure was to replace all resistors with the 220K 2 Watt value.

The second problem with the rectifier stacks is that they are located in the bottom of the cabinet, tucked in a corner, (the cabinet having only a ventilation screen at the top). The whole cabinet runs very hot due to poor ventilation. RCA recognized this as a problem after some of the transmitters were in the field and they sent out a notice to drill three 1/4 inch holes in the grid compartment so that the pressurized air from the grid compartment would provide some cooling to the rectifiers. The small holes are just not enough--but the solution is NOT to enlarge the holes as this reduced air flow through the tube. I installed a 230-Volt muffin fan at the bottom of the cabinet hooked up to the primary of one of the transformers. The fan was bolted vertically onto the floor of the cabinet (using a piece of aluminum angle) and the air-flow was directed at the rectifiers. The fan was placed as close as possible to the removable back panel of the transmitter. The last step was to cut a 6-inch by 6-inch hole in the back panel adjacent to the fan and a piece of perforated metal was bolted over the hole. After the fan was installed, the cabinet ran warm instead of hot. After modifying the rectifier stack and installing the fan there has never been a failure of the rectifiers.

Another problem I had was a screen overload condition. The transmitter would run, as long as the screen voltage was kept below a certain level. This level kept getting lower over the course of a few hours until the transmitter would not put out any appreciable power at all.

All my troubleshooting efforts led to the screen bypass capacitor (on the final) and an ohmmeter check showed it just fine. But I tested it with an old Heath bench power supply and when the voltage was increased to about 100 Volts, it would suddenly short. The screen bypass capacitor is built into the bottom of the cavity around the tube socket and is made by sandwiching four silver-plated pieces of mica between aluminum plates. I made a temporary repair by erasing a circle of silver plating around the pinhole in the mica.

In the six years I've taken care of this transmitter, the only other failure was the blower motor which was replaced by a motor purchased in town. Overall, the BTF-5D was a very reliable and stable transmitter.

RCA BTF-5/10/20E TRANSMITTER TIPS AND HINTS

Steve Brown - WLTE Minneapolis, MN

This is a compilation of tips from Mike Hendrickson and I. Mike is Director of Engineering of Hedberg Broadcasting Group of Spirit Lake, Iowa. Please understand that these tips are our opinions only, and we'd welcome rebuttals.

First, believe it or not, some GOOD things to say about the BTF-5/10/20E series transmitters. Despite some faults, they're built like Sherman tanks and unless you abuse them for an extended period of time, they forgive mistakes. The now antiquated 120 VAC control ladder even has its benefits. It's isolated from the ground with a good transformer (unlike other models of the same vintage), and it appears to have been designed during a time when cutting corners of component ratings wasn't so important. My first encounter with a BTF-10E in 1974 worried me -- ALL the relays in the control ladder were soldered in! Since then, I haven't known of anyone who's had a relay failure that necessitates replacement. Is it the 120 volts or the AC that keeps these contacts clean? The factory VSWR protection is a waste of time. The combination of the mechanical meter and short lifetime lamps, plus the technical bulletin on how to "fix" the problems by disassembling the unit every few months, warrants a look at alternative protection by an external unit such as the Bird Wattcher. The ironic thing is that our system, a BTF-40E uses the identical unit in the combiner unit, and with no maintenance, it has never burped.

EFFICIENCY and STABILTY IMPROVEMENTS

The efficiency curves in the manual tend to be rather pessimistic, at least for the BTF-20E. There are some things to improve PA efficiency and stability, however. A glance at the transmitter schematic for the BTF-5E, shows a series LC circuit across the filament leads (although not included in the 10 or 20 kW models). Mike reasoned that, since the tube in the 10 kW box is the same as the 5 kW model (except for anode size), it wouldn't hurt to add the circuit to his BTF-10E. The metal plates that bolt to the filament connections at the tube socket are not available from GE, but they did supply him with shop drawings and a doorknob capacitor value; and a local machine shop supplied the metal and the labor. The efforts yielded a 5% increase in efficiency. The circuit is hard to adjust, because if it's mis-tuned, you won't see changes in the plate current. Moving the capacitor up and down the slots in the two conductor plates in 1/8" increments, will produce the changes in current that tell you you're getting close.

Check to see if your BTF-5/10/20E has a hose clamp installed on top of the PA cavity, where the transmission line exits. The BTF-10E didn't, and a call to RCA a few years ago produced the comment that it really didn't matter at that power level (although my BTF-20E's had them). Instability in tuning was experienced that acted like poor neutralization, but readjusting the neutralizing sliders didn't change anything--they were always set correctly. There had always been an inordinate amount of RF in the transmitter building that careful grounding hadn't changed.

We decided to apply a sleeve on the top side (outside) of the cavity, notched so it could be compressed by a hose clamp to the 3 1/8" line, where it passes through. After installing the clamp, RF leakage in the area of the transmitter went down considerably. The remote control behaved itself as well as the rack mounted STL receiver, and we gained another 1% to 2% improvement in efficiency.

SIMPLE THINGS TO IMPROVE RELIABILITY OR DECREASE PARTS COSTS

Keep tuning and loading plates in the PA cavity parallel and spaced equally from side to side, through their entire length. Sliding finger stock is NOT the way to tune a transmitter, but keeping constant tension on the fingers, through the proper alignment, will greatly extend the life of the contacts. If you're tuning a BTF-20E at full power or less, with clean, intact sliding finer-stock, and you still draw arcs, check the alignment of the moveable outer plates on tuning and loading assemblies.

The cesium contaminated vacuum arc gap on the rear of the PA cavity is there for a reason, but they do fail. Rather than spending money for a replacement or leaving the protection out, we used a spark plug. Machine copper or brass stock to the same outside diameter as the end of the old vacuum gap and tap it to fit on the small threaded end (top) of the spark plug. Machine a second piece of stock to be larger than the threaded end of the spark plug that goes into the engine, and tap it to screw the spark plug into. Machine the remaining end of this stock down to the outside diameter of the old vacuum gap. Set the plug gap at 1.2 to 1.5 kV with a "hi-potter"; plug the new device in where the vacuum gap went and you're in business.

APPLIES TO ALL TRANSMITTERS

We used this one on the BTF-10E when we moved it from one site to another. The transmitter had been operated for years in the upper level of a portland cement plant, and looked just a bit dusty! When the transmitter was moved to a better location, no attempt was made to clean it up. When it was moved to its final resting place, as a back- up rig, the blower, tubes, PA cavity and anything else easily moveable was removed and sprayed down, inside and out with a weed sprayer filled with detergent and water. This isn't so crazy! Tektronix uses a machine that looks like a big dishwasher to do the same thing with their gear. The box then was thoroughly rinsed with a garden hose and left to dry outside for several hours and brought inside to dry out for a week or so. No transformers were removed for this operation--the blower and motor seem to be the only rust prone items.

We then completely disassembled the PA cavity and tube socket parts, and replaced old parts with new as necessary, then reassembled the cavity and the rest of the transmitter. The only major problem since then was the apparent "drift" of tuning. This turned out not to be the transmitter, but a frequency drifting Harris TE-3 exciter that drives it. When the exciter drifted to a new "home", the engineer would notice power output drop off and attempt to retune the transmitter to correct it! A check with a frequency counter located the culprit.

AEL INTERLOCK TIP

Bob Ladd - WNRR Bellevue, OH

I had run into an open filament transformer on the AEL FM 2.5 KD. After making the repairs, I wanted to view the final cavity while the high voltage was applied to see if any arcing would occur.

The AEL has an interlock defeat mechanism built into each interlock switch, which when pulled out and turned, bypasses that switch from shutting down the high voltage if the

door is opened. I had neglected to pull out the interlock to bypass the switch at the open door. Naturally, when I hit the high voltage, nothing happened.

In every transmitter I've worked on, the normal procedure at this point would be to bypass the interlock then hit the high voltage button again. Not so in the AEL! As soon as the interlock is bypassed, the transmitter does whatever it was commanded to do just prior to the bypass. In this case, the high voltage came to life.

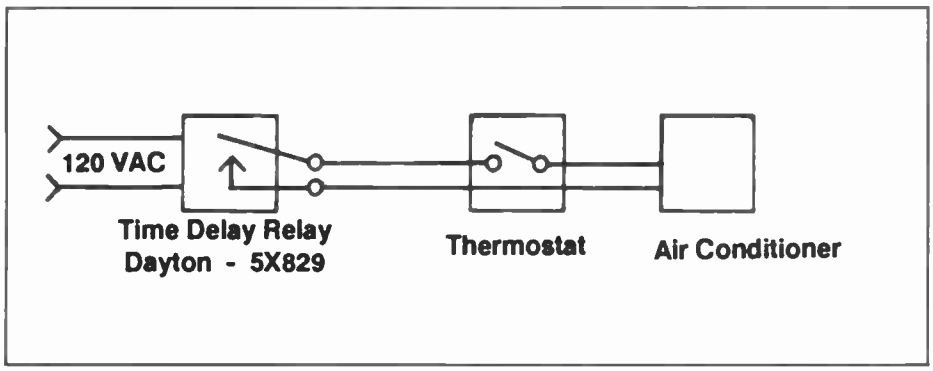
Since interlock switches are often located near high voltage potentials, the chance for high voltage shock is good. Watch for this with AEL transmitters. It could save your life.

AIR CONDITIONER TIP

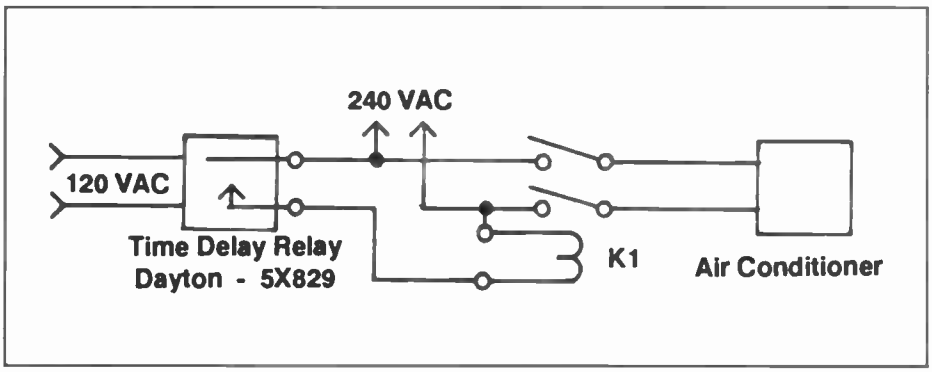
Bill Rett - KWTR Lakeport, CA

If your transmitter building air conditioning compressor is running and the power fails for a couple of minutes or less, the compressor will draw excessive current trying to re-start against the high head pressure and will likely trip the circuit breaker.

The addition of a time-delay relay keeps the compressor from running for the period of the delay, after power returns. The adjustable time-delay relay is available from Graingers.



If the thermostat is not accessible, here is the alternative:



K1 is a plate contactor out of an old RCA BTF-10B

CONTINENTAL DRIVE CARD TIPS

Jerry Mathis - WSCI/WKKG,Columbus OH

The tip from Mark Goff of Tulsa Oklahoma, in the December 1988 issue of Radio Guide, reminded me of a similar problem I had with my Collins 831 G2C transmitter, back in Tennessee. I believe that this was the last version of the 25kW FM transmitter Collins made, before thay were purchased by Continental.

My problem wasn't caused by lightning or any other sudden catastrophe. The transmitter just wouldn't stay on the air a great length of time without tripping the PA plate circuit breaker. This would happen three or four times a day, for no apparent reason -- and it was a 25 mile trip (one way) to the transmitter each time!

I called Continental about this once or twice, but apparently got ahold of someone who didn't know the cure, so I blamed the utility company for transients on the power line. Well, I finally found the source of the problem, the same as Mr. Goff's -- the gating card. Now, as Paul Harvey would say, "here's the rest of the story". I found that the only thing wrong with the card was an open electrolytic capacitor. It was a 10 f/50 VDC capacitor. There were two of them on the card. If one opened, it would cause an imbalance in the circuit, causing the gate drive card to trigger the SCR improperly. Replacing the open capacitor made the card work as well as before.

Over several years, I had at least three of these same capacitors on other cards, go bad. In each case, replacing the electrolytics made the card work okay. Be suspicious of bad electrolytics, if the transmitter starts tripping the PA plate breaker for no apparent reason. This often happens when the transmitter is being turned on or during an over-load re-cycle.

MORE CONTINENTAL 816R GATE CARD TIPS

John Bredsen - KLCC, Eugene OR

We were having occasional trouble with the plate circuit breaker tripping at sign on. Resetting the breaker would get us back on the air with no sign of trouble.

Dave Chenowitz of Continental suggested that quite often the problem is caused by a faulty electrolytic capacitor on one of the three gating cards. His suggestion was to replace, shotgun style, both of the 200 mFd capacitors (C9 and C10) and both of the 10 mFd capacitors (C5 and C6). By using the technique of trying one card at a time, it's possible to determine the bad card.

However, my feeling is that if one cap has gone bad on a given card, can the others be far behind? So I changed all four caps on each of the three gating cards. It cleared the problem at a moderate cost.

A LITTLE DUST - A LOT OF MONEY

Michael Slocum - Topeka Broadcomm Inc., Topeka, KS

Our FM station bought a Harris FM 25-K transmitter, circa 1985. This model uses five IPA amplifier modules, each containing two amplifiers each. The first module amplifies

the exciter output up to 50 watts. This power is then split and fed to the four other modules, amplified, and then recombined through an 8 port combiner for a nominal power of 350 watts to drive the PA. The IPA section was designed with the idea that each module would be isolated from the others to prevent a damaged module from affecting another.

The problem arose when, out of the blue, the other station's transmitter blew out random amplifiers, two on one module and one on each of the two other modules. Harris shipped out new modules, and also suggested a modification to the voltage line feeding the IPA section.

Some time went by, but the same thing happened again -- the transmitter blew out transistors at random. Harris shipped out new modules and said to look for an arc somewhere in the transmitter. None was found. My station, just like the other station's, blew out random transistors. After questioning Harris' customer service dept., one of the technicians said that this had been a major problem for them and they didn't know what was causing the problem. They studied some transmitters that had experienced this problem and found that each unit contained some bad solder connections inside the 8 port combiner. They theorized that, as dust collects in the 8 port combiner, it works its way into cracks in some of the bad solder connections. When this happens, the impedance is thrown out of tolerance, causing transistors to randomly blow. The transmitter needs to be kept thoroughly clean to help prevent the problem.

Additionally, to thoroughly clean the 8 port combiner, it must be disassembled, at which time you should re-solder all the connections inside the combiner. Since not too many stations keep their transmitter in a clean-room environment, Harris decided to re-design the IPA section so that it would be a little more forgiving of the dust.

The transmitter does seem to give one bit of warning. Before the costly happenstance occurs, the transmitter tends to display a greater number of PA overloads than usual, (provided you call PA overloads something usual.

FUSE TIPS

Joel Belik - KIKX, Colorado Springs, CO

If you should suspect an open fuse in a 3-phase disconnect, don't try to measure the voltage on the output lines to ground, to determine which fuse is blown. The problem is, with a load on the circuit, the lines will still show a voltage on the output. To save time, you will be better off looking for a voltage potential across the fuse. The one that shows voltage is the bad one.

I was having some trouble with a 200 Amp disconnect fuse blowing for no apparent reason. The disconnect fed a BE-30 transmitter and the transmitter showed no damage. No breakers on the transmitter were tripped and the unit would come up with no problems after the fuse was replaced. The measured current on each phase was within an amp or two of 100 Amps. What was blowing the fuse? After a number of blown fuses, we finally discovered the leaf switch in the disconnect was shorting between phases. The problem was found to be a short through the plastic that holds the switch.

EBS RECEIVER TIP

A.B. Parker - KSAU, Nacogdoches, TX

Recently, the EBS station in our area went off the air. The new EBS designate was the FM station, which rendered our old AM EBS receiver useless. Upon shopping for a new receiver (on a nonexistent budget), the realization was soon upon me that an alternate solution would be necessary. In lieu of an expensive solution, an under $30 innovation was found.

An under-dash FM to AM converter was purchased from Radio Shack (part#12-350). A 12-volt power supply was assembled to power the converter, using a filament transformer and a bridge rectifier. The result was a low cost FM EBS system that has performed flawlessly since installed.

MASS CALLING SYSTEM ON THE LEVEL?

Ed Jurich - WMIX, Baltimore, MD

A few months back, I replaced a cheap speakerphone in our air studio with a Gentner SPH4 telephone interface. Programming wanted to be able to have caller and announcer talk simultaneously without cutting each other off. The SPH4 seemed to do the job except with problems on some calls that were low level.

As time went on, low level calls became more of a problem until last fall -- most of the calls were low level. The problem with low level calls is that increasing gain creates a hybrid feedback problem by also increasing the amount of announcer feedback level.

What really drove me nuts was the fact that I could make a call on any request line, adjusting levels for soft levels, and the system would work great. As soon as calls came in, the level was so low the VU meters barely moved. It never occurred to me that the phone lines were a problem because every time I called out on the request line, levels were fine.

Baltimore, as does most larger markets, has a mass calling system for radio station request lines or any location where there may be a high volume of calls, (also called choke lines). In a mass calling system, the number you give out over the air is not the actual number, but rather an under-number, or secret number, is the real number.

Quite by accident, I had an occasion to call the under-number to test something and behold, levels were loud. So I made several test calls using the under-number and the request line number and found that every time I called the under-number the levels were fine. Every time that I called the request line number, levels were low. I called another station in town and had their engineer run the same test and he had the same problem. It was the entire mass calling system causing a loss in level. The reason the levels were fine when I called out on the request line is that outgoing calls do not use the mass calling system.

As it turned out, the problem occurred as different exchanges were changed over to electronic switching. This is why the problem got progressively worse.

The electronic switching looks at the line each time a call comes in. For local calls, electronic switching inserts some loss into the circuit so local calls are about the same level of long distance calls. The mass calling system already causes some loss because, in effect, the call to the request line is patched into the under-number so the call is going through the patch

and two more exchanges. The electronic switching then added more loss because it was a local call.

The cure was to re-program the electronic switching not to insert loss into the mass calling system. The SPH4 works fine now. The fastest way to check a mass calling system is to call the under-number and the on-air number, and compare the levels. If there's a big difference in levels, there may be a problem. There will be about a 6 dB loss in the mass calling system, so a slight loss of level is to be expected.

My hat goes off to C&P Telephone for solving the problem in a few days. After battling the problem for months and discovering it was not my problem was both good and bad. It was good that I found the problem. It was bad in that it was the entire mass calling system, as I had visions of weeks or months of re-design work by the phone company. The fact that they identified the problem quickly and did a fast fix makes your heart warm over to Ma Bell.

CSI TRANSMITTER PROBLEMS

Sydney Marshall - WDME

We had excessive AM hum on the modulation of our CSI FM3000 ever since it was installed. A 20 watt solid state exciter drives a grounded-grid triode IPA, which drives a grounded-grid triode PA. Tuning is via strip-line sliders, except for the IPA input, which is a pi-net with tuning caps. Our power is single phase.

Several consultants and I had gone all through the power supply, looking for the hum (it wasn't coming from the exciter). The only unusual reading was a small amount of IPA cathode current -- with the plate off! As this was my first experience with an FM transmitter, I would keep asking about this current. Mostly I would get a shrug or a suggestion to replace the tube (I had).

Finally, after three years of hum, one very good consultant named Howard Soule and I decided to spend the night and do or die. I showed him the cathode current. He replied, "That's odd." We tore into the PA cabinet to test voltage readings at the socket. The old Simpson 260 showed 24 volts AC on the cathode! "What the...", came out of our mouths. I spent hours crawling around inside the transmitter, tracing out the control wiring.

With the "control" circuit breaker off, there was no 24 VAC on the cathode. It took Howie reading off wire numbers and me crawling behind the panel, to discover -- two wires transposed on the IPA overload relay socket! The 24 VAC bus that was supposed to switch to the next relay (one of those "three strikes you're out" circuits) on the IPA overload, was connected to the coil instead. That side of the coil was a direct line to the IPA cathode. We were cathode modulating with a 60 Hz sine wave directly from that oversized 24 volt current transformer! No wonder the indicator bulbs seemed to burn out so often! They were getting RF off of the cathode. Unsoldering and reversing the two wires took about three minutes and ended three years of frustration. Also, the IPA overload circuit was finally functional -- we weren't aware it wasn't.

Another frustrating problem on the CSI unit is the push-on/push-off combination indicator/light switches. You can't tell by sight what position you're in, if the bulb is burned out. Even worse, they fail and "go momentary". The schematic didn't bother to say they were supposed to be "holding". You can't tell by feel, and the control ladder is complex

enough that it's not self-evident. This really confused me on the tune/operate switch, which had gone "momentary". The circuit employs its own time-delay, like a step-start circuit. When you're in "operate", the transmitter keys up first at a reduced power, then (after the time delay runs out), goes to full power. In "tune", it keys up the same reduced power and stays there. Nothing seems to happen if you switch back and forth because of the time-delay. The only way you'd know the tune/operate switch had gone bad, would be to hold it in for five seconds, and watch the power. The time-delay relay makes a barely audible tick. We ran "in tune" for two years, unknowingly.

I enjoyed Bob Ladd's interlock safety tip (Feb89). There is a similar situation on the CSI and I suspect in other transmitters with a non-momentary switch for the plate. If you open a door with the plate on, then self-defeat the interlock, the plate will come back on -- in this case after the filament time-delay. Just enough time to get you in real trouble.

Never count on an interlock to protect yourself. If you've got one bypassed, count on high voltage being able to energize unexpectedly. I feel that transmitters controls should be big old aircraft bat-handle toggles that will work at -40 degrees F, by a mittened hand. Don't think a transmitter can't have an original wiring error -- sometimes it happens. Our transmitter had two other errors in the RF tuners.

MIX-MINUS -- NO BIG DEAL

Marv Olson - KAUS Austin, MN

How many of you created nothing but confusion, searching for a way to create mix-minus for your telephone applications? Here are two simple, and semi-quick, ways I have used to create the necessary mix-minus.

The obvious way is to create a buss inside the console. This can be done by checking the schematic and finding the location of the buss build-out resistors. You'll notice equal value resistors coming from the same electrical point just off each mixer output. These resistors will be in the neighborhood of 2K to 10K. In most cases, there will be two such resistors; one for the program buss and one for the audition buss.

To create a 3rd buss, simply solder another resistor of equal value to this point. Do this to each channel EXCEPT the one with the telephone call on it. Join the other ends of all the new resistors and feed this to a small amplifier. I used a 1-Watt Raymer and it did the job well for about $15. Your created channel will include the mix, minus the telephone caller, therefore -- mix-minus.

Another method I recently used simply involved a stereo console. With all of our updates over the years, we have built in redundancy whenever possible. Even though the AM station is mono, we installed a stereo console to have a back-up ability to feed the FM station from AM control. It also made AM control ready for conversion to stereo if needed. The mono output was feeding the AM transmitter. To create the mix-minus buss, I removed the right side on the telephone input and fed only the left channel. The transmitter was switched to left output of the console and the right output was then the mix-minus. It was that simple.

It should be noted that any stereo material will be missing the right channel in this application. However, by switching the output of the console to left-only during the ball game or the telephone talk show (instead of the normal mono (L+R) output), you have accomplished the task of creating mix-minus for the price of that switch. We have 8- channel audio switchers in place to feed the AM and the FM audio chains, so the switch is just a push

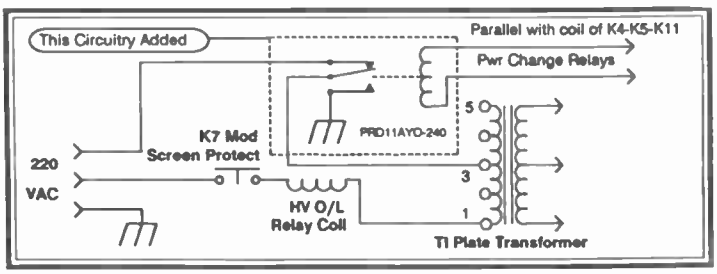
of the button. In the case of FM stereo, the same procedure can be used. The left console output is bridged to feed both the left and right channels of the audio chain. The right channel remains mix-minus for the telephone. Again, if your applications includes any real stereo sources coming in, out, or within the telephone material, this method has some limitations.

BAUER 707 LOW POWER MOD

Robin O'Kelly - KORE-FM, Springfield, OR

Our station operates at 5kW daytime, with a cutback to 161 watts at night. Our daytime transmitter is a Gates (Harris) BC5P. The transmitter available for nighttime operation was a Bauer 707, 1kW, that previously had been the station's main transmitter, prior to 5 kW authorization. The Bauer 707 was designed to have either a 600 watt or 250 watt cutback; not low enough for our situation.

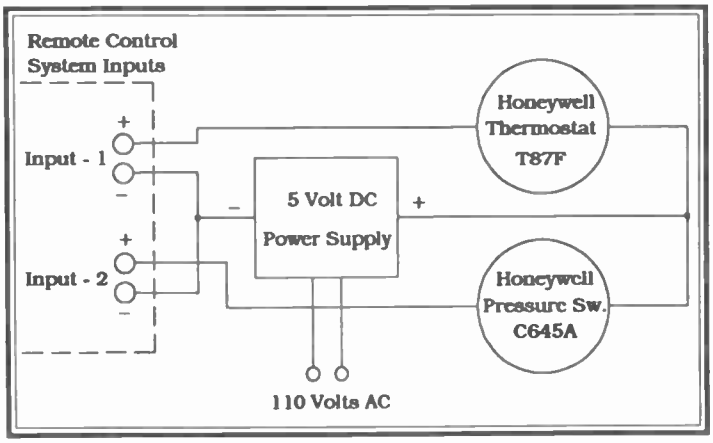
With a 220 VAC supply, the plate voltage runs about 3 kV for the 1 kW power level, while the plate current is around 0.45 A. If the supply to the primary of the plate transformer is reduced to 110 VAC, the plate voltage is halved (about 1.5 kV). When the transmitter is tuned, adjusted and loaded for proper antenna current, the plate voltage is 1.4 kV, and the plate current is 0.19 A (for 161 watts output, that means 60.5% efficiency). A Potter and Brumfield PRD 11 AYO-24OV relay has been mounted on top of the plate transformer to switch the primary output from 220 VAC to 110 VAC, to allow operation at both 1 kW and 161 watts. The contacts of the relay are paralleled for greater reliability. The coil of the relay is paralleled with the coil of K4 so that the switching is controlled by the high/low power switch. The plate voltage must be interrupted when switching power levels to prevent arcing the relay contacts and welding them together. This is recommended anyway to keep from burning the K4 contacts. Carrier shift is -4.5% maximum, using this method, with THD under 5% at 85% modulation from 50 to 10,000 Hz. Audio quality is good. An added benefit, is having a 1kW back-up transmitter available when the main transmitter needs servicing.



THERMOSTAT REMOTE

Sam Mitchell - WOAK, LaGrange, GA

Since it is very important to keep transmitter rooms cool at all times, we felt it imperative to know when our transmitter room was over temperature due to air conditioning malfunction. I installed the following system



Most remote control systems have many inputs, most of which are not used. We purchased a 5 volt DC supply from Radio Shack, and installed a typical wall thermostat (Honeywell T87F) in the transmitter room. The negative side of the DC goes directly to the remote control input and the positive side goes through the thermostat. We adjusted the remote control potentiometer to give us a display reading of 3 Volts, with the thermostat closed.

We then set the room thermostat to a maximum safe temperature. We selected 82 degrees F. Whenever the transmitter room is at the desired temperature, we receive a 3 Volt reading at the studio at that selected remote control position. If the temperature goes above 82 degrees, the reading will fall to zero because the wall thermostat will open when the room temperature rises above our setting. This may seem very crude, but it sure stops the crisis from transmitter room over-temp.

It's imperative that we keep Nitrogen in our coax cable (especially in our climate). We installed a pressure switch on the output of the Nitrogen regulator, which works identical to the room thermostat connection.

When Nitrogen is present at the proper pressure, the pressure switch is closed and we received a reading at the studio on another remote control position. If the Nitrogen pressure drops too low, the pressure switch opens and we receive a zero when we "dial up" that particular remote channel. Since we monitor all transmitter room functions continuously during the day, we are never low on Nitrogen for more than a couple hours.

MCI JH-110 TAPE DECK TIP

Dave Graves - KMJX, Little Rock, AR

When working with the analog torque board on the JH-110, it's sometimes hard to set the offset nulls to exactly zero. Adding two 1 megohm feedback resistors (one from pin 2 to pin 6 on IC-4 and the other from pin 2 to pin 6 on IC-10), will help to make this adjustment easier and more stable. Some newer tape decks already have the resistors in place. If you still have trouble with the offset null adjustment, you may replace IC-4 and IC-10 (741 op-amps), with TLO-81 op-amps. This modification should make for a very stable offset null adjustment.

ITC AND SMC CART DECK EQ TIPS

Dave Hebert, Paco, WA

ITC LOW-FREQUENCY EQUALIZATION ADJUSTMENTS

In early ITC tape cartridge machines (RP/WP series, 3-D series, etc.), dramatic improvements can be made to the low frequency response. The emitter resistor of Q102 (2N5089), R107, and the same emitter resistor of Q106 (Q108 on some models) in stereo units, can be replaced with a 500 ohm miniature pot. You are then provided with an adjustable low frequency control which can greatly improve the bottom end of these units. Since the tape head can have a great deal to do with the low frequency response, this control should be adjusted for flat response at about 100 Hz. On some circuit boards, the emitter resistors are 100 Ohms. In this case, the adjustment control should be 150 Ohms to allow for full adjustment of the low end response. After modification, the overall audio quality of the ITC machines seems to take on an "open" quality.

SMC LOW-FREQUENCY MODIFICATIONS

The SMC model P1 program pre-amp board can be modified to provide a much improved low end frequency response with some minor component value modifications. Change the following components: R6 from 4.7K to 5.6K, C4 from 8mFd to 33mFd, and C8 from 4mFd to 250mFd. If the low-frequency equalization is unsatisfactory at 100 Hz., then further experimentation with the value of R6 can be done. SMC has added a 50pF capacitor across R13 (22K) to help prevent oscillation in the output stage.

SATELLITE DISH INTERFERENCE

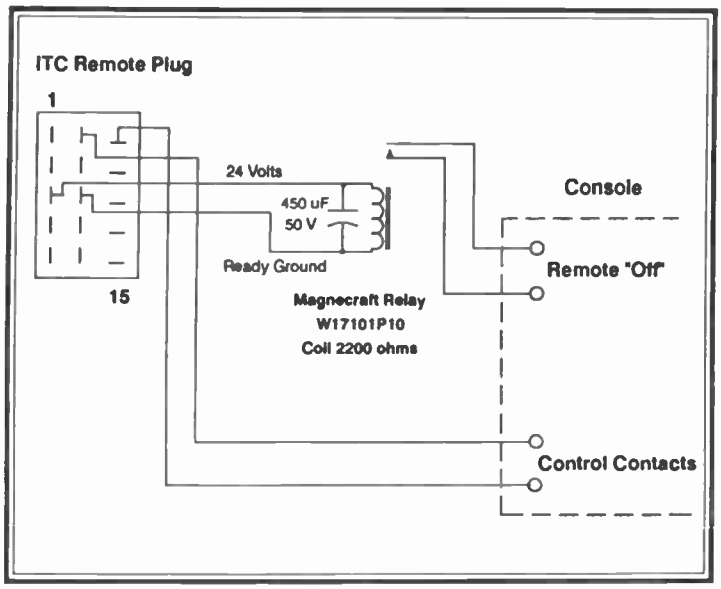
Sam Moony - WTQR-FM, Winston-Salem, NC

A problem developed with interference to Satcom 1-R, transponders 19 and 21, that started off as an occasional pop in the audio. As time passed, it grew from just a burst of noise once or twice a week, to several bursts an hour. We "look" at several satellites and a host of transponders, and none of the others were affected. A check with a spectrum analyzer didn't reveal any signals that could cause the problem. A tunable IF filter didn't clear the problem either. In our search we heard about a microwave oven causing trouble at one station -- but this was not our source. We kept logs on times and durations of bursts, weather conditions etc.

Finally, we tried an AM radio tuned down at the bottom of the band and did hear a noise burst that was coincidental with the satellite noise. A walk around the building localized the noise to a breaker panel in the conference room, with 40 breakers in it! Which one was the culprit and what did it feed? After a process of elimination, a breaker was found, that when turned off, cleared up the problem. Tracing the wiring through the building, we found that the breaker supplied a variable air volume (VAV) box in the ceiling of one of the offices. This VAV contained a large contactor, powering a heat strip and an SCR motor speed control. When the device cycled on and off, the contactor arced and caused the noise which rode into the satellite receiver on the power line. Why it affected only two transponders, we still don't know, but we got rid of our trouble and gained a few more grey hairs.

CART/CONSOLE MUTE CONTROL

WCNN-Atlanta, GA



Problem: You have single cue cart machines, and a logic controlled console. You want the cart machine to cut off the channel after a cart has played and you don't have the secondary or tertiary tone to do it.

Answer: I went into our ITC 3D's and brought the connection for the stop light out to interface with the logic controller for our Broadcast Audio Associates console. Two advantages here: 1. The cart stops, the stop light shines, the channel is off. 2. If there is more than one source on the channel, and it's left on, when you insert a cart, it will shut off the channel because the stop light will light. We did this at WCNN a year ago and have loved it since.

TECHNICS SP10-MKII TURNTABLE FIX

Bob Nance - WEGL, Auburn Univ. AL

Our studios are equipped with Technics SP10-MKII turntables. Included in this circuitry of the turntables, is a de-bouncing circuit. The necessity of this current is apparent, as the on/off functions are accomplished with one switch. For reasons unknown, as the turntables age, the de-bouncing time gets smaller and smaller. Trying to fix this problem, I opened the case of the turntable and just about choked! The entire circuitry is located on one circuit board that can't be removed from the case, and all of the components are on the inaccessible side.

My next thought was to try to de-bounce the circuit from the outside. I thought of this because of the remote switches we use are very old and connected through Belden 2-conductor cable to the remote connection on the back of the turntables. Rather than spending a lot of time analyzing the circuitry and trying to come up with the ultimate solution, I placed a 2200uF capacitor across the on/off button. This solved the problem and made a lot of talent happy, as they did not have to cross their fingers to hope that the turntable started properly each time. Anyone using those turntables might be interested to know that both of ours developed the same problem.

CRITERION SOLENOID TIP

Sydney Marshall - WDME

A recent Radio Guide tip mentioned the filter cap in the high voltage DC solenoid circuit used in some cart machines, such as the Gates ATC Criterion. It suggested measuring the ripple across the solenoid, when energized. A quicker method, at least on the Criterion, is to use a freshly bulk erased cart.

Just pot the machine up in audition and insert the blank cart. If you hear an increase in hum when the tape rolls, replace the solenoid DC filter capacitor. It's the can on the left (100 mFd/100 VDC). I use tubular units mounted on two single tie strips mounted with the original can mounting screws, under the chassis.

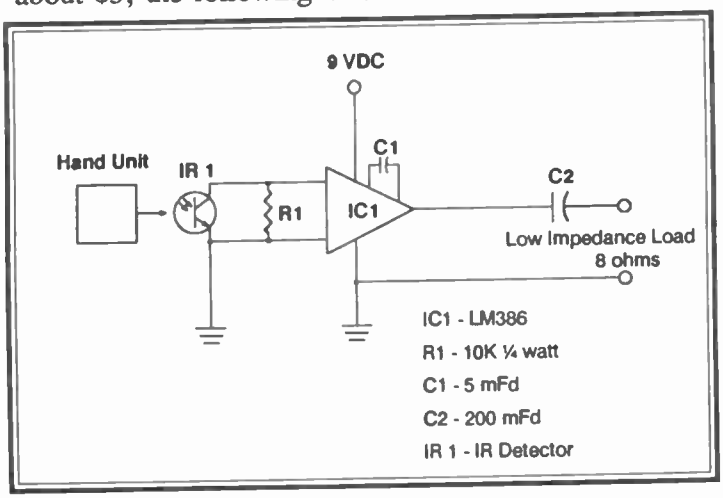
If the hum is still there, replace the 100 mFd/50 VDC can on the right. The center can controls the relay time delay. If this opens, your cart will re-cue just after it starts.

IR REMOTE CONTROL TESTER

A.B. Parker - KSAU, Nacodoches, Tx

With the increased use of infrared in remote controlled consumer equipment, such as CD players, more of these pieces of gear are finding their way into the control room. When the output of the unit loses gain, or ceases to operate for whatever reason, a method is required for testing.

There is a "card" available to convert the IR to visible light but, that's all it does. For about $5, the following circuit can be built:



This circuit is capable of providing much more information. The output may be connected in a variety of configurations: to a headphone, a speaker, an oscilloscope, frequency counter, or an external amplifier. Most IR hand units have an audio frequency component within the carrier wave.

REMOTING THE SL-1200

George Whitaker, Dallas, TX

The Technics SL-1200 is an excellent inexpensive turntable. However, they do not come equipped for remote start-stop. This can be added to the SL-1200 by simply lifting the platter off and bridging a normally open, momentary switch across the yellow and orange

wires on the Moxlex plug nearest the front of the turntable.

To facilitate moving the turntable around, I mounted a mini-jack in the bottom of the case and wired it to the yellow and orange wires. Then I put a mini-plug on the wires from the console remote start pushbuttons. This arrangement will allow remote start-stop from an ordinary, externally mounted pushbutton switch or from the remote start contacts in an Autogram console or other console with built-in dry contact switches.

OTARI MTR-10 USERS TAKE NOTE

Martin Acuff - WZLX, Boston, MA

If you own an older Otari MTR-10, be aware that the technical manual makes no mention of the need to lubricate the top capstan bushing.

The easiest way to gain access to the top capstan bushing is to remove the pinch roller and remove the threaded collar directly over the capstan motor. It's not necessary to remove the motor from the deck. To lubricate the capstan motor, either use Otari-approved oil (part #PZ9E003) or any high quality light machine oil. Otari technical support notes that new manuals include instructions to occasionally oil the capstan top bushing.

OPTIMOD 9100 SET-UP SHORTCUT

Bob Hawkins - WENS Indianapolis, IN

One of the steps in the Optimod 9100 set-up procedure directs that you apply a low frequency tone to the front panel test jack. The goal is to produce a square wave, monitor it on a scope attached to the transmitter and adjust the proper control for maximum flatness of the waveform.

The fact that maximum flatness and minimum modulation coincide allows set-up without a scope if need be. Just adjust the proper control for a dip in the modulation with the square wave applied. When you have minimum modulation you are there.

ANOTHER CAUSE OF SKIPPING CDs

Paul Strickland - KKDA, Dallas, TX

I learned along the way, by destruction, that the laser optics in a CD player are mounted in a rubber gimbal similar to the way a microphone is mounted in a cage. The big difference being that the mount in a CD is a lot more solid. However, these mounts will get hard from age, smoke or other pollutants in the air.

We clean our cart machine pinch-rollers with a product from Scotty Enterprises called

Vita-Drive Rubber Drive Cleaner. This product deep cleans the surface of the rollers and preserves the soft texture.

I used the same approach to clean the surface of the rubber mount that holds the laser optics. The mount is too small to pass a Q-Tip through, but a toothpick soaked in the cleaner can be inserted gently into the passages to soak loose some of the stuff growing along the edges. You have to be careful not to damage the mechanical drives attached to the optics package in the process. With some care you can reduce the number of skipping problems that are common among CD players found in a lot of studios. And all this time you thought manufacturers were putting out bad CDs.

WIRE SIZE MAKES A DIFFERENCE

George Whitaker, Editor

Ed Pryor, whom I consider to be a top-flight engineer, and I, had a discussion a few years ago in which I made a statement that, on a short run, the size of the speaker wire really didn't make that much difference. He told me that it WOULD make a difference. So, just to prove something to myself, I took my living room speakers and wired them up with four feet of 22 gauge wire on each. Then I wired them with four feet of #12 wire. The difference was astounding even at low volume.

Ed was 100% right, and one more time I got to eat crow pudding. On many occasions I had wired control room speakers with small wire, rationalizing that the run was only a few feet and it wouldn't make any difference. Believe me, it does make a BIG difference.

TTC TRANSLATOR PROBLEMS

John Bredesen - KLCC-FM

KLCC-FM has a total of eight translators in various communities to relay our signal to listeners who otherwise would be shielded by mountainous terrain present in Oregon. We have been using units manufactured by Television Technology, Corp. (TTC) of Colorado. Excellent translators, they have given us reliable service for, in some cases, close to a decade.

Recently, however, we had failures in two units in less than two weeks, both related to the same cause. If you have early TTC translators in the field, you might want to consider our "fix". And thinking radically, you might want to do it before trouble starts. At least inspect the PC board where the trouble occurred as described below.

The problem in our case was one where a connector on the power supply board overheated, due, I assume, to be an increase in contact resistance over time. It's the connector (P704) which brings the power transformer leads to the power supply PC board, and specifically involves the pins (6 and 7) carrying the AC from which the 24V is derived. In both cases the pins got hot enough to melt the solder on the PC board, and in one case,

destroy the connector. Later models of the translator also have the four bridge diodes removed from the PC board and replaced by a bridge diode assembly like the Motorola MDA 2506 or an NTE 5326 (25A, 600V) which is on the rear panel of the main chassis, not on the PC board. The PC mounted diodes produced enough heat to discolor the laminate. We made a modification to take care of both problems as follows:

1. Mount the appropriate diode assembly in a convenient place on the rear of the translator. Be sure to use the heat sink compound.

2. Cut the red and orange leads off of connector P704 (pins 6 and 7), and add enough wire, if necessary, to reach the AC terminals of the diode assembly. Use at least #18 AWG. Crimp on a couple 1/4" slip-on connectors and press onto the two diode terminal labeled "AC".

3. On the power supply PC board, remove the four diodes (D702,3,4,5) which comprised the original bridge.

4. Prepare two wires (choose two different colors) about 4" long. Place 1/4" slip-on connectors on one end of each wire. At the other end attach some kind of two-pole polarized connector capable of carrying several amps, such as Molex 03-09 series. (The 03-09 connector is the heavier duty of the two common types found in most electronic stores). From the mating connector, run two leads to, and solder them directly on, the traces of the PC board. (Do not reuse the existing PC board connector). The lead carrying the "+" voltage from the bridge rectifier is soldered to the trace which goes to the positive connection of C702, the main filter cap. The negative lead is soldered to a trace near the other capacitor terminal.

The purpose of the connector between the diode and the PC board is to allow removal of the board without having to worry about polarity when reconnecting. That's all there is to it.

This modification totally removes the higher current of the 24V circuit from the small diameter pins on the original connector, as well as the heat-producing diodes from the PC board. A word of warning, however. While I believe that references to specific TTC pin numbers, wire colors, etc., are correct, please check your own translator manual for accuracy. And do check your work before applying power.

One other tip for these units. If you run into a situation where you've lost regulation of the 24V power supply or there is hum and other garbage on the air from the translator, check the main filter capacitor mentioned above (C702). We've had enough fail that I carry several spares in my "Translator Repair Suitcase"! The exact replacement isn't easy to find, but the last time I checked, Newark Electronic had them.

HARRIS TX TIP

Larry Schropp - Schropp Services Charlotte, NC

Here's a tech tip that may be of interest to some stations still running the old Gates (Harris) BC-IT AM transmitter. If you have problems with the intermittent loss of RF drive causing overloads or tube damage to the 833s (if the overloads aren't set right), the problem could be a dirty crystal switch in the oscillator section.

A FEW QUICK SHORTIES

Bill Jones - Broadcast Engineering, Charleston, SC

The little plastic spools that Solder-Wik comes on are great for carrying solder around in your tool kit. Just fold the outside back, wind the inner spoolful of solder and fold the outside back up to its original position.

Robin Cross - WNIU, Northern Illinois University, DeKalb, IL

The bat handle switch on Mosely STLs and other equipment will oxidize over a period of time if the switch is not "exercised." This oxidation can cause unnecessary down time. it would behoove every engineer with these, or other gear with switches that are almost never used, to exercise them during a period of time when their function is not critical to the station operation.

From Pete Deets - WFHR/WWRW Wisconsin Rapids, WI

The 12 V high current supply in our automation recently failed, but when disconnected from the brain, showed no problems. For a dummy load, I substituted an automotive headlight and a couple of side lights to total the 9 A normal load. It looked rather silly but it worked.

Rich Egan - WIZM-Z93 LaCrosse, WI

I recently encountered an interesting problem with our Marti BR-10 RPU receivers. We were having trouble with a lot of static and noise in some of our broadcasts, even though the signal strength should have been quite strong.

Our receivers are co-located in a rack with an older RPT-40-L transmitter, which contains a small cooling fan. Over time, the vibration from this fan caused some of the hold-down screws on the receiver circuit boards to work themselves loose. These screws not only hold the board in place, but also serve as a connection to ground. I snugged down all these screws and our signal problem disappeared.

RCA BTF-20E TRANSMITTER TIP

Rich Egan - WIZM LaCrosse, WI

Rich called this tip in a few days ago. He has an RCA BTF-20E transmitter and, from time to time, he found that the plate overload would kick out for no apparent reason. After inspecting and troubleshooting, he found that the shunt resistor across the PA overload relay had opened up. With the resistor "gone", the relay became more sensitive and would trip out on levels that normally would not have affected it. He replaced the shunt resistor, and operation was back to normal.

REPLACING S/A DIGITAL RECEIVER P.S.

Charlie Ryan, Littleton, NH

When ABC/Cap Cities decided to add Scientific-Atlanta's SEDAT it caused an already existing problem with my Scientific-Atlanta digital receiver to come to the forefront.

At first I thought the problem was the SEDAT card because the receiver would work in the old configuration, but not with the SEDAT card installed. We got hum in the 7.5 kHz card used for sports feeds. It turned out that the power supply for the audio section would not carry the extra load and ripple was causing the hum and buzz. Replacing the caps did nothing. A phone call to S-A revealed that they do not repair the supplies; they are considered a throw-away. Therefore, a new one was the only way to go.

The original equipment replacement supplies turned out to cost about $375. A phone call to Newark Electronics, had located Sola supplies that would work, and they were much less expensive. The Sola V 5 supply, type SLS-05-030-1, Newark stock #89F1266, was less than $50, and a Dual 15, Sola SLD-15-1515-15, Newark #89F1255, was less than $80.

The supplies arrived the next afternoon and were installed during the night. The 5 V supply bolted into the position of the old supply and required only a minor adjustment in the leads to operate. The 15 V supply did not fit into the card, but after I extended the AC, ground, + and - 15 V and 15 V common leads out the rear of the power supply card, terminated the wires in a 6 conductor Molex pair and mounted the supply on rails across the rear of the rack, the supply worked like a dream.

There were two bonuses. First, with the 15 V supplies mounted in the open air, the whole system ran cooler. Second, I was able to get enough supplies to replace both the receiver and audio chassis supplies for about the cost of one original equipment 15 V supply.

RAISE THE ROOF BEFORE THE BOSS DOES

George Whitaker - Editor

In my experience, I have found that there is one thing that will eliminate more transmitter problems than any other single thing you can do. That one thing is to KEEP IT COOL. A properly cooled transmitter will genuinely operate for years without failure and tube life can be astoundingly long.

However, of all the small market transmitters I visited during my years as a technical consultant, I only remember one that was properly cooled. Almost all of them had air conditioners in the building and yet it was hot in there. Why? Because there was only an eight ft. ceiling in the building.

When you have no air space above the transmitter, the hot air can accumulate and will remain trapped right down next to the transmitter blowers. Then, it is sucked back in to be heated again and then exhausted to begin the cycle all over. The poor air conditioner never has a chance to cool anything because the room air is being heated every few seconds as it cycles through the transmitter. I've seen quite a few air conditioners that would freeze up and be covered with ice while the building was sweltering.

However, if you put a ten-to-14 foot ceiling in the transmitter building, you can put a relatively small air conditioner in the building and still keep it very cool. I've used a 14,000

BTU unit in a building, with a tube-type 5 kW AM rig and kept it cool enough to be only slightly unpleasant for a human being. But we operated for years on the same set of tubes and I only remember being off the air one time in the last two years I had that site. If your transmitter is properly cooled, your tubes should still be shiny silver after two or three years.

In any event, if you raise the roof to a point that will allow for adequate ceiling height, you'll find that the expense of maintaining the site will go down.

TANGLED PATCH CORDS

Steven Priis - KFLQ, Albuquerque, NM

Our transmitter site was located 14 miles north of our studio, on top of Sandia Crest, on a mountain just over 10,800 feet tall. It's over an hour's drive, uphill all the way, to the site, and despite the fact that we are in the desert, not always a pleasant drive.

For that reason, I always try to bring anything and everything that I would possibly ever need: adaptors, meters, test leads, coax assemblies, etc., during our preventative maintenance, or other trips to the peak. It's very frustrating to need a cable, and know that you have one, back at the studio. Another point of frustration, though, is to have all those cables needed to connect the test equipment, and reaching back into the box to find everything tangled together, making all that stuff nearly useless.

The remedy I've found is to put these cables into heavy duty plastic zip-top freezing bags, one cable per bag. I use the new ones that have a place to label what is in the bag. I then stand the bags, on their ends, and look for the description of the cable I want. I pack these bags around other small pieces of test equipment, and I can now find any cable I want, without having to fight with a tangled mess. No muss, no fuss, and cheap. Another advantage of the labelled bags is that it tells me exactly what cable is misplaced. By the way, the box I pack these in is an old hat box from a suitcase set picked up at an old garage sale.

THE KEYPAD DOESN'T FIT THE BEZEL

Rhett Downing - KOWB/KCGY, Laramie, WY

We've experienced an above-average number of heavy lightning storms this summer in the Laramie Valley area. After one such evening I noticed that the diagnostic display did not always read out the channel that was addressed through the keypad.

After another series of storms I found that any attempt to address one of the diagnostic channels with the keypad netted a total carrier failure. Some basic trouble-shooting narrowed the problem down to the keypad and the microprocessor that it addresses. Every time the keypad was activated, the +5 DC supply would drop out. This, of course, shut down the transmitter.

However, no fuses would blow nor would any breakers trip out. I contacted Harris' Field Service and they confirmed my diagnosis of a short somewhere in or between the

keypad and the digital display PC board and components. At that point, I went ahead and ordered an entirely new assembly from Harris since we don't have the test equipment necessary to make the diagnosis. And, considering the fact that the heavy storm activity was in full swing, I didn't want to be without that diagnostic capability for any great period of time. That's when I encountered the second stage of the problem.

When I received the new display board/keypad assembly, the keypad did not fit the faceplate bezel on the front of the transmitter. And, that's not readily apparent (although the keypad's appearance is different -- the old style uses black keys with white lettering; the new one has white keys with black lettering and the surface area appears smaller) until you start to install the keypad at whatever o'clock in the morning.

I knew, at the time I placed the order, that the part number was changed and there was an Engineering Change Notice (ECN) bulletin that was internal at Harris. But the ECN made no mention of any modifications that were necessary. The keypad didn't fit and the only way I could make it work and make sign-on was to face-mount it on the faceplate bezel with four #4 self-tapping sheet metal screws.

I called Harris later on that day and found that there is an adaptor that is required also. Be advised, though, that no mention of that is made in the ECN bulletin and you won't know it unless you just happen to notice the difference in the keypads.

DIMMING LIGHTS

George Whitaker - Editor

Don't you just hate it when someone walks in and says, "If you plug it in, it might work," and they're right? We've all had that happen at one time or another. We have some days when we're absolutely brilliant and then we have those days when we couldn't be a proofreader at an M&M factory.

What causes me to be thinking about this is that I recently did something similar to a very good engineer in Florida. I was down there on a consulting job, went to the transmitter with the owner and found that the lights were dimming with regularity. The local engineer, whom I know by reputation and from seeing his work, is a very competent and really above average engineer. But he had convinced himself at the moment that the power company was doing something weird.

There are two things that I have found to cause these symptoms. One is when an air conditioner compressor locks up and the lights will dim as the unit tries to start the compressor. Then the thermal overload will take the compressor off-line and the lights will return to normal.

The other is when the tower lights get into the RF and vice versa. The tipoff is the frequency with which the events are occurring. The air conditioner will cycle every 30 second to a minute; the tower lights will cycle several times per minute.

In the case in question it became obvious to me within a few minutes of observation that it was the tower lights. We turned off the breaker to the lights and the dimming ceased. The lighting choke had probably been damaged by a lightning hit and was no longer providing isolation for the circuit.

REMOTE STARTING A RADIO SHACK CD PLAYER

Stu Englke - WWDJ, New York, NY

At our sister station we use consumer model CD players on the air with good results. The idea is that if one breaks, they're cheap enough to throw out and get a new one.

The problem was how to remote start them. We use a Radio Shack model and, upon investigation, of the Play button, I found that one side was at ground. So, all that was necessary was to connect the other side of the button to the console remote start logic.

Our console is an Autogram and supplies an open collector ground with an option for a start pulse or a continuous ground until the channel is turned off. With the Radio Shack CD players, I found that if you held your finger on the play button and tried to operate other functions of the unit, they were locked out. This meant that if I used the continuous ground from the channel on the console to start the player, the DJ could not accidently open the CD drawer, change tracks or stop the player until the console channel was turned off.

SKATEBOARD SHOPS HAVE MOTOR BEARINGS

J. D. Kimple - WMCD, New Concord, OH

While working on several cart machines, I noticed that the bearings in many motors were stamped 608Z. These bearings are the same size as -- believe it or not -- the bearings used in skateboard wheels. In fact, they're the same thing. The good part is that these bearings are available from any shop that sells skateboards and parts for about $1.50 to $2 each.

Yes, I did start tapering off skateboarding several years ago and have not been on one now for over three months. But I can hardly wait to teach my granddaughter in a few years.

The next shortie I must consider a Tech Tip, and it certainly qualifies as a "slapper". At any rate, R. Michael King of King Mt. Services, Ltd., of Frisco, CO adds the following to Bill Jones' "Solder-Wik Container as a Solder Dispenser" idea. He says:

KEEP YOUR DESOLDERING ACT TOGETHER

R. Michael King - King Mt. Services, Ltd., Frisco, CO

In regard to Bill Jones' "Solder-Wik Container as a Solder Dispenser" idea, you might try snapping your new solder dispenser on top of a spool with Wik still in it, you now have a one handed desoldering device ready at your fingertips. Pay attention to how you wind the solder. It must be in the same direction as the Wik or you will fight it.

I have to admit that I've gotten lazy in my old age and have subscribed to the theory, "Who needs brains when you've got software?" But sometimes necessity does bring out the best in thinking, and I have to hand it to Maynerd Meyer of KLQP-FM of Madison, MN. for coming up with a:

MAKESHIFT RPU

Maynerd Meyer - KLQP-FM, Madison, MN

When a local church decided to have an outdoor service in a park, a couple of blocks away, they asked if I had an idea how they could still broadcast their service on their local radio station. Normally, they just throw a switch, which puts a PA amp output into the telco system.

After examining the situation, I suggested they take the transmitter from their wireless hearing aid system over to the park (on 72 mHZ) and feed it with a tap into the portable PA system they were using in the park. I whipped up the proper cable to connect a hearing aid receiver into the PA system back at the church so they could use the regular telco hook-up to the radio station. It worked great and they were impressed; however, I'm not sure the "Big GM" upstairs gave me any extra points for helping them out or not. I hope so, I need 'em!

CATHODIC ACTION MIGHT BE CORROSION CULPRIT

Cliff Glasgow - KROP/KSIQ-FM, Brawley, CA

When I first arrived at KROP/KSIQ-FM, the uproar of the moment was over "corrosion" on the base piers of the self- supporting AM tower. The piers has been dug back and exposed, plus the concrete caps jack-hammered off one when I first got to look them over. My initial reaction was that the problem wasn't severe enough to justify replacing the supports, even though they'd been in the ground since 1946. My "gut" reaction was backed up by the report of a structural engineering consultant. Second, I did not believe that in an area with an annual rainfall of less than 2-1/2 inches and sandy soil that this was a rust problem.

After checking with the local irrigation and power company, I confirmed a local problem with "cathodic action". I even managed to locate the consulting firm that handled problems for the irrigation district. They confirmed that the high alkalinity of the soil contributed to the problem. The engineer explained to me that the problem is especially severe at the interface of soil, concrete, and steel.

Essentially, what you create is a battery, with the steel acting as the cathode, sacrificing to the anode (earth). Over time, depending on the efficiency of the battery and the "leads", the steel will give up enough iron molecules to become pitted and weaken. Where structures are completely buried, such as guy anchors, this can happen rapidly. One tower in our area collapsed a couple of years ago and cathodic action was contributory to the failure. If your soil is moist or if your tower is in an irrigated field, this can seriously exacerbate the

process.

When you know what you're looking for, it may be easy to spot this problem by eye. Most towers, guy anchors, etc., are galvanized. In this case, the zinc will sacrifice to copper ground wires or the earth. You might find dark spots and flaking wire where the zinc has completely eroded away and exposed the steel.

In damp climates, the steel will quickly begin to oxidize and you might find rust. Look especially close to where the steel meets the concrete at, or under, ground. If you have to, dig down to the top of the base or the anchor piers. In my case, I had a ground strap break loose from one of the base piers. When I put a meter on it to the pier, I could actually see, with the tower cold, a difference of better than 0.75 V and current flow of some 20 microamps without anything more sophisticated than a hand-held VOM and test leads.

Another handy indication of the propensity of your soil to conduct this way is if your chain link fences rust out quickly - in less than ten years. So how do you deal with it? The engineer who first brought this to my attention, Dennis Silver, PE, of Salt Lake City, has successfully used back-bias. He uses a simple battery, or one of the cheap, little DC power supplies available almost anywhere to balance out the cathodic flow. I opted to use the same method the irrigation and power companies all over the world choose -a sacrificial anode. These are commercially available, are relatively inexpensive (almost anything is, compared to the cost of replacing a tower), and simple to install. The anode is a magnesium slug in a sack of electrolyte and backfill and comes with several feet of #12 wire for attachment.

You can check with a local natural gas company or contact International Metal Company in Sapulpa, OK at 918-224-4746. IMC has at least one eastern outlet as well. The anodes come in standard sizes of 5, 10-12, 17 pounds and much larger sizes as well. The 5-pounders handled all four legs of my AM tower and three guy anchors of our FM.

CHANGING FINGERSTOCK ALMOST A FINGERSNAP

J. P. White - KWDX/KKAS, Silsbee, TX

I discovered some deteriorating fingerstock inside the PA socket of our FM transmitter and knew that I must replace it. I was forewarned of the difficulties when I read the article in RADIO GUIDE by Paul Black, CE, KMEL, San Francisco. He wrote "Repairing Fingerstock In Socket: It's No Thrill."

After thinking through the needed procedure, searching for a schematic (which was not to be had) and after many trips to Eddie's Hardware across town, I was chided for "Spending more time in preparation than it would take to correct the whole problem." As it turned out, they sure got that right. But for RADIO GUIDE'S article I would have tackled the job without all that preparation and I would still probably be trying to put the pieces back together.

With the help of my friend and trusty DJ, Mitch Day, and professional advice from my buddy, Doug Buffington, who knows all about carburetors, we proceeded to replace the fingerstock. The fingerstock is the second piece down from the top of the socket. The six 4/40x2 bolts are heads up, taps on bottom of socket. Consequently, all six bolts must be removed first in order to replace the fingerstock. The 50 or more small parts go wild on you, and trying to put them back in exact order within a space the size of a coffee cup is the

obvious problem.

First, we took one bolt out of the socket at a time and turned it upside down (head at bottom and nut at top). Then we reversed the use of a small turnbuckle, making a small "extender" and put it under the bottom plate of the socket to keep a small amount of pressure on the socket, then put a piece of tape on the heads of the six bolts (to keep them from falling out of socket).

Next, we took all six taps off, removed the top plate, removed the fingerstock, replaced the new fingers, replaced the top plate and put all six taps back on. Finally, we took one bolt out of socket at a time and returned it to its original state, head at top, nut at bottom. Complete overhaul was finished in one hour, thanks to being forewarned by Black, RADIO GUIDE, Doug Buffington and Mr. Eddie. I also appreciated the encouragement from our tube rebuilders at Econco.

DA DUNKING

George Whitaker - Editor

Shortly after constructing our new four tower array in east Dallas we had the biggest flood in 84 years. Three of my tower bases went under, as well as their tuning boxes. I switched to the auxiliary site and ten minutes later, it went under. But, that day and the next several are a story unto themselves. This item has to do with the aftermath.

As soon as the water receded I took everything apart, cleaned it, reassembled it, and spoke kindly to it about ignoring the effects of the dunking. Not having total faith in the efficacy of these actions, I turned my attention to "what if."

Being a DA-2, we have plenty of relay switching going on out in the ATUs. "What if" one of them began to hang up? Well, our Harris phasor came with an alarm that would begin the issue an earsplitting tone should the towers fail to tally. Although this is helpful in knowing why you are off the air, it has a couple of problems associated with it.

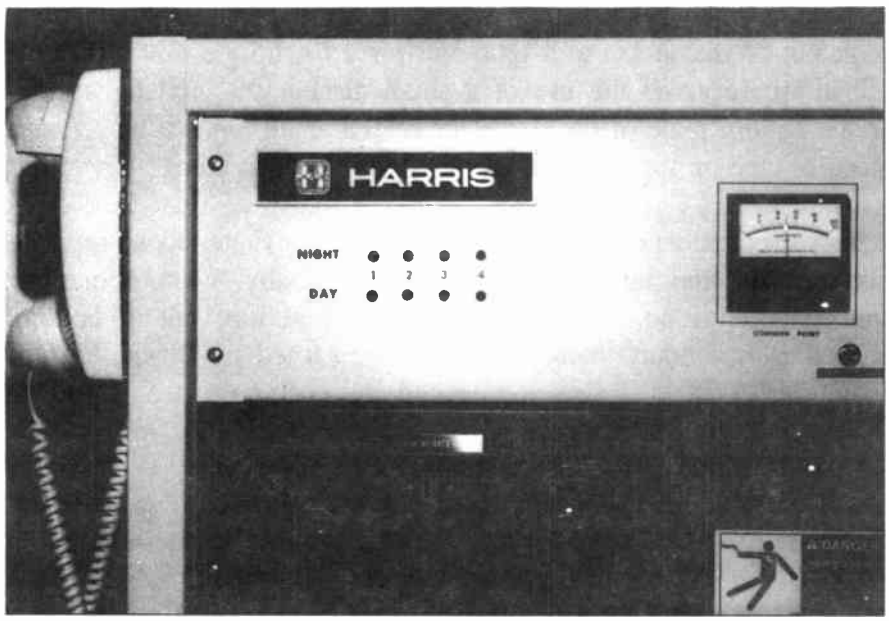
First, it doesn't tell you which of the four towers is hung. Therefore, you must go to each one. Murphy's law tells us that you will try all of the good ones first, whether you have a 2-tower or 12-tower array.

Secondly, there was no provision made for turning the alarm off and it would sit there screaming until you finally solved the problem. This happened to me once during the construction phase and was definitely an impetus in making the following alterations.

I decided that, having had a river water bath, the RF relays would be the most likely thing to cause trouble and, if this was true, then I wanted a tally light system that would show me where the trouble had originated. The photograph on the next page shows the upper left hand corner of one of our phasor cabinets where I mounted the tally lights.

The LEDs are mounted on a protoboard to match up with the LED holders I mounted in the front of the cabinet. Some rub-off letters completed the aesthetics.

Some years ago, Harris went to a standard phasor design where everyone gets the same book and controller. Therefore, what fits our phasor will fit most any Harris unit. So, if you have a Harris phasor, your schematic should look very similar to the portion of the schematic shown in FIGURE #1 on the next page. I limited the portion to only two towers since the wiring sequence is simply repeated out to however many towers you happen to have.



The actual connections are made to the terminal blocks on the floor of the phasor where the incoming control cables from each tower are connected.

The multi-pair cable going to the LEDs only has to be about eight feet long to make a neat "90 degree turn" type installation.

TAKE NOTICE of the fact that the same terminal blocks that have the 24 V tally circuit also carry the 220 V switching circuits. Turn OFF the breaker to the phasor before starting this project.

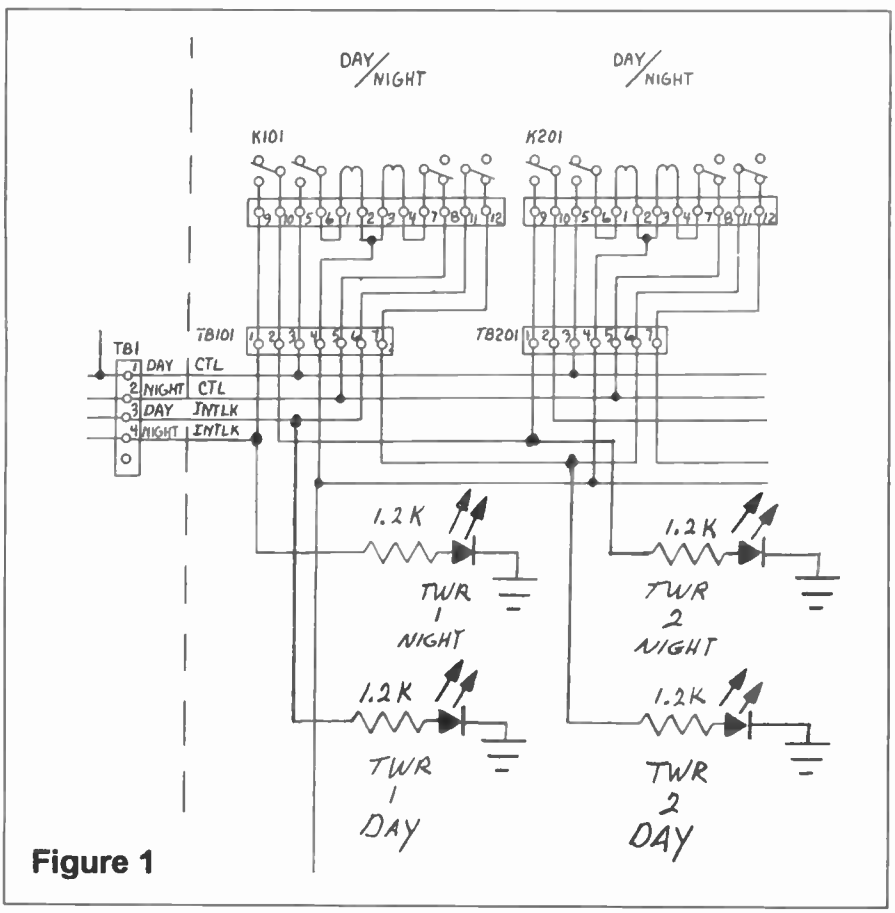


Figure 1

I didn't show them on the schematic for this article, but, you may have to add some small RF chokes in series with each LED in order to keep RF from causing a glow in them.

I found that my night power of 1000 W was no problem. However, at 5 kW in the day, the day set would glow slightly. This does not prevent them from doing their job since you can easily tell the difference if they light up completely. But, I went ahead and put some little Radio Shack chokes in series with the day set to get them to stay completely dark.

The installation does not require any alteration to existing wiring. All you have to do is add the dropping resistor and LED in front of each microswitch. If the switch is open, the current flow will be to the LED. If the relay locks up correctly, and the switch closes, the path of least resistance is on to the next tower and the LED stays dark. Therefore, if one or

more of the LEDs are lighted, the last lighted LED in the sequence is the tower that has failed to latch. IE: if LEDs 1, 2, and 3 are lighted, then tower three is guilty.

As it turned out, the Harris relays withstood the dunking. In the four years since, I have only had one instance of failure to latch and it was not caused by a relay. A wire corroded inside a crimp-on terminal and the resistance became too high to pass the necessary current.

CAMCORDER TO CATCH AN ARC

Tommy Messerli - KMJC, Davenport, IA

Our 816 R-4 had begun to arc occasionally and would trip the plate breaker. Sometimes it would be days, sometimes hours, between arcs. I had been at the transmitter when it happened so I knew it was actually arcing. But, examination did not reveal the spot. It never sustained an arc, just one quick pop and the breaker was tripped.

I couldn't stay there all the time, so, I took a camcorder to do the watching for me. It was set on its slowest speed and aimed into the back of the transmitter. It took a couple of trips out there to rewind the tape since I could only get eight hours at a time. However, the trick paid off. The transmitter arced and went down. I rewound the tape and looked for the location of the flash. It showed me right where there was a pinhole break in the insulation of the high voltage line to the final. The damage was hardly visible, but the camera doesn't lie. I repaired the wire and no more arc.

ODDS AND ENDS KIT

Paul Salois - KPCR, Bowling Green, MO

My kit contains a six foot length of regular zip cord, about 20 feet of 3-conductor shielded audio wire and a ten foot piece of 20 gauge hookup wire. Just wind each length around your hand and secure with a stout rubber band. Probably the most used item is a bundle of clip leads (Radio Shack #278-1156 or 278-1157).

My kit also includes one or two each of 1/8" and 1/4" phone plugs, male and female mic connectors (without the shell), and a 3 prong adaptor for AC plugs. There's a package of adhesive labels for identifying wires, a pencil, a cheap pocket knife, a magnifying glass, a small disposable flashlight, a disposable cigarette lighter and a roll of electrical tape.

I've assembled this by recalling some of the items I really needed in the past. You may have had similar experiences. Feel free to add or subtract as you see fit. Remember, this is not to replace your regular tool box, but to supplement it and keep it from getting too cluttered.

Actually, I have two nearly identical kits. I keep one in the trunk of the company sedan and one under the seat of my family station wagon. I don't use them often, but when I do I feel real smart for having thought of my kit.

Hank Landsberg, President of Henry Engineering in Sierra Madre, CA informs me that the company has come out with a field modification to "digistor" units that were shipped prior to Aug. 24, 1992. Henry makes some really neat things in little boxes. But, even good things can sometimes be made better as we see in this:

DIGISTOR UPDATE

This is a simple modification to the Digistor unit that will improve its audio clarity and reduce background noise. Follow these instructions carefully:

1. Remove the unit from the case by unscrewing the four corner screws.
2. Refer to the users manual and locate the "play Level Adjust" on the Digital Audio Storage Board. (This board is the smaller PC board.)
3. Turn this control fully counter-clockwise, then turn about 1/6 turn clockwise. The slot in the small blue "knob" should line up with the "1" in "VR1" that is printed on the board.
4. Refer to the manual and locate R-10 on the main (large) circuit board. Replace this (100 K) resistor with a 39 K resistor.
5. Reassemble the unit. This modification will reduce the background noise by about 10 dB. For additional information contact the Henry Engineering office.

MOTORBOATING IN A MARTI R-10

C. J. Jackson - WSPA AM-FM, Spartanburg, SC

On the AM side of our stations, we had been having a low level, low frequency motorboating noise appearing in the on-air audio about once every two weeks or so. It could only be heard on cold voice -- just enough to keep the air staff mentioning it to me every so often.

After a couple of months of trying to trace this intermittent noise, it finally appeared and stayed. The problem turned out to be in our AM STL receiver, which is a Marti R-10. On the 890-960 mHz converter module board, the local oscillator crystal is socketed next to a temperature control module, and on our units, a small piece of styrofoam covers this part of the board. Marti secures the crystal against the temperature control module with a small band. This band had lost tension.

At our AM site, the STL receivers are mounted in a rack next to the main transmitter, and the vibration from the blowers was enough to cause the crystal to vibrate it its socket and produce noise in the audio output. A small rubber band around the crystal and temperature control module solved the problem.

Marti uses the same arrangement to temperature-stabilize many of their oscillators. I have never experienced this phenomenon with any Marti RPUs, but if you have a microphonic problem like I've just described, this may be a solution.

KILLER CONTACTS

Vince Edward - WBGM 99FM , Tallahassee, FL

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 routine 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 to the side of the PA box.

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

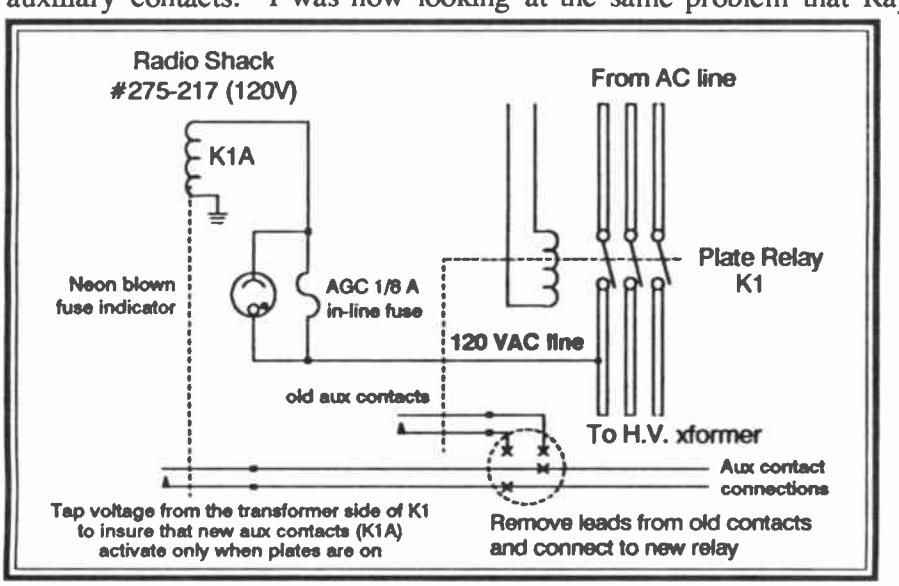
Upon Ray's arrival we rewired the final and replaced the tube socket. (We had lots of fun; you should have been there.) Time to revive the patient again. Filaments on ... wait two minutes for the ready light ... plate on ...#&*!#. Now what?

Power output was well below normal for low power. We tried high power, with a slight change. Nothing else had blown up at this point, so we decided 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 our hair out. 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 cigarettes for the day. Just then, Ray got up, looked down at the transmitter and calmly walked in 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 of the PLATE RELAY (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 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.



The retro-fit circuit shown will eliminate the "Killer Contacts".

TELEPHONE WIRE COLORS

George Whitaker - Editor

Let's take a look at telephone wiring codes. First of all, in a two wire system utilizing standard "I" wire (for indoor), there are four conductors. Red and green constitute a pair, and a black and yellow constitute a pair. Line #1 will always be on the red and green pair and line #2 will always be on the black and yellow pair. In the event you have a single line with something like an old style speakerphone or light arrangements in the phone that requires an external power supply, the black and yellow pair will always be the power carrying pair.

Sometimes it's necessary to make conversions between 6 conductor phone wire and standard green, red, black, yellow; or in rare cases, red, green, black, yellow, blue, and white. The latter is rare and I have personally only seen it a couple of times. The first conversion is quite often necessary to wire phone jacks or extend older wiring with new.

THE CONVERSION TABLE IS AS FOLLOWS:

RED = blue with white trace	GREEN = white with blue trace
YELLOW = orange with white trace	BLACK = white with orange trace
BLUE = green with white trace	WHITE = white with green trace

TIPS FOR THE SONY CDK-006 CD JUKE-BOX

Art Reis - WKBM Barden Broadcasting
Coal City/Wilmington, IL

The Sony Juke-box has been making its way into automation systems across the country for some time now, but its addition to your stations equipment lineup may be greeted with some concern on your part. Oh yes, this neat looking little "bread box" may be the model of efficiency, but what if something goes wrong with it? There are NO controls whatsoever in sight on the thing, except the one that opens the door (and you quickly learn that doing that at the wrong time may be detrimental to your career).

In the back there are obligatory audio output jacks and a 37-pin D connector for interfacing with the automation system -- usually through some sort of interface box supplied by the automation manufacturer. If there truly was a black box in the broadcast biz, this is it!

So what do you do if something goes wrong with this beast? What about regular maintenance? Sorry, the book won't help you with this one. The most useful information in the CDK-006 manual is how to set up the unit from shipping mode, and how to return it thereto. Beyond that, the book dwells mainly on the subject of how to set up an automation system to tell the juke-box what to do. There is no troubleshooting information and the only routine maintenance information is on lens and slide rack cleaning.

The first item is easy. I use a small straw or coffee stirrer to blow warm, moist breath onto the lens, and a small Q-tip to swab off the thin film of moisture (and accumulated crud) from it. I prefer not to use lens cleaner since i am not sure what deleterious effects may occur to the coatings on the lenses. After all, this is the most sensitive part of this, or any other, CD player.

On the second item, the word is simply to use a cloth dipped in alcohol to clean off the

track bar in the back of the unit. DO NOT LUBRICATE THAT BAR -- EVER! Just keep it clean and the unit will do its job happily.

But what if the juke-box does break down? We ran into that situation at WKBM after a particularly wicked lightning strike. Since this thing is dubbed a "juke-box", we played a hunch and called our friendly neighborhood juke-box emporium. No, they couldn't help us directly, but they sent us to the people who could: the "local" Seeburg repair shop.

I talked with someone there and, within minutes, we had arranged for delivery and repair of our units. I'll admit right now it wasn't cheap, but our juke-boxes were pretty well fried by that lightning strike, and there were available (at our option) circuit updates to install. These would improve on the operation of our units, so we had them put in as well. The cost? About five-hundred dollars for repair, and five more for the updates to the two units.

There are things you can do to see how well a sick juke-box is working. As inscrutable as it may look from the outside, the CD juke-box does have controls on the inside. To do that, just remove the two screws on either side, the one one on the top back holding the top down, then lift the cover off. You will see a mother board mounted along the back wall, with nine switches on the top right. One of them marked power is not operational. The "play", "stop", and "pause" switches are the usual bill of fare.

NT, PT, ND, and PD stand for "next track", "previous track", "next disc", and "previous disc", respectively. Using those four buttons, you can actually program the juke-box manually to go to, not just the next disc or track, but to several discs and tracks up and down the line. For example, push the NT button five times and the system will advance five tracks on the disc. The repairing technician thus has a means of determining if the internal logic system of the juke-box is working.

By the way, that ninth button, when pushed, starts the system with track-1 of the first disc and continues in sequence right up to the last track on the last disc.

This form of testing, however, doesn't tell you how well off the actual circuit in the juke-box is functioning. Nor does it tell you anything about any possible problems within the automation-supplied interface box itself.

Actually, my experience indicates that there are more potential problems with the automation interface box than with the juke-box itself. On our interface circuit, we would, without exception, lose a "chip" during electrical disturbances. (That's how we found out we needed more lightning protection).

Now here's the vital info for that repair station depot: Seeburg Regional Service Center, 1200 N. Arlington Heights Rd., Itasca, IL 60143 (708)773-6037. They are not an authorized Sony service rep but they do fix the CDK-006 for some 7000 clients in the US, and they actually helped design the unit. At the moment. there is no one better equipped to repair them.

BTF-20 OFF THE AIR

Mark Tomlonson - WMUK, Kalamazoo, MI

Recently, WMUK was off the air for 10-1/2 hours because I put my faith in two assumptions: 1. Meters on the front of the transmitter will steer you in the right direction and, 2. Objects at rest will stay at rest.

WMUK uses an RCA BTE-20 transmitter. When I arrived at the site, the PA

overload lamp was lit. Turning the high voltage back on, caused the plate current and plate voltage meters to deflect, but not (and here's where I made my first mistake) the driver cathode current or PA screen voltage indications.

Both of these are fed from the same low voltage supply, so the investigation started there ... and stayed there for 10 hours. The contactor was replaced, and the tube socket was torn apart, trying to find the "low voltage supply problem." It would have been continuous work, were it not for the interruptions from the studio.

Almost as a desperation measure, Randell Kells, my assistant, decided to open all the doors and bypass the interlocks to check for arcing and sparks as the transmitter overloaded. When we opened the high voltage cabinet, we found that the cable for the grounding stick had shorted against the high voltage rectifier stacks, grounding and overloading the high voltage supply.

This cable was inspected three weeks ago and was nowhere near the stacks. Since there is not a lot of vibration in the cabinet or major temperature changes, I surmised that spring-tension of the cable had pulled itself over to the high voltage stacks.

Because I was getting some deflection on the high voltage meters, I assumed that all was well in the high voltage cabinet. I was misled because the high voltage overload relay was activating before the low voltage contactor.

I offer this as a reminder of two things: 1. No amount of meter indications and schematics can substitute for a complete visual inspection, and 2. Abandoning assumptions is the most difficult aspect of troubleshooting.

PCL-606 CAPACITOR REPLACEMENT

Don Mussel - Broadcast Engineering Services
Mouth of Wilson, VA

If you are responsible for the care of any Mosely PCL- 606 STL systems, that are over four years old, take note. The power supply in the transmitter has a 7200mFd, 25 volt capacitor that can fail without warning and make you scratch your head trying to figure out what went wrong.

The symptoms: No power output, all LED indicator LED's are lit green, and PA current half of normal.

The cause: The electrolytic has opened up in the variable DC supply to the 5 watt power amp., dropping the voltage to 4.5 volts -- and power output to zero. Replace this capacitor, and the others in both the transmitter and receiver, at four year intervals, and you will save yourself an embarrassing failure during drive time on Friday.

This solution reminded me of the fact that I have replaced somewhere around 500 capacitors in the last year at various stations, in various equipment. Most of the equipment is anywhere from new to ten years old, and the electrolytics are by far the only failures I have experienced lately.

I was visiting a friend's two-way repair shop back in January and casually looked at one of the radios on the bench. I half-jokingly told him the problem was probably the big filter capacitor on the top. He checked it (after spending two hours looking elsewhere for the problem) and found the capacitor shorted. Problem solved!

MARTI TSL SYSTEM RETROFIT
8 kHz FILTERS REDUCE TSL INTERFERENCE

William Collindres - Marti Electronics
Cleburne, TX

An FCC Rule Part 74 TSL, transmitter/studio link, is a valuable tool for the broadcaster. It allows him to bring back remote control data or voice quality audio from the transmitter without using the valuable main channel subcarriers. Also, if the main transmitter goes off, you can still have control over the remote control when using a TSL return link.

The major problem with a Part 74 TSL, or "P Channel", is that there are only 8 channels available for use in the US for all 10,000+ radio stations and 1100+ TV stations. That means that there is a lot of overcrowding in that band in most medium to large markets. The over use of the "P Channels" can cause some problems when several stations are crowded in together, geographically.

Many times a TSL receiver will work great for years until someone turns on an adjacent channel transmitter. The adjacent channel could then cause interference with the existing channel and corrupt the returned remote control data.

Marti Electronics has been supplying Part 74 "P Channel" TSL systems for quite some time and has encountered the interference problem more than once. Although there is no cure for someone being on your exact channel, other than cross polarization of antennas and the hope that they are aiming their transmit antenna away from you, we can help with adjacent channel problems.

Normally we ship out TSL systems with 25Khz filters in the receivers. This allows for maximum deviation on the P Channels and is an easier system for the average engineer to maintain.

If you have a Marti TSL system and are getting adjacent channel interference and since you are an above average engineer (you are reading Radio Guide, after all), there is a cure for the interference.

You can retrofit your existing system with 8kHz filters that will only hear your channel and reject adjacent P Channel interference. The 8kHz filter will reject a channel just 10kHz away and properly clean up any adjacent channel interference.

The procedure will require re-tuning the TSL transmitter to its exact frequency, cutting the deviation slightly and re-tweaking the distortion in the receiver.

The cost of the 8kHz filter is based on a 1/2 price exchange of the filter for your particular receiver. If you want to have us to the work, it will be the 1/2 price exchange and a $35.00 service charge.

THE THIN GREEN LINE

Art Reese CE - Satellite Music Network
Mokena, IL

For those who've spent the last year in the Sahara, several people who consider themselves real audiophiles (including a couple of SMN staffers) actually swear by putting a green permanent marker line around the inside and outside edges (only) of the compact disc.

NOT on the flat surfaces, just on the edges -- the thin plane.

Does it work? It does seem to clean up the sound enough for the virgin ear crowd (including some of your listeners?) to notice on their high priced stereo systems.

Why does it work? Well, think of it as a form of optical multipath, with an assist from the principles of fiber optics. In the case of the compact disc, not only does the laser light go through the disc and bounce off the aluminum back to be retrieved by the sensor, it also propagates through the disc and bounces off the inner and outer edges of the disc, also to be picked up by the sensor.

There are two ways of eliminating the problem: The first is to round off the corners on the edges of the disc, a practise not recommended for consumers, but already done by some recording companies in their disc construction. The second is the green line on the edges. The red-end spectrum absorption powers of the green marker almost eliminates the propagation of stray laser light back to the sensor, and that's all it takes.

Listening tests were conducted on two identical compact discs, one treated with this "green line" method and one without, by Stardust Manager Dave Allison at the SMN studios. The results have been convincing.

SERVICING AGING ITC 99B CART MACHINES

Art Reese - CE - Satellite Music Network
Mokena, IL

As the ITC 99B cartridge machine heads into its 15th year of production, we are beginning to discover some of the weaknesses to which age subjects them. Since our particular units here at Satellite Music Network are presently pushing 8 and 9 years of pretty much dependable and continuous service, we are encountering anomalies which we have not seen before, and for which there is not (nor could there be) mentions in the service manual.

1. Solenoid residual magnetism: We've discovered two versions of this malady. In the first, the solenoid plunger becomes magnetized, which manifests itself in an inability of the pinch roller to retract completely at the end of play. In the second instance, the entire solenoid becomes magnetized. In our case, it was causing the pinch roller to intermittently lose full contact with the capstan, causing a lot of tape "wowing" and time stretching on the air! We discovered the problem with a magtometer although a non-magnetic, steel screwdriver would have done the same thing. In any event, a good healthy treatment with a bulk eraser (we used Garner 105 for such assignments) solved the problems of magnetized solenoids quite handily.

2. Solenoid resistance: It is a good idea to include the measurement of solenoid resistance in your quarterly or six-month PM of your 99B. Replace the solenoid if the resistance approaches 55 ohms, since, at that point, the solenoid will no longer draw the proper current and solenoid operation may become unreliable.

3. Deck Plates: If you start getting unreliable solenoid action no matter what you do to make it better, then it may be time to replace the deck plate. The reason is that the cross-shaft bearings wear out and replacing them in the field is almost impossible.

Besides, if the machine has had that much use, the deck plate itself has already had grooves worn in it by the many thousands of carts which have been inserted and removed

from the cart machine. When you order the deck plates from ITC, be sure to specify if the deck plate is for playback only. A-type record, or B-type record unit. The prices vary widely, since there is a difference in what needs to be added to bring the machine up to current specs. A nice side-effect is that you will find that phase error from cart to cart is reduced with a new deck plate, since all carts will then rest on a true perpendicular surface with respect to the head.

4. False cue-up: The cart stops in mid-operation, or goes into fast forward. The source of this problem can be a number of things. One of the biggies is head noise. A pole piece can develop a noisy internal connection, the result of which then makes the microprocessor think that its receiving a cue tone of any sort from the tape. The check for this is to monitor the cue output amp on the 50-pin control plug. We've found that anything worse than - 40 dB output with a blank cart is cause for replacement. Typical noise levels are in the -47 to -49 range.

The cure is to either turn the head over and swap it for the left channel pole-piece (only in a pinch, until a new head can come along) or get a new head.

The second biggest source of false cueing is usually the head leads. Replacing them is the cure, of course. In a pinch, soldering the wire-to-pin connection (which is not done at the factory) will usually end that problem -- at the cost of the shrinkage of the vinyl insulation. Surprisingly, the rest of the audio path (the audio and control cards) are the parts of the system least likely to cause problems. (All bets are off if there have been lightning problems with the machine in the recent past).

The wise 99B owner usually has a spare microprocessor on hand for such contingencies. However, replace the TLO72 cue amp IC on the audio card first, then the filter ICs on the control card before replacing that expensive microprocessor, just in case.

CONSOLE BLEED

Tim McCartney KBSU BOISE, ID

I have found Broadcast Electronics consoles to be quite popular, probably due to their good quality, reasonable price, and strong customer support. Thus, I have had occasion to work on a few.

An intermittent problem has occurred on two A150 series consoles. Since BE uses the same input and line amplifier boards on most of its models, this advice might be pertinent to other consoles as well, such as the S350 series.

The problem is that the unwanted audio leaks into one of the two program lines, even though its input channel is not switched to program. Sometimes this bleed-through can be attenuated by moving to another source, the delegation switch controlling the unwanted audio.

Of course, this is not an appropriate solution. BE's customer service dept. suggests several simple procedures to resolve such a problem.

INPUT CHANNELS: BAD FETs

First, one input channel circuit board at a time is pulled. If the problem is cured, then the trouble is unique to that board, with bad output FET the most suspicious component (Q6, Q7, Q13, and Q14).

Another indication of defective FETs is a large VU meter "pop" when switching between program and audition on an output channel.

If just one FET is bad, it can affect all of the console input channels. Thus, the culprit component could well be on any input board, not necessarily the one through which the unwanted audio is routed.

LINE AMPS: BAD CAP

If the bleed-through does not appear to be related to any one input channel, the next place to look is in the program mixer-line driver amplifiers. Or, it may be better to try this step first, because just two such boards are used.

If the problem is limited to one program channel, a simple swap of the amps demonstrates whether or not the bleed-through follows. If so, the suspect component is the 1 uFD capacitor (C8) on the driver input. The part can be changed, or an oscilloscope can establish if any DC is present at the capacitor and/or console output.

DC - DAYLIGHT

The worst problem with intermittents is that the bleedthrough may not occur at the selected moment of attempted repair. Thus, it's possible that a final resolution will take from DC 'til daylight.

GARAGE-DOOR REMOTE

A REMOTE CART CONTROL FOR THOSE IMPORTANT TIMES

George Zema, Engr. Supervisor - KFRC
San Francisco, CA

It's happened to all of at one time or another. You're walking through the station and there's dead air. You scurry to the studio and see the jock arriving at the same time. It seems Mother Nature called and he or she thought there was enough time to get the job done and return to the studio before the song ran out.

Here's a device that will allow the jock or weekend board operator to leave the studio, for whatever reason, and still be able to start the next cart. It's all based on something that almost everyone has used, or will use -- a garage door opener.

You'll need to find a store that will sell you just the receiver, its power supply, and a remote control; otherwise you'll have to buy the whole package, motor and all. Each receiver is different in how it talks to the outside world, but, ultimately, you're going to want a dry set (normally open) contacts.

Some will be at a barrier strip on the receiver, and some will need to have wires attached to the solder pads on the circuit board. You may need to cut a trace that supplies the voltage to the motor's relay through the contacts of the receiver's relay. Again, what you want are the dry N.O. contacts.

Some units have a plug-in-the-wall transformer that supplies the necessary 24 VAC, and some have the transformer on board. It's best to have the plug-in type because you'll be burying the receiver in the ceiling, and it would be better to run a low voltage there, than 120 VAC.

Find a centrally located spot where you can put the receiver. Ideally, it should be hidden above the ceiling tiles, if they're easily removed or replaced. Wherever you put it, remember that you'll be running wires from there to the studio, so make it easy. The N.O. contacts go to the remote start pins, either at the cart machine, or, in the case of our Pacific

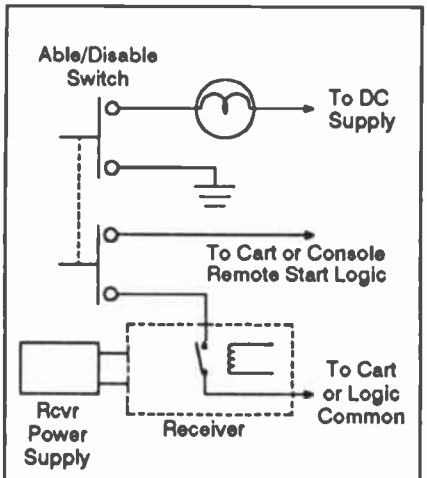


Figure-1
Garage Door Remote

Recorders console, at the logic connector at the back of the board. These connections can be made in parallel with your normal start connections. Doing it this way, allowed us to take advantage of the timer reset circuitry at the same time.

The receiver's 24 VAC power supply is powered by a plug strip located at the console area. Run wires from the power supply to the receiver. As with the N.O. contacts, you may find a barrier strip that will accept the 24 VAC, or you may need to solder directly to the pads on the receiver board.

For our installation, I took the wires from the N.O. contacts and the 24 VAC, and terminated them into a Molex connector so, if need be, the receiver board could be taken into the shop for repair. Next, you'll need to pick up some DC to run the Able/Disable lamp that's part of the alternate action switch. The Able/Disable switch prevents accidental starts.

Load cart. That cart's pot MUST BE UP! Yes, that seems elementary, but you'd be surprised. Press the Able/Disable button. When the cart BEFORE this one starts, that's when you can leave. Take the garage door remote with you and, when you hear the song end, press the remote control which will start the cart. Upon returning to the studio, release the Able/Disable button.

Before committing to a receiver location, temporarily hook up a cart machine and go to the different places an operator may need to go. This includes going into the bathrooms, sitting where they'll sit, and trying the remote control. Go to the lobby, the shop, master control -- in short, every conceivable spot in the station.

You'll want to know how far from the receiver they can be so that there are no surprises. If you're having a problem with carts not cueing, take care of that before you install this system, since the previous cart's pot will still be up. Murphy's Law will guarantee a cart will run through while the jock is ... indisposed.

If there is no house PA system at your station, and there are no plans to get one, buy a little portable radio that they can take with them when they leave the studio. We use this system for record-to-record transitions and NEVER out of a network newscast. Yes, it's tempting to think you are going to get five minutes plus a three minute record, but you can count on the network to feed an unannounced frequency response test 30 seconds after the newscast ends. One last thing: It couldn't hurt to use Teflon coated wiring for your ceiling runs. This should easily satisfy most local fire codes.

We've been using this system at KFRC for almost four years, and the only failures were caused by the operators either not using the Able/Disable switch or not having the cart's pot up.

SURGE PROTECTION

Chuck Condron - Condron Broadcast Engineering
Salt Lake City, Utah

I am a contract engineer for several stations in Salt Lake City, Utah. One station's transmitter (KMGR-FM) is located on Lake Mountain which is very rocky. We used to go off the air almost every week due to major power bump/lightning related problems. We greatly reduced those problems by upgrading our ground system.

In the beginning, we had two wimpy ground rods at the base of our FM tower and one wimpy ground rod at the service entrance. Both ground rods wiggled, as the ground is so rocky and doesn't hold the rod in the ground very well. We contacted Lightning Elimination Consultants (formerly Lightning Elimination Assoc.). They advised us to use "Chem-Rods". Each Chem-Rod is a 6' X 3' hollow copper tube in a "T" shape with a 3' diameter. The Chem-Rods are filled with copper oxide type chemical that "leaks out" from various holes and chemically treats the ground to help the "groundness", as I put it.

We installed seven of them basically forming a circle aroundour building--including one at the tower, one at the service entrance, and one at the power pole. Each rod is connected to the other rods with 3/4" copper tubing and are all common to the station ground straps and power company ground. The addition of all this copper and chemical treatment has greatly improved our "ground" and reduced our surge problems to about two a year as opposed to one a week!

We also have a 3-phase surge suppressor in parallel with our 3-phase AC line on the power pole side (made by Wilkinson). Our Mosely MRC-1600 has MOVs on the status and analog inputs as well.

At KOOL-FM in Phoenix, my partner Charles Brentlinger of Brentlinger Broadcast Engineering, uses a Lightning Elimination Consultants "Surge Eliminator" SE-series surge suppressor. It uses a series-parallel system. After we installed it, KOOL-FM experienced a huge reduction in surge related problems.

SATELLITE RECEPTION

Neal Arman - WPTT-TV
Pittsburg, PA

Is the dish round? After sitting in the weather for any length of time, most earth station antennas begin to warp. To test your dish, cross 2 pieces of string across the dish. One string should go top to bottom, and the other, left to right. At the point where the two strings meet, there should be almost no space between them. The larger the gap, the more out of round the dish is. Depending on the type dish, normally a retightening of mounting bolts can fix this problem.

Is the feedhorn in the right place? The formula used to determine feedhorn location is quite simple.

First, measure the distance across the dish (don't take the spec sheet's word for this even a 1/4 inch is a big deal). Now measure the depth of the dish.

Next, square the diameter, then multiply the depth by 16. Finally, you should divide

the squared diameter by the result of the depth times 16. This is the theoretical focal length of your dish.

Are you using a LNB with a polarization device? Most of these devices have at least 1dB of insertion loss.

For very little, you can replace the feedhorn with a dual-port horn and two LNBs and gain back that 1dB. Remember that 1dB could put you over the threshold of the receiver.

How rusted is your feedhorn? After a few years most feedhorns suffer some corrosion. Don't bother cleaning and scraping; a new feedhorn can be had for under $75. If it shows any sign of rust, replace it. The rust causes the surface to be uneven, and you will see cross polarization problems.

Are you using LNBs or LNAs? If you're still using LNAs, it's time for a change. The consumer market has driven the satellite market for years, and all the technology is in the LNBs. By using LNBs over LNAs, you can pick up the loss you have in that 100-foot run of cable.

Is your dish on a polar mount? Polar mounts make life a lot easier, but they do have problems. If your dish is not sitting right on True North (check the FAA for magnetic vs. true compensation degrees for your area) the arc will be off slightly, and the dish will not perform to specs. Remember it's been moved a thousand times and been through hundreds of wind storms.

A look at all the basics will make your dish work like it should. Don't forget to check all the little things like RF fittings. A little rust can kill reception. Also take a look around the dish. Trees and wooden fences hold water during and after a rain and can degrade your reception.

FM-10K "AUDIO" PROBLEM

Tim Raymer & Doug Waugh - KMSU-FM
Springfield, MO

We recently experienced a hairy problem with our Harris FM-10K transmitter. We use the Harris MX-15 exciter and have had very good service out of these units since the installation in 1986. Recently, a problem developed that had us climbing the walls for days. An audible whine had developed on soft passages. Eventually, through troubleshooting, we isolated the problem to the transmitter site.

Upon firing up our back-up transmitter, the noise disappeared entirely. We pulled the exciter on the main and patched the back-up transmitter's exciter to our main transmitter and headed back to the studio.

The exciter performed perfectly on the test bench. Back to the site we went, for more tests. Once again, we hooked up the MX-15 and, once again, the problem appeared.

This went on for some time before the problem was found. The coax supplied with the FM-K series, to connect to the exciter output, is a piece of RG-213 coax with two type-N connectors. Since the exciter has a BNC female for an RF output, Harris supplies an N-to-BNC adaptor for the connection. We replaced the lead with another RF test lead, and the noise disappeared. Our solution to the problem was to replace the RG-213 with RG-223, which is double silver shielded RG-58 sized coax. We terminated it with silver plated

connectors - one N, and one BNC ... no more problems.

Upon further investigation, the type-N connectors on the factory-supplied RG-213 were found to be loose. Tightening should do it, if you have no aversion to adaptors. Another solution proposed by Kevin Brooks of KZIM, was to replace the BNC on the MX-15 with a type-N connector.

Check your RF leads in your transmitters. It may save you a lot of grief.

MORE ON DATACELLS

Tom Lange - TECS Electronics
Kohler, WI

The saga of dealing with the SMC datacells is never ending. It would appear that these things can be patched together forever, thanks to readily available CDS photocells. I have been replacing the broken photostrips with these photoresistors with success.

I have been using a 5-pack of Radio Shack stock #276- 1657 which, until recently, have been all the same type. Although now a mixed variety, most are even smaller, which will make replacement easier. You may want to subject the cell to the light from the lamp to get an "on" resistance measurement. Most of the cells I have been using will render approximately 50 ohms with the lamp on. This would result in a theoretical insertion loss of about 0.67dB. The name of the game here is to find photocells small enough to fit two in the datacell case.

Pull out the old strips (or remaining bits and pieces) and solder the leads of the CDS photocells to the exposed terminals. You will have to position the cells to avoid shorts, etc. If the existing insulating material hampers reassembly, remove it and apply clear tape to the inside of the cover. Good Luck!

OTARI TIP

Greg Hahn CE - WRKA
Louisville, KY

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 tension springs. Rotating in the other direction could be made too easily. It was very hard to cue 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

Marvin Fiedler - KCOR
San Antonio, TX

AT&T has a modular plug-in telephone RFI filter. It eliminates most RFI problems on single phone lines. 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 a mike, speaker, AC cords, phone lines, coax cables, computer ribbons, etc. It is item #273-104.

HAND HELD TUBE CHECKER

Andrew Bell - WBIN
Benton, TN

It was 6:00 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 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.

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 all the tubes, and may even seem a little "off-the-wall", I can say from experience (luck), that it worked for me.

MISC TIPS

Steve Weber - KGRV
Winston, OR

A POKE IN YOUR EYEBALL

Late one evening, while vacuuming the old RCA, a red-hot speck of metal soared out

of my oscillator, and crashed into the glass lens protecting my eye. The AC circuit breakers had all been flipped off, except for the crystal oven breakers. The 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.

TRANSMITTER TIPS

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, also due to loose crystals in 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 the plate-on. The bias undervoltage relay, rated at 2.05 volts, requires 2.49 volts, thus the PA bias voltage must be maintained carefully. Time 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.

TONE TEST OSCILLATOR

Steve Hnat - Hnat Hindes
Thompson, CT

Many broadcasters today are taking advantage of telephone frequency extenders. Along with these devices, is the necessity for spot frequency checks at 1kHz and 4kHz, 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 on the next page.

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 either be 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 plus or minus 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.

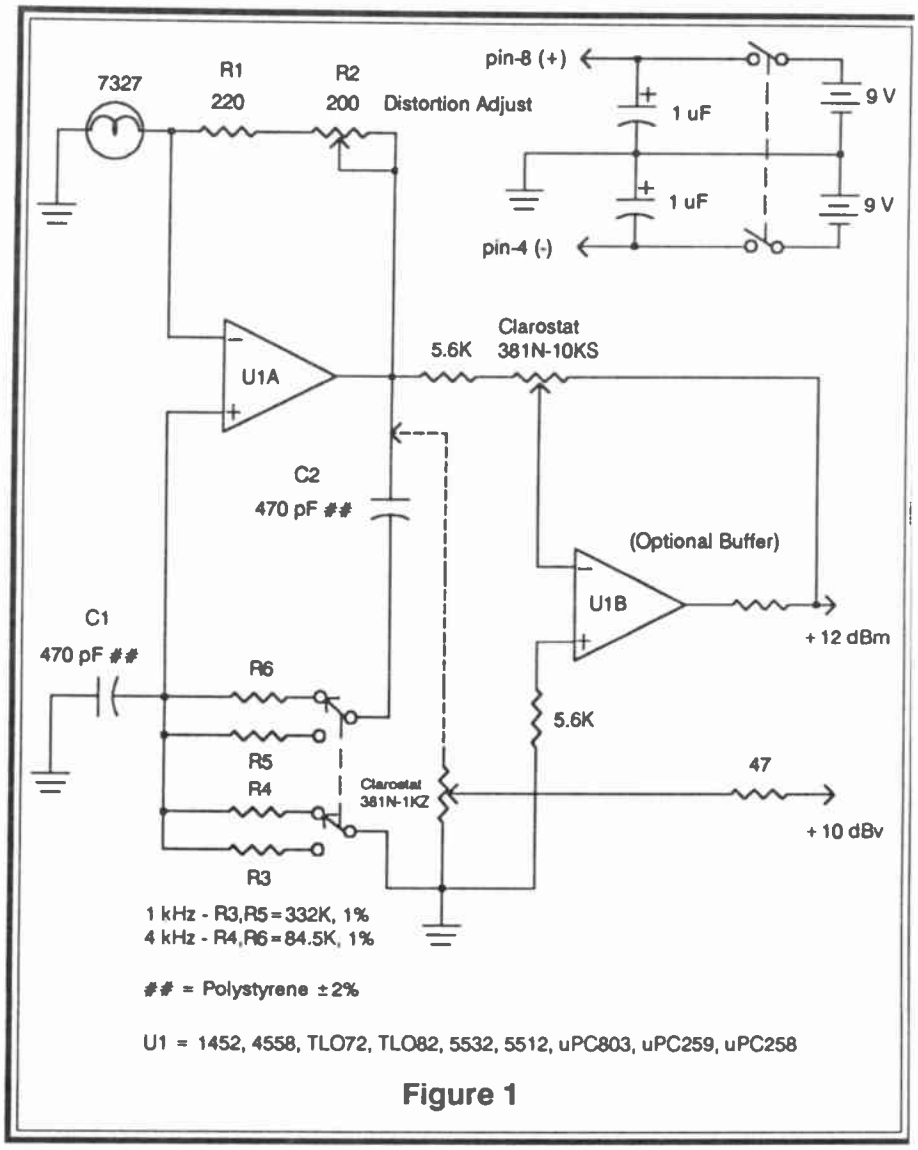


Figure 1

CIRCUIT SPECS

Max Output (with driver) - +12 dBm (600 ohms)
THD @ +12 dBm = 0.05%
Freq. tolerance = ± 1.8% @ 4 kHz = ± 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.

CD PLAYER CLEANING TIPS

T. Alan Dickerson - KTQQ
Sulphur, LA

As a lot of stations experienced, CD's are not the perfect animal we were led to expect. 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 the CD was played in.

The reason I asked 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 the note for 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 during a 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 disc, 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 disc comes in contact with the disc. Mine has a little rubber gasket that can use 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.

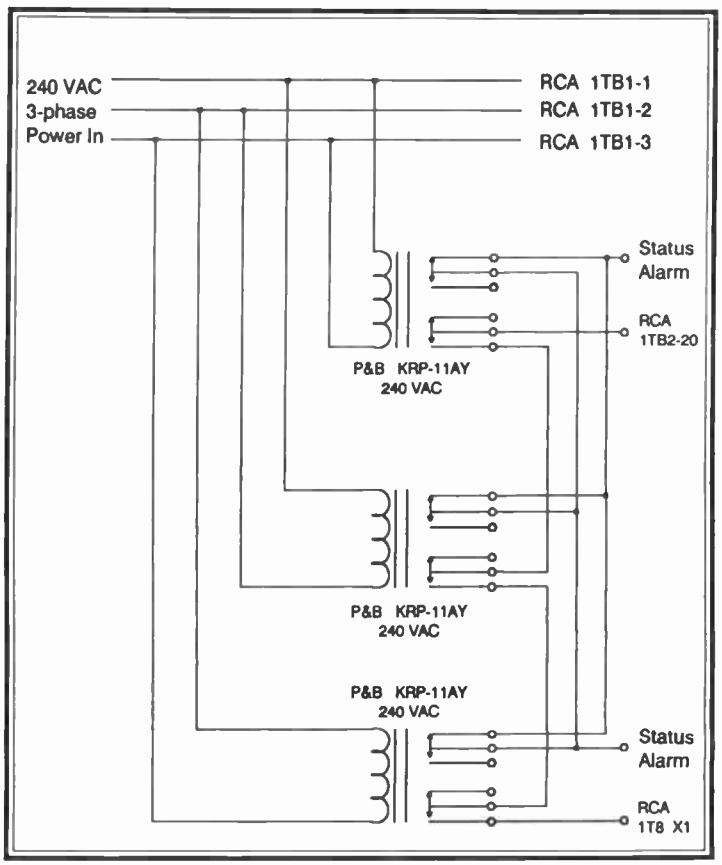
To end the saga of our CD problems, we have given up on our home-style Technics players, and are currently using three Denon cart CD players. The basis behind these is that they keep the user from touching the disc at all. They perform really well, and stand up to the user's abuse. Time will tell if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

TRANSMITTER AC POWER PHASE LOSS THREE PHASE LOSS PROTECTION

R.V. "Bud" Stuart
Susanville, CA

Here's a drawing on how I have provided protection and a 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

Allen Sherrill - KQKQ/KKAR
Omaha, NE

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 tape.

These problems are usually traceable to the solenoids which control the pinch roller

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.

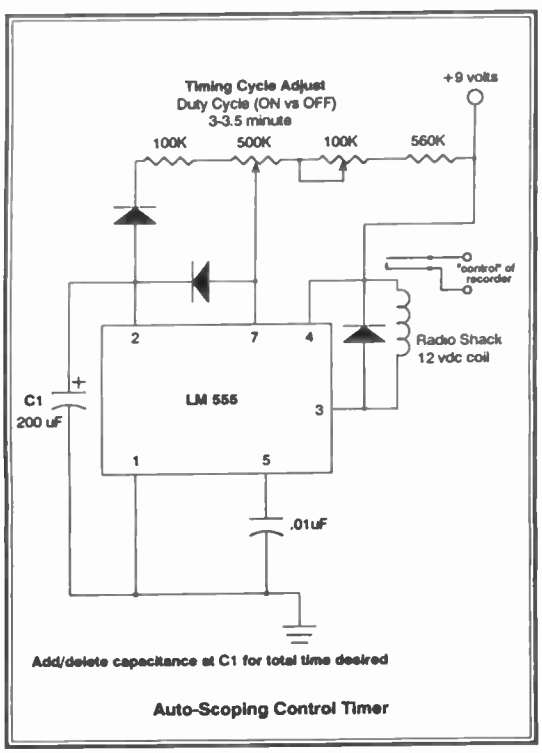
TECHNICS SP-15 TURNTABLE SPEED CONTROL

Recently I repaired a Technics SP-15 turntable with an intermittent speed control problem. When the start button is pressed, the unit would run at what looked like 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. Resoldering the joint restored normal operation.

AUTO-SCOPING CONTROL TIMER

Frank Hertel - Newman-Kees Measurements
Evansville, IN



Auto-Scoping Control Timer

Hook "control" output of the timer to the "remote" jack on your boom-box or wire in series with motor voltage. Tune boom-box to desired station, and press "record" button on boom-box. Boom-box will record approximately 30 seconds out of every 3.5 minutes that the box is on.

MARTI RPT-30 TECH TIP

Eddy Carrell
Marti Electronics Cleburne, TX

A common technical question we get here at Marti concerns the input level adjust of the RPT-30 transmitter.

If you have ever purchased a new remote microphone or headset sports mike to use with your RPT-30, and all of a sudden had more microphone input level than before, with visually no control over the input level, there is good reason for that happening.

RPT-30 microphone input was designed around a typical output mike level of -68dB. However, newer mikes, as well as many of the newest headset mikes have an output of -50dB. Since the input pot is 25K linear taper, it can only handle about 10dB of extra mike input. A mike that's 15 to 20 dB hotter than the circuit is designed for, causes the mike preamp to overload and distort when the pot is barely opened.

If you are using a newer style remote mike or headset mike with high output, we have a cure for this annoying distortion. The solution is to permanently pad the input to the mike preamp with a handful of 2200 ohm resistors.

This will require you to use a preamp board (800-251) from the RPT-30 chassis. First, remove the knobs and hardware from the four level control pots on the front panel. Here is the tricky part: The Neutrik mike connector has a small hole near the center, in addition to three pin receptacles. This hole contains a tiny locking mechanism. Use a small (.075" wide) flat blade screwdriver, insert the tool into the hole and turn it slowly until the screwdriver engages the connector lock. Go slow and use care, or you will break it! Turn the screwdriver counter-clockwise about 1/8 of a turn until the mike insert releases. Do all four connectors then gently push the black plastic inserts out of the metal shells while simultaneously pushing the gain adjust spots inward until the board releases from the front panel. Now you can remove the board and change the resistors.

The resistors in question are 570 ohm 5% and are numbered R2, R3, R9, R10, R17, R25, and R26. Replace these with 2200 ohm resistors of the same tolerance. This will give you a 10 dB pad from overloading with a hotter mike, yet will still allow you to use any of your lower output mikes without penalty. Now reinstall the board and be careful when you lock the Neutrik connectors so that you don't break the lock mechanisms.

SQUEAKY (CLEAN) CD

Keith O'Brien - WJRH Easton, PA

Many of the consumer lens cleaning discs are not worth the money. Most of the time they will not remove all the grime from the lens, and the brushes can even knock the lens out of alignment. A more effective way to clean nicotine build-up, and the like, from the lens is to open the player up and gently remove any contaminants with a cotton swab and rubbing alcohol.

Constant handling of CDs by DJs can cause severe scratches that cause the disc to skip on the best of players. One of the best ways to remove a scratch is to use toothpaste or car polish (any very mild abrasive will do), and a gently buff out the scratch with a lint-free cloth.

Be sure that, when you're buffing, you are moving from the inner radius to the outer radius of the disc. Don't buff in circular motions! Although this method is not foolproof, it will remove many scratches that you encounter.

If you wish to clean your CDs, don't try to use the consumer CD cleaning kits. A quick and easy way to clean a large amount of CDs is to fill a bucket with water and add a small amount of a mild dish detergent, such as "Ivory". Take one CD at a time, duck it under the water and rub it gently with your fingers (once again, no circular motions). Remove the disc from the water and quickly dry it with a lint-free cloth. Don't worry, the water will not harm the CD.

TRANSMITTER TIPS - FALSE READINGS AND BLOWN RECTIFIERS

Russ Erickson - RF Product Mgr.
Broadcast Electronics

When doing troubleshooting on a transmitter, remember that the volt meters on the front of the transmitters can sometimes be deceiving. This is because the sample voltage derived to drive the meter is taken prior to entering the PA cavity. The first time it happened to me was on an RCA BTF- 10E, but it could certainly happen on just about any grid-driven tetrode PA.

There was an indication of screen voltage on the front panel multimeter. The problem was, the voltage sample was taken prior to entering the PA. So, although I was getting a meter indication, there was no voltage getting to the screen. The only way you could verify this is by taking the voltage measurement at the feed-thru cap going into the PA, after ohming out the circuit from the screen grid to the cap to insure continuity.

It can also happen on the grid bias supply. You have probably noticed the change in the state of the grid bias with and without grid drive. For example, on a 30kW transmitter, the bias can change from -200 volts to -250 volts with drive applied. If you notice no change in the grid bias between filaments-on and plates-on, there is an open circuit after the point where the grid bias voltage is sampled.

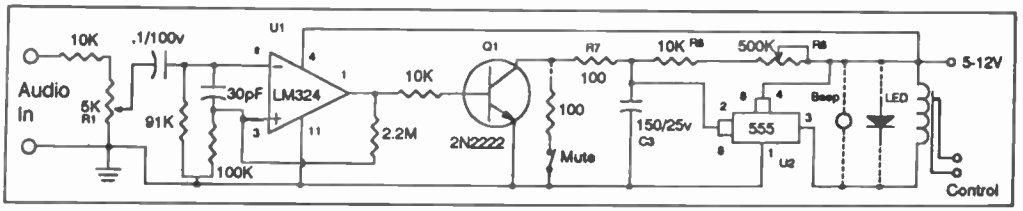
Always take your scheduled filament voltage readings at the base of the tube socket, as recommended by the manufacturer. If your transmitter does not use a true RMS reading iron vane filament voltage meter, you could inadvertently adjust the filament too high or too low, causing the tube to decarburize too rapidly, or to become a "getter", where the filament becomes poisoned by contaminants. Always try to maintain your filament voltage within +/- 3% of the nominal.

Do you know what is inside those large rectifier stacks (large epoxy sealed blocks with solder or screw terminals)? Picture a series string of diodes with a resistor and capacitor in parallel with each diode (for RC compensated rectifiers). That's it! The manufacturer then puts that assembly in a shell and fills the shell full of epoxy.

If their voltage rating is exceeded, they will usually blow a hole in the case at the ends of the rectifier. If there is a hole blown through the case at the center, it generally means the current rating was exceeded. This may help you determine if you have an AC line problem (peak voltage exceeded), or a transmitter power supply problem (excessive current draw due to a short).

LOSS OF AUDIO ALARM
A CIRCUIT FOR DEAD-AIR DETECTION

David Woodcock - WNWC Madison, WI



Sometimes an operator at our station may be doing production work in another studio while a taped program is being aired. This operator may be the only person on duty and may not know when there is "dead air" from a mechanical problem with a tape machine or a splice, causing a tape machine to stop.

I have built several of these alarms to put into the production studios. The input to the circuit is fed from the output of my modulation monitor. That way, it detects audio loss from any cause.

R1 adjusts the gain of the alarm circuit. This sets the turn-on threshold of Q1. U1 is a quad op-amp. (A741 or 748 can be used, but you'll need a negative voltage with these.) Q1 is any medium gain NPN transistor and acts as a discharge path for C3, through R8 and R9. This adjusts the delay time of the alarm.

U2 is a 555 timer which turns on when C3 reaches two-thirds of the supply voltage. You can also add a mute switch if you are going to use a beeper alarm, by adding a 100 ohm resistor connected to the collector of Q1 and going to a switch with one side connected to ground.

An LED, beeper alarm, or relay may be connected across pins 3 and 4 of U2.

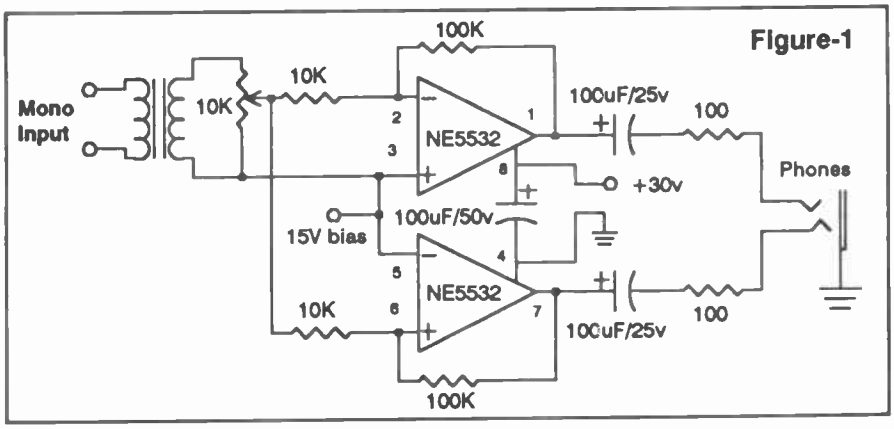
HEADPHONE AMPLIFIERS
INEXPENSIVE HEADSET AMPLIFIERS USING 5532 OP-AMPS

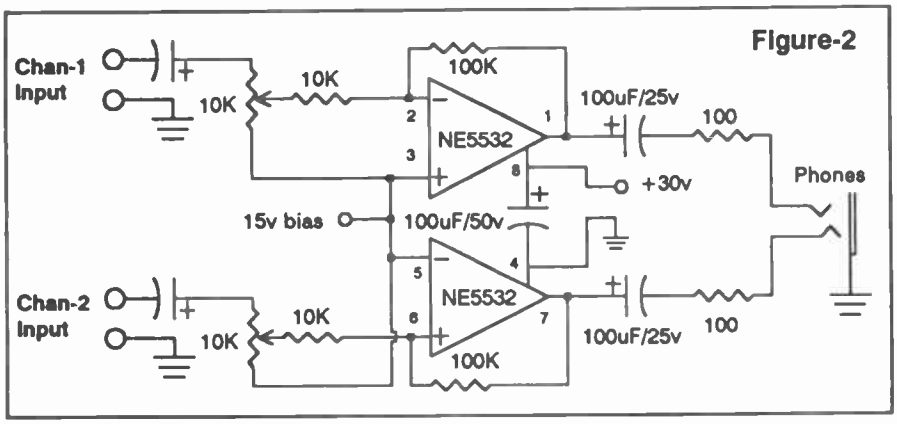
Hal Schardin - WCCO Minneapolis, MN

A couple of years ago, WCCO was looking for a multiple headset amplifier. Many times WCCO will take a program on the road, and it is necessary to provide headsets for announcers, guests, producers, and engineers. It is also necessary for each individual to be able to control his or her headset level.

Initially, the output of a PA system was bridged to promote the headset feed, but on some remotes, the level would also get ducked to prevent feedback. Also, separate 8 ohm pots tend to get noisy real quick.

For most remotes, 600 ohm phones are used. Little real power is needed to drive these headsets, as the transducer is next to the ear -- and today's "cans" are much more efficient than their predecessors.

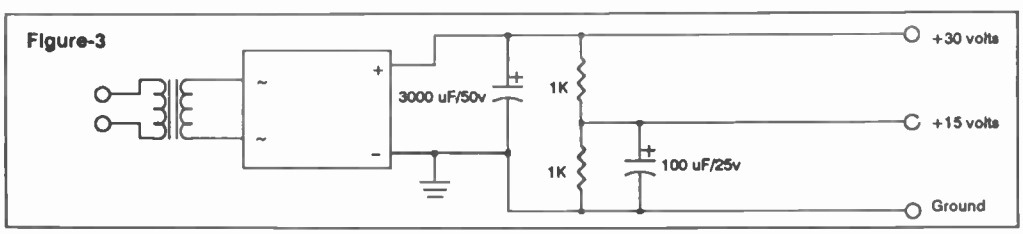




Now I hear a lot of you saying the NE5532 was never meant to be a power amp. Yes, that's true, but I say the proof is in the puddin', and we have not had one of those chips fail yet. The 100 ohm resistors in series with the outputs limit the current, should a mono plug become inserted into a stereo jack (they also limit the level to low impedance phones.

Figure 1 shows a mono setup using a transformer to take a balanced input. This is the setup we have used a remote locations to provide for headset back-cue. Yes, you can use an op-amp to provide active balancing. However, I've encountered better common mode rejection with a transformer, in this sort of application.

Figure 2 shows a stereo unbalanced setup. There is very little real difference between Figures 1 and 2, so you should be able to figure out a balanced stereo or unbalanced mono configuration.



I've shown the power supply circuits I've used. I've used an existing 24 VDC supply in one application (the only need was to generate a VCC/2 point for bias). The AC supply shown in figure 3 was used to power five headset amps in the remote application mentioned earlier.

MOTOR MAINTENANCE TIP

Don Price - WRNS Kinston, NC

Have you ever had trouble keeping motors running smoothly and quietly? Here is a tip that works well, especially on motors with bronze sleeve bushings such as Tapecaster and others.

Disassemble the motor and thoroughly clean it with a good solvent. Then you can use a product called "Trufoil" (trade name), which was developed for combustion engines. The product contains PTFEC (Fluon), which suspends itself in oil and coats the moving parts. This product comes in 8 oz. bottles and is available at "True Value" hardware stores.

Mix 1 part "Trufoil" with 5 parts regular oil, such as 3-in-1 or equivalent, and apply a few drops to bushings and/or bearings in your motor.

I have used this on many motors and have found that they run smoother and quieter with less heat.

TFT-760 S/N

Ken Wilson - KVLU Beaumont, TX

Not only is our studio located in a campus building that screens out all AM signals, our EBS monitoring assignment is 20 miles away. Because the 760 is a little susceptible to lightning, and for aesthetics (there's no overhead wires on campus), a tuned indoor loop seemed to be the best choice. Even so, there was barely enough signal to turn on the carrier light.

The audio was full of birdies and howls that virtually drowned out the monitored station. The racket was originating in the divider chain of the two-tone generator and, to a lesser extent, from the receiver's synthesizer.

After trying the usual bypassing tricks, with no luck, I thought the problem might be a ground loop. The 760 two-tone generator has two grounds: the power connector and the front panel. It is the same for the receiver, with the addition of the antenna connector. With the unit operating, I removed the screws holding the front panel of the two-tone generator and gently pulled it away from the chassis. All the birdies disappeared! Floating the front panel of the receiver eliminated the rest of the noise (a sort of deep warbling sound).

This fix involved a mask around the back of the two front panels and replacing the original screws with nylon 4-40s. Now I have a clean, clear signal.

POPPING RECEPTION

John McDaniel -WKZI Casey, IL

I had a problem that I could not solve for over a year and finally found a solution. Our satellite receiver is located at our transmitter site about 1/2 mile east of the city limits. Every time the wind would blow from a certain direction, we would get a popping sound on

our ABC satellite reception. I changed the power supply, checked all the lead-ins, and even had the local electrical co-op check for loose connections several times.

I finally realized that we had left a piece of coax on our tower when we had installed a new Marti antenna and coax. We took the old piece of coax down and the popping noise was gone.

MAGNETIZE OR DEMAGNETIZE

George Whitaker - Editor

Most engineers, even rank beginners, realize that working with magnetized tools around tapes and tape machines can have very undesirable consequences.

I regularly demagnetize the tools I use by taking the cartridge bulk eraser and erasing them just as you would a cartridge. Turn the eraser on, move the tool up to the eraser, slowly withdraw the tool to arm's length, and then release the button on the eraser. This will remove the magnetism from the screwdriver, pliers or whatever.

If you desire to magnetize a tool, simply lay the tool on the eraser, turn the eraser on and off about 3 times, and you will have a magnetized item.

CART BEARING TIP

John Hunter - KBRE Cedar City, UT

Why spend valuable engineering budget to have cart motors rebuilt at $150, when you can do the work yourself with locally available parts?

All you need is a small wheel puller to remove the bearings from the shaft (available at a local auto parts store) and bearings that you can buy from the same auto parts store or bearing supply house.

For motors made by Japan Servo (SMC, ITC, etc.), you may be able to use Federal Mogul/Bower BCA bearing #38-SS or suitable cross reference. For UMC Beau motors, a larger diameter unit is needed. You may be able to use part #R6-CC. You can rebuild all the noisy motors in the plant for $20 to $30 each!

BATTERY TERMINAL PROTECTION

George Thomas - WJDX Jackson, MS

Mr. Hartwell's article in January Radio Guide was right on track. It brought out many items that require periodical attention on stand-by generators.

Here's a tip that my father always uses to prevent battery terminal corrosion. Remove the terminals from the battery posts. Clean and coat both terminals with a thin layer of axle grease; cover all metal surfaces completely. Replace the terminals, and tighten them securely,

and cover them with grease.

This prevents air from getting to the metal and thus inhibits corrosion. Do it to your car battery too. It'll save you a lot of unnecessary post cleaning and terminal replacement.

CART LOADER

Fredrick Fess - WLRB/WKAI Macomb, IL

To reload carts, use an old reel-to-reel machine. I use an old Viking that must be about 50 years old. I took all the electronics out of the machine and, since it was so mechanical, it was very simple to adjust the tension for the cart tape.

I then set it up horizontally on the bench, put a seven inch reel of cart tape on the supply side, and the cart spindle on the other, threaded the tape to the cart spindle, and put the machine in play while starting a timer. With the machine running at proper speed, and with some practise, I was making carts within one second of the desired time.

CD TEST TONES

Marty Acuff - WZLX Boston, MA

Here's a time and personnel saving tip that automates an oscillator for proofing phone lines, tape machines, etc.-- without the big cost of a programmable oscillator.

Use a programmable CD player with a suitable test CD, such as the Denon or NAB test discs. Just program the machine to play the desired tracks in any combination of sweep and/or step frequency runs, S/N tests and so on. Set the CD player to continuously repeat the selected tracks.

Using a prime CD player with dual D/A converters or broadcast grade outputs, you can rival the quality of a good audio oscillator.

This is a great way to transform a two-man operation into a solo project, liberating your staff to do more constructive things than "babysitting" an oscillator!

ITC TERTIARY SLOWDOWN

TERTIARY RELAY CAUSES CART DECK SPEED PROBLEM

Paul Black - KMEL San Francisco, CA

When we built our new studios, we included a 120 VAC warning lamp in the control room, that comes on with the tertiary tones from the cart machine. We're all cart, so before a song or spot comes to an end, the lamp flashes to wake up the jock.

There's nothing special about this idea, but we came up with a strange symptom -- the

carts would "wow" briefly while the tertiary tone was active. Sometimes you had to listen pretty close to hear it, but we have one operator whose ears are pretty sharp, and he continued to swear it was happening.

The circuit is simple. We use ITC Deltas and all that happens is the relay in the machine closes a circuit, with 24 VDC on it, to ground, pulling in an external relay that turns on the light. The tones on the carts are usually bursts to make the light flash. The music carts are usually bursts, and those were the ones getting written up.

We finally took one cart, played it in audition on the air board and patched it down the hall to the production room so we could hear it without disturbing the jock. Sure enough, it "wowed". Typically, at the start of the tone too.

We pulled that Delta out of the air control room, took that cart, and set the whole mess up on the bench with an external relay and power supply to simulate the circuit.

Yes, it did it there too. Not only that, it did it on the spare Delta, and with various carts. It was head scratching time. A call to ITC didn't help much; they had never had any similar complaints. We were on our own.

Mystified, I was sitting there playing with everything, making the relay click, when I noticed that the digital VOM would flip its display every time the relay was pulled in. The VOM was set to a low DC voltage range, and the leads were laying across the wires going to the relay. I turned on the 'scope, put a probe near the relay wires, and turned on the tone. POW! A spike the size of Mt. Everest was on the display. That was it! Inductive kickback from the external relay coil was getting through to the TTL chips in the machine, via the internal relay, causing the servo motor to "burp" every time the tone came on.

I've used this circuit in several installations, but never with a machine that had so much digital control inside. Obviously, suppression was necessary.

The answer was a cap/diode across the coil. I called ITC and told them they might want to include a note in the manual, warning that external relays should be spike suppressed. I also fused the 24 volts to the coil in case one of the component shorts, to keep the house 24 VDC supply from failing.

We also have a new policy that all relays get a suppressor on them -- just in case.

CSI 25 kW TUNING

Paul Black - KMEL San Francisco, CA

It's common knowledge that the proper way to tune a grounded-grid triode amplifier is to dip the plate current, peak the power output with the loading control and, when you achieve as much output as you can, run the tuning control slightly past resonance (the "dip" point) so you get a little rise in output with only a slight increase in plate current.

However, if you're running a CSI 25 kW rig, circulating current inside the final cavity has a nasty habit of finding an unwanted path to ground. When this happens, the breaker in the primary of the plate transformer usually goes, which means a trip to the site to reset it. Here's a tip that seems to work with our rig. When you tune it up, run the loading control a little ways past the power output peak in a clock-wise direction, and keep the dip on the plate current just barely on the high side of resonance. I was told that, the theory is, this reduces the circulating current inside the cavity to the point where the chance of arc-over is lessened.

Our rig here at KMEL seems to prefer its tuning and loading set up as stated above. It certainly arcs a lot less when adjusted this way.

PROTECT YOUR METER

Eric Chromick - Waynesville, OH

Most DVMs and analog meters don't come with a hard case, and it's a hassle to carry spare leads, batteries and fuses around. Radio Shack's #44-1101 "Deluxe Storage Mailer" works well. If you have a large meter, or want to keep a handful of small tools from bouncing around in your briefcase, the U-matic video tape cases are great.

It takes a few minutes with a wire cutter and/or a knife to chop out the hub locks. Then you can line the case with a little spare foam, and you have a case that will hold your meter, leads, etc., and takes a lot of abuse.

H.V. STACK CHECK

Henry Hoffman - WLRH Huntsville, AL

Here is a little elaboration on an idea that ran several months ago in Radio Guide: To check any high voltage rectifier stack use a 100 watt light bulb series with a 1N4001 (or similar) diode and a 120 volt AC line.

Disconnect the stack completely and place it in series with the light bulb and diode combination. If the leads are hooked in one direction, and the lamp lights, yet when the leads are hooked in the reverse direction, the lamp does not light - the stack is probably good.

If the light is on when the leads are connected in both direction, it could be a shorted stack. No light with either connection may mean an open stack.

MOSELEY PCL-606C MOD

John Stortz - WKES St. Petersburg, FL

At WKES, we've found the Moseley PCL606C to be a reliable STL - we're using four of them. One problem has developed when attempting to record the receiver signal level at the remote transmitter site. After a power failure (we have lots of them), the 606C comes back up monitoring the audio instead of the desired RF level.

A footnote on the schematic of the metering and status board lists how to fix this. It recommends cutting or drilling the PC board to alter the preset configuration of U2. Since U2 is mounted in a socket, we simply removed U2 from the socket and bent pin #1 out of the way so that pin #1 did not go back into the socket when U2 was reinstalled.

By altering the preset in this manner, the board is not disturbed and all presets are still available without cutting or soldering the circuit board. Any of the other presets may be achieved in the same manner.

TASCAM 122 EQ FIX

Steven Herbert - KCRW Santa Monica, CA

Over the years, I've observed the frequency of our aging Tascam 122 and 122-B cassette decks gradually decline, occurring in the reproduce mode at the high end.

After a year or so of adjustments, the EQ pots were set at maximum. Replacing the heads typically would bring the machine into specification with little or no headroom. Replacing electrolytic capacitors, suspected of drying out, did nothing and all the transistors in the circuit were operating as specified in the service manual.

Finally, replacing the EQ pots themselves brought the high end up and gave back some adjustment range on the pots. Replacing an R20 (part #5280004002 from Teac) yields an increase of 4-5 dB at 10 kHz on average. It appears that the tin coating on these metal variable resistors began to corrode over time.

Our cassette decks are within a mile of the Pacific Ocean in a suburb of Los Angeles; both factors that probably accelerates the aging process. A shot of contact renew and lube may bring the old pot up 1 or 2 dB but for our money, it is better to replace them outright.

CONTACT CLEANING ALTERNATIVE

Joe Schloss - KICD Spencer, IA

On page 16 of the December issue of Radio Guide, in the article Gold and Grungy -- a point of caution.

Some of the erasers have sulphur compounds in them, and will eat the plating away making the problem worse. A better way may be going to the store and getting some Scotch Brite. It comes in different "roughnesses". If you combine this with some Cramolin R-2, you can't beat it. Don't rub real hard, or you will remove the plating, thereby throwing the tolerances off.

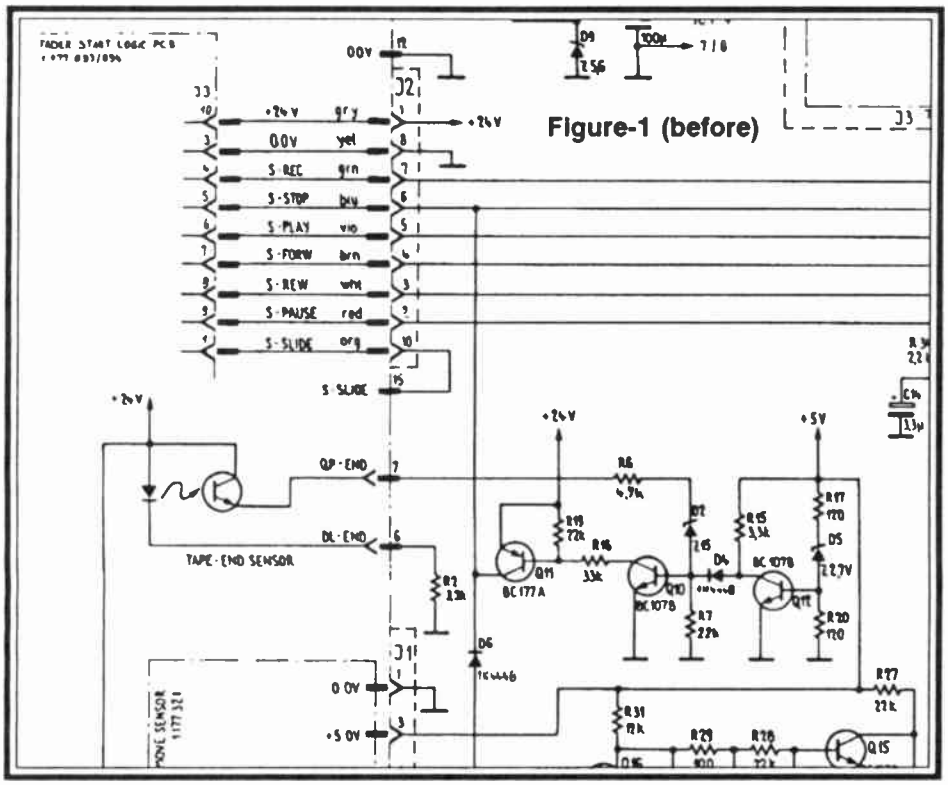
REVOX PR-99 RECORDER TAPE SENSOR MOD.

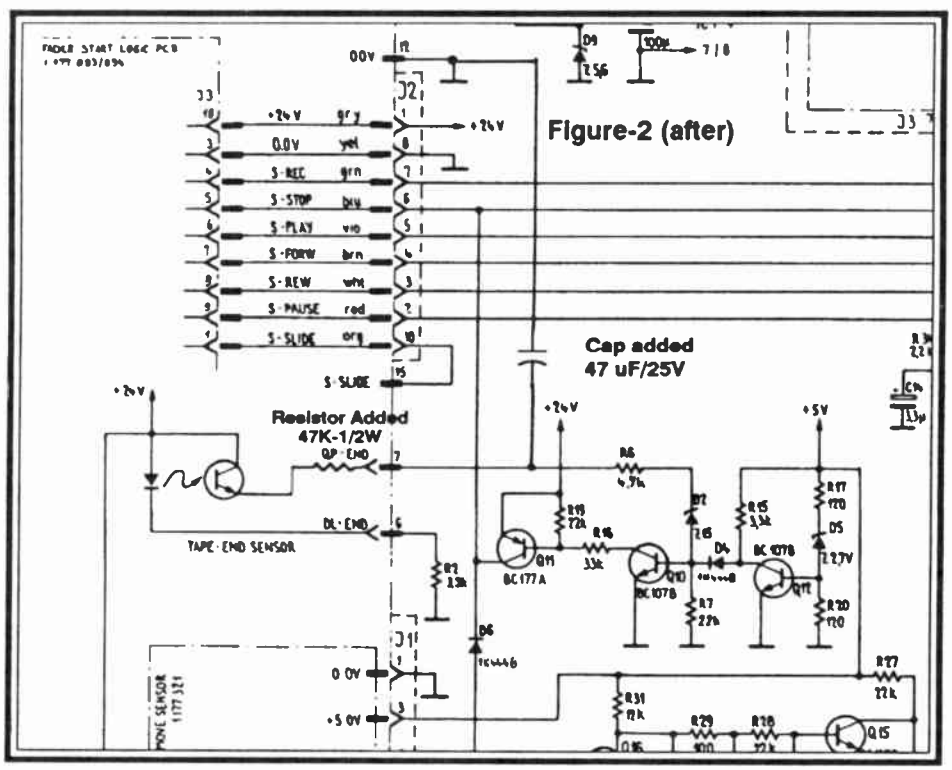
Hal Schardin - WCCO Minneapolis, MN

After WCCO installed four Revox PR99 reproduce decks, it was soon apparent there needed to be a time delay in the infrared tape sensor. Bad splices, and stretched tape would cause the machine to stop abruptly in the middle of the program.

I looked at the schematic provided in the owner's manual, and decided that the simplest solution would be an RC component. The "R" part is 47K, 1/4 watt resistor installed in the head nest. You can lift the gray wire off the phototransistor, and attach it to the nearest terminal on the dummy head next to the sensor. Now put the 47K resistor between the phototransistor and the gray wire.

Next, remove the back of the Revox and install 47 uF, 25 volt capacitor with the (+) lead on pin-7 and the minus lead on pin-12 of the Tape Drive Control PC Board. FIGURE





Before you seal the unit back up, you have to adjust potentiometer R-51. The alignment procedure here is to see what voltage measured across the capacitor will cause the machine to stop, and then to set the voltage for 1/2 to 3/4 of a volt more. In our situation, we shoot for 6-1/4 volts, give or take a volt. (It's a tricky adjustment.)

You can now block the tape sensor with your finger, hit play, and take your finger away -- it should take 1 to 2 seconds for the machine to stop. At 7-1/2 IPS, that's 7-1/2 to 15 inches of stretch, or one heck of a bad splice!

A CHEAP MIXER

Hal Schardin - WCCO Minneapolis, MN

A while back, a station manager came to me for technical assistance. He wanted to assemble two studios in neighboring communities. The idea was to represent these communities will a couple of short daily broadcasts. These broadcasts would consist of local interviews and community events. Since these were an experimental venture, costs had to be kept to a minimum.

I debated various mixers, phone attachments, frequency extenders, mike amplifiers, powered mikes, etc., and decided the Radio Shack 32-1200B stereo mixing console was the best piece of equipment. This unit can accommodate multiple inputs, and physically doesn't look half bad, either. A schematic is part of the owner's manual (thanks!). See FIGURE-1 for original circuit.

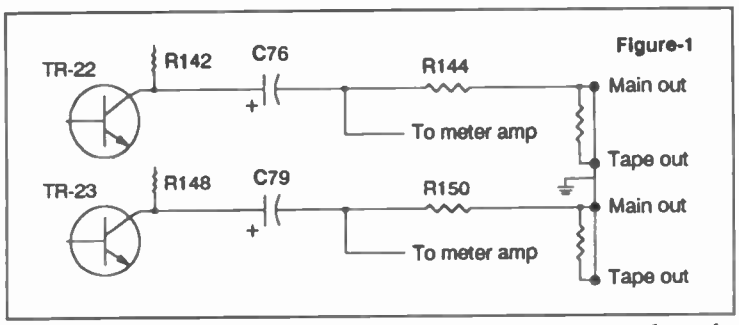


Figure-1

The "main outputs" are relatively high impedance, and unbalanced. To lower the impedance I chose a 5532 dual op-amp. I set up the op-amp as a voltage follower, as no gain was needed. This worked well for driving a phone coupler.

The first step of the modification is to remove the bottom panel; this is the only panel you have to remove. Fortunately, the circuit board has the part numbers printed on it. You will need to remove the two 1K resistors, R144 and R150. The technique I used was to move the solder with a solder sucker; then I straightened the leads. I pushed the leads through the board, and then I shook the resistors from within the mixer. Now you can attach the input leads of the op-amp from the collectors of TR22 and TR23.

The final circuit is shown in FIGURE-2. Since the TR22 and TR23 transistor's collectors run at 6.7 volts, I used them to "bias" the op-amps by direct connection to the non-inverting op-amp inputs. The output of the op-amps is decoupled through a 10 uF capacitor. A series 600 ohm resistor protects the outputs from excessive load. The other end of the 600 ohm resistor then connects the "main output" jacks.

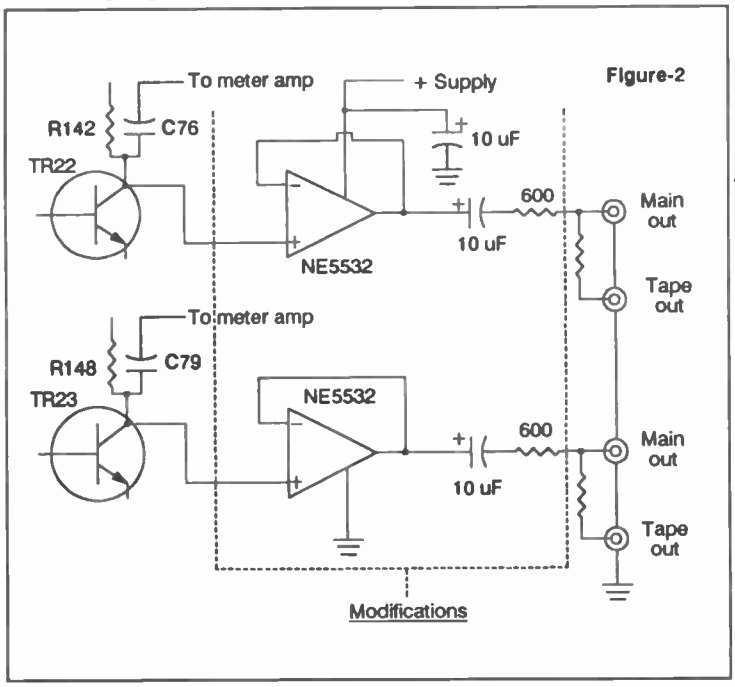


Figure-2

Supply voltage for the 5532 is decoupled with a 10 uF capacitor near the chip. The 26 volt supply is picked up near the power transformer, where it enters the main circuit board, from the emitter of TR28. I managed to fit a small circuit board with the 3 capacitors, and 2 resistors within the mixer.

The main output could now feed a QKT coupler -- or a small 600/600 transformer could drive the dedicated phone line, etc. Since this application

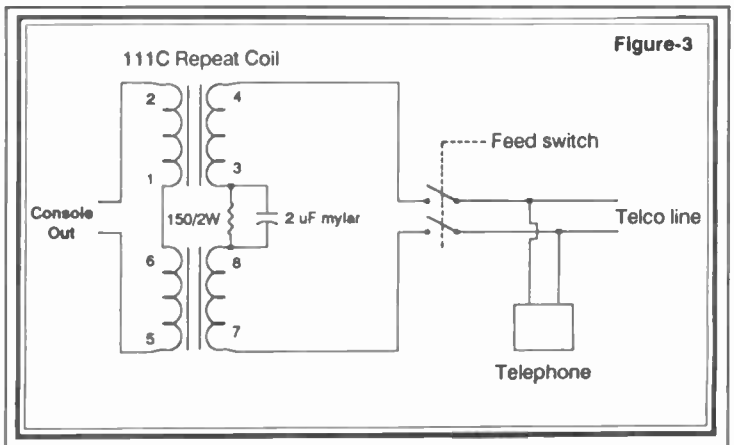


Figure-3

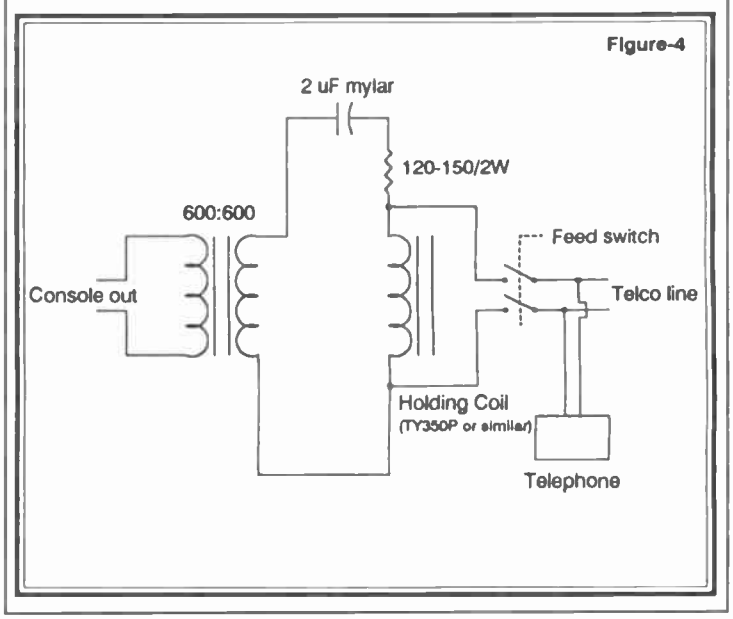


Figure-4

required the driving (and holding) of a dial phone line, I used a 111C repeat coil I had lying around. The 111C appears to have enough iron in its core to hold a phone line and not get into core saturation. See FIGURE-3

Another way to feed the phone line is to use a small transformer, a holding coil, and a capacitor to block the DC. See FIGURE-4. With the setups shown, the dial phone establishes contact, the switch is thrown on, and the phone can then be hung up. A radio is used to get air cue.

A RACING RELAY

Ron Wood - KOWO Waseca, MN

The KOWO-AM transmitter is a CCA AM 1000D. For what seemed a year or so (I didn't keep an accurate time count), it would be intermittently shut the plate voltage off with what appeared to be some type of overload condition -- but no overload lights ever came on. After much thought, measurements, parts replacement, and calling factory techs, the problem is still there.

It was finally discovered to be a "mechanical" race between the plate TD relay K2 and the main plate contactor K4. The TD would operate normally in its time cycle, but its metal straps that were the movable contacts had lost some spring tension.

Therefore, as soon as the plate contactor would slam shut, it vibrated the main transmitter component mounting plate just enough to mechanically shake the TD contact that was in series with the plate contactor pull-in coil. The TD contact bounce would open the plate contactor. The TD would close again, the plate contactor would slam in and vibrate the mounting plate, and the "race" was on. I can only imagine that the sound it made would put a gattling gun to shame.

Looking at the old and new TD relays side-by-side, made it clear that the contact holding power was different on the two parts. Maybe the coil pull-in had lost some holding

power, but I didn't make any further tests on the old part, since the new TD solved the problem.

Although this may seem to be a straightforward problem, in my mind it's the subtlety that is so interesting. The TD appeared to be working correctly, but on a DETAILED check, it was found to be faulty.

SMOKING IN THE STUDIO-AN ARGUMENT TO BAN IT

Warren Schultz CE - WYFR

An article appeared in the February 1988 issue of RECORDER ENGINEER/PRODUCER magazine, authored by Darrell Wilk, V-P of Marketing for ITT Schadow, ITT Schadow is the manufacturer of switches used by Pacific Recorders & Engineers audio console manufacture. In the article, titled, "APPLICATIONS GUIDE FOR SWITCH CONTACT SELECTION," the author discusses switch failures and cause for failures.

Within his introduction, the author sites a fact that airborne contaminants from cigarette smoke will affect switches. In particular, the sulfides from burning paper (cigarettes are wrapped in paper) form a film on the silver contact surface. The oxides react in the presence of moisture. The silver sulfide film creates an insulating film that insulates the contact from making an electrical circuit. The result is a noisy and intermittent switch contact. Because the surface is a film, its breakdown voltage can require at least the application of 5 volts.

Unfortunately, our audio systems operation in the 0.01 to 1 volt range.

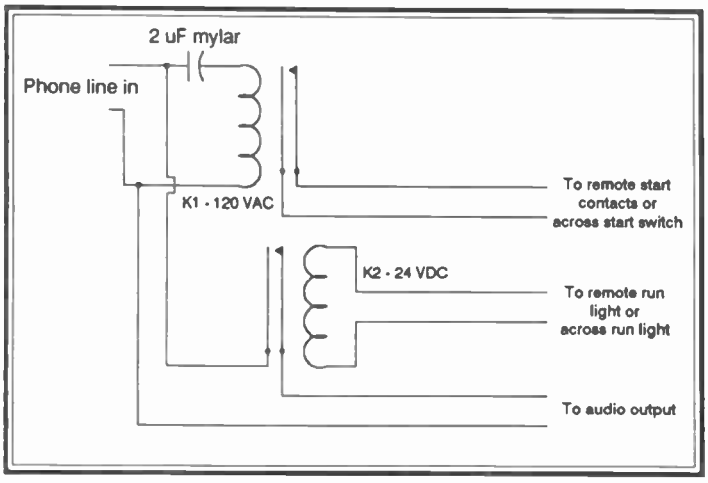
Cleaning of the switches will flush away the contaminations. However, the cleaning process can also flush out the original lubrication and cause early switch failure. We had one case at WFYR that, after a number of cleaning attempts, all switches on a BMX-14 console had to be replaced. This was an estimated direct and indirect cost of $600!

We had recently measured a BMX Series-1 console that has been in service for 10 years in a heavy smoking area. The switches were still serviceable. However, in performing intermodulation measurements, we came across conditions where distortion was 0.6% IMD in place of the uniform 0.02% IMD. Working the module switches would change the distortion level. Finally, using a contact cleaner (De-Oxide by GC) cleared the problem.

A TELCO INTERFACE SOLUTION

Keith Stokes - KLSU-FM Baton Rouge, LA

For several years, the station had been using answering machines for the listener information line, but found that they just would not hold up to the volume of calls that were generated. I decided to come up with another idea. I had an old Spotmaster cart machine that was removed from service that I thought would be useful, both for its longevity and the ability for the staff to spice up the audio with music or sound effects in the production room. At the time, no one was making a universal cart machine controller, so I had to come up with one of



my own.

All you need are two relays: one a 120 VAC, and the other a 24 VDC, and one capacitor.

The capacitor blocks the DC from the phone line from energizing the start relay. The ringing voltage fires relay K1, whose normally-open contacts are across the start light of the cart machine. K2 is connected across the start light of the cart machine. Its normally-open contacts interrupt the audio output of the machine. The output transformer holds the line while audio is fed to the caller or until the cart cues.

The only thing you have to ensure is that the cart machine does indeed have an output transformer. If not, you will have to add one so that you will not unbalance the phone line, in which case you will induce hum on the line.

CONTINENTAL 816R-1A DRIVER CAP FAILURE

Jack Parker - WUBE-FM Cincinnati, OH

Over the past 3 years, I've experienced failure, on one occasion, of the driver plate tuning variable capacitor in my Continental 816R-1A. In addition, I know that my transmitter has had a least one other failure of this capacitor, as has one other Continental transmitter at my transmitter site. This failure is caused by 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, cause 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. Continental does have a fix for this problem, with a modification kit which places a doorknob capacitor in parallel with the vacuum variable. This modification redistributes the circulating current in the IPA plate circuit through two legss, which reduces the current through the vacuum capacitor to roughly half of its original value. The modification kit is priced at just under $100, which is far better than paying $400 to $500 for a new vacuum variable! (Thanks to Jay Crawford, CE of WEBN-FM, Cincinnati, for his input on the 816R-1A problem. He'd been fighting with this a long time.)

SMOKING CHOKES

Wayne Kube - KBTX-TV Bryan, TX

I had a rather interesting occurrence, recently, at a station that I contract for. The transmitter is a Harris FM 2.5K. It has a solid state exciter, but a tube driver -- the final is also a tube, a 5CX1500B. The transmitter is usually trouble free. The phone rang at about 6 a.m. (the second most common time after 2 a.m.). The sign-on announcer had turned on the plates and started to log the first set of the day's meter readings. He noted that the output power was pegged, the plate current was much higher than normal, and the plate voltage was against the upper pin on the meter.

After attempting to decrease the output with the power level control, he could still not get it to go below 125%. He tried shutting down the plates and restarting, but the results were the same -- that prompted the call to me. I had him try it again and, while we were verifying the readings, he reported a burning wood smell. "Shut it down, I'll be right over," I told him.

Driving over, I tried to think of something that could cause this, but all that I could imagine was that the power line voltage had somehow increased enough to cause the increase in high voltage. But, this would have to be some kind of increase. The normal plate voltage is around 4kV, and the meter scale reads to 5kV. This was past that point! Arriving I checked the input 240 volt line. It read 247 volts, a little high, but certainly not enough to cause these problems. I verified the increased readings with the plate energized. Yep, everything too high, except screen voltage was lower than normal. That made sense, because the power is controlled by varying the screen, and that was down to its lower limit already. Well, I thought of re-tapping the high voltage transformer. Setting the primary taps to the highest input points and the secondary taps to the lowest output points allowed the plate voltage to come up at normal. Plate current was also normal after the screen voltage was increased with the power control to bring the output up to 100%. It looked good, though it didn't make sense. But, after watching it for a couple of minutes. I also noticed a smell like that of burning wood.

I shut it down quickly, and then tried to figure out what was made of wood in a modern transmitter. I shut off the disconnect, opened the rear door, and shorted out all the high voltage points. Then looking closer, I could see a trickle of smoke still coming from one of the filter chokes after the high voltage rectifier. Seems that the laminations and the windings were held apart by some wooden wedges, and there was enough heat being generated in the choke to let the smoke out of the wood. Strange.

The high voltage supply in this transmitter is a typical circuit with a four diode full wave bridge across the secondary, followed by a series choke, a shunt filter cap, another series choke, and another shunt cap. Thinking maybe the choke was bad, I removed and checked it, but it measured okay. Still, I swapped it with the second choke, but the results were the same. Both caps and all four rectifiers checked out okay as well. Measuring the secondary voltage with a high voltage probe showed that it was too high.

A call to Harris Field Service left them scratching their heads after they suggested everything that I had already tried. About all that we could come up with was that there was something wrong with the high voltage transformer. That seemed unlikely, but nothing else made much sense either. I ordered another transformer and another choke, since it could have been damaged from the generated heat. Replacing the transformer cured the problem. The secondary voltage was back to normal with all taps in the proper position. The choke

was also replaced, all was normal.

The theory is that something went bad in the primary of the HV transformer, possibly arcing between turns, effectively increasing the turns ratio. The arcing caused a lot of high frequency noise that the first choke had to deal with, causing it to overheat. Sounds weird, but that's what happened. It's the first time I've ever seen a transformer go bad and start to increase its output.

TEXAS TOWER GROUNDING

Bob Schnieder - Broadcast Technical Services Lubbock, TX

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 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 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 the 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 chiselers 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 Heliax, 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 3-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 25 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 a 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 4 holes per substation and tie them 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 2 eight foot copper grounding rods welded to the end of our 4/0 copper wire. Down the hole it went, and then we tied it to our tower. I also ran 4" 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 2 years and has not had a problem with lightning. I've personally seen the tower take a 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've 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've seen ATUs vaporized by lightning, and I don't think, in that instance, any protection would 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.

CONTINENTAL 816R-2A DRIVER MODIFICATION

Robert King - WBUS Bourbonnais, IL

The first problem involved the driver stage of the Continental 816R-2A FM transmitter. In July 1988, I attempted to install a pair of Amperex 4CX-250BC tubes (drivers). The change was being made because of a drop in the screen current -- one sign that the tubes were weakening. If the drive to the final stage (4CX15,000A) is not close to saturation, the transmitter becomes unstable.

When the new tubes were installed, and the transmitter was turned on, the static current (by removing exciter drive for the two drivers (125 mA each) was adjusted according to the service manual. I suddenly heard what appeared to be a small pop in the driver cage. What was a balanced current reading between the two drivers, suddenly changed with the small pop sound. The left driver stayed at the proper current, but the right current dropped to 50 mA. I changed position of the driver tubes, and the problem (low cathode current) moved with the tube. The old drivers were installed, since they were the only "good" ones I had.

My technical report showed that three attempts had been made to put in new drivers, each attempt had a somewhat different outcome, but it always seemed to appear that a driver tube was the problem. On one other occasion, the screen regulators were shorted again, making it appear that the driver tubes were at fault.

In the meantime, the old drivers were put back in their respective tube sockets, and the transmitter was put back on the air. The transmitter worked fine: another attempt would be made, in the succeeding months, to change the drivers.

In August 1988, another set of drivers (Amperex 4CX- 250BCs) were installed. Now, the cathode static current dropped in the left (front) socket about 74 mA.

Drivers from the old set and the new set were mixed, with the old driver in the left socket and the new driver in the right socket. The static current was set.

When drive (from the exciter) was applied to the set of drivers, the right cathode current dropped to 100 mA (it normally operates at 180 mA). The old drivers were installed

again until the problem could be found.

You are not going to believe the pattern of the problem, if not gotten already so far. The transmitter worked fine, except for a slight drop in drive to the final stage caused by the aging pair of drivers. When new drivers were installed, the transmitter was unstable, at best. Cathode currents were unstable in many attempts. There was a suspicion that screen regulators were shorted during this entire escapade of attempting to put in new drivers, which started in May of the same year (1988).

But finally, persistence paid off. I determined to, again, inspect the driver cage like I had never done before. Many previous inspections did not reveal the problem. I pulled on wires to see if something would come about. I found a loose filament transformer connection that should have been tightly screwed to the driver chassis. The connection was barely touching the metal chassis.

My theory was that the new tubes were drawing more filament current than the old tubes, making the loose connection conduct poorly. When the old drivers were re-installed , that stage always worked. When the new drivers were in, the transmitter was unstable and the cathode current of some of the drivers was low.

Tightening the screw onto the chassis has corrected the problem permanently, and that has been a year ago.

My next problem related to the gating cards of the same transmitters, such as some of the Collins series. Previous articles in Radio Guide, have shown me that a careful inspection of the problem with these gating cards was in order. I realize that the problem appears to be so obvious. and I wondered why I (or anyone else) had ever caught it before.

The problem with these cards is that the capacitors (C5, C6, C7, and C8) are nearby the high wattage resistors (R11) which radiates a high amount of heat. These capacitors are right in the pathway of the heat convection, which dries them out. Why not disturb that convection with a small fan? That is harder than it sounds.

Things to consider:

1. The fan must move a high volume of air. In a restricted space, the fan can only be so thick because of the small clearance caused by the back service door.

2. Air should be moved from the back of the cage to the front (nearest the service door), so that dirt is not blown into the card's edge connectors. Due to tight clearance, as described above, that will not be possible.

3. The fan should be of the right dimensions so that it can be mounted right on the end of the card cage, with just the construction of a plate which is the same size as the cover -- and still have a fan to move the highest CFMs (cubic feet per minute) of air.

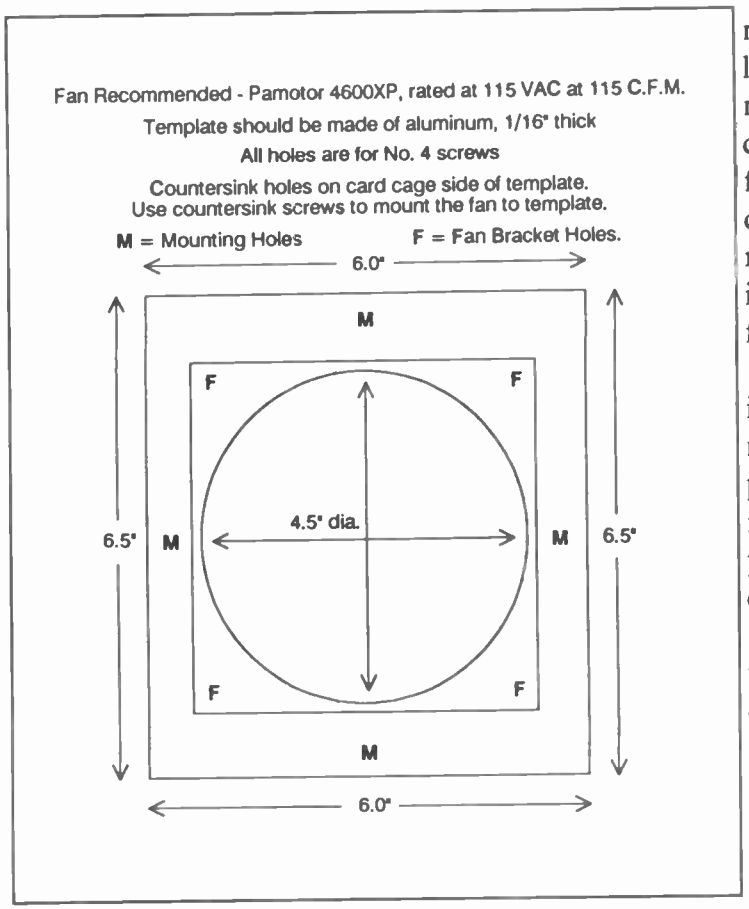
4. The voltage rating of the fan should be a value that is easily accessible from within the transmitter, preferably, that can be controlled with the filament buttons on the front of the unit.

Well, in July 1989, I came up with what I thought was an idea. I will not give the fan information in this first attempt because later tests showed it did not work.

A special kind of fan was installed and, three months later, capacitors installed on the boards and near the high- wattage resistors had shown they still dried out. That showed that the fan was not moving enough air.

Another attempt was made with a different fan and, although it is way too early to tell, I believe I have come up with a better solution, but not perfect.

A Pamotor fan, Model 4600XP (120 VAC/115 CFM), was mounted on a metal plate, one inch larger than the one (metal cover) that was removed. The metal (6.5" X 6.0") is about 1/16 of an inch thick, and a hole (4.5") was cut for the fan's air flow. The metal was

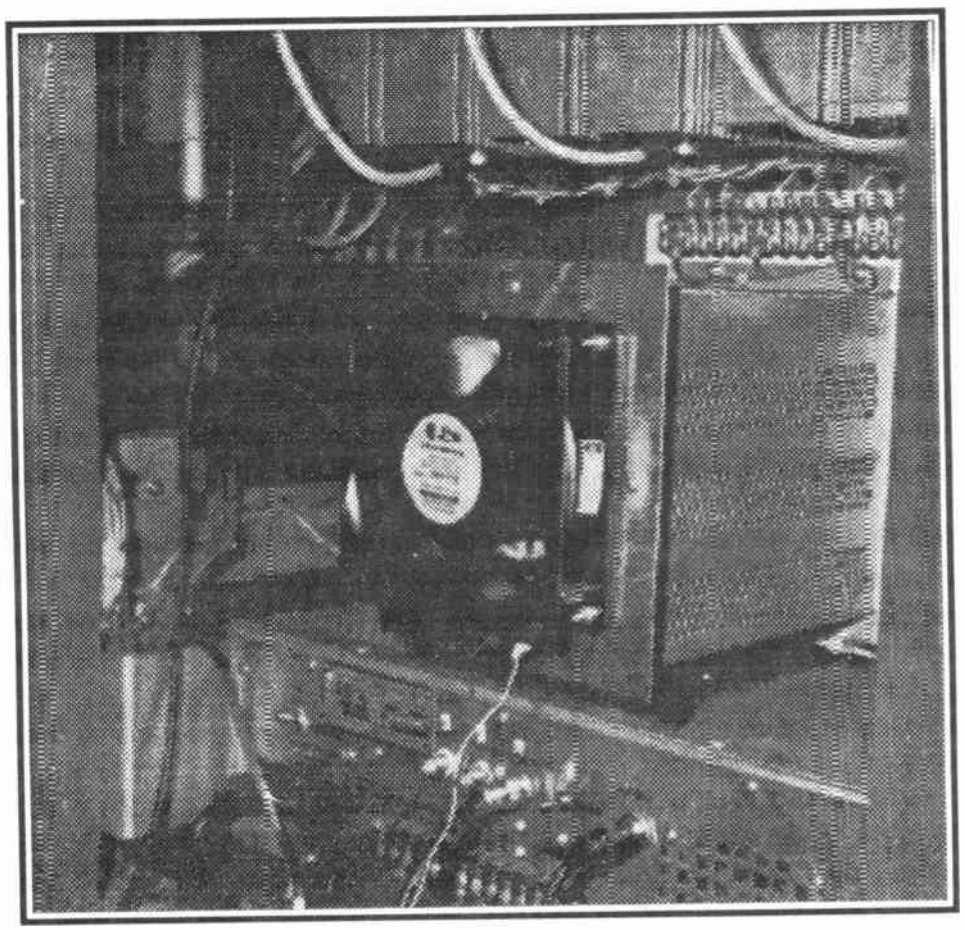


made slightly larger because of the large hole for the fan. Making the metal the same size as the original cover would have made the plate too fragile with the large cut-out in the center. The Pamotor fan has bearings rated for high-heat environment, so it is recommended that it (or a similar fan) be used.

The mounting of the new plate is identical to the old plate. The fan is mounted. perfectly centered, on three plates, and the same screws and mounting procedure are used for putting the plate onto the edge of the card cage.

To make the most of the air flow, the air was made to blow into the cage, over the boards and high wattage resistors.

This should reduce, if not eliminate, the drying out of the capacitors and the browning (burning) of the circuit boards.



With the fan in place and operating, the service door directly behind the fan was put into place. From a neighboring compartment, the clearance was checked between the door and the fan frame and there's about an inch of clearance. Air flow into the cage does not seem to have been greatly reduced by the service door, and air flow was felt all the way into the wiring area of the card cage. I had wanted to move air

away from the board, but that was not practical, so the air was blown into the cage.

With this fan, it is recommended that the edge connector for these cards and checked periodically for dirt build up in those connectors. FIGURE-1 is an exact drawing of the plate you should cut and drill to size. FIGURE-2 is a picture of the modification itself. Now, the gating cards themselves. It is highly recommended -- that the engineer have two sets (one set in the transmitter and one spare set: 3 boards to a set) of gating cards. Turning on and off the transmitter to find a bad gating card can do more damage than what you spend for a spare set of cards.

When I have a problem related to a gating card, all of them are changed. The spare set is installed and the old set is tested. Most likely, the problems are the capacitors reviewed earlier in this article.

I have found that keeping two sets of these cards has more than paid for the cost of the second set -- and I am talking about a complete spare set. There is another problem seen in these Continental and Collins transmitters. DO NOT allow dirt build-up in the final stage area where the fingers of the tuning shelf or door meet a metal surface. This can cause arcing, and I have seen what can happen when these areas are not kept clean.

The arcing, in one of my transmitters, got so bad that holes, about an inch in diameter, were burned into the tuning cavity area of the final stage. This makes tuning impossible, and a costly metal plate has to be installed. This arcing can also occur on the doors. CHECK AND CLEAN THOSE AREAS AT REGULAR INTERVALS!

IGM INSTA CART NOISE

Tony Wortman - WJAG/KXEL Norfolk, NB

Here at WJAG, we have a 1980's vintage IGM Insta Cart Model 12STK. Over the years, at intermittent times, this Insta Cart would develop a low level hiss on certain trays, when played on the air. IGM suggested that we had bad heads, and should send them in for replacement, which we did for several of the noisiest ones. When they came back, they were OK for awhile then, from time to time, they would be noisy again. Usually cleaning them or using a different cart would help -- it seemed. Other trays also developed the same problem over time. However, cleaning and demagnetizing usually helped. This got to be very annoying and frustrating.

One day I decided to tear into this thing again. I took an ohm-meter, and checked the resistance from the head to the ground. I found that all the noisy heads had a very high resistance. At first I thought it was the heads. However, upon further investigation, I found that where the head assembly mounted into the body of the unit, the aluminum had oxidized with the other metal and caused the whole head assembly to have a high resistance connection. Moving the head assembly cleared up the problem.

My solution was to make a separate grounding strap that tied all the assemblies to the ground, and not depend on the original design. The machine sounds like a new one now.

OPTIMOD 8100 OSCILLATION FIX

Keith Stokes - Interstate Communication Baton Rouge, LA

Several years ago, the company I worked for, Patton Circuit Systems in Baton Rouge, Louisiana, was maintaining the local high school radio station. The station uses a CCA 2.5kW transmitter, which originally had a narrowband grid tuning network. CCA had a recommended kit for modification to a more wideband network, which we installed. Over the next several days, we got complaints from listeners saying that we were appearing at three places on the dial. Sure enough, we found that this was true.

We discovered that the Optimod 8100 was producing a $\pm$ 400 kHz signal on its output. We discovered it to be the output IC, the Analog Devices 518. We had a spare which we installed, and the oscillation promptly went away. The next day we called Orban, who immediately sent a replacement, free of charge. We don't know how long the problem had existed, since before the modification to the grid circuit, the signal was not passed.

OTARI 5050B POPPING FIX

John Oelke - KSHE St. Louis, MO

Here is a fix for popping audio, if you do production on an Otari 5050B series, 8 or 4 track recorder. This noise is particularly annoying or noticeable when you have to punch in on a channel with no audio present. The cure is to replace the record relays.

Otari offers a replacement relay. The part number is RY2YC099. The original part number is RY2YCO52. They are not too expensive (about $4), but the job is not for beginners. The circuit board is double sided, and the spacing of the pins is that of an IC. If you know what you are into, the job is well worth the effort. You'll need one relay for each channel. Otari's phone number is 415-341- 5900.

A WEIGHTY TELCO PROBLEM

Rich Hann - Calhoun Communications Sioux Center, IA

A problem that I recently encountered involved a high level of 60 Hz hum on a station's 15 kHz equalized lines. The phone company measured the noise and was insistent that there was not a problem. As I observed the phone company people taking the measurements, I noticed that they were using a "C-message weighting" filter on the test set. I suggested that it was not appropriate to use that filter in this situation, and that the correct filter was the "15 kHz flat" filter. The problem with the C-message filter" is the response is down more than 50 dB at 60 Hz, causing the measurements to practically ignore the 60 Hz hum.

I was unable to persuade the telephone company personnel that there was definitely a problem with both the line and their measurement procedure. Their reply was that it was necessary to use the "C-message" filter for all measurements.

After a number of calls, I managed to talk to someone sympathetic in one of the company's regional offices. He was able to educate the local people, and convinced them that corrective action was necessary. The section of the "Bell System Practises" that he referred them to, was Section 857- 110-110, "Local Channel Circuit: Control of Noise, Distortion, and Crosstalk."

CD MAGIC MARKER

W. Grant Dozier - WVMG Cochran, GA

Being a station in a small market, only a short time ago did we start using CDs on a regular basis. With several jocks inexperienced in the proper handling of the discs, we starting experiencing scratches almost immediately. As we all know, a scratch on a disc can cause the player to "go crazy".

I have discovered that "covering" the scratch with an opaque "magic-marker", keeps the player's laser beam from scattering, thereby enabling the player to restore the missing data as it is programed to do.

I would be interested in hearing from others who have the "scratched-disc" syndrome, and would like to know what solutions they have as an alternative to throwing the disc away.

SMC DATA-CELLS (REVISITED)

Donald L. Coleman - WBRK/WRCZ Pittsfield, MA

John Wittenmeier is not alone in his problems with the non-available Sigma Data Cells, as used on older SMC automation gear. When I discovered they were no longer available, I talked with SMC about a retrofit. Their reply was to spend a few thousand bucks for a new automation system.

I discovered that Magnecraft makes a fine solution. Their part #W301T1-12B1 is a 12 volt opto-isolator. I removed the metal cover over the Data Cell and removed the bulb and the photo-sensitive strips, saving just the header. Two of the Magnecraft units are then mounted on the header with their bulbs in series. The result is somewhat larger than the original, but I have found that they will fit in any of the dozen or so locations in my equipment.

John must have smaller fingers than I do. I could not remove the original data cell bulb without damaging the photo strips.

I started making this conversion over a year ago and so far have not had one failure.

TRANSMITTER AC POWER CONTACTOR PROBLEM

Robt. Denham - Cameron Communications

All transmitters have power relays or contactors for the various power supplies/ On the Collins 21E/M they are mostly horizontally mounted and pose no problem, but on some older RCAs and Gates, as well as several models of the AM series Wilkinsons (we have a 10K-D), they are mounted vertically into wall-studded receiver nuts using three or four screws. If the relay is an open-point type (fully exposed) you probably are already making sure that the contacts are clean and the arm tension is OK.

Look carefully at the mounting screws. They are but a small insulator away from being a short circuit for the power supply they control. If all mounting screws do not have equal torque, then blower vibration can (and by Murphy's Law will) cause a screw to back out in time and expose the head to the power at the contacts, and shut you down. It's no big deal, until you find you ain't got a replacement. So next time into the juice box, take a set of screwdrivers.

Now here's the bad news. The design engineers think these babies are invincible and put them in the only place in the box that a circus contortionist can get to.

OTARI MX-5050 BRAKE TIP

Jack Parker - WUBE-FM Cincinnati, OH

On the "Otari MX-5050 Tip" in the October issue, I've found that the brake drum in an MX-5050 has a matte finish which, with normal wear, will rub off on the brake band. This is evident by the dark deposits on the band. When a sufficient amount of this matte finish is rubbed off, it will result in binding, as noted by Greg Hahn of WKRA in Louisville.

The folks at Otari suggest that when brake bands require replacing, you should also replace the drums as well. The cost is very nominal (about $20 for all four pieces), last time I did an MX-5050. Otari also suggests that you replace the little tensioning spring on the solenoid arm, also nominally priced at less than $2 for two springs!

SAVE THOSE DATA-CELLS

Lane Lindstrom - WPOK/WJEZ Pontiac, IL

For those of you still blessed with a Sono-Mag AS-series audio switcher, here is a tip that you may or may not be aware of. The "heart" of the switcher is a plug-in opto- isolator -- the Sigma Data Cell. This little jewel, over the past years, has not only become super expensive, but also is hard to find. I was told that Sigma sold out to Magnacraft, and Magnacraft dropped production of the cells altogether.

The AS-series switchers used the Sigma part 301-R2-24. I've been re-lamping our

Datacells for the past five years with success. The lamp I felt that worked the best was a 28-volt long life filament in a T-13/4 style package with wire leads (Newark Part #44W1030).

First remove the aluminum cover by carefully bending back the four indentations on the base and then lifting off the cover. The ceramic light dependant resistor is very fragile, and is held in place on the cover with a clear silicone. Snip out the old bulb, solder in a new one, replace the cover, test it, and date it. You'll be glad you did the next time a power glitch, that brings all the channels on at once, pops the filaments in about half your Datacells. Don't pitch 'em -- repair 'em.

AEL TRANSMITTER NOTES

Ray Jenkins - WAVL-FM Apollo, PN

Those engineers who have AM-5KD or AM-10KD transmitters manufactured by American Electronic Laboratories (AEL) in the late 1970s, before they discontinued broadcast manufacturing, may find this information useful, particularly since AEL no longer provides any assistance to broadcasters.

CONTROL PANEL POWER SUPPLY

The 25 VDC regulated supply which powers the control panel relays, lamps and PC cards is not metered. If the regulator fails, its output jumps to about 42 volts and can ruin the PC cards. Of course these cards are not available and, if the damage is major (in my case fire related), you will either need to build a replacement from scratch or forgo the overload and/or the warm-up/cool-down features.

I placed a 10 ohm/2 watt resistor in series with the on push-button lamp, so that it is dim at 25 volts. If the regulator fails, the lamp will brighten considerably, warning the operator of high voltage condition. Since our studios are at the transmitter site, this is sufficient. If you are remotely operated, you may want to work up an auto-shutdown circuit.

UNEXPLAINED HIGH VOLTAGE SHUTDOWN

We experienced a few transmitter shutdowns last year which cleared out when troubleshooting was initiated. About this same time, our morning man reported that, occasionally on start-up, the INTERLOCK lamp lit as soon as the ON button was pressed. But -- the BIAS lamp. which normally lights a couple of seconds later, took much longer than usual.

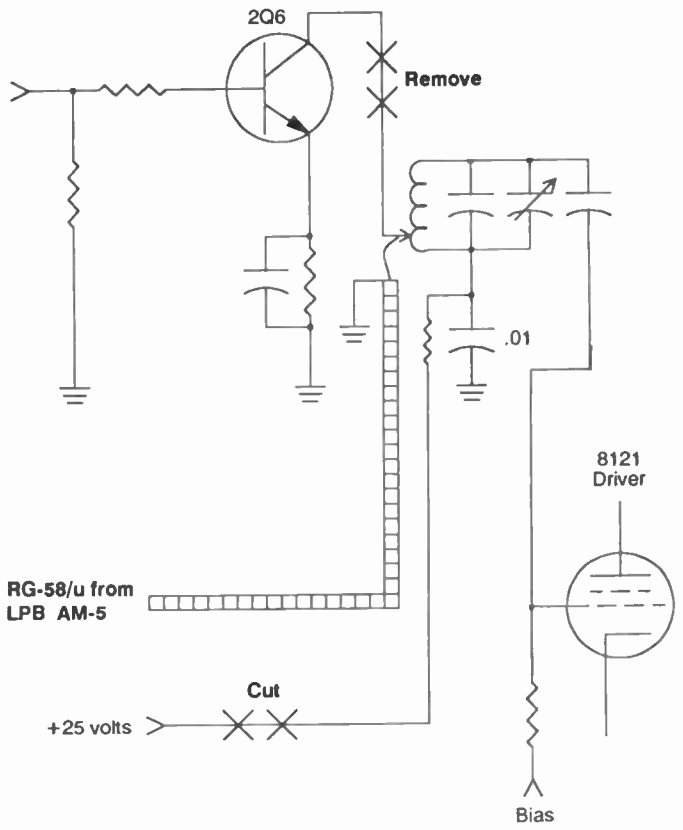
Investigation showed that the air pressure switch, mounted in the "floor" of the PA enclosure (to protect against insufficient cooling air pressure), was not properly closing. Why this switch was not placed in a side wall, remains a question, but there is no question that its intake fitting acted like a "floor drain" and collected enough dirt, in over ten years, to interfere with proper switch operation! Disassembly and thorough cleaning did the trick.

PA MODULATOR FILAMENT VOLTAGE

These are measured with a panel meter which shows the filament voltage AT THE SOCKETS, which aids in keeping track of the filament buss connection. Should the filament voltage read less than it had been reading (this is a good case for daily logging of filament voltage), the culprit most likely is a dirty buss connection. After cleaning them be sure to get the connections TIGHT.

EXCITER PROBLEMS (AND A SURE FIX)

The AEL exciter can sometimes generate more ulcers than kilohertz! The solution to our myriad of intermittents, burned 2Q6 stage resistors and the like was to replace the solid state portion of the exciter with an outboard LPB model AM-5 transmitter.



Connection of LPB AM-5 to AEL Transmitter

The AM-5 feeds, via a piece of RG-58/U coax, the driver grid tank coil (which was also the 2Q6 connector coil). The 2Q6 collector is disconnected from the coil tap, and the center lead of the RG-59/u is attached. The coax braid, of course, is grounded at a lug nearby. Power is removed from the 2Q6 stage and the oscillator PC card. In the LPB AM-5, the modulation is disabled by turning the MOD pot down and shorting the audio input terminals. OUTPUT is set to provide the proper Driver Grid Current. We made this change in May, 1989, and the rig has been humming along fine ever since, except for a shorted cap (see next item).

6kV CAPACITORS

The 6kV paper capacitors used in the HV and MOD are not standard off-the-shelf items. They can be made on special order, by the original manufacturer, in a 4-6 week time frame. It pays to have one of each on hand (the cost on special order is only half of what AEL wanted for them when they stocked them).

ORDERING INFORMATION:

Condenser Products Corp. P.O. Box 997 Brooksville, FL 33512 904-796-3561

Capacitor 1C1 10uF - 6kV #KMOC 6 M10

Capacitor 1C3 10uF - 6kV #KMOC 6 M4

AIR FILTERS

Lastly, the air filters can use a little help since the 1" filters supplied are subject to a lot of floor dust, due to their location (combined with a couple of aggressive fans). I suggest mounting a 16X20X1 filter on the intakes (louvered doors). Duct tape holds them in place very well.

Now can anybody tell me where I can obtain a couple of spare audio driver modules for the AEL? They were made by Sanken, and I cannot find them anywhere. If either of the 25 VDC supplies (1A6 and 1A7) lose their regulation, kiss these audio modules good-bye!

A SINKING MOTORBOAT

Rod Rogers - CE KINA/KQNS Salina, KS

After about a year of intermittent problems with our FM- 3.5K, I decided it was time to get serious about the IPA regulator problems. On several occasions, the transmitter would go into erratic operation that sounded like "motorboating". Naturally, when I got to the site, it acted just fine most of the time -- but, I finally managed to catch it in the act.

I found that the IPA supply voltage was low and, upon changing the IPA match control, I could reduce the current required from the regulator. The IPA voltage would then "snap" back to normal, and the motorboating would disappear.

What was happening was the LM338 regulators (which are run in parallel) were shutting down. I had lost a few in the past, but none were bad this time. In fact, after removal of the regulator assembly, it seemed that there was nothing wrong! I then put the transmitter back on the air, and checked the voltage across the three 0.2 ohm/10W resistors, to see how these three chips were sharing the load. All were equal, reading about 0.6 volts, further telling me that there wasn't anything wrong. Calculating this reading across 0.2 ohms indicates a current about 3 amps, very acceptable since these are 5 amp devices, and the total current to IPA was running around 9 amps.

It was later that I happened to reach in and feel the TO-3 case of these regulators, with the transmitter in operation. I found that they were hot enough to burn the tip of my finger. (Please be careful if you try this; this area is pretty clear of any high voltage, but I don't want anyone hurt following my advice.) I had been letting the tube cool a bit in the past, since there is an air passage to this regulator assembly, it had been cooling too.

The problem was that, for some reason, these regulators were running extremely hot, with the current through them well within limits! At this point, I had two theories: an oscillation somewhere in the regulator (or IPA), or something was wrong with the mounting of the regulator chips, preventing good heat transfer.

Being a true blue broadcast engineer, I started with the cheapest option first (I have heard that the IPA amp replacement runs around $1500). I added more heat sink compound to both sides of the mica insulator; they were better, but still too hot for my satisfaction. Here's the ringer! I noticed a small, countersunk, phillips-head screw under the chip mounting that holds the mounting in place. Upon dragging a razor blade across it, I found it was not countersunk far enough and, due to this condition, was preventing the device from setting flat enough for full contact! After disassembly, and re-countersinking with a special drill bit, all three chips are running much cooler, and our "motorboating" problem is cured.

I'm not sure which other Harris transmitters may use this same regulator assembly, but I assume that the problem could arise in them too. By the way, the best heat sink compound seems to be the white, sticky, messy stuff, shipped with solid state tower flashers. If you're in a pinch, the silicon grease shipped with Andrew Heliax connectors will do. There always seem to be a surplus of both at most operations.

I hope this not only helps someone else with their intermittent IPA problems, but have included the whole troubleshooting story for the benefit of those just starting out, as many of the other procedures used may be applied to other situations. Good Luck!

ITC CURES

Neil Schwanitz - WXYT-AM/WVAE-FM Southfield, MI

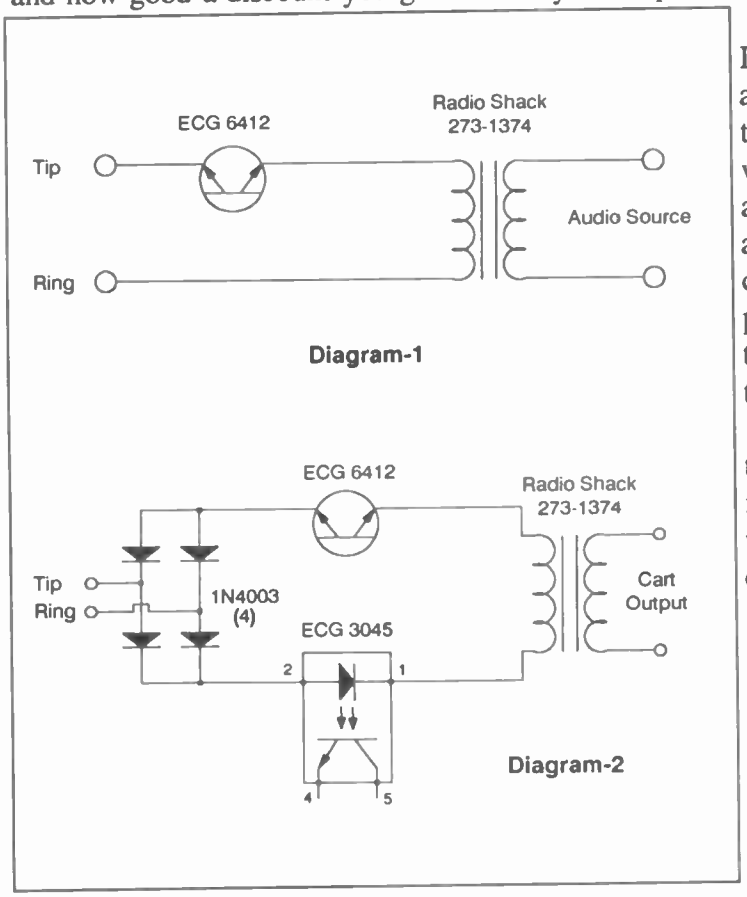
I was paging through an issue of Radio Guide and saw an article by Vince Edwards of WBGM on ITC cures. Other capacitors, as well, will dry out in these decks. I have made it a standard practise to re-cap that machine the first time it's on the bench. This will save you the problem of the audio going South, on one channel, later. The best caps are those Japanese style. They have a higher voltage rating in a smaller package too. The best source for these little wonders is MCM Electronics in Dayton, Ohio. They have a toll-free number (800-543-4330), and carry a full line of Japanese ICs too.

Having problems with your ITC splice finder locking in the erase mode and running 'till the cows come home? Flip the deck over and locate R106 (6.8K/2W). The value probably has changed to about 3.2K and it may look healthy. Change this for a 6.8K, 5-watt.

AUTO ANSWER - CHEAP

Robt. B. Hoy - WWBD - Philadelphia, PA

This should be the last entry in the race to create the simplest auto-answer device. With just two parts, we can couple an audio source into a phone line, and the cost will be less than a case of my favorite suds ($4.98 on sale). Price seems to depend upon where you live and how good a discount you get on the Sylvania part.



The "diac" or "Bilateral Trigger Diode" looks like an open circuit until a voltage of either polarity is applied that is above its threshold of 63 ($\pm$7) volts. When this voltage is exceeded, as when the phone rings, the device acts as a switch and goes into conduction. This "answers" the phone and holds the line through the transformer, which couples the audio to the line.

When the caller hangs up, most telephone companies provide a momentary reversal of tip and ring which causes the diac to stop conducting to release the line.

The circuit will work on any "ESS", electronic switching and signaling, telco office. It may not work on others but, for a few bucks in parts, it would be worth trying it.

For those who have a larger budget, I would recommend

the circuit shown in Diagram-2. We have added a bridge rectifier and an optical coupler to the circuit. The bridge just makes sure that the LED in the coupler sees the proper polarity. If you are careful to observe polarity when connecting to Ma Bell, you can leave out those expensive diodes, and save anywhere from 20 to 50 cents.

The optical coupler can be directly wired to the remote start of a cart machine so that we now have an auto-answer message machine. Be careful to only connect to machines that use 25 volts or less for their remote controls. So of the old models used 100 AC, and they weren't even isolated from the line! If your machine won't work with the coupler, I guess you will have to bite the bullet, go to the "Shack", and get a cheap relay and plug-in supply.

Either circuit will accommodate an extra LED that could be used as a status indicator. Just be sure to keep the polarity proper and put in series with the other components - no ballast resistor is needed.

COAX CABLE PROBLEMS

Douglas White - White and Assoc. Saginaw, MI

It's interesting to note that two problems mentioned in Radio Guide were what I found at a client's station. Upon my first visit, usually the studio and transmitter facilities get inspected for unusual things that stand out or obvious problems.

The first unusual thing discovered was the cable connecting the composite output of the audio processor/stereo generator to the STL transmitter. The manufacturer states that RG-58 should be used, and if a long run is required, RG-62 should be used. What I found was a white cable with molded F connectors at each end. It was a 75 ohm cable used for Cable TV! The actual connections to the equipment were made through F to BNC adaptors. The cable and adaptors were removed and the proper cable was installed. An audible difference was noticed! Stereo separation wasn't measured, but I'm sure it was affected.

Another unusual discovery was that the transmission lines going up to the main antenna and the backup antenna had no pressure in them. After a little investigating, it appears that this condition may have existed for 3 years... So, a trip to the nearby welding shop for a custom regulator and a couple of tanks of Nitrogen was in order. VSWR is 1.3:1 on the main line, and hopefully will be lower once the line is purged and pressurized again.

STL RUMBLE

Val Alvin - Alvin Engineering Services Watertown, SD

An interesting noise problem was recently solved at an AM station in Eastern South Dakota. A station moved into its studio and, in the process, installed an STL between the studio and the transmitter. Shortly after it was put into operation, an intermittent low frequency rumbling noise was noticed on the signal. Because it was coincidental with the move, it was assumed that there was some defective STL equipment or that something in the link was causing this very low frequency intermittent noise.

The station engineer was aware of the noise and, through the process of elimination, using tape recordings, etc., he determined that it was coming from the transmitter and not the STL. Further investigation showed that the noise is caused by vibration of the equipment, and it was traced down to a loose screw on the plate cap of the tube in the transmitter. This, again, indicates that simple screw tightening is important to keep a station operating properly.

MOD TRANSFORMER TESTING

Jim Alexander - Broadcast Engineer Services - Russelville, AR

In a recent issue of Radio Guide, some discussion was made concerning the testing of AM modulation transformers. My favorite method (which I make no claim as to being the originator) consists of removing all leads to the transformer and applying 120 VAC to secondary winding. Then CAREFULLY (high voltages can be present depending on the windings ratio) measure the voltages on the primaries. These should be equal, or at least within 5 to 10% of one another, if the transformer is OK.

If you are nervous using a "suicide cord" (power cord to device with no fuses) for the test, insert a beacon lamp or electric heater of 600 watts or greater in series with the hot AC test lead. In the event of a short, the lamp or heater element will simply operate. This type of test circuit, with smaller lamp loads, is often quite handy in working on units which blow fuses before you can tell what is going on. Simply short out the fuse and use a series lamp load of about 2 to 3 times the wattage drawn by the device. The lamp will glow to the relation of the degree of load (or overload), and the device will operate at a reduced power to enable you to get a few readings on the unit under test.

AUDIOFILE POWER SUPPLY FIX

Paul Moder - KATO/KWKQ Safford AZ

I do most of the engineering at a small market AM/FM combo. Since I'm also the operations manager, program director, production director, etc., etc., I rely heavily on advice from factory engineers in order to save time when troubleshooting problems with equipment.

Recently, our ten year old Audiofile (Cetec 7000 Automation system) began playing the wrong carts. It would show on the CRT and printer that it was playing the right one, but any fool could hear that what was on the air was not what was on the screen. After numerous headaches, resets, and memory clears, I finally checked the power supplies with a scope. I found a strange looking square wave of 120 Hz hanging on the 12 volt DC power supply, with an amplitude of 290mV.

I called the factory, described all the symptoms, and told them about the strange waveforms. They said they'd never heard of such a thing and it couldn't have any effect on the Audiofile because it was within specs. They said the problem was either in the logic board or the interface card. I would have to send them a deposit, and they would send me replacement while they fixed mine for parts and labor.

Refusing to admit defeat and spend the boss's money, I decided the first thing to do was track down the source of the strange wave, just in case it WAS the problem (what did I have to lose?) I turned off the power and added a capacitor to the output of the power supply. Upon re-energizing the Audiofile, I found that the waveform was gone! Then slowly it reappeared. Aha -- a faulty regulator chip; when the chip warmed up, the waveform reappeared. By blowing air across the heatsink, I was able to clean up the DC line.

Still not believing that the experts could be wrong (and it being Friday), after a long week of frustration over the problem, I decided to go home and start with a fresh outlook on Monday. The system worked perfectly all weekend! When I closed up shop, I had left the cover off the power supply and the back door off the equipment rack. This provided just enough additional cooling for the chip to clear up the Audiofile's confusion.

Sometimes trial and error beats the best factory advice.

66-BLOCK TIP

George Mimbs III WIKS FM New Bern, North Carolina

If you're using or are going to use a 66B style punch block for your station wiring, this hint may be of use.

Place the block on your copy machine and copy it! Then you've got a life size identifier for your wiring lists. You may want to enlarge it if your copy machine will do that.

BANDPASS vs NOTCH FILTER

Edd Monskie Hall Communications Norwich, Connecticut

In the May 89 issue of Radio Guide, Conrad Troutman of WSYR talked about using bandpass filters to eliminate intermod problems on a "Marti" receiver. However, to avoid the insertion loss, you would do better to install a "notch" filter instead. You have to know the exact frequency and then get a single, double, or triple bottle version of the notch filter. Each bottle added, increases the depth of the notch. If the offending transmitter is not real close to your frequency, insertion loss is almost negligible.

The problem with the bandpass filters is that they are too broad in their bandpass. If you re-tune them for a sharper bandpass or gang several together, again for sharper bandpass, the insertion loss greatly increases. As long as you know the offending frequency, use a notch instead. The same people that make the bandpass bottle like Wacom or DB, also make the notch filters.

CASSETTE SPEED ADJUSTMENT TOOL

Eric Chromick Waynesville, OH

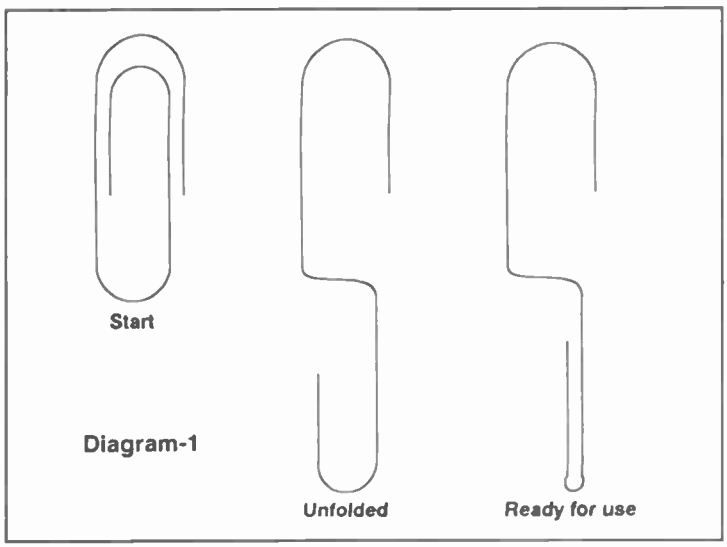


Diagram-1

I can never find my little screwdriver or a tuning tool that's long enough to adjust the speed pots in a cassette machine. One day a simple solution came to me; a small paper clip, when unfolded to look like the letter "S", can easily be bent into a perfect tool. After unfolding it, use a pliers to flatten the smaller side, and your left with a rigid end that fits the trimmer and a wider end that gives you something to hold onto.

I've made up one of these for every cassette machine I have to work with, and have taped them to the bottom of each machine (or inside the battery compartment on portables). The same tool also works on the recessed screws in XLR connectors without tearing up the threads. You might need to hold the tool with pliers if the screw was tightened by "Conan the Intern".

TANDY TIPS

Eric Chromick Waynesville, OH

The Datamite, (available from Jones Service & Design, 1842 S. Nugent rd., Lummi Island, WA 98262, (206) 758-7528) is an analog to digital converter that plugs into the cassette port on the Tandy Model 100 computer and, along with its software, can function as a chart recorder, a volt meter, or a frequency counter. The chart recorder function, alone, makes this a terrific piece of equipment. If you've ever looked at chart recorder prices or tried to rent one for a couple of days, you'll agree that the $62.50 (+ S&H) is a great deal.

I found a BASIC program called FRQCNT.BA on the Madison Tandy Users Group BBS (608-655-3806) that turns the model 100 into a fairly accurate frequency counter. It uses the cassette port and cable with no mods to the computer.

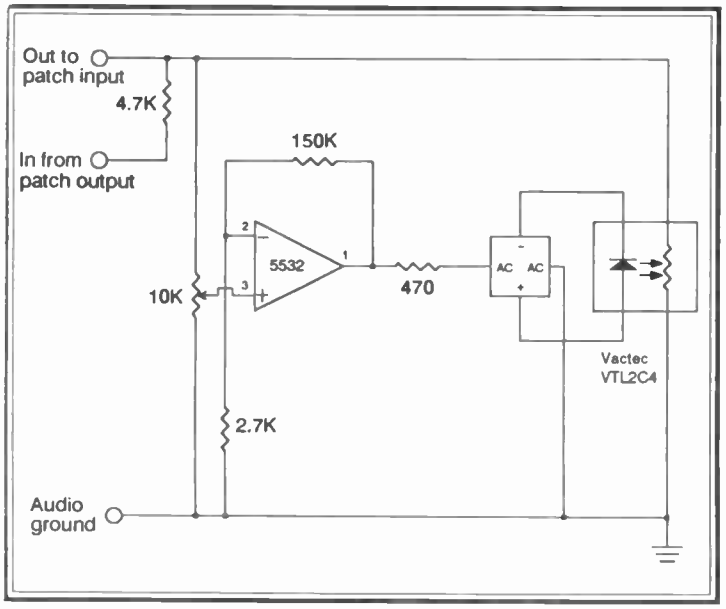
Since the program was written in basic, it can be easily modified. The frequency value is an integer variable so you can print the frequency value to a RAM file, cassette file, printer or even the RS-232 or modem for remote readings. If you want to measure the stability over a long period of time, writing the frequency values and TIME$ to RAM or an external device saves you from having to sit and watch the counter, while allowing an accurate time reference.

The program was written for cassette machine speed adjustment, which it does well, but the capabilities of the Model 100 allow you greater flexibility than a conventional counter.

BMX MIKE COMPRESSOR

Frank L. Berry - WQYK St. Petersburg, FL.

I designed this very simple and straightforward microphone compressor for use from the patch points of our BMX-series of consoles.



The secret behind the success of this circuit is the Vactec model VTL2C4 LDR package available from Newark Electronics. The VTL2C4 exhibits characteristics which make it ideal for use in the compression of audio signals. It has a fast attack and slow release time, when used as a shunt leg in an "L" or "T" pad.

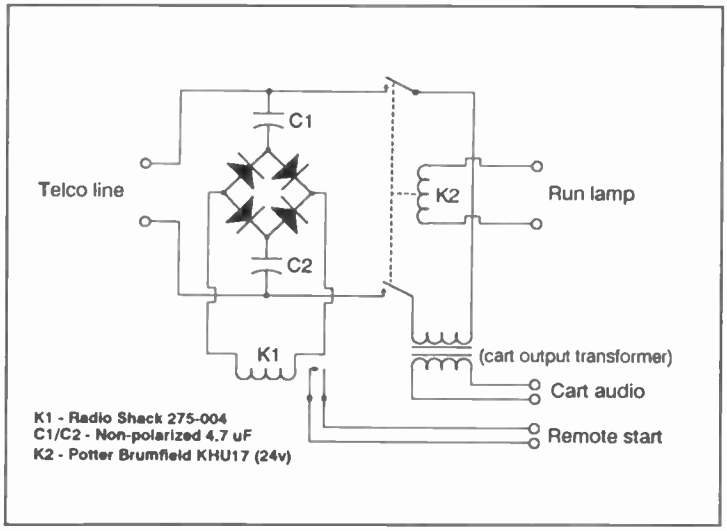
Slope calibration controls are unnecessary as the driver op-amp gets its audio from the OUTPUT of the controlled gain network and will automatically balance to the gain necessary to keep the compressor output level constant.

Any garden variety op-amp can be used to drive the LED within the LDR package, I chose the 5532 because I had plenty in stock.

In setting up the compressor, you will notice a reduction in microphone level as the 10K compression control is turned up. I have adjusted mine for 13dB compression, and instructed the jocks to run the microphone faders full open. The microphone levels peak at +2dB.

CART TELCO COUPLER

Dave Higginbotham - WCAW/WVAF Charleston, W VA



A friend of mine passed this circuit along to me for an events call-in line. The ring voltage is rectified and used to start a cart machine. The run lamp voltage is used to operate K2 and seize the line via the output transformer of the cart machine.

For better quality audio, or cart machines that don't have output transformers, install a 600 ohm to 150 ohm transformer with the 150 ohm winding going to the phone line.

OLD TECHNICAL BOOKS - A SOURCE

Benjamin P. Dawson
Hatfeild and Dawson Consulting Electrical Engineers Seattle, WA

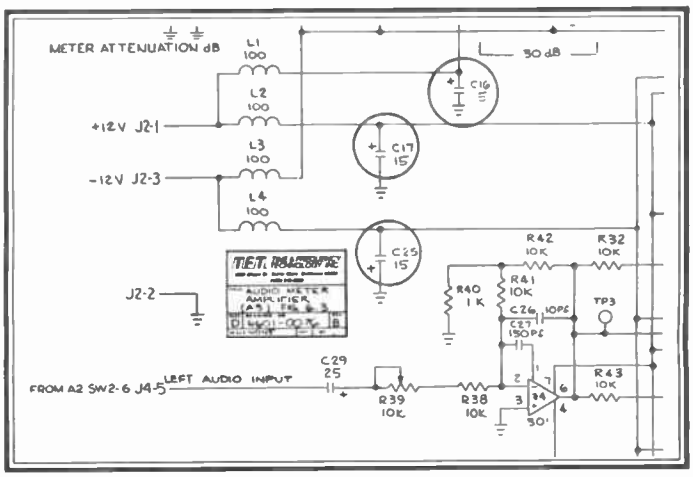
I noted that in your February/March issue, Jeff Glass requested the name and address of a bookstore that deals in used and out-of-print books on radio engineering matters. It's unfortunate that many valuable books have not been reprinted, and the copies in public libraries (for those lucky enough to 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 book stores 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.

TFT MOD MONITOR-- ANOTHER SOLUTION

Robin Cross - WNIU DeKalb, IL



In the Jan. issue of Radio Guide, Bruce Macmillan has an article on left channel clicking in a TFT 724 Stereo Mod Monitor. About two months ago I had the same problem in a 724 of similar vintage. The symptoms were, clicking in the left channel and the left meter going to full scale in sync with the clicking. I used a different attack in repairing the Mod Monitor. If it worked once, then by replacing exact value parts, it should work again. I tried replacing every component in the metering and left channel circuits. No effect.

What cured the problem was replacing the filter caps on the Audio Meter Amp Board (A3). It seemed to me that after ten years or so, the filter caps could have dried out and lost their effective capacitance. After replacing, C-16 (5 mFd), C-17 (15 mFd), and C-25 (15 mFd), all symptoms went away. By using exact replacements in the original circuit, you can be assured that the equipment will still meet factory specs and should be within calibrations tolerances.

CHECKING RF AMMETERS

Bob Schnieder - Broadcast Technical Services Lubbock, Tx

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 movement 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 network. (More about the resistor network later).

Your RF ammeter is designed to measure AC current through a thermocouple. The movement of AC through the thermocouple creates the current that moves the meter needed to read the RF current. The RF ammeter will measure 60 Hz 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.

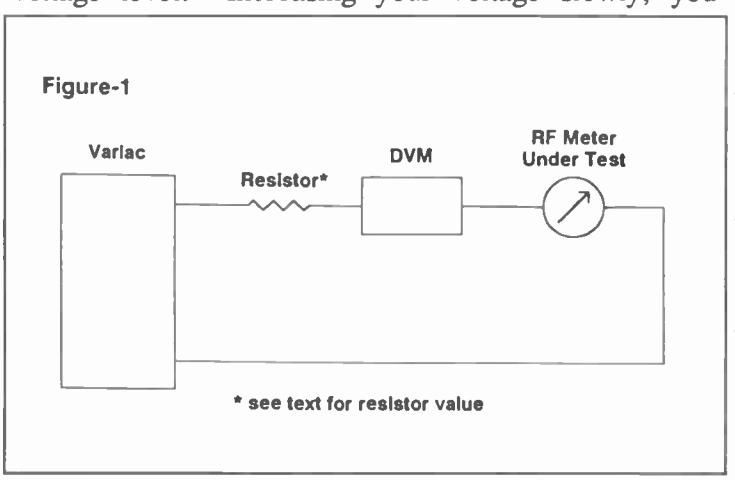
Depending on the amount of current you want to measure, you can design your own resistor network. The popular DVMs have a 10 ampere limit on AC current measurement. Many stations, depending on their power, will have meters rated at 0-5, 0-8, or 0-10 amperes. The purpose of this test is not to calibrate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

Now for your 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 needs 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 parallel 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 hooked up properly, you will start your Variac at its minimum voltage level. Increasing your voltage slowly, you will be able to compare 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 meter in series, and now you can check meter against meter.

Figure-1



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

WET NOODLE ANTENNA

Edward C. Dulaney - KJAC 92.7 FM Lubbock, TX

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.

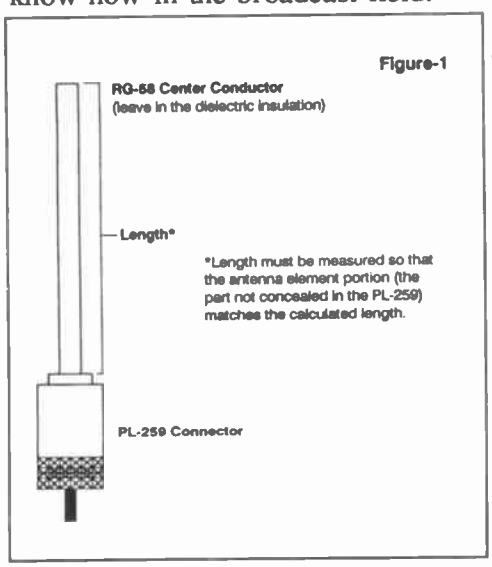


Figure-1

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 decided to make an emergency antenna. Using the formulas 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 WAVELENGTH (in meters) = 300/frequency (in mHz)
3/4 WAVELENGTH (in meters) = 225/frequency (in mHz)
1/2 WAVELENGTH (in meters) = 150/frequency (in mHz)
1/4 WAVE LENGTH (in meters) = 75/frequency (in mHz)

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 two or three 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.

RCA BTF-20E HARMONIC FILTER POSITION

Russ Erickson Mgr. - RF Products
Broadcast Electronics Quincy, IL

In regard to Meryl Valne's article in Radio Guide (September 1989), 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 accentuated. 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 preforming as 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 finger stock is located, after adjusting 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 on 1/4 wave cavities, is the extremely sharp tuning of the PA loading. Some manufacturers 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 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 and design. I was also impressed long ago by the simplified design with no sliding contacts and no 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.

SAT DISH DROP-OFF

Pat Cerone - WXRA/WEZG Clay, NY

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 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 coax and tried it with that. The voltage was 28 volts! So there was our answer. A bad coax line -- about 160 feet buried in the ceiling. We installed a new piece of

R:G-6, and the receiver loves it. The "S" meter reading is better than ever, about 4dB better.

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

REMOTE CONTROL MONITOR

Hal Schardin - WCCO Minneapolis, MN

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 potentiometer integrated circuit.

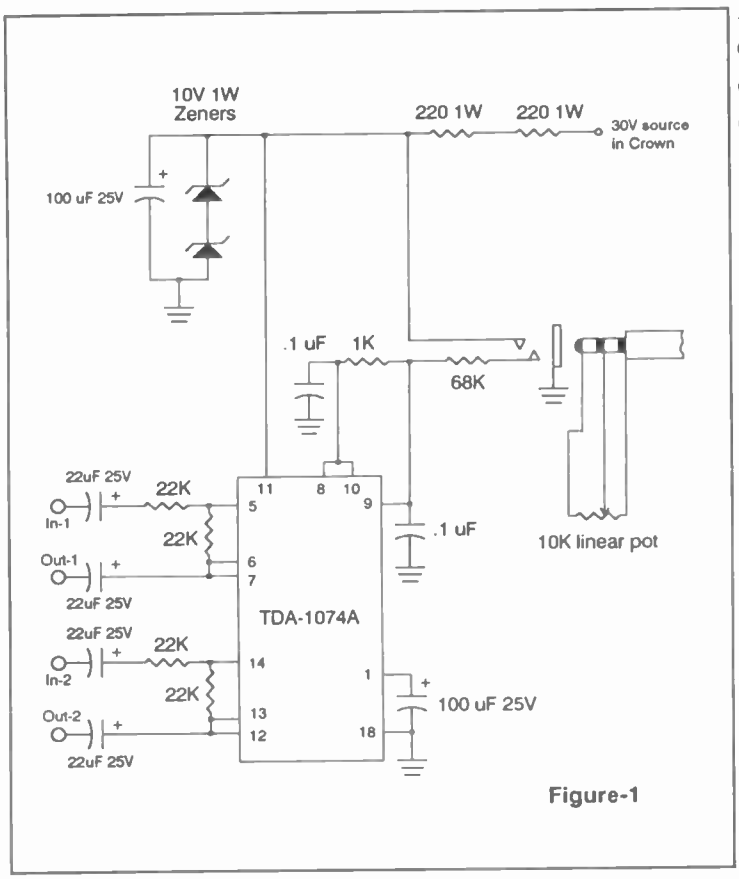


Figure-1

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 pigtails for input, output and control. Then I covered the circuit board with installation, 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 amp's back panel. Then I soldered together the two wires that needed 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.

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 connects 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.

OMEGA CART DECK MOTOR FIX

Earl W. Hocker - KTAN/KFFN Sierra Vista, AZ

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 the trouble could be due to the 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 since January 1987 and May 1988 had been found to have an abnormally high rate of premature wear out of 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 a 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 troubles.

AUDIOFILE POWER SUPPLY FIX

Steve Tunwall - KMA-AM/FM Shenandoah, IA

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 tried to solve this problem by adding or subtracting grounds and adding filter capacitance. I wasted lots of time doing the same kinds 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 unbelievably hot. New 7812 regulators did no good.

Mr. Moder found that taking the back off provided enough cooling to solve the problem. His article appeared at the time I was working on our problem, but the backs were already off of 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 the 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.

CHEAP & DIRTY OFF AIR ALERT

Jim Bremer - KARZ/KHTE Redding, CA

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 using 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 into 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 it 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.

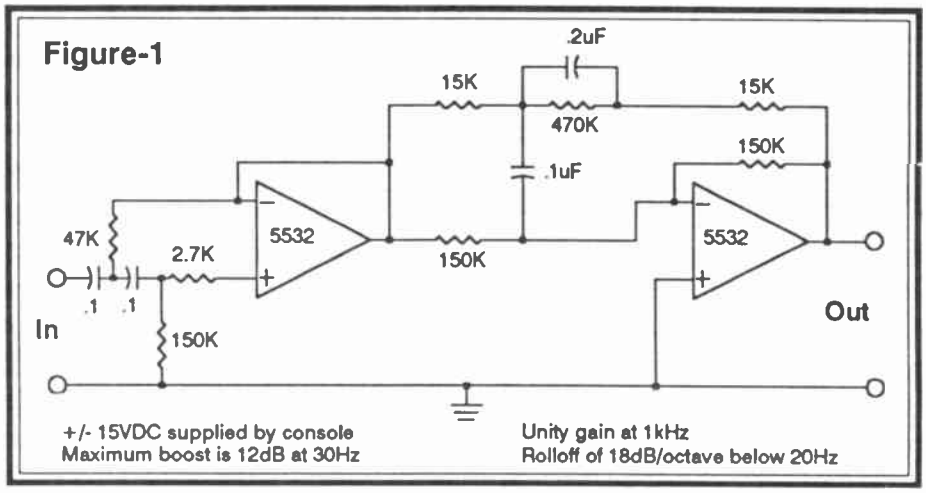
Keep in mind that this unit is only monitoring the carrier, not the audio. Nothing beats a good silence alert device for overall dead-air monitoring. However, this idea may be of use to you. It could also be used for monitoring an FM translator. It will even work for an AM transmitter if you can find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

STUDIO MONITOR EQ AMPLIFIER

Frank Berry - WQYK-FM/AM St. Petersburg, FL

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 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 cabinetwork 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 bD 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.

TURNTABLE REMOTE CONTROL

Philip J. Hess Pittsburg, PA

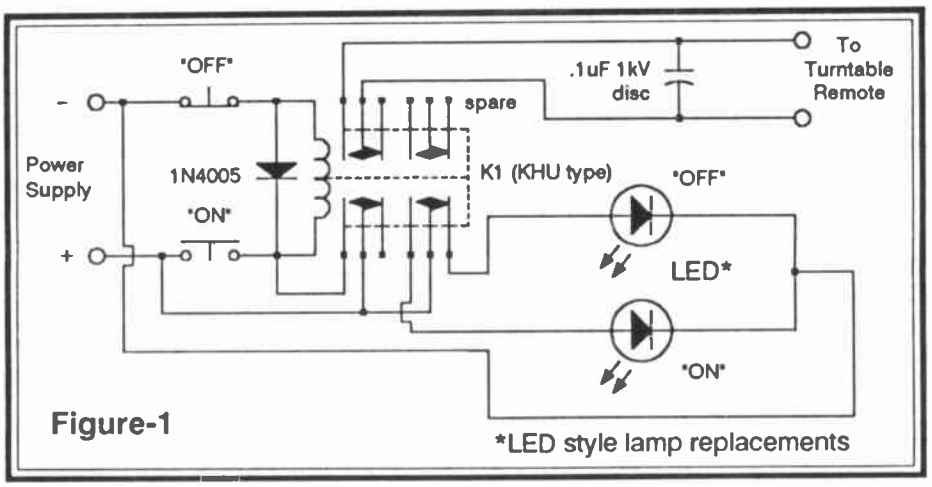
Often, it's said, necessity is the mother of invention. Being an engineer at a college radio station with a limited budget means that I must be inventive in solving requests for little black boxes. Such was the case after some remodeling in the air studio. I'd recently raised the console to install remote 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 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. Their negative side of the power supply goes to one side of the relay by means of 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 of the ON button. Additionally, the ON button is paralleled on one set of the relay's four sets of contacts. It's this connection that makes an ordinary KHU relay latch at the push of a 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.

MOSELEY TECH TIP -- SIMPLE CURE FOR "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 "phasejitter".

Based on these reports, we did some testing on 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.

AUTOGRAM RTV-20 FRONT PANEL RESET

Rick Walsh - WHCN Hartford, CN

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 motherboard 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 found this very useful. However, I would advise against providing this feature in an air-studio.

TIPS FROM THE FIELD

Chuck Gennaro - Roberts Broadcasting Merril, WI

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-2000E, 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 the 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 are shipped with an improperly assembled pinch assembly (ours was OK). It may pay to check yours against the drawing in the service manual.

TRANSMITTERS AGAIN

Back to transmitters for a minute. Walter Bollinger (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 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 looked burned. Replacing a few of the relay clips that were burned or 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 ridgid 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 mud 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 cells that are present; for the sampling lines as well as the AC feeds to the tower lights. Moisture in 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'd be interested in hearing about their experiences.

CART MIS-CUE SOLUTION

Tim Verthein - KOZY/KMFY Grand Rapids, MN

We recently installed new Sono-Mag automation equipment at KMFY-FM, in Grand Rapids. I was thrilled to be the engineer for our new studio installation. This system included cart Carousels and dual-deck playback units, plus related switching and programming gear. We also installed a new Audi-Cord DL series play/record dual slot cart machine for the production studio. All equipment is stereo.

After getting all the equipment on the air, we discovered that, in two of the Carousels and two of the dual deck slots, carts would stop at the secondary tone rather than the stop tone. We considered incomplete erasure, or the possibility that the new record deck was getting a pop on the tape along with the secondary tone, or even that the cue detectors were off frequency.

It was finally determined that the new Audi-Cord was putting the tones on with a "burst" and the phase locked loop detectors in the Sono-Mags were detecting this burst as a 1 kHz tone, and stopping the cart. While Audi-Cord's method would, in most instances, be the better way, what we needed was to let the tone build somewhat gradually on the carts (more of a trapezoid than a square shape). This was easily done with a 5uF electrolytic across the resistor on the base of Q12 (in this case R66-1K). This allowed the tone to build more slowly, eliminating that burst. Since this was a dual deck, the same treatment was given to R43 on Q9, on the slave recording card.

Once the problem was found, it was a very simple modification. Cost was about a

buck, plus 10 minutes install time. This kept 30% of our carts from mis-cueing. I imagine this problem could occur with any carts made on the Audi-Cord machines and played back in decks with PLL detectors, so keep this is mind should the mis-cues haunt you.

ROUGHING UP AN MR-2

Kyle Dickson - WCRJ-FM Jacksonville, Fl

We are using a random access automated system on our AM station. The commercials, liners, IDs, etc., are all aired using the Nakamichi MR-1 and MR-2 cassette decks.

After about a year's use the MR-2s started having a problem rewinding and fast forwarding. They would move very slowly or not at all. In a random access set-up, you can imagine the problems this caused, especially when more than one deck was having the problem.

First thought was that the reel motor's drive roller had gotten soiled from extensive use. The drive rollers were cleaned thoroughly with very little success. The machines would run OK for a day, then the problem re-occurred.

After going through a trial-and-error period, replacing the decks with new tape, etc., I figured it was time to replace the drive rollers. I ordered a couple from Nakamichi America. They were back-ordered, and I had to wait for delivery. Once they arrived, I popped them in, and it solved the problem.

I had noticed no visible reason why the old ones shouldn't have worked. I figured they had just lost their gripping action, so I got a piece of very fine sand paper and roughed 'em up a little. They have worked great ever since.

The problem can be fixed without removing the machine or removing the drive rollers. By the way, I don't recommend removing them. They are held on by a tiny plastic washer, and are impossible to locate if they are dropped. I haven't been able to locate a company who supplies them. I've got one of my machines customized using a home made washer.

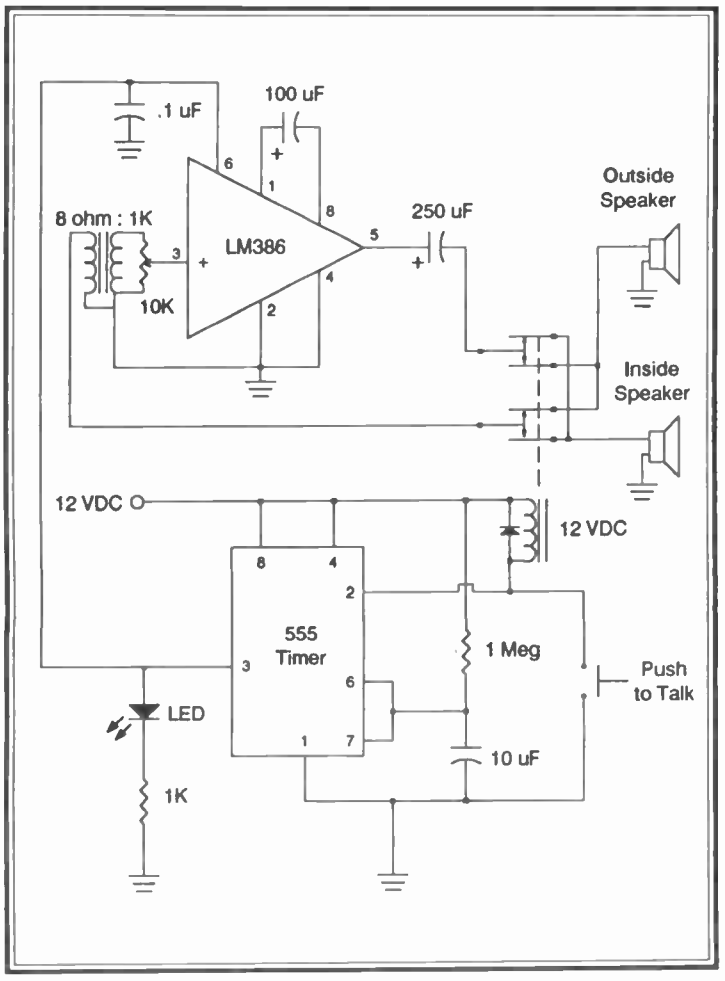
This fix won't save a whole lot of money (the drive rollers are only about $6 each), but it will keep the PD off your back while waiting for shipment -- and it's simple.

DOOR INTERCOM SYSTEM

David Driessen - WGBA-TV Little Chute, WI

We often get deliveries after 5 p.m., and the doorbell was driving everyone nuts. We devised this door intercom to restore peace to our lives. We also don't risk missing an important tape because the delivery person thought no one was "home".

The system consists of a weatherproof speaker outside which also acts as a



microphone. It is surprisingly sensitive, picking voices up from 6 feet away outside. Inside, we have a 3-inch PM speaker and a PTT button. Push to talk and, when you let go, it switches to receive for ten seconds and then mutes.

The two chip circuit consists of a LM386 audio amp and a 555 timer. When you push the button, it triggers and holds on the timer which powers the audio amp. The button also switches a DPDT relay which connects the outside speaker to the output of the amp. The inside speaker is connected to an 8 ohm to 1K ohm audio transformer.

The transformer matches the low impedance speaker to the high impedance amp input. The low input/output impedance and reduces hum pickup. We connected the outside speaker with about 75 feet of unshielded 20 gauge zipcord! The level control at the output of the transformer allows you to throttle back the gain a little which, because of the 100 uF cap between pin 1 and 8 on the audio amp, is set to about 200. The 250 uF cap at the output removes the DC from the output of this single supply amp.

When you let go of the button the relay drops back, reversing the speakers. The 10 uF cap and the 10 meg resistor provide about a 10 second timeout for the monostable multivibrator. After 10 seconds, the power is removed from the audio amp, preventing any hums or buzzes. An external muting relay is not necessary for the inside speaker. The original circuit oscillated, which was cured with a .1 uF cap across the power supply pin to ground (pin 6 to pin 4) on the audio amp. The LED shows that we have power. A plug-in 12 VDC transformer provides the juice.

The diode in reverse across the relay prevents inductive spikes from the relay coil from hurting the timer. Use a heavy duty pushbutton to survive everyday use.

USING THE GENTNER EFT-900 AS TELCO INTERFACE

George Whitaker - Editor

On page 13 of the Gentner EFT-900 instruction manual, it shows a hook-up to be used as a standard interface. However, as the unit comes from the factory, this will not give satisfactory results due to the fact that the mix-minus audio is not sufficiently nulled. You can

get a usable null by changing R-25 from a fixed resistor to a 1000 ohm multiturn pot. This resistor is located on the lower board adjacent to the input transformer (T-1).

I got my mix-minus by bridging the input of the control room mike pot. This gave me a sample of the mike audio at a level sufficient to drive the EFT-900.

After getting my connections made, I used a pink noise generator connected to an amplifier/speaker to provide audio into the mike at a steady level.

With the mike pot set at its normal operating position, I first turned the mike on and, with the speaker in front of the mike, set the level of the pink noise amplifier to give me 0 VU on the board meter. This made my pink noise roughly equivalent to the volume of the jock's voice. Then I turned the mike switch off.

Next I went to another phone and called the listener line that was connected to the EFT-900. After the call was established, I brought the output of the EFT-900 up on the console, and then, by adjusting the multiturn resistor, proceeded to get the lowest reading of the pink noise I could obtain.

Following this, I had the jock talk as he normally would and adjusted the EFT-900 "send" control to the point just below the threshold of firing the L.E.D. I found that, if the level was high enough to fire the L.E.D., the null was not deep enough and you could hear a change in the sound of the jock on the air when he would bring the phone up. In listening to the air signal, you can back down slowly on the send level and will find a point where the bleed-through of the jock's voice can be adequately eliminated, and yet the caller can still hear the jock. This part of the adjustment is real touchy, and just a few degrees on the input control can make the difference between sounding good and sounding terrible.

For doing remotes, I added a simple switch to open the mix-minus feed to the EFT-900 so that, during a remote, the control room mike is not fed into the unit. You can just turn the "send" control all the way down each time. But then you would have to reset it each time you went back to using it for two-way conversation.

By using line switching in front of the Gentner, we can bring any one of our listener lines up on the EFT-900. This gives us the option of using frequency shifting for remotes or two-way communication with our listeners, with only one piece of equipment.

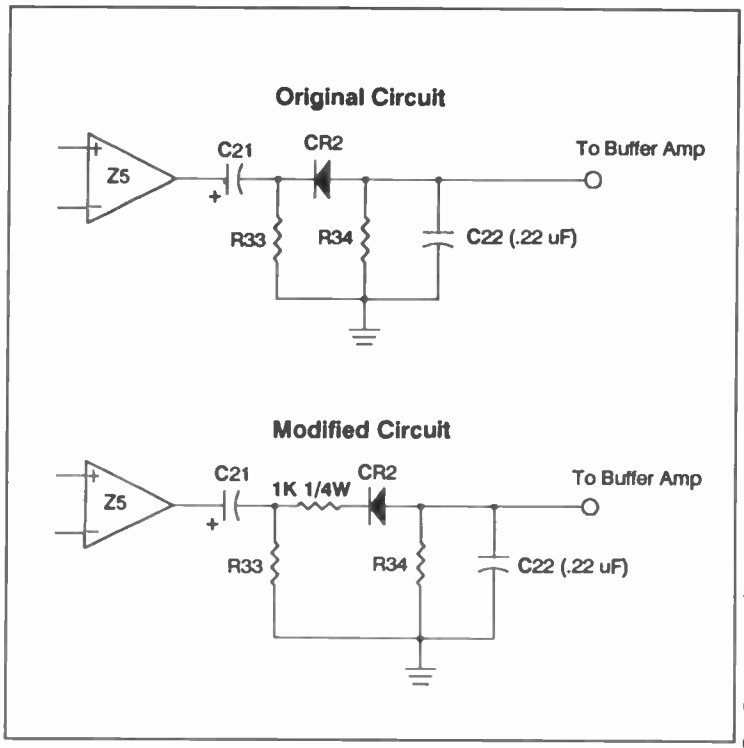
SMC SOLENOID FIX

Mark Young - WJON St. Cloud, MN

Just wanted to add to the solutions of the SMC 350 Carousel solenoid problems found in the October issue of Radio Guide. The solenoid power supply is borderline in the first place and, when the electrolytics start to dry up, the problem of the solenoid not engaging starts to show up -- especially if the machine is fired several times in a short period of time. Replacing the electrolytics has solved this problem for me on several machines. The SMC 700 series decks have the same exact problem.

TFT 724A MONITOR CLICK FIX

Bruce Macmillan - WCUW-FM Worcester, MA



Our TFT Stereo Monitor has worked flawlessly for 11 years, but recently began having a random "click" noise in the audio outputs -- predominantly in the Left channel. This showed up on the Left mod meter as peaks above 100%.

I drove the Composite input with a 1 kHz sine wave, and sure enough, when the indicated level got near 100%, the Left meter started to boogie. On the 'scope, the audio output sine waves showed periodic "bites" out of the negative peaks. I tried replacing op-amp chips to no avail. Then I started looking around with the 'scope probe and found that the "bites" were in sync with the charging ramp on the peak holding capacitor (C22) that follows the meter rectifier diode CR2. This diode is driven by a uA301 op-amp (Z5) through coupling cap C21.

At negative signal peaks, the diode conducts and essentially connects C22 across the op-amp output. The op-amp doesn't like that, and puts out a noise spike that gets into everything.

The solution is to add a 1K resistor in series with diode CR2, making a kinder, gentler load that the op-amp is happy to drive. Meter calibration is not affected, and the risetime constant of 220 microseconds is still more than fast enough to catch signal peaks.

HARRIS FM20K HOT FILTER

Tony Wortman - WJAG/KXEL Norfolk, NE

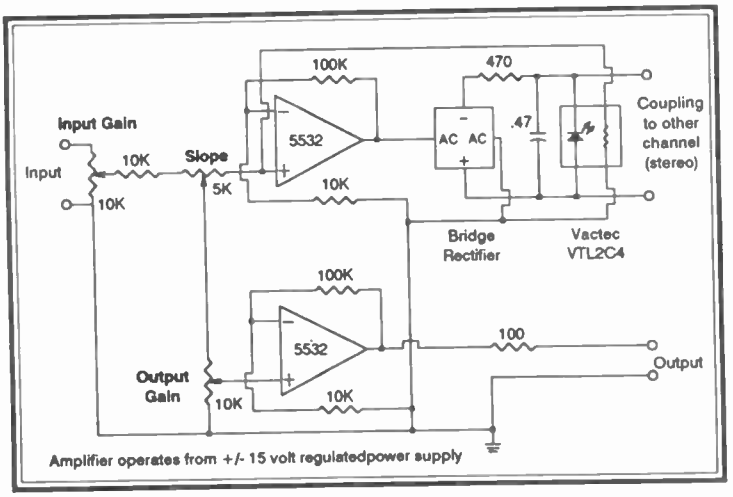
One day, while doing routine maintenance at our FM transmitter site, I brushed the transmission line at the output of the harmonic filter on our Harris FMS20K and almost burned myself. The transmission line and harmonic filter were very hot. I figured that a bullet had gone bad or lightning had caused some kind of problem.

That night I took the unit off the air and, with some help, we wrestled the unit apart. We found that a set screw had worked its way loose, over the years, and eventually destroyed the bullet and end fitting on the harmonic filter.

We replaced the bullet, rebuilt the fitting on the harmonic filter and silver soldered it tight to eliminate further problems.

HIGH PERFORMANCE COMPRESSION AMPLIFIER

Frank Berry - WQYK St. Petersburg, FL.



This amplifier is a refinement of the microphone compressors we use in our BMX consoles. It has been designed to include input gain, output gain, and compression slope controls, and can provide up to 10 dB system gain.

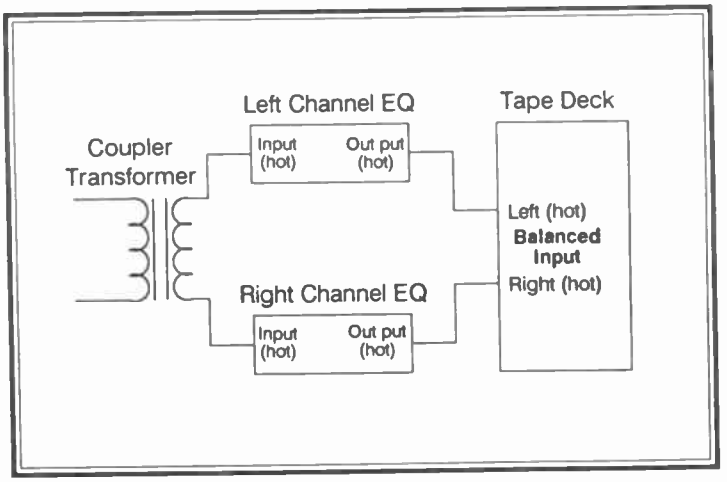
I have added this amplifier to some of the mixers we use for satellite remote broadcasts, to provide modulation protection for the up-link transmitters.

The IC amplifiers are direct coupled, so any DC offset appearing at the input of this compressor amplifier will be passed along to the output. If additional gain is required, increase the value of the 100K feedback resistors.

The amplifier operates from a +/- 15 VDC supply. The supply should be well filtered and regulated.

LOW-COST EQUALIZER INTERFACE

Rick Pitchford - University of Wisconsin Oshkosh, WI



In Fall, 1988, we began broadcasting a 30 minute dial-up delivered daily news program.

We needed an equalizer to make it more listenable and, being a non-commercial student run station, it needed to be inexpensive.

The equalizer, an $80 consumer unit, was cheap enough, but an active interface into and out of 600 ohm balanced looked to be more expensive than the equalizer itself.

Before scrounging for a pair of hi-Z/lo-Z audio transformers, I tried something on a whim. I tied the voice coupler transformer high side to the equalizer left unbalanced input hot (see Figure). The output of the equalizer is similarly tied to the recorder's balanced input. This system works well and gives twice the amount of control range, since both channels are used on the mono news feed.

NAUTEL AMFET-5 OVERLOAD FIX

Hal Kneller - WKII Port Charlotte, FL

Following about three years of flawless operation, our Amfet-5 started having MOD DRIVER overloads, and the stand-by module would switch on. We were never able to trace the problem, but noted it often happened when heavily modulated low frequency audio was present.

Nautel suggested we check the output power with the NAPC18 module set to PRESET, and the power backed as far down as the trim pot would allow (NOT the ALC level, the OP control). They said about 1/8" indication should be present; any less would be considered too low, and cause the monitor module to sense a loss of carrier and switch over at heavy modulation. Well, we had that much. We took this to heart, and added a bit of additional power to that minimum by adjusting R35 (MOD BAL) on the NAPC18 module to about 1/2" of power deflection (low power setting on output meter switch). This has cured the problem.

Also note, it is vital the transmitter operate at 71 or 72 volts as indicated on the front panel meter. Any less, and you'll get this same type of overload indication due to the monitor not seeing enough carrier. Any more, and you'll be pressing devices too close to their limits.

Another hint. We pulled out the muffin fans and installed a gutted 2-1/2 ton air conditioner air handler above our ceiling to cut the propeller tip noise (the transmitter is in our main studio). This eliminated all the noise, and with the plenum installed, actually supplies MORE air than the fans did. We used 12 inch fiberglass duct and our A/C man made a fiberglass box to go over the opening on the rear of the transmitter. A good air filter, in an easy to reach place, is easy to change. We supply approximately 1100 CFM, the muffin pans were about 900.

EXCESS WOW & FLUTTER IN CART DECKS

Paul Jellison - WLW Cincinnati, OH

I have noticed that some tape machines seem to have a problem pulling long tapes after a few months of service. Sometimes this problem will even show up on short tapes. In doing a little research, I have a solution that seems to work.

After you have gone through the normal routine of changing pinch rollers and adjusting pinch tension, and you still have a tape machine with an excessive amount of wow and flutter, inspect the capstan shaft. Is it polished very smooth where the tape runs? If so, you could have a shaft that is so slick that it just won't pull, no matter how much pinch pressure you apply! I have actually observed some machines stop the tape and pinch roller, and yet the capstan keeps running.

In talking with people in the cart machine business, the reason for all this follows: Some tape formulations, in the last few years, have become very hard. This causes two things -- excess polishing of capstans and increased pulling tension.

Now for the fix. Remove the motors and dissemble them as if you were changing bearings. Once you have the capstan removed from the motor and the bearings off the shaft, take some masking tape, and cover the bearing surfaces and any threads. Now take the shaft to a machine shop or heat treat shop, and have the shaft blasted. This will rough up the

surface, and it should pull the tape much better.

I have had good luck with this on several machines, but I don't think it would work on ceramic shafts as they are very hard.

MEGGER CAN BE A MUGGER

Bob Schnieder - Broadcast Technical Services Lubbock, TX

Most anyone who is in electronics, from student to engineer, is knowledgeable about an ohmmeter. We know it will measure resistance in ohms, and that it operates by placing a small voltage at the terminal leads and is calibrated to read the resistance in ohms. Most ohmmeters measure up to 10 or 30 megohms, and can help to solve many problems. We know that a fuse will be either zero ohms or infinite -- good or bad. We can use the meter to check diodes, transistors, and even some capacitors.

Many technicians who own an ohmmeter never have heard of a Megger. A Megger is an ohmmeter that measures resistance in the 1000 to 2000 megohm range. Instead of the low test lead voltages of the ohmmeter, the Megger voltages are 500 to 1000 volts. A Megger is a useful instrument when working on a high-power transmitters, transmission lines and antennas. When used on a regular preventative maintenance schedule, you will be able to detect a problem long before it creats off- air problems.

I have used a Megger for years and was glad to see that Heathkit is offering one in their latest catalog. It is described as an insulation tester, but for the broadcast engineer, it is more than that.

Meggers can be used to test coaxial cables for leakage. The proper procedure is to remove the connections from the ground and center conductors at each end of the cable and then measure the resistance between center and outer conductors. With the high voltage applied at the cable, a faulty insulation will show as either a short or lower megohm reading. A normal ohmmeter could show the cable to be good, and you would not even see the problem. Testing your transmission lines on a semiannual basis, and logging your readings, will tell you if your transmission line is deteriorating. A leaky transmission line has caused many a problem for directional array.

Meggers can be used to check high voltage capacitors. When high voltage capacitors go to a dead short, you won't usually need a meter. The obvious bulge or tar that greets you, when you open the back of the transmitter, clearly shows the shorted capacitor. Normally, the capacitor was leaky long before it shorted out. A monthly or bi-monthly check with a Megger will probably alert you well before the off-air catastrophe.

To test high voltage capacitors, simple remove the leads from the capacitor, and attach the Megger. I personally get little exercise, so I have a hand cranked Megger to keep me in tip-top physical shape. As the capacitor comes full charge, you will be able to read the resistance in megohms -- it should be at least 1000 megohms. Now remember that you have just charged this capacitor to 500 or 1000 volts. This capacitor is LETHALLY CHARGED. Use your grounding stick or other method to short out both terminals of the capacitor to each other before you remove the Megger leads. Logging your resistance measurements will usually let you know if your capacitors are becoming leaky.

You can also use the Megger for those capacitors that are breaking down under load,

but you can't see with your regular ohmmeter. I have found many bad mica capacitors fast with a Megger. The only other way was to replace them one at a time, to see which was breaking down.

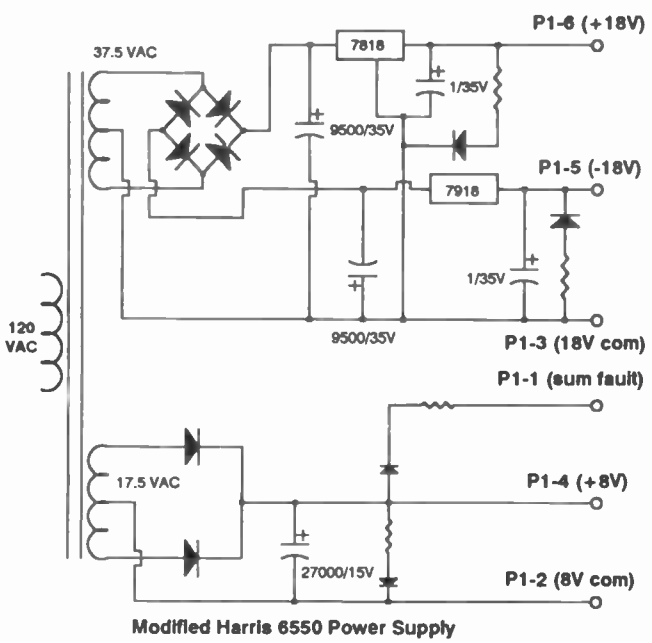
You can use a Megger to test plate blockers, power transformers, modulation transformers (you name it). The list goes on and on.

A Megger is a useful piece of equipment, but must be used with great caution because of the high voltages involved. Improper operating procedure with a Megger can make it a real mugger and cause you injury.

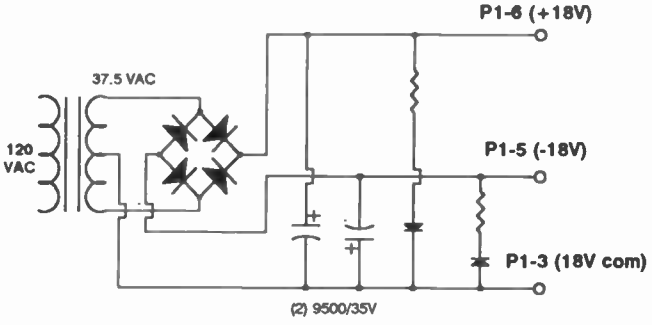
HARRIS SATELLITE RX FIX

Bill Rett CE - KXBX/KWTR Lakeport, CA

In 1984, we acquired on a lease purchase plan through UPI Radio News, a Harris satellite receiver model 6550. At the end of the lease, we dropped UPI but kept the receiver, took it off line and stored it.



Modified Harris 6550 Power Supply



+/- 18V section - Harris 6550 Power Supply (factory)

This Spring we became an Oakland A's affiliate, and decided to use the Harris receiver for the network SCPC feed. Since all that was required in the receiver to receive the feed, was the original Harris downconverter card and a tuneable baseband demod card, we purchased a Scientific Atlanta tuneable direct plug-in replacement for the original fixed-tuned Harris baseband demod. The result was that the receiver was now operating with only 2 plug-in cards instead of the original four.

The unit initially worked fine but, after about 8 hours of operation, the downconverter would fail, and the receiver will squelch up. After being shut down for an hour or so, it would then work OK for several hours, then fail again. I noticed that the downconverter card was running extremely hot, and when I measured the + -18 volt rails, I found them running +- 25.5 volts. Upon removing the power supply module I found that the supply outputs are totally unregulated! The lack of load on the supply output (due to only

on the supply output (due to only using 2 cards) allowed the output to go to this value. Our primary AC voltage here usually runs about 125 volts, which makes the situation even worse. Luckily the power supply has ample room to add two 18 volt regulators on the heat sink, which has solved the problem. I used 7818 and 7819 3-terminal regulators in a TO-3 case. Apparently, one of the regulators in the downconverter card was overheating due to the high supply voltage and going into thermal shutdown.

I found that Harris still supports this and other early satellite equipment of theirs. I found them very helpful and they can also supply new cards and repairs at a reasonable cost.

AUDIO IN A PINCH

Gary Wachter - Digitronics Tempe, AZ

In the Dec. issue of Radio Guide, Ray Jenkins was running down his experiences with the infamous AEL transmitter. This brought back many "fond" memories of the two AM-5KDs we went through at KTSA, San Antonio.

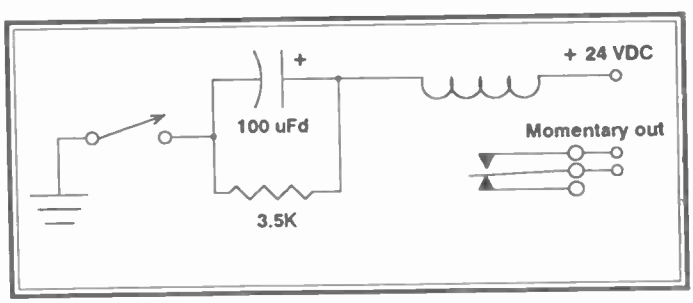
At one point, a long holiday weekend was about to start up, and the spare set of Sanken audio drivers had just become history. Not really wanting to stay on the old RCA hulking giant for an extended period of time, I proceeded to find a temporary solution.

A Sansui 35 watt AM/FM stereo amplifier was procured from a local store (trade, of course) and placed behind the transmitter cabinet. The Sankens were removed and the audio feed was run to the auxiliary input of the Sansui. The speaker output was then used to drive the transmitter. You know what? It sounded better than ever! We just had to make sure that no one played with the tuner section of the Sansui and unintentionally simulcast another station through our transmitter.

Anyone contemplating replacing the Sankens with another type of small amplifier should, of course, install it inside the transmitter cabinet. At KTSA, we finally solved all of the AEL problems permanently -- we replaced them with a pair of transmitters from a "well-known" manufacturer in Dallas!

TIPS FROM THE FIELD

Robin O'Kelly - KORE Springfield, OR



RELAY PULSE CIRCUIT

This circuit takes an on/off contact closure and outputs a momentary pulse.

STL CHECK

If you ever have doubts about whether an STL microwave transmitter is operating, try bringing a car radar detector near it. If it is radiating at all, the detector will go off. This seems to work on systems from 10 gHz to 24 gHz, and possibly others, depending on the detector.

RF INTERFERENCE SOLUTION

We recently had complaints of RF interference to TV audio in a mobile home complex located behind our tower site. We had interference reports from three different homes, and I checked on a few others. After checking my station ground strapping, harmonics, etc., I went to one home to work on the problem. I discovered that the local cable company had installed an underground cable system and had decided that grounding the system was unnecessary because "lightning doesn't hit things that run underground. I ran a ground wire from the cable entry point at ONE home to the telephone ground rod and cleaned up the problem for the entire complex. They have not had a problem since.

At another station, I had AM interference into an electronic phone system. It was so bad that the telephone "sang" while still in the box! I solved this one by running a small diameter additional ground lead from inside each telephone to a bolt on each of the metal desks on which the telephones sat. The desks were not grounded to anything, so don't ask me why it worked.

REVOX A-77 MOTOR TIP

One of our Revox A-77 machines liked to wind down its capstan motor and stop, every now and then. This machine has tape drive board 1.077.725 which is different than our other machines. Of course, all of the signals on the tach board are developed by the motor turning, so no real troubleshooting was effective.

Replacing all of the components on the board and the tach sensor was equally ineffective. What did work was adding a 1.0 uF capacitor across the tach input leads to the board. The machine has not "died" for a year now, and it seems to suffer no ill effects such as wow and flutter.

MORE ON TFT 724A MONITOR CLICK FIX

Frank Zeller WBJC FM Baltimore, Maryland

I read Bruce MacMillan's article, in the January, 1990, issue of Radio Guide with some interest, since WBJC has a pair of TFT-724s of the same age. It is an amazing coincidence that several days after reading the article, one of our monitors developed the same problem of audible clicks and flutter in the left meter.

The addition of a 1K resistor between C-21 and CR-2, as was suggested, eliminated the flutter in the left meter and the audible clicks. I was not convinced that altering the design of the monitor that had worked so well, for so many years, was the solution.

The resistor was removed and the circuit around Z-5 was checked with a 'scope while the left meter was fluttering. Glitches were observed on pin-4 of Z-5 (the 12 volt bus). The glitches appeared on the bus only when the left meter was near 100%. Filter capacitor C-25 (15uF 25V) was defective. Replacement of the capacitor corrected the problem.

SOLID STATE FM TRANSMITTERS AND BLOCKING CAPACITORS

Craig Miller Honolulu, Hawaii

A few years ago, I had a problem with my solid state QEI 500 watt backup transmitter. It would work fine into the dummy load, but would die when it was switched into the antenna.

KHPR uses a Comark FM antenna on which the center conductor comes out on a strap to one of the arms of the CP antenna bay. This effectively puts a DC short between the inner and outer conductors of the antenna and, hence, the feed line.

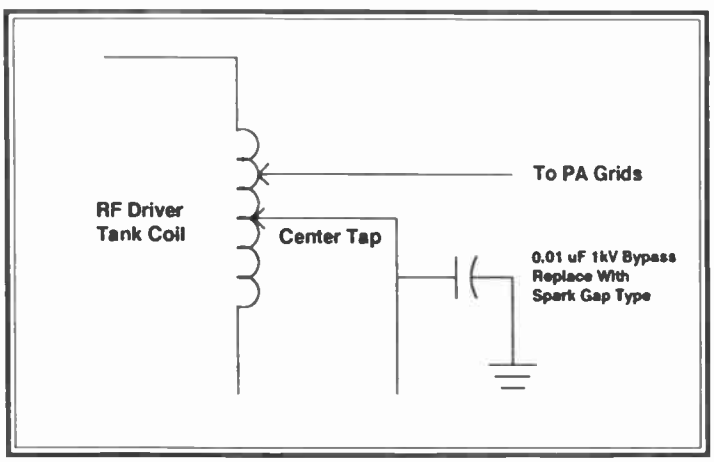
The problem with my QEI was that one of the blocker capacitors on one of the four output transistors was shorted. This put the 50 volt collector supply right onto the center conductor of the feedline. When the QEI was on the dummy load, the collector would see 50 ohms to ground, through the shorted capacitor, and it would have enough juice to handle that extra load. But when the QEI was switched onto the antenna, the collector supply would see a dead short to ground, and that would bag out the supply--and the transmitter would appear to be dead.

After replacing the shorted blacking capacitor, the QEI worked fine on both the dummy load and the antenna. When working with solid state transmitters, remember that there isn't enough voltage to cause serious arcing, but you still have to keep DC off the inner conductor.

HARRIS/GATES BC1-T, G AND H TRANSMITTER MODIFICATIONS

Jim Alexander Broadcast Engineering Services Russellville, AR

The center-tap of the RF driver tank coil, in this series of similar transmitters, is by-passed to ground through a .01 uF, 1000 volt disc ceramic capacitor. This capacitor is prone to fail during thunderstorm activity, and I have seen a number of these transmitters with connections showing frequent replacement and/or replacement with a large surplus type mica capacitor.



I have, for years, replaced this capacitor with a Mallory AT103A. This unit consists of a .01 uF ceramic capacitor which features a built-in spark gap in a single package.

This change will normally preclude further problems with the bypass capacitor.

CONTINENTAL TRANSMITTER SHORTED BIAS TRANSFORMER

Richard Egan - WIZM LaCrosse, WI

I was recently working on our Continental 828E-1 5kW AM. The Switchmod bias power supply transformer A7T3 had shorted and burned up. The short was caused by a failure of a diode on the power supply board, A7A3.

I replaced the transformer and the shorted diode; all other diodes checked good. The transmitter came up fine, and all readings were normal.

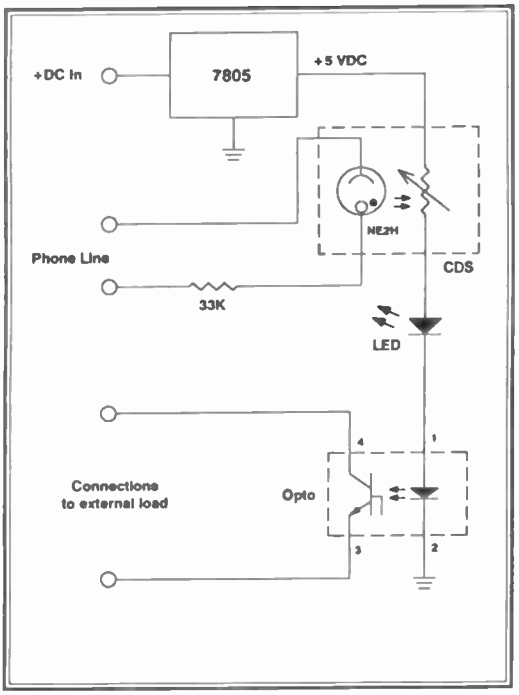
Early the next morning, the transmitter failed again. Much to my dismay, I found out it had burned out the bias transformer. Two power supply diodes had shorted this time, though they had checked good just the day before! Technicians at Continental told me that these diodes are sometimes weakened by a failure, but won't go bad right away. It's best to replace all of them if one fails. I went one step further, by placing fuses in series by each leg of the secondary of the transformer to provide some protection from future shorts. Just break the traces and solder them on the back side of the board.

Another word of caution on this transmitter -- try to keep it as clean as possible. This goes for all transmitters, but this one in particular. Supply voltages are very high (-13000V) and have a tendency to really attract dust which could cause arcing if allowed to build up.

TELEPHONE DETECTOR INTERFACE

Joel Clark Humke - J.C. Humke & Assoc., Aurora, CO

Once in a great while we all find ourselves in desperate need of a circuit that will transform the ringing telephone into a stimulus this is loud enough or bright enough to wake up the control room operator. I'm sure a few of you have plotted to interface with a cattle prod in the operations chair -- this circuit could do that too. It can also be used to start cart machines on listen lines and similar domestic uses.



, There have been many homebrew designs of similar circuits, and many of them use optos, with DC isolation from the phone line being provided by electrolytic capacitors. The disadvantage of a direct LED interface is that the capacitors have to have a large operating voltage and a large enough capacitance to pass the current necessary to light the LED. The use of an old fashioned (outdated?) neon bulb in the circuit provides the advantages of: 1. Nearly infinite line shunt impedance 2. Over 33 K ohm ringing impedance 3. No coupling capacitors required 4. Low construction costs and parts count

At first I experimented with the standard NE-2 bulb (RS 272-1101) which can operate with a 220k series resistance, but I found that the firing

voltage was just too low and this bulb would light just from the 48 VDC on the phone line. I found the NE-2H operation with a 33 K series resistance to be stable and dependable.

To make this "roll your own" neon-CDS ring detector module, is simple. Just carefully glue the neon bulb to the face of the CDS photo cell, then slide a little insulation over the leads and bend the leads so the photocell leads exit the package in one direction, and the neon bulb lead exits in another. Then carefully wrap the unit in black electrical tape and make sure that no light is getting into the photocell. To make the unit look like "factory"' you can use some heat shrink tubing over the assembly, as long as you use extreme care not to heat the components inside to the "crispy" state.

I found that the current through the photocell, LED and optoisolator was just about 10 mA. So with a 5 volt supply voltage, and an automatic voltage drop across both the opto and LED of 1.85 volts each (and if Kirchoff was right), that leaves only 1.3 volts across the photocell for it to switch from near zero current, when dark, to about 10 mA when it's lit up and has a resistance of about 130 ohms. This is a power dissipation of about 13 mW in the "on" state, which it handles quite easily.

When you wire your external load, to be switched by the optoisolator, I suggest you use a small series resistance and a capacitor across the load (between 22 and 220 uFd). This can be used to insure that your circuit will not be triggered by short term line spikes provided by Mother Bell or by inductive spikes caused by rotary dial telephones.

This same circuit, using larger resistors and larger capacitors, can even make the circuit see more than one or two rings before it activates. You may use alarge range of supply voltages on your secondary load circuit, thanks to the optoisolator. Even the "name brand" manufacturers have trouble with the spikes caused by rotary dial phones. If you have that problem you can experiment with increasing the value of series resistance to the bulb, upward from 33K.

STANDBY GENERATOR TIPS

John Almon - Nashville Network Nashville, TN

The tips by Ralph Hartwell II, on standby generator maintenance, were a welcome sight, and brought out a few thoughts on often neglected diesel generator sets and ways to eliminate problems before they happen. Diesel engines are more expensive than gasoline engines, and a little extra care is necessary to keep them in top condition.

Unless you are in the sunny tropics, chances are you'll need a block heater to allow easier cranking of diesels. We run our block heater set to 100 degrees (F) all year long. Pacific Transducer Corp of Los Angeles sells a magnetic surface thermometer which can be stuck on the engine block and will let you know that the heater is working properly at a glance. (model 313-FRR)

Diesel mechanics say it is rough on the engine to be shut down before it reaches operating temperatures. Avoid putting undue strain on the engine by setting automatic switches to run the engine for at least 20 minutes each time it cranks, and keep this in mind when operating manually.

Nothing upsets diesel quicker than contaminated fuel! Be sure to use a water separating

fuel filter sized for total gallonage at the inlet of a day-tank and another on the outlet of the day-tank. Don't use fuel consumption as the figure for flow on these filters. Often 50% of the total flow is returned to the storage tank by the fuel block, so check with a filter or engine salesman for proper sizing to keep filters from clogging before they should.

If engines are operated less than once a month or a fuel problem exists, check into a fuel circulator system. This system consists of a timer-operated pump that circulates fuel from the bottom of the tank at one end back into the top of the other end. While flowing, two or more large water separating fuel filters trap water, tank scale, trash, and other such contaminants. Circulation also prevents fuel separation where the different fuel components settle into distinct layers.

For remote sites, a water presence detector can be added to a water separator bowl to alert operating personnel of a potential fuel problem.

CRITICAL CABLE CONNECTORS CONNECTED QUICKLY

Gerald Wakayama - TFT Inc. Santa Clara, CA

Since more radio stations are switching from phone lines to microwave STL, the situation will arise where the engineer does not have all the connectors and adaptors necessary to complete the RF plumbing. Especially if there are equipment additions or just installing the new STL system.

Where did type "N" come from when we already have PL-259 UHF connectors? Well, in this world of Gigahertz, a dB and a half connector loss is just too much for a system that relies on every dB to obtain every bit of dBm.

Thus, the type "N". But rather than carry $10-$20 worth of adaptors, take note of the BNC connector. It will do in a pinch. When you can't find the "N" cable that connects the ANT to RX or TX, use your BNC cable. Just cut off the knurled twist lock and you have an "N" adaptor cable. On the female BNC, file off the twist locking tabs, and the match is perfect to an "N" male.

Now that you have temporarily remedied the situation, you can address your other emergencies.

However, please note that you must replace the quick fix cable with one with the right connectors. Just like using the right tool for the right job, use the right connector where it belongs.

TE-3 EXCITER FREQUENCY DRIFT

Paul Salois - KPCR AM/FM Bowling Green MO

There are a great many Harris FM transmitters out there with TE-3 Exciters. The following problem became very frustrating since my copy of the tech manual on this unit

stated, "NOTE: L3 is Factory adjusted in the field." After trying everything else I could think of, I talked to some people at the factory and the following is what they came up with.

ADJUSTMENT OF THE MODULATION OSCILLATOR

The symptom is that the AFC Alarm light comes on, and the transmitter plate circuit goes off. The Modulated Oscillator operates with the cover off but starts to act up when it is screwed on. The trouble is that L3, the Coarse Frequency adjustment, has drifted.

When the Modulated Oscillator gets out of adjustment, the procedure to bring it back in is as follows: With the cover off, the Modulated Oscillator and the AFC switch off, turn the 10-turn AFC unit to the middle of its range. Set the multimeter on the AFC unit to the AFC position (the middle position). Then with a non-metallic alignment tool, adjust L3 until the multimeter swings slowly from minimum to maximum and back (about one swing per second or even slower if it will do it). Turn on the AFC switch and adjust L3 to bring the reading on the meter to 25 or so. Put the cover back on and see that the meter now reads 27 exactly. If it does not, note the amount it did rise, remove the cover and re-adjust L3 so that, when the cover is on, the reading is exactly 27. Verify and re-adjust the transmitter frequency if necessary using an accurate counter.

ITC CART MOTOR BEARINGS

Kirck Harnack - Kranack Engineering Memphis, TN

Most motors on the ITC "Premium" cart machines can be easily rebuilt. If the motor is making noise, the problem is usually bad bearings. New bearings for motors labeled "ITC" or "Beau" can be easily obtained at your local bearing supply house. "Nidec" bearings are a little harder to find but can usually be ordered from the same supply house.

Taking the motor apart is easy, once you get the hang of it. Take the motor out of the cart deck. Remove the "E" clip or whatever device captures the shaft, and gently tap the shaft out through the bottom of the motor.

Sometimes removing old bearings from the motor is a trick. It's OK to mess up the old ones in the process of removal; just try not to score the surfaces where the new bearings will rest. While you have the motor shaft out, clean it thoroughly. We use carburetor cleaner but any good solvent will work. Also, clean out the wells where the new bearings will rest. Reassembly is straight forward. Gently tap the new bearings into place. Be sure to replace any compression washers you took out with the bearings. Reinsert the shaft, replace the clip and dust cap.

When putting the motor back into the cart machine, be sure to align it properly so that the pressure roller hits the capstan squarely, head on, and that the pressure roller shaft is exactly vertical when the roller is engaged. ITC sells gauges to aid us with this, although it can be done by careful observation.

E-Z ESE AUTOMATION

Dave Seavy - KROC AM/FM Rochester, MN

About a year ago, we decided to automate our AM station, since we carry Larry King all night. A board operator was really a waste of resources. Since our FM is live full time, I wanted a system that was simple enough to be run by the FM jocks, yet adaptable enough to handle our special needs.

The price of automation is going up, since it has again become a popular way of delivering programming. I found that you had to settle for "bare bones" or the "Cadillac". So I decided to "build" my own system.

The heart of "Otto" is the ESE 790 timer. Many stations use ESE for unattended recording, lighting control, etc., but I found that when used as a programming control, it performs as well as any commercially made system, if you want to spend a little time piecing together other control equipment.

I purchased two tone decoders from Mutual. One for turning on the network, the other for starting a cart deck during local avails. I had to be able to defeat the decoders, to accommodate inserting the local news at the bottom of each automated hour. This is done by programming the ESE to turn off the power supply to the decoders at the specified times, then restore power when the decoders are needed. With two outboard relays, the decoder either turns the console channel on the Mutual, or turns the channel off, and fires the "spot" cart deck.

I then had to dedicate a cart deck for weather forecasts. That was no problem, as I could program the ESE to fire that deck after the pre-determined time that the that the local commercials would end. This eliminated the need for secondary cue tones. Another situation that I had to overcome, was weekend programming. We stop taking Mutual at 0500, but our weekend announcer doesn't go off the air until 0600. Using two Revox PR-99s, we run pre-recorded programming on Saturday mornings.

The ESE is programmed to roll the first deck at 05:05:31, right after the ABC news and the local weathercast. At 05:29:00, the ESE kills the audio from reel one, fires the local revenue, then transfers to and rolls reel two. Slick! Sunday mornings are just as easy. The ESE turns on ABC for Perspectives, then rolls an Otari to record the show while it is being aired (for rebroadcast at a later time).

It would take two months of Radio Guide to cover all the functions that the ESE does for KROC. It has proven to be a very reliable method of automating, and I've spent less than $4000 setting the system up. Of course the commercials and newscasts have to be pre-recorded, but our evening board operator handles that while he rides herd on the controls during the network shows.

SOFT TUBES & REGULATION

Rich Egan - WIZM AM/FM LaCrosse, WI

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 performance. An older tube will show 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 a 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.

SMC DATA-CELL TIPS

John Wittenmeier - 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 have 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 cents 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.

PREVENTATIVE MAINTENANCE

John Graham - WFCJ

It seems like every station I've gone to work for, has been maintained by the crisis approach, rather than the preventative approach. One station I worked for was a disaster

waiting to happen. By applying a systematic maintenance program to this station, I was able to cut down on a lot of equipment breakdown, and reduce the stress level.

I begin by gathering up all the service manuals and seeing what each on has to say about maintaining that piece of equipment. Then I divide up, on a daily, weekly, monthly, quarterly, and semiannual basis, all the maintenance that must be done to that piece of equipment.

After determining what maintenance must be done, I use a chart that I read about years ago; one that Peter Burk had used. What he did was divide the equipment in groupings. I divide mine into like equipment categories (such as all tape decks, or all cart decks). The chart is divided into 24 weeks. and there are 12 groupings. Each week all 12 groups are covered. For some, it is weekly maintenance and for others, it is a monthly or quarterly maintenance. For semiannual, the focus is on just one grouping. Everything else is weekly maintenance.

I've used Mr. Burk's chart for years, and it has helped me greatly. By scheduling your maintenance each week, it allows you to do other projects that need to be completed. I keep my chart in a 3-ring notebook. My notebook is divided into the 12 groups that I have on the 24 week chart. Each piece of equipment has its own page with serial number, location, and manufacturer's name. The page is divided to state what the problem was, how it was solved, and the date. On most of the audio equipment, if I have conducted any tests, I keep a separate sheet so I can refer to it in the future.

For my transmitter maintenance, I log every meter reading that transmitter has -- each week. If I have any trouble during the week, I note that as well as the new readings. Each month the transmitter is cleaned and tested on the dummy load; the back-up transmitter and its systems are also cleaned and tested.

Many may think it unnecessary, but I log weather conditions in the area: temperature, humidity, barometric readings, wind chill, heat index, and sky condition. If you have an AP wire service, they give it every hour. Recording weather conditions can serve to help trace out possible line pressure problems, changes in VSWR, icing conditions, and other tower problems.

Tower maintenance includes a yearly inspection by a tower crew, and re-lamping is also done at this time. Each month an inspection is done, and also after each heavy storm that comes through.

A filing system is included in my maintenance program. Many magazines come across my desk with articles on maintaining this or that equipment. The older I get -- the less I remember. For me, my filing system is my "memory". I file things away on troubleshooting transmitters, aligning CDs, and a host of other subjects that can be a help in times of trouble.

One other maintenance idea that I started several years ago, is my "Monday Morning Check". This is an 11 X 14 sheet of paper with a basic list of things to check at the beginning of each 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 discover problems with equipment that no one had told me was acting up.

A preventative maintenance program takes time to develop, but it can make life easier for you and help you keep your sanity.

SOLID STATE RECTIFIERS -- PASS OR FAIL

Gary Minker - WIRK-FM/WPBG-AM Lake Worth, FL

With all the marvel in 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 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 troubleshooting 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 "OCTOPUS TESTER" from Bob Schnieder.
3. A Sencor LC-77 Capacitor Tester

Testing rectifiers can be done in a 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 drop across low voltage devices gives a good indication of the condition of the device. The curve trace of the Lissajous patterns 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 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 junctions(s) is helpful along with these next tests in the Sencor 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.

SMC 350 CAROUSEL MUSIC

Jon Hartmeyer - WCLT Newark OH

I have discovered some simple ideas that will help in finding and fixing certain problems with 350 series Carousels. I've been working on these carousels for about 1 1/2 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 4 or 5 times, the machine would operate OK on its own. I did notice some squealing, so I assumed 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, it was back.

This time I used a hand demagnitzer for tape heads on 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've 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 OK. Then I adjusted the alignment of the 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 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 OK. The solution I've found to this problem is to first clean the drum where the tires ride. If that doesn't work 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 places 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.

AUTOGRAM/COLLINS CONSOLE AMPS

John T. Winquist - WFPS Freeport, IL

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. This 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 manufacturers's design. Instead of converting the chassis, why not put a terminal strip on the 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 grey 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 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 some day we will finish the job, but for now everybody in this station is quite impressed (myself included).

ORBAN OPTIMOD 8100 FIX

Mark Bohach - WHOK Inc. Lancaster, OH

After a recent thunderstorm, I noticed that my station 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 $\pm$ 0.5% to the beat of the music. This was very unusual since I do not composite clip (or ever will). The second symptom 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.

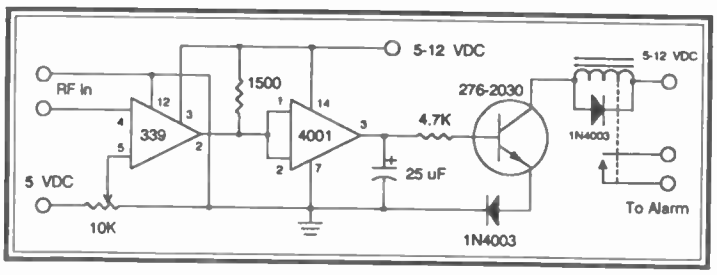
I then called Orban customer service to order the right part and to find out if there was any problem using the NE-5534 as an emergency substitute, I was told two very interesting things. First, the 518 IC usually simply dies, and that the problem that I encountered was somewhat rare. Second, they had never tried to substitute a 5534 for a 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 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 the problem 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

John Graham - 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 without soldering anything to it. The circuit has been working for some time without any false triggering.

SANS MOD TRANSFORMER

Ron Schact - WNAK Nanticoke, PA

What do you do when your one and only modulation transformer goes to ground, or worse, across the windings. First, generally, if it goes to ground, you can put it on a block of dry wood and get back on the air until a new transformer is obtained. Don't think this is a permanent cure, because usually whatever made it short to ground will ultimately cause a primary to secondary short.

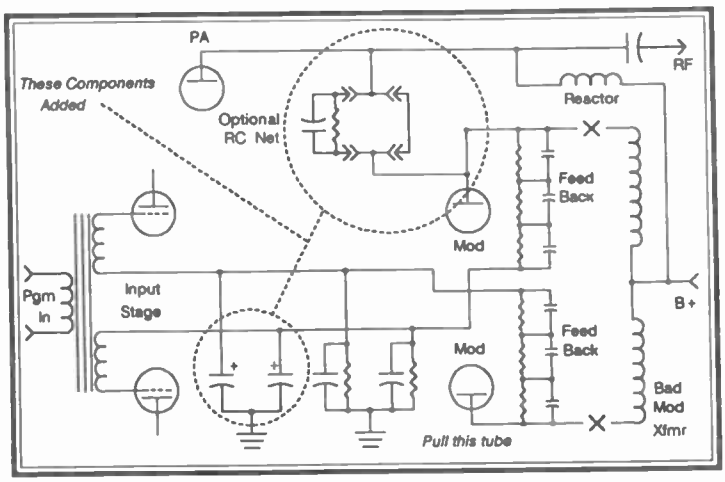
Here is where old Heizing comes in. This modulation method has been used over the years in various communications equipment such as aircraft, as the equipment is not as heavy without a modulation transformer. Here is how we can get back on the air without the old iron. You must remember that you won't modulate 100%, your positive modulation will be low and you may have a tad more distortion, but, you will be on air, serving your listening audience in radio land and making money to buy the new transformer.

First, as always, turn off the transmitter AC breaker and discharge all power supplies with "the stick". After the old transformer is disconnected, choose the plate lead from one of the modulator tubes (preferably the side with the best tube). Tie this line directly to the RF side of the modulation reactor, Normally, the RF side of the choke goes to the PA stage plates. If you have no spare parts, leave it there.

If you have some big resistors and capacitors, set up a parallel RC combination of a resistor and a capacitor, in series with this line. The capacitor should be about 4uF rated at least at the transmitter plate supply. The resistor should drop around 500 Volts across it for 1 to 5 kW or about 1000 Volts for 10 kW and up, at a wattage rating according to its DC dissipation. For an average kilowatt, a 50 watt job will do. This will give a more symmetrical waveform, helping in the positive direction. But as I said, if you don't have the parts, don't waste your time looking for them.

Finally, pull the unused modulator tube. Locate the input transformer. In most transmitters, the feedback ladders return to the low side of the input transformer, in a 180 degree phase-shift. Generally, most transmitters will operate just fine with no DC returned to the first audio grids. If this is the case with yours (RCA, ITA, Ratheon, Gates), take two trusty clip-leads and ground the two bottom ends of the input transformer secondaries. If you must preserve the DC on the input stage grids, ground the same points through a pair of 10uF 150V capacitors. This will eliminate the feedback but will let the DC through OK.

If you have a Raytheon, the feedback ladders can be completely disconnected, as they are on the second stage. Eliminating the DC and AC feedback will generally make the input stage operate closer to Class A, working on both sides of the AC cycle rather than either the positive or negative side, as it was used to.



Without audio applied, fire up the transmitter and check the idling plate current on the remaining modulator. Run it up to about one and a half times its normal (again, we are trying to approach class A operation). Now, very carefully, bring up the audio. The transmitter will need much less

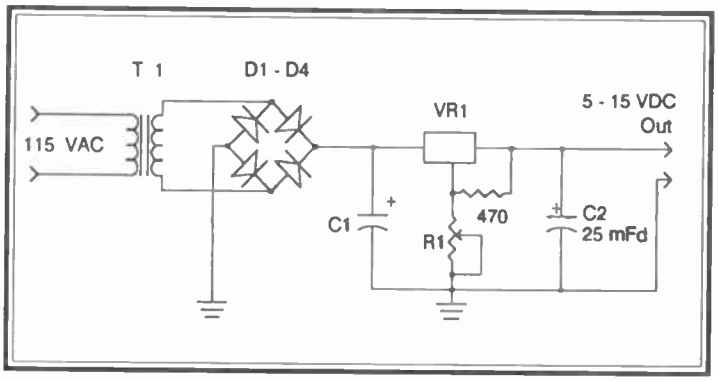
audio with the feedback strapped out, so watch out. Basically, adjust the modulation so it "sounds OK", but usually 60-70% is good.

I hope this saves somebody some air time in an emergency as it has worked for me at numerous stations from 500 Watts to 25 kW.

ADJUSTABLE POWER SUPPLY

Chuck Gennaro - WFHR Wisconsin Rapids, WI

An adjustable power supply is a handy item to have, whether for testing, construction, or even keeping a piece of equipment running while its main supply is being repaired: As with many other things, a commercial unit can be expensive (translation: corporate bean-counter says no). Here's one you can build from your junk-box.



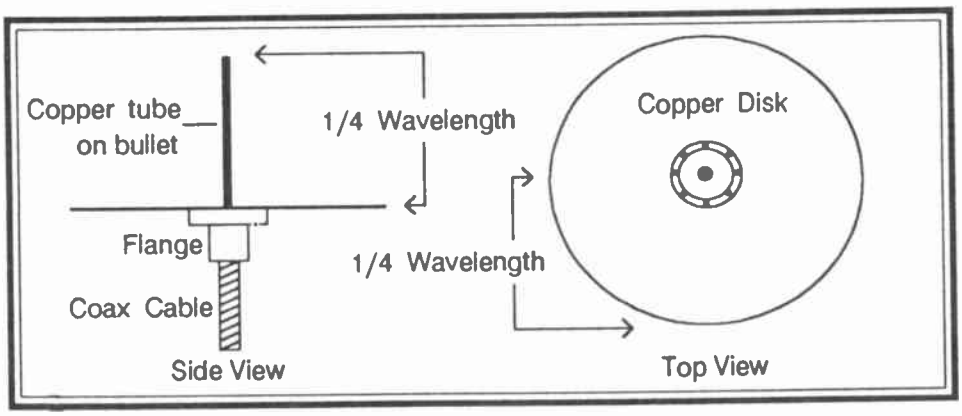
T1 can be almost anything, within reason. 18 Volt transformers seem to be glutting the surplus market. A 35 Volt center-tap unit will work as well with a full-wave bridge rectifier; use whatever you have on hand. 1N4001, 1N4004 diodes, all work fine. One of those encapsulated, four-lead rectifier units is great. C1 and C2 are for filtering the DC output. Again, the exact values are not critical. 1000 uF to 4000 uF for C1 will give satisfactory filtering. C2 should be around 25 uF. VR1 is a 7805 or other 3-lead IC voltage regulator. These little devils can supply up to 1 amp, with proper heat-sink, and provide overload protection too. They will shut down and cool off, if overloaded. R1 is a 1 k pot. It "fools" the regulator into providing up to 15 volts by shifting its ground preference.

This supply will produce regulated voltage from 5 to 15 Volts at up to 1 Amp., if the regulator is heat-sinked. More current can be supplied by adding a couple of series-pass transistors. 2N3055s will work as well as anything. Again, the type is not critical. Don't forget that the current output is also dependent on the capability of T1 and the rectifiers ratings.

EMERGENCY FM ANTENNA

David Stewart - KBNA El Paso, TX

Ok, you've smoked your FM antenna and perhaps melted the line down also. This stunt will help you get back on the air quickly. It's real easy with a rigid line because of the flange, but can also be done with flexible cable by adding a field flange.



As shown, the impedance will be about 40 ohms. If the ground plane consists of 1/4 wavelength rods oriented downward at 45 degrees, the radiation resistance will rise to 50 ohms.

Start with the transmitter power as low as possible, then raise power to some reasonable VSVR (1.5 or so). Your goal is to have something on air.

CD SKIPPING CURE

Jerry Mathis - WSCI/WKKG Columbus, OH

Many radio stations are using consumer-type CD players in their studios and control rooms. They'll work fine for awhile, then they start having problems. One of the main problems I have encountered is that the music will "skip", much like a turntable stylus jumping one or more grooves of a record. I have found that cleaning the laser pickup lens will solve the problem, at least temporarily (until the lens gets dirty again).

To clean the lens, remove the player from the studio and take it to your bench. Plug the unit in, and open the CD drawer. Be careful not to damage the drawer while working on the machine. Unplug the unit and remove the cover. There are usually four or six screws on the sides (possibly one or more on the rear).

After removing the cover, you should be able to see the laser pickup assembly under, and about in the middle of the drawer mechanism. On top of the assembly you should see a small (about 1/8" dia.) lens. You'll probably find it clouded by dirt and dust.

The lens and its mounting are rather fragile, so we want to be careful. Take a cotton swab and pull some cotton loose at the end, so it makes a fine and delicate brush. Use this to lightly brush the debris from the lens. You can gently blow on the lens as you clean it to be sure all particles were removed, and you don't leave any strands from the swab. Don't use any chemicals, not even alcohol or disc cleaner -- just the light cotton hairs from the swab. Re-assemble the unit, plug it in, and retract the CD drawer. There's a good chance the machine will play perfectly. If it still skips, then it's time for a trip to the shop.

Don't overlook the possibility that you may have some damaged CDs that are causing the problem. CDs are touted as being practically indestructible (ha!). If you have a disc that always skips in one spot, try the disc on another machine (preferably one of the same model). If it skips on both machines, you may have a bad disc. If it skips just in one machine, try the aforementioned cleaning procedure.

Incidentally, you might want to check before you open the machine to see if doing so will void the warranty. If the unit is practically new, this might be a problem. If the machine

is six months old, and your nearest repair depot is in South Podunk, you're probably not going to send it back to them anyway.

If anyone out there has some tips on troubleshooting and aligning CD player electronics, I'd like to see them. The consumer units almost never come with a schematic, and certainly not a service manual. Is there some basic troubleshooting that could be done with a DVM 'scope, and maybe a frequency counter?

"PLEDGE" NOT TO CLEAN TEFLON-COATED SOLENOID PLUNGERS

Tim McCartney - KBSU Boise, ID

A cart machine is supposed to fire every time. So, when it doesn't, the culprit frequently is a solenoid which fails to properly pull in the pinch roller.

A sluggish solenoid is usually improved by the dampening adjustment at the back of the can, since the speed of solenoid operation is directly proportional to the speed at which the air is allowed to move through the small hole in the solenoid seat.

What to do if this adjustment fails to improve the sluggishness?

The ITC Customer Service Dept. maintains that its Teflon-coated plungers normally offer no resistance to the dampening action and, therefore, not likely to be the source of the problem. However, if the plunger's Teflon-coating has worn or been scratched, it is possible that dirt and dust have accumulated to offer resistance It's time for a new solenoid. A plunger cannot be purchased alone, since the entire assembly is matched by the manufacturer.

ITC recommends limited solenoid cleaning. The screw and the spring on the back of the can may be removed and blown out with an air hose. As for the plunger, it can be removed and wiped with a clean towel. Other efforts at the plunger cleaning assure some trouble ahead.

Short term hope does exist, while a replacement part is on order. The use of the furniture wax "Pledge" can sufficiently lubricate the plunger to restore the needed response. Using cotton swabs or a clean cloth, apply the wax to the exposed portion of the plunger. ITC warns, however, that such lubricants will, in time, collect dust and re-introduce similar problems.

At KBSU, we tried the "Pledge" approach to extend solenoid life, with some success. After about 8 months, another application was needed and, in a sense, our ITC cart solenoid plungers are now Johnson Wax junkies -- "hooked" for life.

These findings suggest that solenoid life might be extended a year or two with regular "Pledge" applications. But, there will undoubtedly be some on-air starting failures unless this maintenance technique is regularly followed.

We are glad not to have committed the cardinal sin of plunger lubrication errors, however. That would be an application of graphite -- its abrasiveness can quickly chew right through the Teflon-coating.

Teflon Presidents come and go, but Teflon solenoid plungers are here to stay. In theory, at least, nothing sticks to Teflon and trouble is avoided. But then there's the real world ...

CARE AND FEEDING OF MCMARTIN BF-25M TRANSMITTER

Bruce Anderson - KIQX Durango, CO

Once you learn the quirks of any transmitter, you can either modify it or learn to live with it. The McMartin BF- 25M 25 kW FM transmitter is no exception. We've had one since the station went on the air in 1981. With a couple of quirks ironed out, we're living with it quite well, thank you.

The first major modification was a factory bulletin changing the final from the original tube to a 3CX-1500A7. After this modification, the BF-25M was very stable and quite tunable.

Our line power is at the end of a 3 1/2 mile haul up the mountainside. Although we have three-phase closed delta service, the line is susceptible to glitches -- especially if something zaps in Tacoma, Washington or Orange, California. Add to that our abundance of electrical storms, and we have had overloads and breakers tripping all the time. The solution was essentially three-fold. First, we super grounded everything, and not just to the electrical service. Three inch copper strap was run from the bond on each equipment rack and each cabinet of the transmitter and high voltage power supply to an outside buried grid around the building. The tower was also bonded to this grid.

GREAT GROUNDING EFFORT

B.G. (before grounding), we took many strikes, a couple of which wiped out various components in the building, including the remote control. In fact, you could follow the trail of destruction around the cabinets, from the power supply through a contactor and right to one of the blower motors in the PA -- which from that point on insisted on running backwards (the starting winding got zapped). Since the great grounding effort, we've been hit by lightning quite a few times, and there's been no damage to the transmitter. In fact, we've hardly gone off the air due to the elements.

Second, we protected the line coming in with a gob of MOVs and rectifier stacks have held together since then. Third, we added considerable regulation to the low voltage power supply. Until then, we were popping heads off transistors right and left, particularly Q1 through Q6 in the overload protection assembly and Q2 and Q4 in the control ladder. Since the regulation, nothing has gone south.

We added a Bird Wattmeter to the output of the driver stage, which gives us a quick glance at what that section is feeding to the PA. It also lets us know precisely what's going out to the antenna (or coming back) if we ever experience a PA failure and run the driver straight into the harmonic filter, which the BF-25M is capable of doing with some re-plumbing.

MICROPHONICS A PROBLEM

We drive the final with about 1200 watts, which lets the PA coast. All three of our tubes show absolutely no signs of dropping off, after about two and a half years continuous service.

It is recommended that you remove the exciter from the driver/IPA cabinet because of the microphonics in the unit and its proximity to the blower. It's so sensitive, though, that we have it shock mounted in a rack away from the entire transmitter box.

Before shock-mounting, it would pick up the blower rumble through the concrete floor and metal rack!

We've moved some things around in the PA cabinet, mostly to keep sensitive components away from heat. The rheostats for the filaments are too close to the overload protection board for my comfort, especially when the hinged door they're on is closed.

Moving them couple of feet down the outside of the box might mess up McMartin's pretty contact-paper/wood-grain exterior, but it sure keeps things cooler.

I've considered installing a box fan to further circulate the air in that part of the cabinet, but it doesn't appear necessary at this time. Also, we felt no need for adjustment of the IPA filament voltage, so we un-ganged that rheostat from the driver filament rheostat and put a fixed 25 W resistor in the circuit.

In the same area, the four bleeder resistors (R47 through R50) in series/parallel are subject to considerable stress and invariably fail within a few days of a new PA final installation, so we keep a set of spares.

So often transmitter manufacturers (and I include virtually all of them) have designed units for operation at or near sea level. A scant few have taken into consideration high altitude cooling in their original designs, and a few more have high altitude kits available. Most of the rigs around here operate at 8000 to 10,000 feet elevation, where the air is a fraction of what it is at sea level.

WHIMPY BLOWERS

The poor little Centrimax blowers are kind of whimpy for moving the volume of air it takes to cool things at this altitude. The one in the IPA/driver section has a tough time keeping these tubes cool, but it manages. The two blowers below the PA cavity simply aren't enough, especially with the additional friction caused by a heavy duty filtering system on the back of the transmitter. I'd like to see about a three-horsepower blower in the final, but we've added a one-horsepower inline Dayton shop blower to the output duct. That makes for a much cooler operation.

The BF-25M is obviously designed to have the stack heat vented either straight up or toward the rear of the unit and out of the building. Ours goes back, which takes the duct-work of both cabinets right over their respective air intakes by about 6 feet. The radiated heat from these big square metal pipes goes right into the intakes. So we wrapped the ducts with heavy installation, and ended up reducing both stack temperatures 5 to 10 degrees. Electronic equipment doesn't like four basic things. I've learned: water, heat, bugs, and dust.

Hopefully, you don't submerge your BF-25M and we've just discussed decreasing the heat factor. Bugs and other critters can be a royal pain if they're not controlled. Don't give them reason to be there, and they'll go elsewhere. In other words, keep the munchies wrapped air tight, or out of the building entirely, and the critters will tend to forage somewhere else. But not letting them in, in the first place, is wise, and easily accomplished if you have control over even finer particles, such as dust.

We keep a positive pressure inside the building and (except when the door is open) the only way something can enter is through the filters. Regular furnace and air conditioning filters suffice for the building, and they're relatively cheap to replace when dirty. We have a couple of Space-Gard (tm) Model 2200 air cleaners attached to the back doors of the transmitter. Regular inspection every 3 to 6 months reveals that absolutely no dust has entered the RF cavities of our BF-25M, and the only dust in the rest of the rig has crept in from cracks in the cabinetry.

KEEP SPARE PARTS HANDY

We try to keep spare parts around, including plenty of Teflon rods for tuning controls (Which tend to get brittle after awhile and break) and sheet stock which is used in the PA tube socket as a plate blocking capacitor. One early modification, which was done to our BF-25M, was to replace all the bulb indicators with LEDs. Another change was to reroute the tuning and loading controls for the IPA and driver sections so they come straight out of the cavities and through the front wall. This alleviated bends in the controls and gave a more

positive feel to the functions. We ended up drilling a couple of additional holes in the front plates to do this, and ended up with an extra hole (the former IPA grid tuning control) which we slapped a dummy knob on and labeled FIDELITY CONTROL. It keeps the competition wondering! The chains that drive the driver and pa, tuning and loading mechanisms, stretch over time, and should be replaced (lubrication helps very little).

MOTH BALLS OR MICE

William Payne - KTFX Tulsa, OK

Buy yourself a couple of boxes of moth balls and spread them around the interior perimeter of your transmitter building. Mice don't like them or the smell and never will seek your building as a refuge from the cold.

As all of us know, mice can cause us down-time when they get fried! Many times we don't discover the cause until we uncover their tiny carcasses.

A simple sprinkling of moth balls will do the trick. About every 30-40 days, you'll have to spread them again, as they dissolve over time.

CONTINENTAL EXCITER TIP

Greg Hahn - WRKA Louisville, KY

When my Continental 802 Exciter lost all its RF output, the front panel metering led me to believe that I might have a bad RF output transistor.

The meter reading labeled "I", had more than doubled its normal reading. I assumed this to be a reading of final collector current, and when I shorted the base/emitter junction of the final and the "I" reading didn't go down, I replaced the transistor, even though it checked good with my ohmmeter. I thought it must have been breaking down under the load. When that didn't fix my problem, I discovered that the "I" meter on an 802 exciter reads the current to BOTH the final and the driver transistors, and it was the driver that had shorted.

A new driver transistor from my recommended spares kit fixed the problem. My unit was under warranty and Continental sent me a new spare for free.

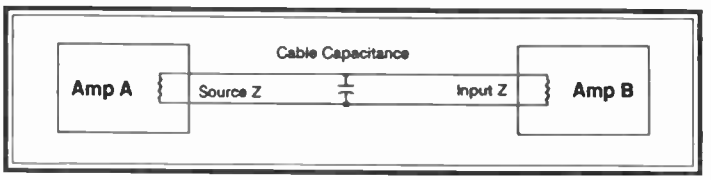
Another note worth remembering is that "solder wick" is really indispensable in removing RF-38 style and other similar RF transistors.

EFFECTS OF CABLE CAPACITANCE

Greg Hahn - WRKA Louisville, KY

You're probably familiar with the effects of RC networks in preemphasis and deemphasis circuits. They cause intentional changes in the frequency response.

The same thing can happen in the interconnection of any two pieces of audio equipment when the capacitance of the cable starts adding up on the long runs.



The Belden catalog says 8451 cable has a capacitance of 34 pF per foot. Most cable that I have found is in the ballpark, so I'll use a nice round 30 pF per foot for my calculations. The diagram shows two amplifiers connected together with 1000 feet of our 30 pF per foot cable. This gives us the equivalent of a 0.03 uF capacitor. The total resistance of the circuit is the output impedance of Amplifier A in parallel with the input impedance of Amplifier B. The cut-off frequency, Fc, is the point that the high frequency rolloff reaches -3 dB. It can be determined by the following formula:

$$Fc = \frac{1}{6.28\ (RC)}$$

Where R is total resistance of circuit in Ohms, and C is the total capacitance of cable in farads.

If the output Z of Amplifier A is 600 ohms and the input Z of Amplifier B is 10k ohms, our total R is 566 ohms. Plugging those into the formula above, we get:

$$\frac{1}{6.28 \times 566 \times 0.00000003} = 9378 \text{ Hz}$$

If this is the program feed to our FM transmitter, we have a problem. Since the capacitance of the cable cannot be easily changed, we'll have to change the resistance of the circuit.

If we terminate the end of the cable at the input of amplifier B with a 620 ohm resistor, that will make the load Z 584 ohms. This, paralleled with the 600 ohm Z, gives us 296 ohms for circuit R. We now have:

$$\frac{1}{6.28 \times 296 \times 0.00000003} = 17{,}932 \text{ Hz}$$

This is a much better situation, due to the gentle rolloff characteristics of the RC network, it's still not good enough for top notch audio. We need a cutoff frequency of 30 kHz or better. At a 30 kHz cutoff, you will be down approximately 1 dB at 15 kHz. You'll be down 0.5 dB at 15 kHz, with a cutoff frequency of 40 kHz.

The best way to lower the resistance of the circuit is to use an amplifier with a very low output impedance to drive the line. Many of the active balanced outputs on the newer equipment have output impedances of 100 ohms or so. With an arrangement like this, you wouldn't even need the 620 ohm terminating resistor and your cutoff would still be over 50 kHz.

Another way would be to use a transformer to lower the source impedance to 150 ohms. Use another transformer at the other end to convert back to 600 ohms and step up the voltage to your original level. The second transformer should be terminated with the 600 ohm load.

Don't trust the manufacturer to give you the true output Z. The figure they give may be the proper load for their equipment. The true output Z can be found by running a 1 kHz tone through the amplifier under test. With no load connected to the output terminals, measure the output level. Then find the resistance value, when placed across the output, required to drop that level by 6 dB. This resistance is equal to the true output Z of the amplifier.

BATTERY OPERATED AUDIO TRACER

John Bresden - KLCC-FM Eugene, OR

Anyone who has worked around audio systems knows that it's necessary at times to be able to go to any point in the path to trace a signal when troubleshooting. A traditional way is with a pair of headphones. This works (after a fashion), but it loads the circuit and, given the relatively low level of the typical line, can be difficult to hear if the location isn't quiet.

A solution to the problem is to use some type of amplification. You can drag out an amplifier and a speaker, look for an "unused" power outlet near the project, and hope that a good ground loop doesn't interfere with the feed. A simpler solution is to get a small battery powered amplifier/speaker combination, and consider it another piece of test equipment. Radio Shack has such a device (Catalog #32-2031) for around $18. It's powered by four "C" cells and has the bonus of a mike level input. It's quality won't threaten JBL or Bose, but it's good enough to tell if the signal has bad distortion or hum. It comes with 3.5 mm mini-jacks for both inputs, but these can be changed to whatever you choose. I think there would even be room for an XLR type connector for the mike input, which would allow you to do quick mike checks.

One problem with any battery powered equipment is that of leaving it turned on when you're finished with it. Radio Shack also has a solution to that problem! For about 2 bucks, you can get an LED with a built-in flasher. It's the same size as a standard LED and can be mounted on the front panel through an appropriately sized hole. I did this with the amplifier/speaker here at KLCC. One word of caution -- be careful with the supply voltage. It is rated up to 5 volts (without dropping a resistor) because of the internal circuitry. In the case of the amplifier/speaker, the four batteries supply 6 volts. A series resistor won't work because, when the internal CMOS chip has the LED turned off, there is no significant current to cause a drop across the resistor. This results in the full supply voltage being applied to the LED flasher. The simple solution is to place a regular LED in series instead of a resistor. This provides a second flashing source which can enhance the visual alert. More diodes can be placed in series for higher voltages. Of course you can always use a voltage divider, but this has the disadvantage of increasing current draw from the battery.

CAPSTAN PLUNGER TALES

John Gaboury - KWAC Radio Yuma, AZ

It was a dark and stormy night. The reel to reel playbacks leered menacingly at me. I knew what the problem was -- but I didn't know what to do about it. The capstan roller wouldn't keep constant pressure when the machine was activated by the sequencer and ...

wow, wow! The capstan solenoid PUSHES a flexible rod, instead of pulling like a sensible solenoid. As a result of that and poor geometry, the solenoid plunger was galled, and the ridges would allow varying degrees of engagement. The machine and the company were out of production, and no spare parts were available. I had one spare solenoid which I could install, and wait a week until the "wow" started again.

I thought of the hammer on my Colt .45, put the spare plunger in my pocket, and the next day went to the friendly local gunsmith. He said, yes, he could case-harden the plunger.

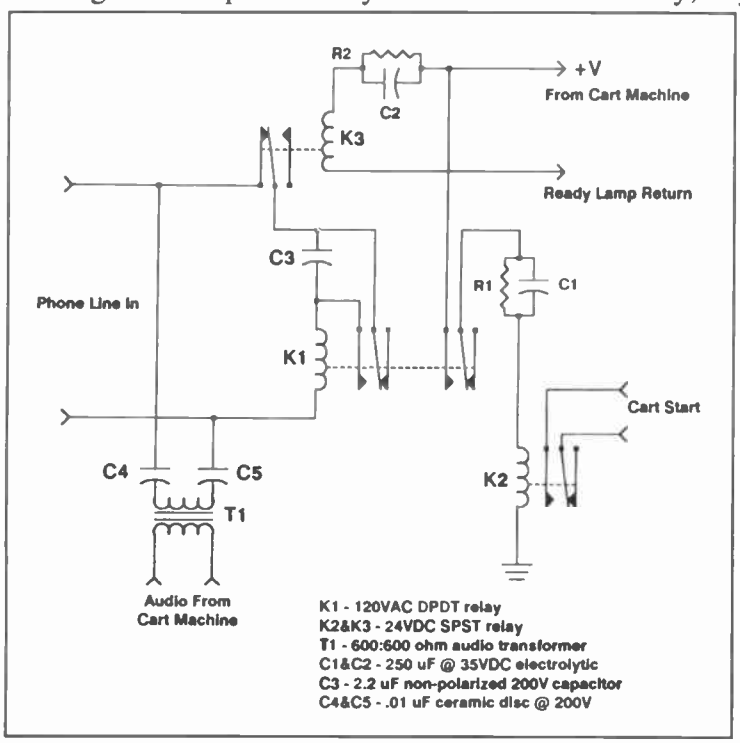
He took the plunger, put it in a pie tin with a raised center, and poured the tin full of a case-hardening powder (Kasenit). He heated the plunger cherry red, then tipped it over into the powder. After it cooled, he took a file to the plunger, and it turned the file! I now had a plunger which was extremely hard on the outside, soft inside, and retained all of its magnetic properties.

Case hardening is a process which causes malleable iron or mild steel to absorb carbon to a depth of several thousandths of an inch. This gives a very hard and durable surface. Other processes such as nitriding and cyaniding can produce the same results, but are far too dangerous for any but the expert. The deck kept proper capstan pressure throughout the rest of its life.

LISTENER INFORMATION LINE

Jay White - KASH/KKSD Anchorage, AK

It seems, more and more, that if I'm not coming up with new ways to do things, or looking for the perfect way to save time or money, my job just isn't exciting any more. I must admit, when the GM told me we were going to start a sports score call-in line, I considered two things: the old answering machine that the announcers have such a hard time putting messages on, and the $200 magic box that answers the line and plays a cart. This isn't saving time or money.



Here's a circuit that I came up with to solve the problem: As the ringing voltages reaches K1 (120 VAC relay), through C3, it is latched on, by bypassing C3. The second set of contacts on K1 delivers +VDC from the cart machine to the RC network of R1 and C1, providing a momentary voltage to K2 to start the cart machine. Cart audio is fed through T1, C4 and C5, back to the caller.

The line is "hung up" by using the remote ready lamp voltage to open the normally closed contacts of K3. Firing the relay through R2 and C2, provides the momentary function to unlatch the K1 relay, thus disconnecting the line when the cart cues up.

This is a pretty generic circuit that will work with most cart machines, with minor modifications.

IGM AUTOMATION TIP

Dave Bickford - WMKS Springfield, VT

Attention IGM EC automation users. Be sure the only files on your EC software disk are AUTOEXEC.BAT, CONTROL.EXE, FILE.TDY, and COMMAND.COM (or any that IGM may have added recently). We had the extremely annoying problem of the switcher starting two sources at the same time. We'd end up with a spot over music or two spots at the same time.

We checked out every possible cause, from noise on the cue track of carts, to possible interference from fluorescent lights. Finally, after numerous phone calls to IGM, they had me check the files on my disk. Somehow certain files that were on my DOS disk ended up on the disk I was using for the EC system! After re-formatting that disk and copying the correct files from a new disk supplied from IGM, the problem went away. Our EC has been working perfectly ever since. Many thanks to IGM's Rick Sawyer for his infinite patience.

OLD TAPECASTERS NEVER DIE

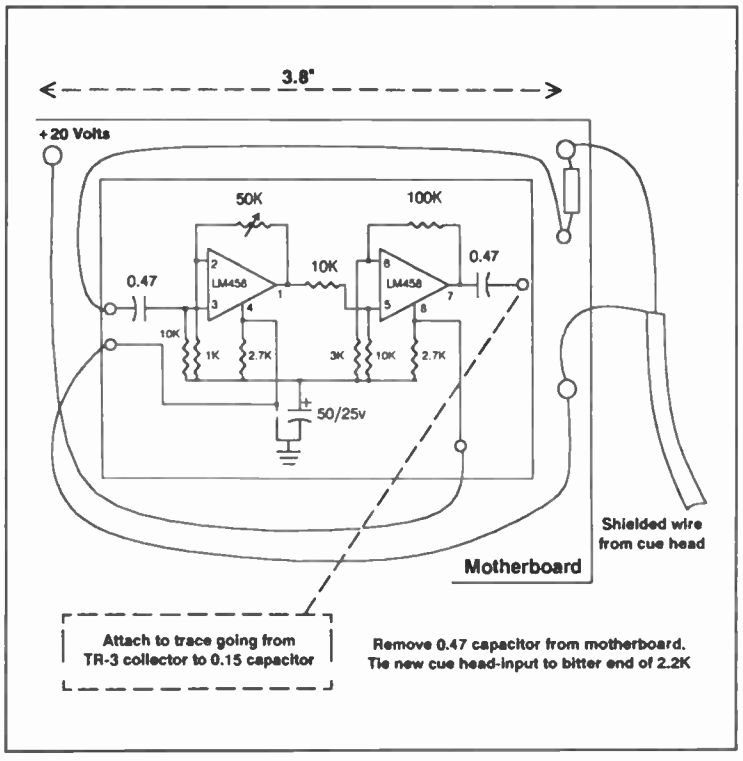
David Raley - PE Laurel Hill, NC

If your station is one of those that can afford to dispose of its cart machines as soon as they are scratched, just turn the page; nothing here will be of any use to you. This is written for the technician who has to maintain, with spit and bailing wire, a barn full of junk that should have a log chain thrown around it and dragged into the river.

Understand from the beginning, I mean no denigration of Tapecaster. The old style manual lever Tapecasters are, if anything, too rugged. At a time when all the good little "state-of-the-art" machines had the decency to melt through the cracks in the floor, that old "topless wonder" still puts in a day's work. But ... From time to time, after the heads are worn through to the mounting stud, they will miss a cue. Somebody once told me that if the heads were so worn that cues were missed, the audio quality would have suffered so much that any sane person would replace them. The missed cues were a feature, like the "cry strips" on a car's brake shoes, to let you know it was time for a change. Well, we're talking radio here; that leaves out the sanity part. Besides that, some heads do wear unevenly. Now, 101 station managers out of 50 will tolerate bassy sounding spots 1000 times longer than they will abide a cart running through. I once had to put the old heads back in; they sounded better to a person who shall remain nameless. And (sorry Tapecaster), sometimes they run through just for the exercise.

When, a few years back, I told a certain station manager that he couldn't turn up the cue gain because there was no control for that, he had me install a pot for that purpose and was astonished that it didn't help. If you are associated with such a person, or if you just want to save yourself some grief, read on. The solution is at hand.

What we have here is a straight forward two stage audio amplifier with variable gain in the first stage, built around an LM1458 dual op-amp. It replaces the three transistor pre-amp of the Series 700 and will doubtless work in many other similar machines. The gain of our circuit, at full throttle, is 20 dB higher than the original circuit. You may have to adjust it



down to eliminate false cues. The layout isn't critical. It's better to build it on a small piece of perfboard and attach the in/out and power to the motherboard, rather than drilling on the motherboard itself.

Remove the three input transistors that it will replace and any other un-needed parts that are in the way of a flat fit. Keep the attaching wires reasonably short. Separate the two boards with a couple of pieces of weatherstripping such as you use under the pinch roller rod.

Parts should cost $10 or less. If there is a great outcry of demand, I'll get up a kit for $15. If you're on contract for "routine repairs", be sure to charge the station extra for this field change.

OTARI FALSING FIX

Mark Croom - Broadcast Technical Services, Pequot Lakes, MS

When I came to KTIG as an announcer about five years ago, I was warned that "certain programs are not to be played on the live-assist system". It uses four Otari ARS-1000 reproducers with a Persons 3A programmer. The reason given was some of these syndicated, high speed duplicated program reels would cause false stops (and false advances) at unpredictable times. It was a problem we have lived with ever since the system was installed. After I took some technical training, I decided to attack the problem and see if anything could be done about.

What I found was that the 25 Hz detectors had no delay time built into them, so they would respond to 25 Hz tones only milliseconds in length. Many of the programs we air here are recorded sermons and the like, and if a speaker would crowd his mike and create a "pop", it would cue the detectors, even though it was not a true cue tone. Other types of low frequency noise would also cause false cues and their attendant disruptions in programming.

After some experimentation, I came up with the following solution, which has worked well in our machines: (1) Increase the value of electrolytic capacitor C107 from 10 uF to 47 uF. This increases the charging time so the machine is less sensitive to brief bursts of noise in the 25 Hz range. (2) Add a 20K (or so) resistor in parallel with C107 to provide a "bleeder" resistance. This makes the detector less sensitive to brief but repetitive noises which might cause false cuing, it seemed easiest to me to add this resistor underneath the board on the solder side. You may want to insulate the leads with heat-shrink or something similar. If you have experienced this problem, I hope this will help you to a more trouble-free automation experience.

MORE ITC-3D PARTS TIPS

Vince Edward - WBGM Tallahassee, FL

In the June issue of Radio Guide, Larry Fiebig gave out a great tip, on 3Ds that wouldn't run when the start button was pushed, or would chatter the start relay. C206 is the first part I replace when my decks show these symptoms; it works every time.

Here are three more tips, for 3Ds that drive you nuts:

1. Audio "pop" when a cart recues. Pull the cue board on the deck that pops and swap it with another deck card. If the audio pop disappears, replace C27 on the offending board.

2. Audio "pop" on one or more decks (swapping cards makes no difference). Flip the machine over and replace C13 (a,b,c) on the utility card. If you're careful, you can do it without removing the card.

3. The cart runs and runs ... and runs, without re-cuing. You get a complaint that a deck won't re-cue. So, you pull the lid and jack up the cue sensitivity a bit. A couple of days later, the same complaint; again, you just use the same cure. This cycle continues, until, oh-oh, no more adjustment on the pot! You pull the cue card and check every part.

Didn't find anything wrong, did ya? Thought so.

Change C205, C207, and C210. These caps, over a period of time, will dry out. Although they may check good on your meter, they are unable to pass audio. 4.7 uF can be used in place of the 5 uF caps, and it works every time.

RCA BTF-20E POINTERS

Meryl Valnes - KVOX AM/FM Moorhead, MN

I was sitting at home trying to recuperate after a long night's work, when the phone rang. The operator on duty said the FM transmitter was off the air. Our station broadcasts at 99.9 mHz with an RCA BTF-20E transmitter.

When I got to the station, I tried turning the transmitter on. I got plate volts and plate current, but no RF output. Upon opening the transmitter, I found what was left of the center conductor of the feed line going out of the transmitter and finger stock of the loading control, lying on the tube shelf -- and five nice holes in the outer conductor of the feed line.

After the parts arrived, I put the transmitter back together and found that it would not load up properly. I could only get 13 kW of power output (our normal power is 18.5 kW). I should point out that my transmitter has always been hard to load up properly and would just barely make 105% of operating power.

After spending several nights in vain trying to find the problem, I telephones Jim Droege in Beatrice, NE. He suggested trying to retune the driver for a better match to the final, since I had low PA grid current and high PA screen current.

Before I could try this, however, I burned up the same parts again, plus about 6 feet of the feed line connecting with the harmonic filter, contaminating the harmonic filter. Once again, I ordered the parts for the transmitter, plus 6 feet of 3 1/8 feed line, and a 90 degree elbow. I called Jim and had him come up to give me a hand.

We took the harmonic filter down and found black soot throughout the entire filter.

Using the RCA manual and the harmonic filter information book as guides, we thoroughly cleaned the filter. A drawing in the literature showed the filter should be installed 24 inches from the top of the transmitter cabinet. Ours had been installed 7 feet from the transmitter. As long as we had the harmonic filter and all the feedline down, we decided to install the filter by the book's specifications.

LOAFING ALONG

After we had put everything back together, we determined the driver was tuned up properly, re-neutralized the transmitter, and tuned it up. When we had everything ready to go back on the air, we checked the tuning and loading controls. They were within an inch of being where the book said they should be. Now I am able to get about 21 kW out of the transmitter, and it loafs along at 18.5 kW. I don't know for sure if moving my harmonic filter fixed my loading problem, but it was the ONLY thing that was changed.

What knocked us off the air? I was missing one or two of the fingers on the finger stock for the loading control of the transmitter. As I was having problems with the exhaust fan in the transmitter room, I can only guess that the heat built up in the transmitter, causing continued deterioration of the finger stock for loading control.

The second time this happened, I know what caused it. When my transmitter was installed, the modulation monitor tap was on the 90 degree elbow of the feed line. The exhaust fan had gone out again, and the center conductor of the "N" connector fell, and shorted out the feed line.

My suggestions to keep this happening from you are: 1 Keep a close eye on the finger stock for tuning and loading controls. When they show signs of wear, replace them. They cost about $120 per control. 2 If you have your modulation monitor tap in the feed line, REMOVE IT. On my transmitter, J4 on the top of the transmitter was not being used. I'm now using it for my modulation monitor. If something should happen to it, it will fall on the Teflon shelf, with very little harm. If I had done this before, I would have saved myself $9600!

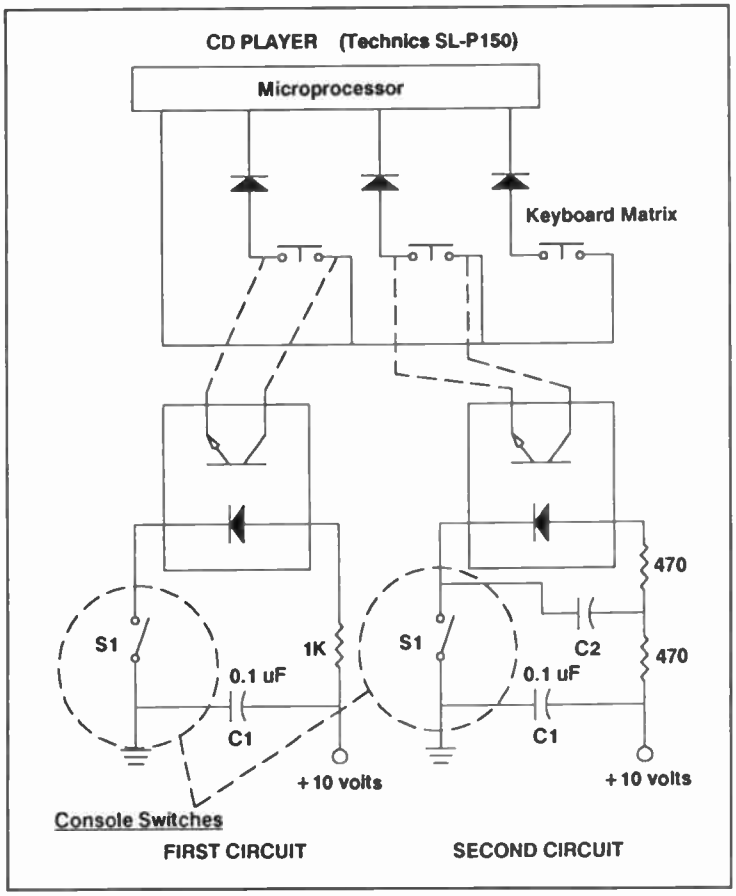
I should point out that last fall I had put a new 4CX15000 into my transmitter and replaced the tube socket. I am currently using the same tube that went through all the problems and am expecting to get another year or so life out of it.

CD INTERFACE

Ted Fuller - WRNA China Grove, NC

I chose opto-isolators over relays for my consumer CD player-to-broadcast interface needs. Relay contacts sometimes have trouble with very low currents and may eventually develop some intermittents. I was also concerned about using relays in a matrixed keyboard circuit, which is connected to a very sensitive micro-processor. Optos are low current, low noise drivers with high isolation. The entire remote interface had to be located inside the CD player, and it had to be small.

I mounted all the components on a small PC board, and placed it directly behind the CD keyboard. A single shielded cable ran from the board through a small hole in the CD, and on to the console. Three inches of wire connected each opto-isolator directly to the



terminals of the PLAY and STOP switches. Short, isolated wires at this point will help prevent static damage.

10 mA through the opto-diode will provide sufficient conductivity through the opto-transistor to act as a closed switch (for General Electric HA23A1 and HA1SA1 opto-isolators). Opto-transistor polarity is important here, and the keyboard pulses must not be distorted. Diodes may be found in the CD circuit between the keyboard and the micro-processor, and may help determine polarities. A schematic of the CD may help speed connections.

The interface was powered by 10 volts un-regulated as found inside the CD. Avoid connections to regulated portions of the CD supply, as regulator overloading and erratic operation of the CD may result. Looking at the schematic, S1 was a relay contact on the console control board. Some consoles may have logic capable of driving the opto-circuit directly, without any mechanical switches.

The first circuit was the one I used, since there was no need to eliminate contact bounce. C1 helps to prevent RF and unwanted pulses from entering the CD power supply, since some electrolytics in some supplies may pose a high impedance at RF.

The second circuit will help with contact bounce. Care must be taken in the circuit placement of C2, to avoid false triggering and too much C2 discharge through the opto-diode. Use a small value of C2 so that the opto-transistor will change states quickly. In the worst case, add a Schmitt Trigger.

GENTNER VRC-1000/2000 METERING SYSTEM FAILURE

Don Colbert - KLSE/KZSE Rochester, MN

Broadcasters who use the Gentner VRC-1000 or VRC-2000 remote control systems, may be surprised to learn of at least one additional error message which cannot be programed and which is not sufficiently documented to be easily understood. It is called "metering system failure". It can occur whenever one of at least three conditions exist.

These include: 1. A DC analog input voltage which exceeds the range of the analog to digital (A/D) conversion system (i.e. -5 to +5 volts DC or 0 to +10 volts DC). 2. A DC

analog input voltage which is within the range of the A/D conversion system, but contains noise signals which peak outside the range. 3. A faulty multiplexer and/or A/D converter. This problem is mentioned as a possible cause of metering system failure in the Gentner manual, troubleshooting section. However, no mention is made of this problem causing an error message.

When a metering system failure occurs, all disable functions are locked out, including the manual disable on the command module. Since the A/D converter is continuously sampling the metering lines, error messages keep on accumulating. As soon as an alarm message is erased, either by entering the (#) or (010) codes, another is instantly generated. Therefore, the Gentner will continue calling the telephone numbers on the call list. These latter statements apply if the fail-safe has been disabled to allow the transmitter(s) to stay on.

Here are some suggestions for isolating the cause of the problem:

1. Remove the metering input cable connector from the back of the Gentner. If the Gentner alarms can now be cleared, the problem is most likely to be in the voltages coming from the transmitter(s). If the alarm condition is still present, it's probably trouble in the Gentner.

2. Assuming that disconnecting the metering inputs cured the problem, reconnect the metering cable to the Gentner (so the metering lines are properly loaded) and check the voltages on each line with a digital voltmeter and/or DC-connected oscilloscope. Any lines whose voltages (DC or DC plus noise) exceed the 10 volt range of the Gentner, should be removed from the punch block. The trouble should disappear as soon as the offending voltage(s) is/are removed.

WARNING: An excessive voltage on any of the metering inputs may cause spurious pulses to appear on other input lines. It has not, as yet, been determined if this phenomenon is caused by A/D fold-over or internal breakdown of components, which allow multiplexer and/or A/D pulses to feed back to the input lines. If these spurious pulses disappear when the Gentner is shut off or the metering cable connector is removed, they are being caused by an overdriven input line.

At KLSE/KZSE, a faulty power meter calibration potentiometer, on a Gates FM-1C transmitter, produced a DC potential of 13 volts. The plate current and plate voltage sampling inputs were within normal range. In addition, plate voltage, plate current and power were being sampled from a Harris FM-25K transmitter. The overvoltage on the Gates power metering line caused 3 volt pulses, with a repetition rate of 16 Hz., to appear on the top of the DC analog voltages coming from the three Harris sampling lines. There were no pulses on any of the Gates sampling lines. Removing the metering input cable connector caused the Gentner to settle down. With the connector block back in place, power was removed from the Gentner and the pulses disappeared.

Suspecting some weird relationship between the Gentner and the Harris analog board, the board was exchanged with a new spare. No luck. Finally, a DC check of the individual metering input lines on the punch block revealed the overvoltage on the Gates FM-1C power circuit. The line was removed from the punch block and the Gentner was restored to normal operation. Until a replacement potentiometer can be installed in the Gates power metering circuit, power is being calculated using the Gentner's indirect method.

RPU RANGE INCREASE

Patrick Keogh - WNFL/WKFX Green Bay, WI

Here at WNFL we had a need to increase the range of our RPU system into an adjacent market. Our system consisted of a standard Marti RPU on 450 mHz. We use RPT-25 transmitters with 5-element yagi antennas at the remote site, and use a BR-10 Marti receiver with a colinear vertical (6dB gain) antenna with a 7/8" Heliax at 240 feet, on one of our AM towers. The usable range with this system was 10-15 miles.

The adjacent market of Appleton, some 15-20 miles to the South, was of interest to our sales dept., from the time that we absorbed an FM station in that market and moved our studios up to Green Bay. Our ability to do remote broadcasts some distance past our known Marti range, became a reality when the following scheme was implemented.

Since you can't tamper with the power output of remote transmitters (legally), or very well have sales people perched on rooftops with 42-element long-john beams, I decided that we'd do something to the receiver. I came across a company known as Advanced Receiver Research, in a ham magazine, and looked them up. They offer a line of compact, high quality, receiver pre-amplifiers for the communications industry. They can be reached at Box 1242, Burlington, CT., 06013, or phone 203-582-9409. The prices of their products are very much within the budget of most broadcasters.

I selected a model P432VDG, which has 16dB of gain. This unit is designed for service in the 430-450 mHz Amateur Band. It has bandwidth usable for our RPU, which is at least 450.450 mHz. The pre-amp is enclosed in a small box the size of two match boxes, and has BNC connectors for input and output. The design of the pre-amp uses low noise GaAsFETs for better rejection of overloading and intermod.

The pre-amp was inserted between the output of a duplexer and the receiver. We use a duplexer with our base transmitter/receiver in place of a T/R relay, to achieve some degree of intermod rejection in the receiver. Our studio site is within a couple of miles of a well occupied hill, where most two-way services for the community are located. Our duplexer, or the use of a bandpass cavity, is recommended by Advanced Receiver Research to keep the pre-amp from possible overload by out-of-band signals. Without the use of the cavity, the benefits of the pre-amp might be completely wiped out from the crud coming into it and wiping out your RPU signal.

A cheap Radio Shack AC adapter was pressed into service to power the pre-amp. This system expanded our useful range 5-10 miles beyond our previous coverage. We can now get a usable signal into Green Bay from the Appleton area, which opened possibilities to the sales department.

The pre-amp has proved very reliable in our application and has been in use for three years now, with no problems from lightning. Also, remote locations that were noisy or hit-and-miss, were cleaned up now with usable signals. The price of the P432VDG pre-amp was $79.95. A bandpass cavity can be had for about $150-$180. Of course, since we had a duplexer, our outlay was for only the pre-amp. I would suggest this project for any station that needs more RPU range, or one that just wants to clean up scratchy spots. Although not a cure-all, it sure helped us.

TECHNICS SP-15 TIP

Bill Tilton - KELA/KMNT Centralia, WA

I have had several of these turntables fail, apparently because C4 (100 uF 250 V) on the Power Circuit Board is a little underrated. The symptoms include failure to start reliably. A dead spot develops every 90 degree rotation. Replacement of C4 solves the problem.

I have also noticed that the speed increment switches develop mechanical problems due to dust or grime collecting around the push-buttons. A thorough cleaning improves operation.

This also applies to the start, stop and speed lock controls.

HARRIS FM TX TIPS

Kyle Magrill - Daytona Group Ormond Beach, FL

Here are a couple of technical tips for the Harris FM- series of transmitters. Unfortunately, I don't have the schematics at hand, so I cannot give exact part numbers. The recommendations are as follows:

1. On FM-20, 20H, and 20K series, make sure that the hose clamp, which secures the anode strap, is placed evenly around the tube. Improper alignment may result in poor contact between the tube and the strap, which almost always leads to arcing which can destroy the straps. It's not a bad idea to use two straps for this purpose. The FM-25K, although using a different cavity, also exhibits similar problems, and benefitted from a second camp.

2. With respect to the FM-25K, the area above the cavity where the high voltage feed-through is routed, is very inaccessible due to the need to remove a large number of screws on the back cover plate. Nevertheless, it is important that this area be cleaned occasionally to prevent catastrophic arcing of the high voltage components and wiring present in this area.

3. A low efficiency (less than 80%) problem with a 25K revealed no obvious signs of failure and the 8990 tube tested good. Close inspection of the tube socket revealed that several very small wires, all designated as part of L8, were missing. L8 connects the cathode to ground. Apparently, one or more of these small wires had broken free and several more appeared to have burned up. Replacing them with resistor leads solved the problem.

4. It's fairly common for the bias bridge to fail in the older FM-series transmitters. If this occurs, the transmitters will continue to operate in a grid-leak fashion. They will exhibit unusual tuning characteristics and most importantly, if the drive falls below a minimum point, the tube will become a diode, and "super-conduct". If that happens, you will get a current overload. The symptom may happen while the operator is adjusting the tuning or loading of any stage. Usually, the final will be reacting more or less normally when, suddenly, the PA current meter will jump up simultaneously with an overload trip-out. Use the test points provided inside the front access door to test output of the bias supply.

I've seen this problem in the 20H, 20K, and 2.5H, but since the supplies are all the same, it could happen to any one of the series.

SPARTA 602-A TX FIX

Michael Martindale - KVON/KVYN Napa, CA

Here is something that engineers with an old Sparta model 602-A FM transmitter should know.

I received a call one morning, telling me we were off the air. Ironically, it was the same morning of the 30 second silence campaign. I arrived at the site and discovered smoke in the transmitter building. After the smoke cleared (about 2 hours), I was finally able to enter the building. I assumed a short and that the breakers had tripped. What I did find, was a short in the screen supply, and that the breakers HAD NOT tripped. The system was real hot, meaning the machine was cooking itself.

I lost a cap, choke, rectifiers, various other parts, and yes -- the transformer. The insertion of HV fuses on the AC side of the rectifier stack can prevent this from happening. There is a mod kit available that is easy to install and will save you a lot of headaches and money.

COLLINS 831G SOCKET PROBLEMS

Paul Easter - D&E Broadcast Services Corpus Christi, TX

A Collins 831G transmitter I maintain, had burned up a driver plate transformer in Jan. of 1989, and then another in early June of 1989. When the first one failed, we checked the transmitter completely, especially the overload circuits. We could find no reasons for the failure. The transformer looked like it had slowly overheated over a long period of time, then shorted, primary to secondary, feeding 220 VAC into the driver plate supply rectifiers and filters.

The driver plate transformer was the only expensive spare part the station had, leading us to believe that the transformer had failed in the past. When the transformer failed the second time, we were even more suspicious. (A few months later, while we were cleaning out the storage building at the transmitter site, we found a third drive plate transformer.) We coupled our 'scope to the output of the transmitter (at the line section for the wattmeter), and started looking. If you tuned the driver plate tuning capacitor just right, the carrier would start to "pinch off", that is, heavily AM modulate. This was also where the grid current would peak on the PA tube (the next stage). For a few micro-seconds at a time, the carrier would go away. I wouldn't have believed it if I hadn't seen it myself.

We examined the transmitter and socket again, hi-potted everything twice, and found nothing. We were getting very tired and decided to call it a night. We tuned the transmitter so that it wouldn't exhibit AM modulation.

The next night, we found a few small burn marks on the screen ring of the tube itself. The socket looked fine, so we cleaned everything carefully and re-inserted the tube and tried it again. The problem persisted, we then removed the "chimney" (also called an air guide), and re-inserted the tube. We examined the socket very carefully with an inspection mirror. The screen collet seemed to be out of alignment in the back left area of the tube.

We found that both the screen collet and the stand-offs in the tube socket were threaded. If the collet is taken apart and then re-assembled improperly, there is a gap on the

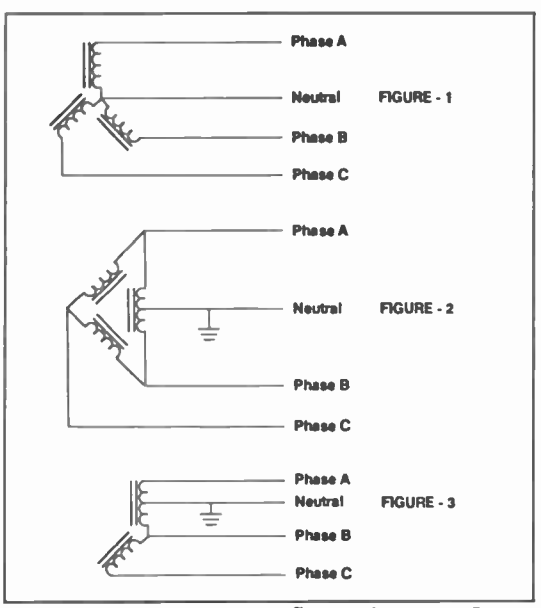
screen ring in the tube and the screen collet. Further examination proved this to be the case. The tube socket had been replaced some time ago (the old one was on the spare parts shelf). After removal of the collet and re-assembly, the problem was gone. The fingers of the collet were at the very top of the screen ring of the tube, though. We felt this was a little too close for comfort.

We removed the tube, and inserted a brass washer under each of the stand-offs. The fingers of the collet now touch the screen ring right in the middle. The tube socket alignment in this transmitter is very critical. Since the amplifier is grounded-screen, the screen collet alignment is especially critical. Of course, when any work is being done on the socket, especially the screen collet, the neutralization should be checked.

Any time a socket is reassembled (in any transmitter), a few minutes with an inspection mirror and a good light is time well spent. Mechanical drawings of the critical assemblies in transmitters would be helpful, when problems like this occur.

3-PHASE XMFR CONFIGURATIONS

Michael Hendrickson - Hedberg Broadcasting Group
Blue Earth, MN



An article in the June 1989 Radio Guide, brought to mind that there are many younger technical people in the field who may not be familiar with 3-phase power. Many stations do not require 3-phase power because they operate at a lower power level. This article is intended to give some brief information on 3-phase power transformer configurations as supplied by the power utility.

Normally the radio station is only concerned with the secondary connection of the power transformers. These connections supply the power to the station. There are two types of connection configurations, the WYE configuration and the DELTA configuration. The DELTA configuration can come in two variations, the CLOSED DELTA and the OPEN DELTA.

The WYE configuration (FIGURE-1) is a 120/208 volt secondary. The voltage from each phase of the neutral is 120 volts. The voltage from phase to phase is 208 volts.

The CLOSED DELTA (FIGURE-2) and OPEN DELTA (FIGURE-3) each supply a 120/240 volt secondary. The voltage from Phase A or Phase B to neutral is 120 volts. The voltage from Phase C to neutral is 208 volts. The voltage from phase to phase is 240 volts. Phase C is normally referred to the "wild leg".

The National Electric Code specifies that Phase C is NOT to be used for any load connected from Phase C to neutral. Phase C is to be used only for phase to phase loads. There is a no problem with having a CLOSED DELTA configuration supplying power. The problem with a DELTA configuration arises when the power utility supplies you with an

OPEN DELTA (FIGURE-3) The power utility likes the OPEN DELTA configuration simply because it requires only two transformers instead of three. Each of the voltages specified for the CLOSED DELTA apply to the OPEN DELTA. The problem with the OPEN DELTA is that the phase relationship of each leg can vary as well as the voltages, depending upon the load. Harris Corp. has an excellent paper describing the problems with an OPEN DELTA configuration.

I have found, over the years, that if you specify to the power utility that you need three phase power, the utility will normally supply you with a 120/240 OPEN DELTA configuration. I've met with considerable resistance when I told them I wanted a CLOSED DELTA. In a couple of cases I was told there would be a special charge for the third transformer. However, when I told the same utilities that I wanted 120/208 three phase, there was no problem, even though the WYE requires three transformers. I now automatically specify 120/208 three phase when I need three phase power.

If you are in a situation where you have service with an OPEN DELTA configuration, the fix is simple. Request that the power utility supply the third transformer, and close the DELTA. There will be no change in the secondary voltages in the electrical service. If you request the utility to change the configuration to a WYE, you have to remember that the secondary voltages will be 120/208 and NOT 120/240.

For more information on the OPEN DELTA problems, see the paper published by Harris Corp.: Susceptibility of the OPEN DELTA Connection to Third Harmonic and Transient Disturbances. The paper was issued in 1967, and revised in 1969.

CD TIPS COMMENTS

Robert LaFore WQPW/WVLD Valdosta, Georgia

I feel that some additional comments are due on Ed Sackley's CD tips in the September issue.

As Mr. Sackley points out, it is very important to keep the rails of the player clean and lubricated. In most cases, this will cure the problematic behavior. But beware--on many of the newer models, the "grease" has been replaced by a very thin oil. Applying grease to these CD players will cause all kinds of grief.

In my opinion, any station that expects to do CD direct on the air should invest in a service manual for the unit, and then order any materials for lubrication from the manufacturer.

Here at Power-96, we use two, Technics SLP-999 players and two three year old, beat up, SLP-720 decks that still work great. (We replaced them because of the auto-cue function on the SLP-999's.) With the service manual, it has been possible to maintain all of these units in an "on-air" condition.

We even went one step further, by purchasing the Technics test fixture called "servo gain adjuster." It's a neat little box you can connect to any SLP model and check the

alignment in a matter of minutes. The unit features three "idiot lights" that tell if the setting is too low, too high, or just right. Maintaining CD players is not hard or complicated--if you have the tools and information to do the job properly.

MORE ON CD SKIP

Glen Dingley KHSH Alvin, Texas

In reference to the engineer in Cochran, Georgia, with the CDs that skip, I have found something else that helps the sound of scratched CDs. Try "Armorall" (yes, the stuff you put on car tires to shine them up.) Spray the Armorall directly on the botton of the CD (where the music is embedded), then wipe gently with a circular motion with a lint-free cloth. I have found that simple procedure saved CDs that I thought would need to be discarded.

It also seems to increase the dynamic range of the audio. I would be interested in others who have tried this and agree. Or maybe a manufacturer that has documented this and agrees or disagrees.

SONY CASSETTE BATTERIES

Marvin Fiedler KCOR San Antonio, Texas

Sony does not supply replacement NICAD batteries for the Sony TCM-5000 cassette recorder anymore. If you have a TCM- 5000 and need new NICAD batteries, return the dead battery (they need the old case) to:

Jeff Martin
Alexander Batteries
P. O. Box 365
McHenry, IL 60050
800 323-3813

Alexander will re-pack your case with 1000 mAh cells for $20.00 plus handling.

CART SECONDARY TONE DELAY

Dave Higginbotham WCAW/WVAF Charleston, West Virginia

This problem had been encountered before, when we tried to make six ITC Omega cart decks start sequentially. What was happening was, when the cart started, the tail of the 1kHz cue tone (as the tape came up to speed) would pass through 150Hz, tripping the detectors. The cure is simple. The 1kHz tone has a 1-2 second disable. Tie this to the secondary tone detector--and no more falsings.

No specifics can be given, as cue circuits differ, and each individual machine must be examined in all situations. Call the manufacturer, and they will help. I have done this with both ITCs and Carousels.

HARRIS FM-20H3 TIPS

Charles Benner WUSL Philadelphia, Pennsylvania

First, if anyone has replaced the TE-3 exciter with a BE FX-30 and was not totally contented with the VSWR as read on the FX-30 reflected power meter, may I suggest the following:

Replace the 2200 pF capacitor and pair of 22 ohm resistors at the IPA input stage (C22, R63, R64).

Make up your cable between exciter and IPA as short as possible, using Belden 9914 coax cable.

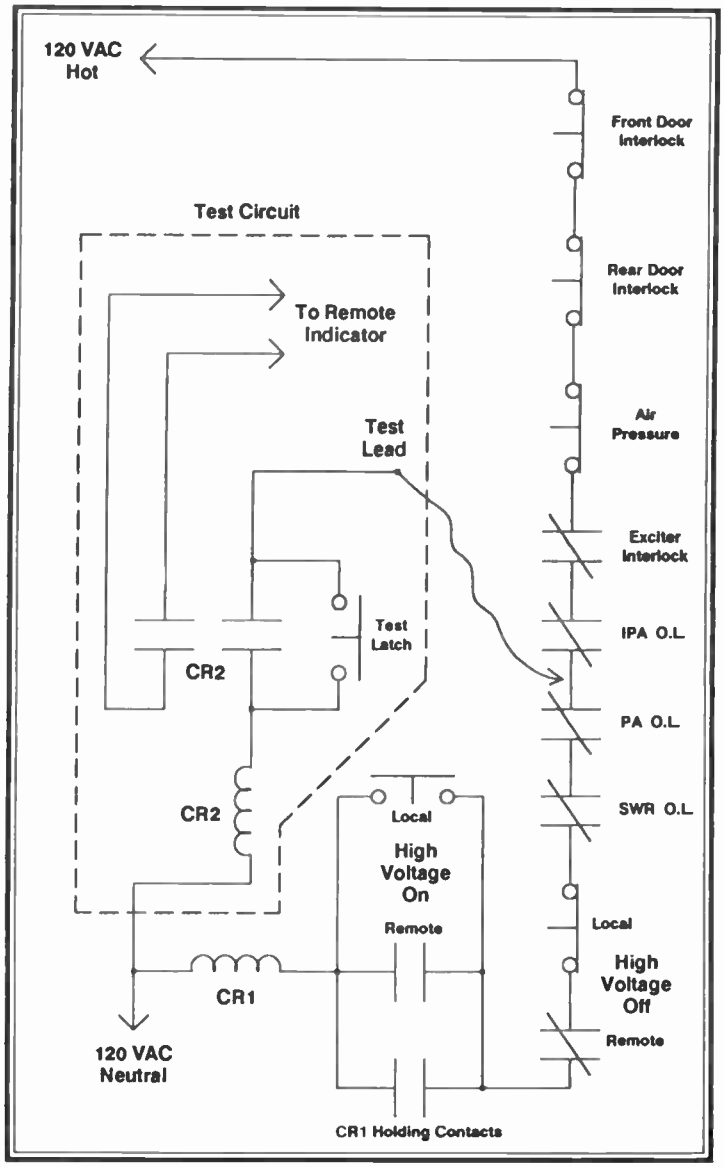
The final step is to get the strap placement correct on the IPA input (very simply, un-solder the bus wire and slide it up or down for the best exciter loading). Generally you can get the VSWR very low at this point. Then when you have tuned the IPA grid for the lowest VSWR, put the box back into the antenna and made your final IPA grid adjustment, you may just find what I did. The VSWR is so low that it is not readable on the FX-30 meter. Don't settle for higher VSWR than you have to have.

Second, concerning the FM-20H3, I have had several occasions where the transmitter would just dump for no reason. It would always be turned back on and run for another week or a month--only to dump again. After much heartache and grey hair, I narrowed it down to the contacts on K1 (the filament contactor). All the contacts would look to be making perfect contact, but the only way the problem was solved was to replace the contactor. I have replaced this contactor on two different occasions during the last four years. I do not know why replacing it works, but it always has for me. I have gone for 14 months, now, without the transmitter dumping, but I suspect it may start again. If it does, I will simply replace K1 to afford myself another year of peace.

CONTROL LADDER TESTING

George R. "Bob" Howe WBGL Champaign, Illinois

Your transmitter keeps shutting off due to loss of high voltage. This can be particularly exasperating when it only happens once or twice a day. All you need to do to get it going again is to push the high voltage "on" switch, either remotely or locally. Everything seems to be normal but you suspect that one of the several interlock overload switches that are in series with the high voltage relay is intermittent. How do you prove it quickly and efficiently?



The diagram shown is a typical control voltage schematic for a high voltage circuit. K2 is a 110 VAC relay (preferably one with a neon bulb and resistor in parallel with its coil) for trouble shooting. I have used the type that plugs into an octal base. It would be best to locate the test relay and latch push-button external to your interlocked transmitter and run the test lead through a wire entry-way. Keep everything isolated and be careful!

With all power disconnected and discharged, connect your test relay at a midway point in the control circuit. Close doors and energize your transmitter. Latch your test relay with the push-button and wait. When your transmitter exhibits the intermittent shut-down problem, all you need to do is see if your test relay is latched or not. If it is, then your intermittent contact is downstream (towards neutral). If it isn't, then your problem is upstream (towards hot). With the power disconnected and discharged, move the test lead to another point in the control circuit chain and go through the procedure again until you isolate your problem.

Happy hunting.

REVOX PR-99 MKII CAPSTAN MOTOR LUBRICATION

Tim McCartney KBSU Boise, Idaho

KBSU's Revox PR-99 MKII reel-to-reel deck intermittently slowed down during normal record and playback.

The pinch roller and capstan were not slipping. A check of the capstan motor servo circuitry indicated abnormal readings during the slowdowns. Thus, it seemed logical to troubleshoot that circuit board.

However, the customer service people at Revox recognized this problem as mechanical, not electronic. When the capstan motor itself resists normal movement, electronics readings become invalid. So, the manufacturer's analysis was that the capstan motor shaft required lubrication.

The procedure is to release the clip from the back of the motor, remove the cover, and pull the shaft out from the front of the deck. Close inspection reveals three 1/4-inch felt oil washers; the more easily identified washers are located adjacent to two more visible bronze bearings. An eye dropper filled with 30-weight oil is recommended for saturation of each felt washer. After re-assembly, KBSU's motor returned to a reliable speed.

Another clue to the problem was excess resistance while rotating the motor cover; after lubrication, this resistance was greatly reduced. Such advice is not, however, found in Revox's operating manual or set of schematics.

KBSU's deck had been in constant service for 2 1/2 years when the problem surfaced. Now, the station's other two PR- 99s have been lubricated in anticipation of the same problem occurring.

CONSUMER CD INTERFACING

Jim Turaville KWOX Woodward, Oklahoma

There's a lot of interest, in the "bottom line broadcasting" stations (ones that can't afford the fancy new gadgets from NAB), to use the consumer Compact Disc players for on air and production use. The reasoning is (and may not be bad reasoning at that), that for the cost of a fancy "broadcast quality" Compact Disc player that will outlast three or four of the consumer grade decks, you can buy three or four of the consumer decks. Unlike the professional units, you can probably get the sales department to grab them on trade.

The problems come in interfacing those consumer decks to the broadcast world. I have noticed that someone has finally come out with a basic $69.00 interface that will bring that high-impedance-10db, up to a level that the older consoles will accept. Most all of the newer consoles can readily take the high-Z low level inputs, but there are lots of older consoles out there which can't. Even our Auditronics 200 series consoles lack the input gain adjustments to comfortably run those types of equipment without an interface amp.

One solution that may be viable for some stations, is to convert an existing device for that interface amp. I have taken a Shure M64 stereo pre-amp, and changed the input resistors R5 and R6 from 150K to 100K, and dropped a little gain on the front end. Running the amp in the "flat" position, gives good frequency response, clean sound and a +4 db output. Another solution is to take an old phono pre-amp (after all, you're replacing that turntable

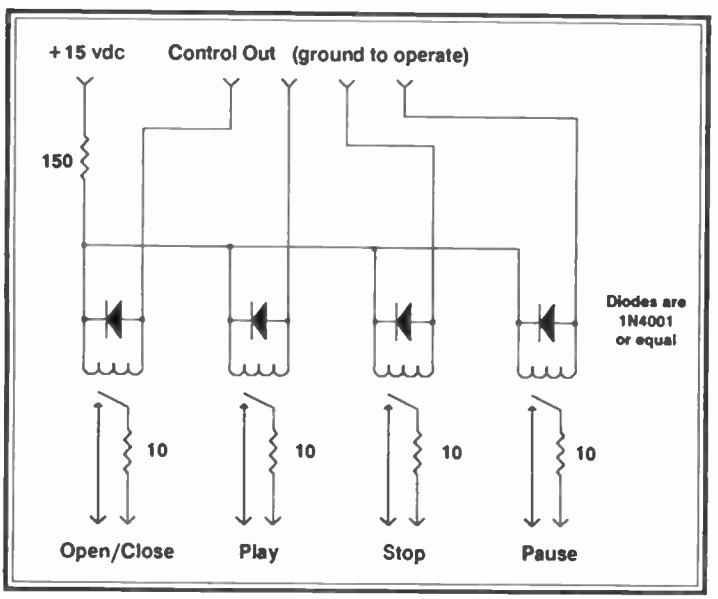
with the CD player anyway) and defeat the RIAA equalization. On the Stanton models, and many others, this is available as a front panel switch. Then give it some input padding, to prevent overdriving the unit, and you have an interface to the CD player.

One of the trickiest and handiest things is the remote control of the functions on the CD player. One engineer complained that the jocks were using the buttons so much that they were wearing off all the lettering, and the buttons were getting soft and unreliable. I solve this by remoting all of the desired functions, when the unit is fresh out of the box. Note: this will void your warranty with just about every manufacturer, so make sure it's a CD player you can throw away in a year if it goes bad, or if you are friends with the technician at the local electronics repair shop who will understand why you tinkered with the guts of the unit. I have performed this interfacing on three different brands of players--a Technics, a GE, and a Magnavox. I have been 100% successful and have never had a failure of the control circuits since the first one 18 months ago.

I have found that most all of the players run on a +15 volt supply. This supply is not overrated, so care must be used if you choose to piggyback any components off of the internal supply. I have done so in all four of my units, and had no problems, since there is no constant current drain for the controls. A supply point for the +15 volt supply can be found by turning on the power and probing around the PC board with a voltmeter. I have always found the +15 volts on a jumper on top of the board. Since we will use a 12 volt relay (which will latch from 9-14 volts), I would recommend a 150 ohm series resistor off the +15 volt supply point to provide the desired current limiting.

The front panel with the push-button controls is quite accessible on the foil side. Take the cover off of the unit and, with the power on, and a CD in the drawer, use a 10 ohm resistor as a jumper. Find the back terminals of the front panel switch to be remoted, and alternatively jumper the terminals together with the resistor, to determine which two will cause the function to occur. For example, if you wish to remote the tray open/close button, find the back of the button on the foil side of that PC board. Using the 10 ohm resistor, short the terminals on the back of the board until the tray opens and closes when jumpered. The same test is true of PAUSE, PLAY, STOP, SKIP, etc.

I use a 12 volt DC reed relay to do the remote switching. The reed relay is used because the coil resistance is about 1050 ohms on the 12 volt model, and offers the least amount of current drain to the unit's power supply. On the last unit I interfaced, I actually soldered the contacts of the relay directly to the back of the front panel PC board.



The relay weighs virtually nothing and is easily supported just by a good solder connection. I still use the 10 ohm resistor in the line that goes to the switch terminals, just as a bit of safety precaution. All of the units I have worked with use a real low voltage switching on those buttons, so 10 ohms will not be any

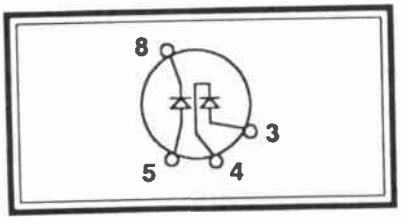
different from a dead short.

I tie the coil of the relay to the +15 volt supply, as mentioned above, and switch the ground to fire the relay and activate the control. Be sure to back bias a diode across the coil of the relay! By switching the ground of the coil to fire the relay, the control will interface to almost any of the remote systems built into your console, as most of them are open collector to ground functions.

SOLID-STATE REPLACEMENT FOR GATES TUBE-TYPE AMMETER

Thomas Lang TECS Electronics Kohler, Wisconsin

The following modification should interest users of the old Gates remote antenna current metering units that use a 6H6 tube to rectify a sample of the RF current via RF transformer. This modification involves replacing the 6H6 with solid-state diodes to eliminate the need for AC power for the filament of the 6H6. This is advantageous in the event the AC to the tower is lost, or removed due to permission to turn off the tower lighting. The diodes must have a fast recovery time, as you are rectifying an RF signal. I used high-efficiency types from Digi-Key (800) 344-4539, stock #HER-104. I used an old octal tube base as a plug with the diodes soldered to the pins. This allows simple plug-in replacement at the tuning house. The figure shows the pin-out:



De-energize the antenna and remove the 6H6 from the socket. Adjust "remote" pot to a much lower setting--I found that the sampled output was much higher with the diodes than with the 6H6.

Apply transmitter power to the antenna and calibrate the remote meter as usual. The "remote" pot may have to be adjusted to get the calibration pot you use into a workable range.

This procedure was performed at WPLY, Plymouth, Wisconsin, in the fall of 1988. Routine calibrations show stability to be commensurate with the old 6H6 tube, with a typical error before calibration of +-0.05A, with a nominal antenna current of 2.00 Amps. Accuracy is consistent when the station reduces to nighttime power with a current of 1.05 Amps.

TONE OSCILLATOR CIRCUIT

Robert Hensler KCFR Denver, Colorado

At KFCR we use a slate tone in all of our studios. The tone is used to set reference and balance levels on many of our production tapes and as a reference level for our satellite up-link. With the tone always present at the board through the patch panel, quick trouble shooting of both the board and the other outboard equipment is facilitated, without having to lug an oscillator around. The tone is originated from a central location and fed to all of the production studios.

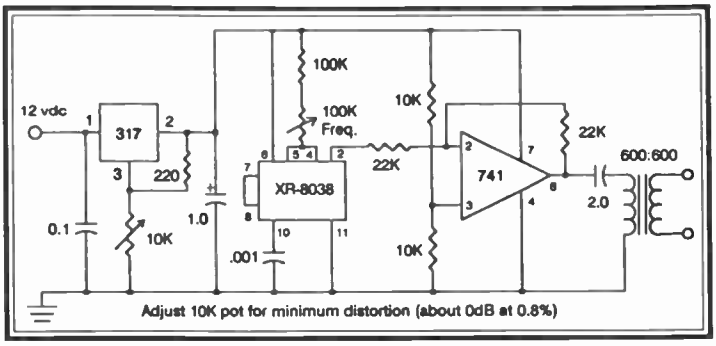
The oscillator for the slate was a very old H. P. tube type that finally decided that it

had had enough. After if gave up the ghost, I was left with the problem of replacing it. My choices were to buy a new one off the shelf of build one myself. For this purpose, I only needed a fixed frequency at constant level. I felt that buying one was more oscillator than I needed and, frankly, just a little self-indulgent and expensive; that left me with building one.

The oscillator I built had to have enough gain to drive all of my studios, have less than 1% THD and use a single +12 VDC power supply.

In all of the studios at the station, I have installed a +12 VDC Radio Shack regulated power supply. This voltage is used for all of the control circuits in the studio, requiring an external DC power source. This includes all of the mechanical and solid state AC relays needed for switching on warning lights, small audio circuits, tone decoders, scanners, or anything that requires 12 volts of DC or less. This saves money, time and AC outlets, along with simplifying trouble shooting, and is readily and inexpensively replaceable. Since all of the studios have this same power supply, the equipment is also reasonably transportable from room to room. Whenever a new piece of self-made or purchased equipment requiring a DC source is needed, I try to select it using this already available power source. This included the oscillator to be built.

In my looking around for circuit diagrams or ICs that might do the job, I found a precision waveform generator IC made by EXAR. It will produce a highly stable and sweepable square, triangle and sine-wave with adjustable duty cycle. It will do this with a minimum of external parts and at less than 1% THD. The frequency is determined by the adjustable pot at pins 5 and 4 and the capacitor at pin 10. I used only the sine-wave, but the square and triangle waves are available at pins 9 and 3 respectively, by adding a 100K ohm resistor between pin 9 and V+. Frequency sweeping of FM can be accomplished by applying modulation to pins 7 and 8 for small deviations, or only to pin 8 for large shifts. Sweep range typically exceeds 1000:1. The duty-cycle can be adjusted by putting independent variable resistors between pins 5 and 4 to V+. The cost of the IC was about $25.00.



The diagram shows the circuit as I built it, for a constant 1kHz tone at 0 db output with 0.8% THD and single power supply.

The 317 variable voltage regulator was added for filtering and better control of the quality of the signal, by adjusting the regulator for the best distortion. I got about 1.2% without the regulator. The 741 opamp was used as a buffer between the XR-8038 and the output. The 600:600 transformer was added for isolation and to balance the output, but would not be needed for many applications, This circuit had been in operation for about six months without any variation in frequency, distortion or output level. The total cost of the project was under $35.00.

AUDITRONICS 218 CONSOLE FIX

Bill Harris KMJI Englewood, Colorado

The production director said, "There's a terrible noise coming out of the production room console, and we can't do anything in there." There certainly was a terrible noise, hum, buzz, and a low-frequency oscillation that made the VU meters swing up-scale with each pulse. Any audio we put through the console was severely distorted. This was a four year old Auditronics 218, and aside from a couple of switch replacements, it had never done anything close to this.

After determining that is wasn't something unusual patched in, I found that the noise was only on the program, audition and mono buses. If I switched the monitor to any external source, such as air, it didn't appear in the monitor circuits.

Time for a few voltage readings. The unregulated $\pm$ 24 VDC main supply read $\pm$ 24 volts at the connector to the console motherboard and on the motherboard main voltage distribution bus.I thought perhaps it was coming from one of the input modules, so I pulled each one in turn. Some of the hum went away, but the buzz and the oscillations didn't. Now it took on a new characteristic; the program bus was crosstalking into the audition bus, only a half dozen db down. Time to look at the program and audition line amplifiers. Each module has its own on-board $\pm$ 18 volt regulators. There was -18 volts, but no +18 volts. Moreover, there was no +24 volt input to the regulators!

The program, audition, and mono line amplifiers, in this board, plug into a "daughter-board" of sorts, Mounted next to the main mother-board. There is only one ground connection between these boards--a short piece of solder-filled braid. When I started moving connectors and wires around, the hum quit and the crosstalk went away. On closer inspection, I discovered that the piece of braid had broken loose from the mother-board, removing the entire ground reference for all of the output line amplifiers. I resoldered the braid and added a second short wire at the same location, just in case.

There is a happy ending to this saga. Apparently, this joint had been deteriorating for a while. The annoying little buzz that came and went periodically in the output of the console, is now gone entirely. It won't be missed.

LOW COST STL PREAMP

Mike Worral KCMT Chester, California

KCMT is a new FM station, just on the air as of March 30th. The STL path covers about 13 miles over water and heavily forested terrain. What's worse, there is no line of sight from the studio to the transmitter site--there is an intervening mountain that just pikes its peak into the STL path. Subsequently, the received STL signal is very weak. The audio was usable, but changes in temperature during the day would cause the signal to dip below the mute threshold and the audio would squelch out.

The cheap and dirty solution was found (where else) at Radio Shack. Their part #15-1115 is an in-line coax amplifier designed for the 430-1430 mHz band. I think they intended it for scanners and LNB home satellite systems. At any rate, I preceded this amplifier with an in-line FM trap #15-577 to keep my 25kW FM from overloading it, mounted all components inside an aluminum enclosure, and presto! The front panel signal level indication on my Moseley PCL-606/C jumped from about 20 uV to about 300 uV. The audio is quieter and the FM transmitter does not bother the amplifier.

TECH MANUALS ARE AVAILABLE

Stephen D. Crum WARM Cincinnati, Ohio

Regarding the servicing of consumer CD players, Sony publishes excellent service manuals for its players. These manuals are more precise and informational than ANY broadcast equipment manual I have ever seen. It would be worth having one even if you don't own a Sony CD. They are available from Sony Corporation, Publications Dept., P. O. Box 20407, Kansas City, MO, 64195. Phone number is (816) 891-7550.

Sony has a repair center in Cleveland that can often provide some assistance over the phone. Their number is (216) 433-4680.

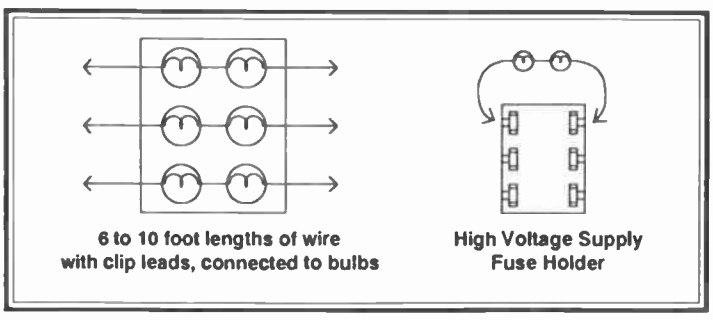
TRANSMITTER SOFT START CIRCUIT

Don Roden WHNT Huntsville, Alabama

It's 2 am and the transmitter is off the air. After a trip up the poorest road in the country, you look inside the transmitter and sniff for traces of resistor or transformer. Everything seems to be OK and you turn on the filament. The filament comes up fine and the meters look normal. The plate timer gives a ready light and you push the plate-on button. The blowers wind down and you are standing in the dark.

Yes, you are definitely awake now! But what happened, and how can you find it without damaging the circuit breakers, transformers, or rectifiers?

To keep the breaker from blowing off the wall, when troubleshooting high-voltage shorts in both AM and FM transmitters, build a "soft-start" circuit using light bulbs.



To use this circuit, disconnect or remove the HV fuses and place the light bulbs across the fuse-holders. 250 watt bulbs are good for small transformers. Parallel/series two or more bulbs for 208 or 240 VAC feeds. Try the circuit when the transmitter is working normally and adjust the wattage of the bulbs to produce enough RF

output to help troubleshoot the RF section and antenna. Log all meter readings for comparison during a failure. Code beacons and sockets make a good tester for the big transmitters and you will have a good set of spare tower lighting parts.

One caution--when troubleshooting screen-grid tube transmitters (tetrodes and pentodes), disconnect the screen, if the light bulbs are on the plate transformer, to prevent possible screen damage.

The same circuit can be built into the workbench for testing transformers and power supplies. Again, size the bulb for the job.

BRASS ROD SOURCE

Jim Swift WSNX Muskegon, IL

If you're ever in a spot for some brass rod, (such as used for tuning and loading controls), make a trip to the local hardware store. I have found that toilet-ball rods work great.

ITC 3D PART TIP

Larry Fiebig WBLZ Cincinnati, Ohio

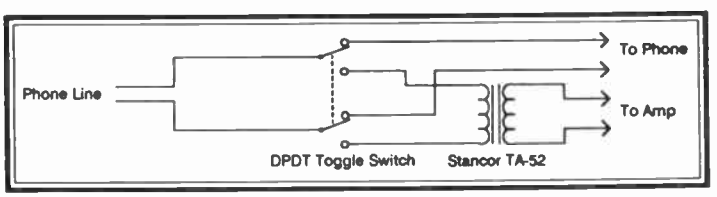
On ITC cart decks, if you get a "rattle" from the run relay and the cart won't run, replacing C206 on the cue card fixes the problem every time.

While you're at it, replacing all the 10K level control pots will save you trouble down the road.

TELCO TIP

Ken Abernathy WFMX/WSIC Statesville, North Carolina

A phone set can be modified for remote feeds on the telco dial-up system. The transformer holds the line when switched to "feed". This arrangement has worked very well for WFMX and WSIC.



The transformer is mounted inside the phone set and the switch and jack are mounted on the front.

TECHNICS SP-15 PITCH CONTROL PROBLEMS

Steve Fluker WMFE FM Orlando, Florida

The article written in the April Radio Guide, concerning the SP 10-MKII turntable on/off problem, reminded me of a problem that I have had with the SP-15. This is basically the same turntable, however it has a variable pitch control. I have five of these turntables in my studios. They are all nearly nine years old and, in the past, four of the five have all developed the same problem. There are several symptoms which have occurred. The first is with the + and - buttons. It became difficult to adjust the pitch on these turntables. When you push these buttons, sometimes the pitch would change and sometimes you would just have to keep pushing the buttons, again and again.

When working properly, you can just hold the pitch adjustment buttons and the pitch will continue to change until you release the button.

On another turntable, I could only adjust the pitch to - 2.2% instead of -9.9%. When it reached this point, it would stop changing and pressing the + pitch control would not work unless you pressed the return to zero button first. On still another turntable, I was unable to adjust the pitch at all. The first thing I tried, was to change the switches out, thinking that they had just worn out due to years of use. This did not help.

Soon another problem began to crop up on one of the turntables. When the turntable was started, it would intermittently run jerky; the platter would jump and then run backwards, stop, and go back and forth rapidly. On another one, the speed of the turntable ran approximately 20% fast, regardless of where the pitch was adjusted.

Although some of these symptoms do not seem related, they were all caused by the same bad chip--IC-305. This chip controls all of the pitch functions. It is difficult to troubleshoot, since all of the reference voltages and waveforms on the IC's pins check good with the service manual, even when the turntable is acting up. I have proven this chip to be the troublemaker by swapping it out with the same chip in a good turntable, and the problem followed the bad chip. I called Technics tech support in Atlanta, since I had so many turntables go bad, but they claim that they had not heard of this problem.

Not long ago, after I fixed all of my SP-15s, two of the same turntables at another station developed the exact same problem. These turntables were about seven years old. I have not been able to discover what causes the ICs to go bad, or just what the problem with the IC is. Technics hasn't been able to give me an answer either; however, I have discovered that they have added a 220 uF 6.3 volt capacitor between pins 25 and 28 of the IC on two new SP-15 turntables which were just purchased.

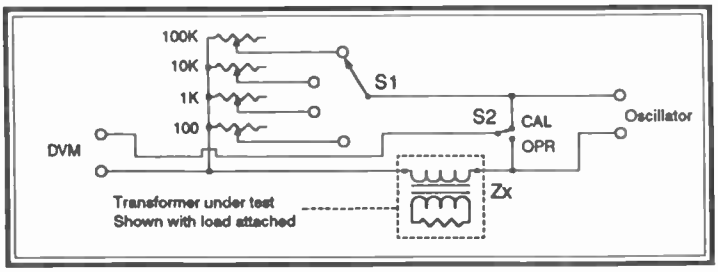
Unfortunately, IC-305 is a 28-pin custom Technics part and is not easy to come by. At one point, I ran into a six-week delay because there were none in the country. Also, be careful about the price of the chip. The first one I bought cost $66.00 at a local parts outlet. The next time, I ordered them through the Technics distributor in Tampa Florida for only $22.00 each. The local outlet was getting the chip from the distributor in Tampa and marking up the price 300%.

EMERGENCY TRANSFORMER IMPEDANCE TESTING

Howard Enstrom FM Technology Associates Mount Dora, Florida

Problem: you're not sure of the winding impedances of a transformer that might be pressed into service. No manual or manufacturer information is on hand, and only common test equipment is available.

Solution: winding impedances can be measured with fair accuracy using a voltage comparison method. Rig up the circuit shown, using four pots (linear taper) and two switches. Connect to the shop DVM and audio oscillator (set for 1000 Hz).



Set S1 to the estimated impedance of the transformer winding in question. Alternately, operate S2 between CAL and OPR, while adjusting the selected pot, until equal voltage is read in the CAL and OPR positions. Then determine the value of the selected pot, either by a DC resistance measurement of the pot, or from a calibrated resistance scale. The resistance value will be close to Zx.

Note: the winding impedance is affected, of course, by whatever loads are on other windings. For accuracy, those loads should be connected, using suitable value resistors.

CONTINENTAL GATE CARDS-MATCHED CAPS

Stephen R. Weber Jr. Fresno, California

Recently, I was called on to diagnose and repair a 10 kW Continental at KOJY in Dinuba. It was randomly blowing out exciter and control supply fuses and tripping the main HV breaker. As you may guess, the problem turned out to be one of the gating cards. One of the 10 mFd caps tested about 3 mFd. We installed a re-built spare card and cured all symptoms.

If you maintain one of these transmitters, I highly recommend adding an inexpensive capacitor meter to your toolbox. Even one of the ones built into some of the new digital VOMs are good enough for this. Use this unit to periodically check the three capacitor pairs on the gating boards. Also use it to check any caps you may want to use for spares or replacements for these boards.

The important thing here, according to Continental, is the value MATCH of the caps in each of the pairs, more than their absolute value. They should always match within a few percent. "Shotgun" replacement with unmatched capacitors should thus be avoided, as randomly picked electrolytics, with the terrible tolerances they have, could create more problems than you had to start with.

If you opt to replace your gating cards with a set of the new generation "capacitorless" IC gating cards (which Continental now offers), beware of a possible problem. Before you install them, check to see that the cards you receive are made of the same thickness PC board material as your original cards! One of the three sent to KOJY was thinner than the others and refused to stay in the card edge-connector properly, when inserted. There may be more like this out there somewhere.

LIGHTS OUT

Roy J. Humphrey Pittsburg, PA

The DJ on the other end of the phone mentioned something about one of the "lights" being out on the inside of the transmitter. Also the sound was very distorted. Assuming a simple 4-400 replacement, I installed a new one but was startled to see no filament glow. A second tube change -- still the same symptoms.

I measured the AC at the filament terminals, with the tube removed, and it showed the correct voltage. The filament leads appeared to be corroded at the point where they entered the crimp-on connectors. If fact, the individual strands had a crystalline appearance. Installing new leads returned the system to normal. Even though the filament voltage was normal, the tube had failed to light due to high resistance and corroded connections.

You can usually anticipate this problem, if you notice unequal brightness among the 4-400 tubes. The best plan, at that point, would be to replace all the filament leads.

THE CASE OF THE INTERFERING INFRARED

Lee Waller - WGHQ-WBPM Kingston, NY

For a period of several months our entire stable of CD players in the control room would do strange random things. They would skip, halt, jump tracks, open drawer and cue up when there was no disc in the machine. I checked the machines completely and even sent one back to the factory but nothing was ever found wrong.

Finally, the overnight jock noticed that these events seemed to occur most often as he was moving about the room. "Maybe," he said, "stray commands are getting into the remote sensor on the front of the units. "Well, not likely, I thought. But, to humor him, I placed black tape over the remote control windows. We've not had the problem since. I still don't know where the stray infrared was coming from, but it sure eliminated a problem that was driving the entire air staff to violence.

CONTENTS

BY TITLE

KEYWORD LOCATOR

This is not a complete index, but it should help you find specific equipment or topics.