RADIO GUIDE

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A Forum for Radio Engineers

Ray Topp Editor/Publisher (507) 280-9668

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Check Your Files

How many of us have worked endless hours on a piece of gear, only to find that there had been a manufacturer's tech-note or update sheet released on that very same problem? It happens a lot!

For whatever reasons, the information is not getting to many of the people who need it. Most manufacturer's tech-notes do get distributed, but the distribution is, many times, limited to only the people whom the manufacturer believes has their gear. What with the exchange of used equipment and the turn-over of station engineering personnel (not to mention the emergence of a large number of contract engineers), getting the tech-notes and equipment updates into the hands of the appropriate person is not an easy job.

I will offer space in the Radio Guide for publication of any tech-notes and updates regarding any piece of gear, that you may have. This will allow those of you who would like to contribute to the Radio Guide, a way to do so without having to actually write an article. Sooner or later I know you will write an article. But for now, submitting any equipment tech-notes and update information, that you have in your files, can be a initial step.

I would suppose that much of this information has a copyright of sorts, so I will run it past the original manufacturer just to keep things straight. This will also help to eliminate any mis-information regarding older equipment updates that may have been updated themselves. Why do I ask station engineers, rather than manufactures, for this information? The Radio Guide is a Broadcast Engineers forum, and any published technical information will always be submitted from engineers themselves.

I would hope that manufacturers would welcome this opportunity to allow their tech tips, modifications and equipment updates, to be disseminated to all broadcast stations in the country. Every engineer I have talked with, has said the same thing - - equipment problems are not the problem! The trouble is not being able to find the already existing information on a specific piece of gear.

So dig into your files and send in those pieces of paper. Maybe we can all save a few late night hours in the process.

How Important Is It?

Thanks to all of you who have sent in technical tips and articles. I have received numerous calls from engineers, thankful for the information. Complicated or simple - - someone, somewhere, will always find a use for it.

It's not important that you try to analyze the appropriateness of your articles. What is important, is that you send them in. Radio Guide does not have a staff of writers nor does it have a large backlog of articles for publication. That's the way it started and that's the way it will continue. I need information from people actually working in the field. It's the only way that I can be sure that the Radio Guide serves its readers.

We do pay, anywhere from $5 to $30 for tips and articles, so you may want to keep that in mind. As long as you are willing to contribute to the success of Radio Guide, it seems only fair that you should get more than a pat on the back. You won't get rich, but your technical information will get published! Fair enough?

I would like to establish and continue a section in the Radio Guide, that deals with technical help wanted. If you have a question regarding a technical problem, a troublesome project or just can't find a part for a Collins 300G, let me know and we'll publish it in the Radio Guide. You will be amazed at the response you'll get. Put your ego in your back pocket and give it a try. Your job is to fix equipment - - no one ever said you had to know it all!

In This Issue . . .

Harris FM-20H3 Tips

By Charles Benner - WUSL
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First, if anyone has replaced the TE-3 exciter with a BE FX-30 and was not totally content with the VSWR as read on the FX-30 reflected power meter, may I suggest the following:

Replaced 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 could 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.

Revox PR-99 MKII Capstan Motor Lubrication

By 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 manufacturers 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 ¼-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 2½ years when the problem surfaced. Now, the station's other two PR-99s have been lubricated in anticipation of the same problem occurring.

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

Automatic EBS Msg. Recording

By Ronald F. Balonis, CE - WILK
Wilkes-Barre, Pennsylvania
717-825-9898

On paper, the Emergency Broadcast system (EBS) is a simple system. But in actual practice it becomes much more complex. At radio stations, it must interface with the usually chaoic broadcasting activities. Within this operational framework the specific 'in-the-rules' EBS procedures must be followed, and the EBS equipment must work for the EBS system to function as planned, flawlessly. Even so, inspite all that can go wrong, at most stations, most of the time, it works, as intended

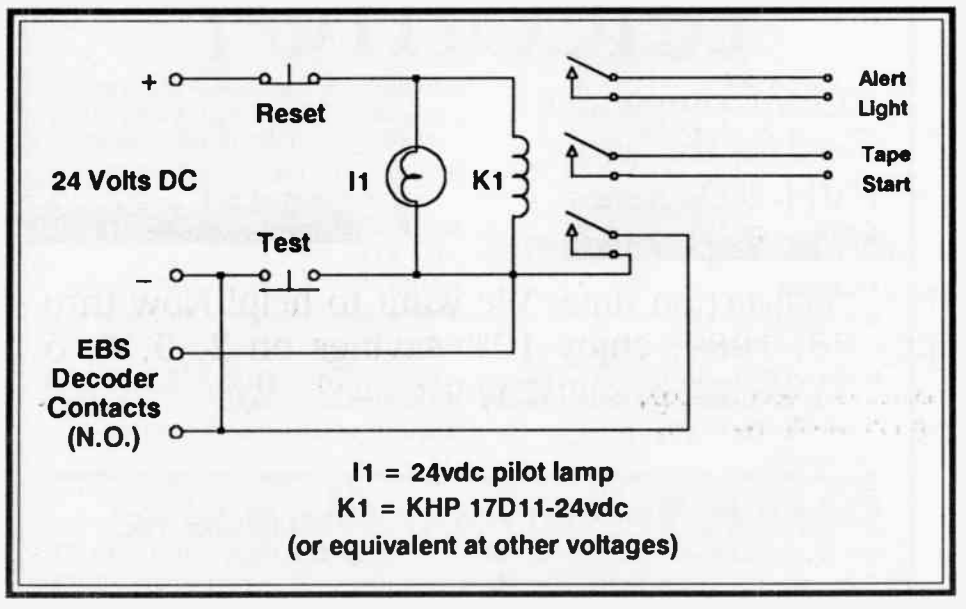
But there are times at every station when the equipment works and everyone knows the procedures and what to do and the system fails because of a 'software' fault: It can fail in the confusing and tense what-to-do moments after the EBS ALERT sounds.

Not accounted for in either the EBS rules and procedures or the EBS equipment is the fact that in the typical radio station, the announcer or operator has many tasks to juggle at the same time. It comes with the job. Waiting around for an EBS ALERT is only one of them. Getting the EBS message taped or written down for re-broadcast, on a drop-everything-else-moment's notice, can be a weak link in the EBS message distribution daisy chain.

The solutions to the problem range from finding fault with the system, the procedures, or the equipment to conflicts about it with the announcers and operators who have the moment-to-moment EBS responsibility. There is, however, a technical solution for this EBS weak-link. That is to set up the EBS equipment so that on an alert, any and all alerts, the EBS DECODER automatically records the EBS messages on a cassette tape recorder. A cassette tape is available to 'back-up' the operator.

The diagram shows an EBS message tape recorder control circuit--one of several ways to accomplish automatic message EBS recording. In this one, the relay electrically latches ON when the EBS decoder detects the two tone Emergency Action Notification (EAN), and it remains ON until manually RESET, even when the EBS decoder has been reset. The tape recorder's (cassette) input connects to a "live all the time" audio point in the EBS receiver, or to another receiver that's tuned to same station. The normally open contacts (NO) of the electrically-latching relay connect to the remote start of the tape recorder (that way the cassette records even when the decoder is reset). The circuit also enables TESTing of the EBS Message tape recorder and the circuit. It's a simple circuit, it can be assembled from almost any combination of junk-box or on-hand parts.

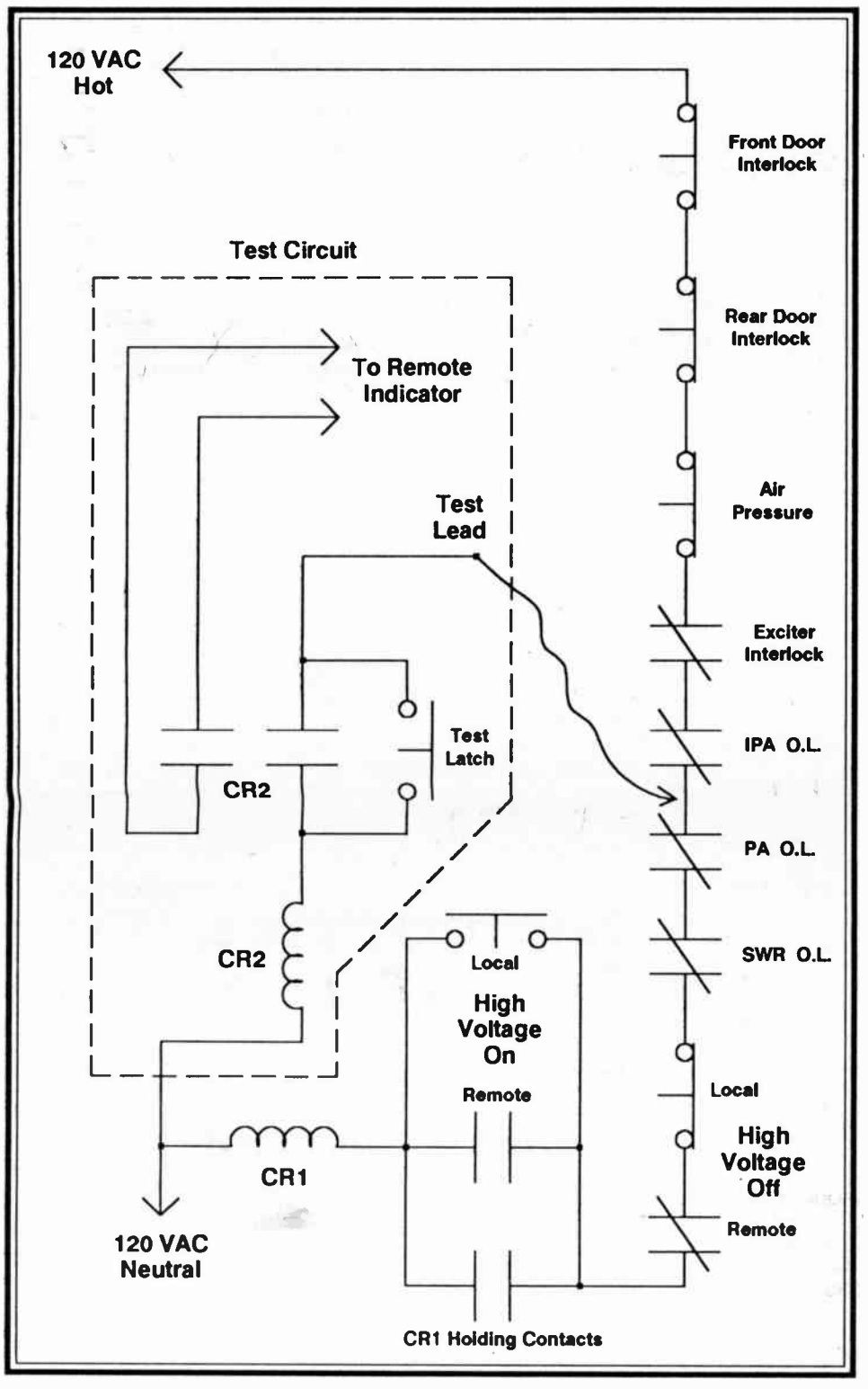
Automatic EBS message recording, however, is not free. In a way it adds another level of complexity to the EBS equipment system of a station: The tape recorder and the control unit must be checked and tested so that they don't also become a weak link. And, there is another button for the announcer or operator to press to RESET the EBS equipment after an alert. But, it is insurance against the weak 'software' EBS message link, and, it provides a recorded record of the weekly EBS tests that are received, so that the reason for the ones that aren't logged can be logically determined.



Control Ladder Testing

By George R. "Bob" Howe - WBGL
Champaign, Illinois
217-359-8232

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 it's 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.

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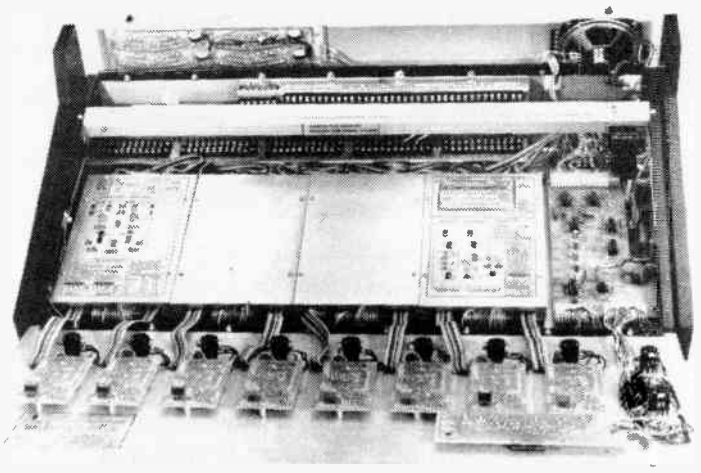

PARTIAL SPECIFICATIONS

INPUTS: Two per channel except the last channel which has nine. Balanced bridging 1k ohms in mic mode & 150k ohms high level. Input #1 of each channel programmable mic thru high level. Input #1 of each channel may be strapped for mono or stereo feed.
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Consumer CD Interfacing

By Jim Turaville - KWOX
Woodward, Oklahoma
405-256-4101

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 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.

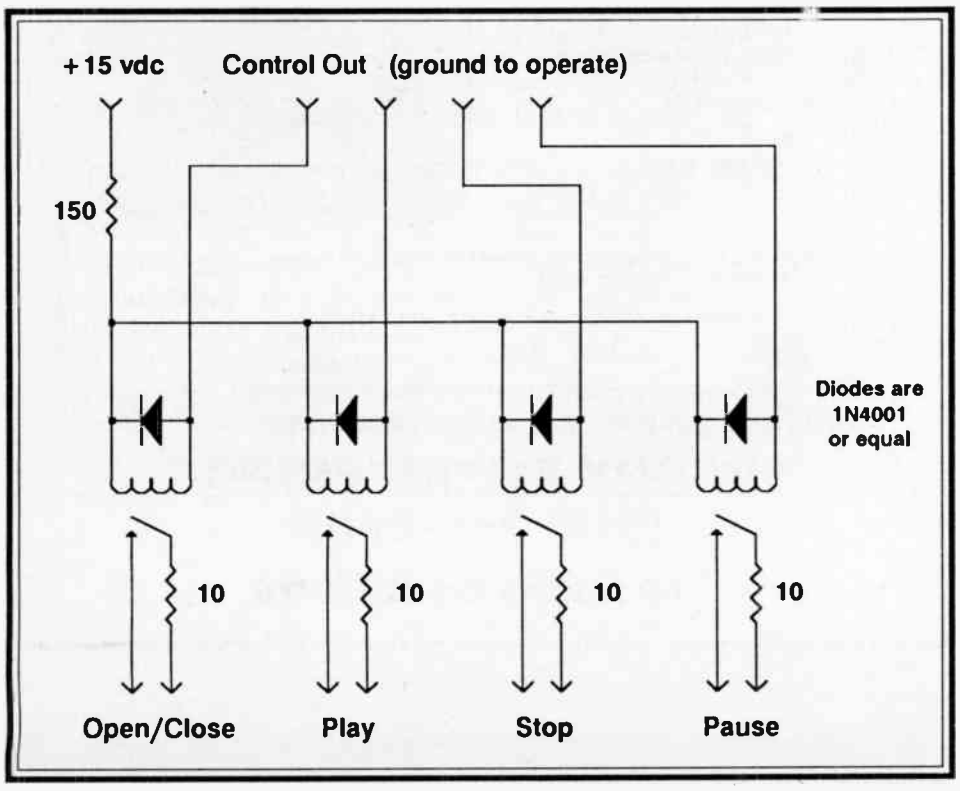
The front panel with the push-button controls is quite accessible on the foil side. Take the cover off of the unit and, with the power on, and a CD in the drawer, use a 10 ohm resistor as a jumper. Find the back terminals of the front panel switch to be remoted, and alternatively jumper the terminals 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 closed 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. (Continued on Page 7)

Consumer CD Tips . . . (continued)

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! You will need this to keep spikes off of the unit's power supply, that may be caused by the inductive "kickback" 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.



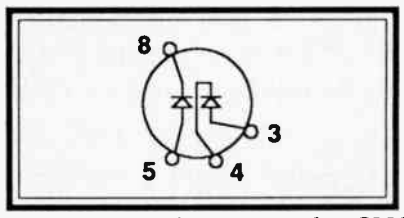
Solid-State Replacement for Gates Tube-Type Ammeter

By 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. Figure one 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

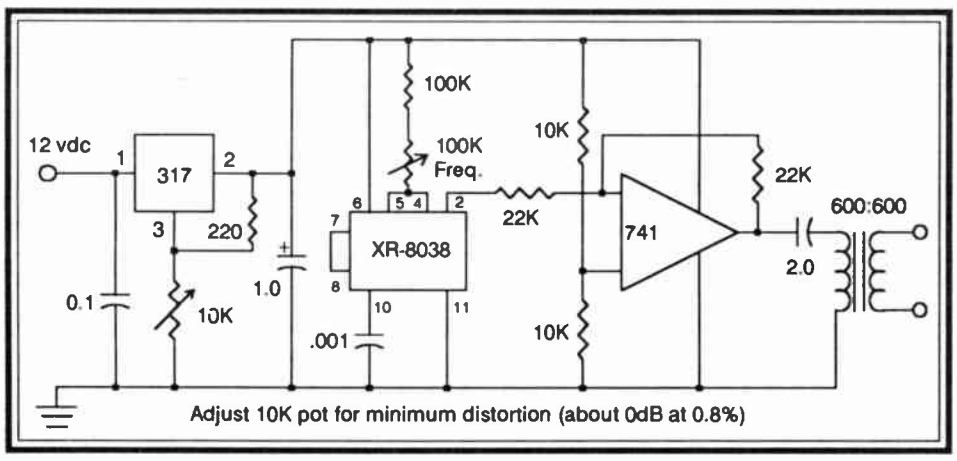
By Robert Hensler - KCFR
Denver, Colorado
303-871-9191

At KFCR we use a slate tone in all of your 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 it gave up the ghost, I was left with the problem of replacing it. My choices were to buy a new one off the shelf or build one myself. For this purpose, I only needed a fixed frequency at constant level. I felt that buying one was more 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 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. The XR-8038 IC will run on a single power supply from 10 to 10 VDC. It will produce a highly stable and sweepable square, triangle and sign-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 sign-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 this IC was about $25.00.



The diagram shows the circuit as I built it, for a constant 1 kHz 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.

Equipment Guide

June 1989

Box 7001 Rochester, MN 55903 (507) 280-9668 Ray Topp - Editor

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The **Equipment Guide** is published as the primary source for all of your used equipment needs - - buying or selling. In my opinion, the other used equipment forums and publications are not serving your needs. Here's why **Equipment Guide** works:

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

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Ray Topp - - editor

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2 - Describe your help wanted or position wanted.

3 - If you have equipment for sale or wanted, enclose $3.00. Make the check payable to Rochester Radio.

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$1000 for the package.

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Auditronics 218 Console Fix

By Bill Harris - KMJI
Englewood, Colorado
303-741-5654

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 it wasn't something unusual patched in, I found that the noise was only on the program, audition and mono busses. 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 ±24 VDC main supply read ±24 volts at the connector to the console mother-board and on the mother-board main voltage distribution buss. 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 buss was cross-talking into the audition buss, only a half dozen dB down. Time to look at the program and audition line amplifiers. Each module has it's own on-board ±18 volt regulators. There was -18 volts, but no +18 volts. Moreover, there was no +24 volt input to the regulators!

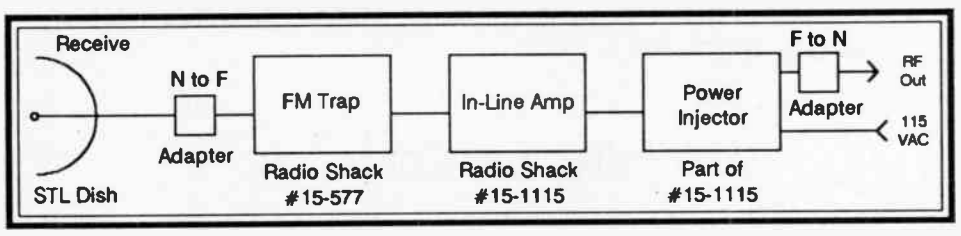
The program, audition, and mono line amplifiers, in this board, plug into a "daughter-board" of sorts, mounted next to the main mother-board. There is only one ground connection between these boards - - a short piece of solder-filled braid. When I started moving connectors and wires around, the hum quit 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 re-soldered 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 Filter

By Mike Worral - KCMT
Chester, California
916-258-4300

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 pokes it's 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. (Note: The STL receive antenna is mounted on the same tower as the FM transmitting antenna - - indeed, within the transmitting aperture)

Open Delta Three Phase
Broadcaster Beware

By Rob Yaw - KOJM/KPQX
Havre, Montana
406-265-7841

Figure 1 shows the very popular, delta-primary / wye-secondary, method of providing a consumer three-phase power service. Most broadcasters, and other consumers using delicate equipment, use this method for their primary service.

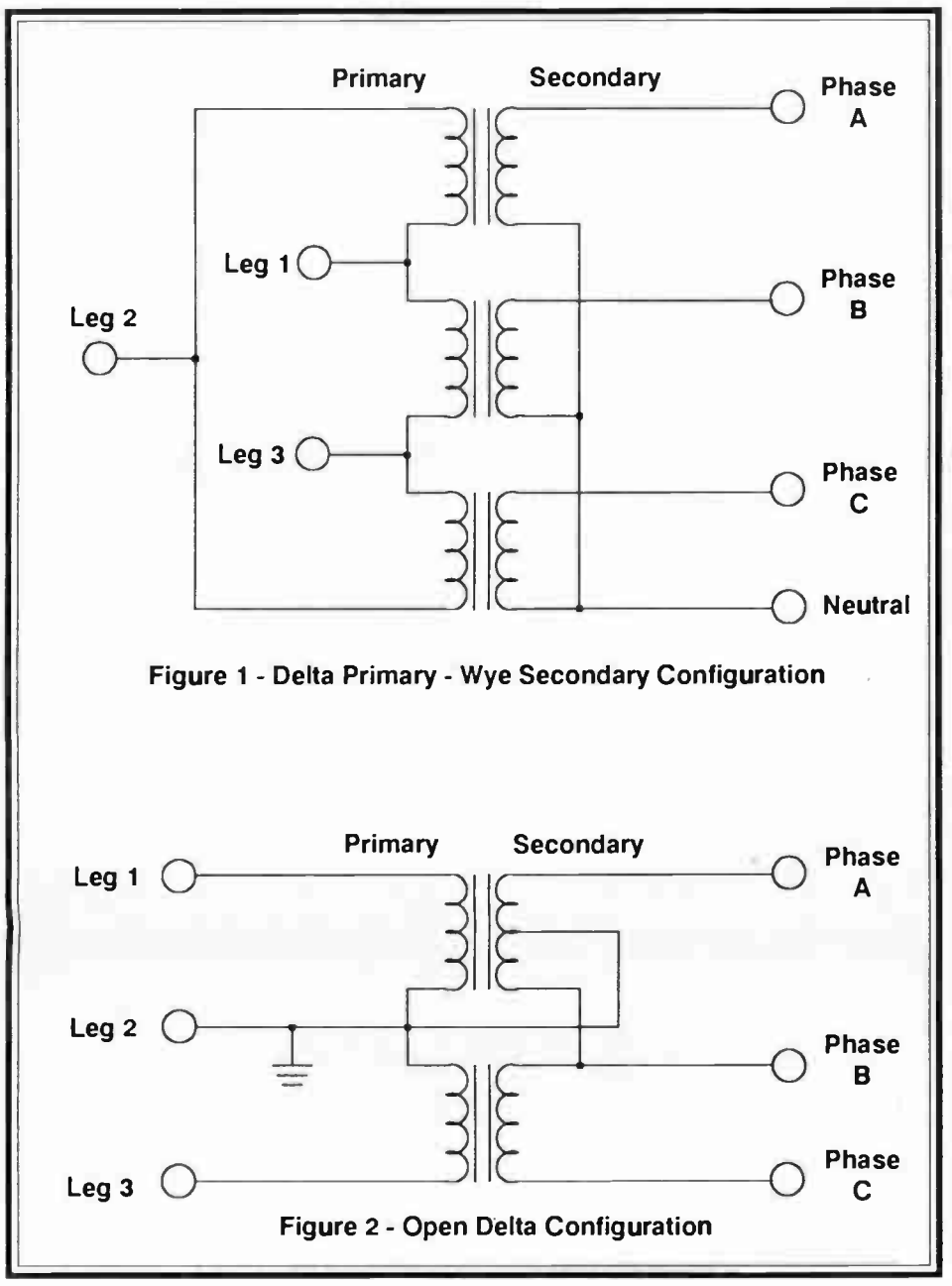


Figure 1 - Delta Primary - Wye Secondary Configuration

Figure 2 - Open Delta Configuration

Figure 2 shows, what is known as, the open delta three-phase system, that uses two phases operating against ground. It is advantageous only from the standpoint that it requires less wire and only two transformers. These advantages are far outweighed by the problems this system may cause the broadcaster.

The open delta system has numerous problems that are simply inherent to it. The line voltage, for example, is very load dependent. If the load on the system changes, as it will during transmitter power-up, the line voltage changes too. The voltage will eventually stabilize, but this may take several seconds to do so. Another problem with this system, is the rather large voltage and phase imbalances that may be present between phases. The system also exhibits poor voltage regulation and high transient propagation. Phase C, with reference to ground, is often referred to, in the electrical industry, as the "wild leg." It could not have been more appropriately named. The voltage on this phase can be practically any value under a no load condition and eventually stabilize to approximately the same values as the other two, under load.

A little over a year ago, I was hired, on a consulting basis, to do a technical appraisal of an AM/FM facility in the eastern part of the state. The facility was being sold and the new owner-to-be wanted an engineering opinion of the equipment and an overall status report of the entire facility.

(continued on page 11)

Open Delta . . . (continued)

On arrival at the station, the AM was off the air and had been off all morning. "It does this all the time," I was told. "Sometimes it will come back on, if you wait long enough."

Arriving at the transmitter building, I found a 5 kW Continental 828-E1 transmitter that appeared to be in showroom condition. It wouldn't run, but it looked good. I also noticed a large pile of RF driver cards in the corner. Going right to the RF driver in the transmitter, the problem was soon discovered. All the power transistors were shorted from emitter to collector. Replacing all the transistors had the transmitter up and running. Next morning - - it was the same thing all over again.

At this time, the open delta configuration never crossed my mind. After all, nobody in broadcasting ever uses it so why even think about it? I recommended power line conditioning devices of various sizes, shapes and prices, and continued my inspection of the facility. After a thorough inspection of the transmitter, I was convinced that it was in as good a condition as it appeared. Something had to be coming in on the power line.

The problem continued for this station. Large supplies of RF driver transistors were kept on hand, along with my phone number. My home base is over 300 miles from this station, so we spent considerable time on the phone.

One day, last July, a phone call from the plagued station brought the news that the high-voltage transformer had literally burned up. A new one was on the way, but something had to be done about this situation.

The only person at the site, with any technical knowledge, was the air-conditioning technician. I asked him if he could read the voltages at the transmitter disconnect switch. He said he could - - and did. I couldn't believe what he had to report. One of the phases was 80 volts higher than the other two. He didn't seemed concerned. This was normal for a "wild leg" system. I asked him to go out and look at the power pole and count the transformers. He soon returned and reported that were two transformers on the pole. Finally, the mystery started to unravel.

The power company confirmed that the system was indeed an open delta. It had been that way since day one. The original owner wanted it that way. The service was immediately changed to a delta-primary / wye-secondary. The troubles have ended.

There is no question that the open delta system can provide adequate service for some applications, but is is very questionable as to whether it is the service for the broadcaster.

Tech Manuals Are Available

By Stephen D. Crum - WARM
Cincinnati, Ohio
(513) 241-9898

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.

Please-We Need Your Help!

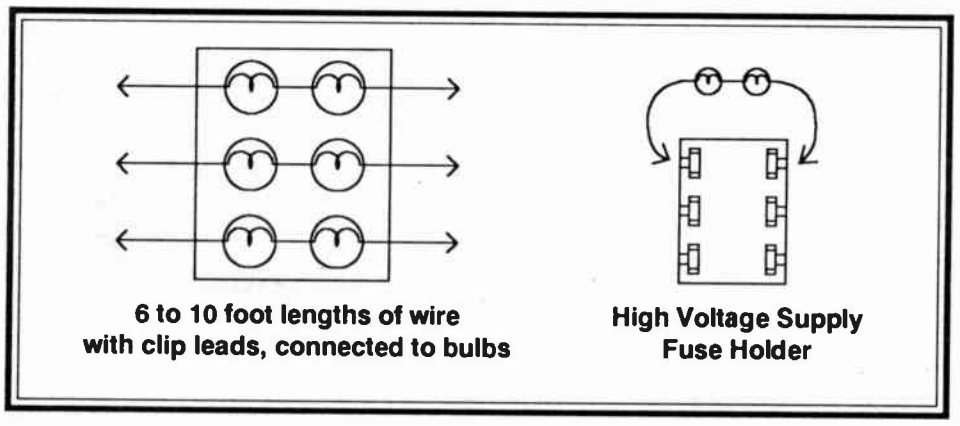
If you have any short tech-tips, send them in or better still, call me at (507) 280-9668 and we'll talk about them. Remember, it doesn't do anyone any good if you keep that information to yourself. Don't assume that everyone knows about your special technical tip. Send them in - - they'll be printed in the next issue.

Transmitter Soft Start Circuit

By 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 & 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.

ITC 3D Part Tip

By Larry Fiebig - WBLZ
Cincinnati, Ohio
513-742-3600

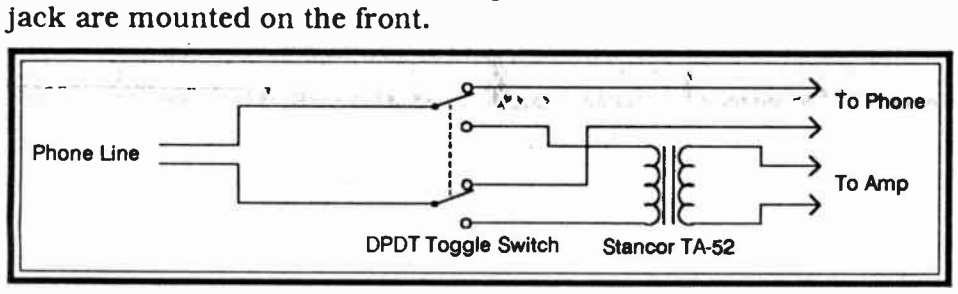
On ITC cart decks, if you get a "rattle" from the run relay and the cart won't run, replacing C206 on the cue card fixes the problem every time.

While your at it, replacing all the 10K level control pots will save you trouble down the road.

Telco Tip

By 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

By Steve Fluker - WMFE-FM
Orlando, Florida
407-273-2300

The article written in the April Radio Guide, concerning the SP10-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%.

Teac SX-3300 Tip

From Ralph Messer - WTZE
Richland, Virginia

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.

Thanks Ralph . . . Editor.

Continental 816R-1A Card Fix

By Lewis Downey - KRCL
Salt Lake City, Utah
801-363-1818

KCRL uses the Continental 816R-1A (10kW) on Farnsworth Peak, west of Salt Lake City. The site is a 1½ hour 4-wheel-drive trip, for maybe three quarters of the year, and a $400-$500 helicopter ride or ½-day on skis/snow-shoes in the winter. We used to be able to count on gating card problems after power bumps, so you can picture the frustration.

Our symptom of gating card failure has been driver plate supply breaker trips. A pre-failure symptom is bumps in the power change as you take the transmitter power up and down in manual power control. We discovered, by trial and error, that the small SCRs on the gating card (2N2323/AD114) were being destroyed, presumably by transients accompanying power bumps. The gate-cathode junctions of the little SCRs were opening up. This knowledge made the repair of the gating card much more cost-effective ($15 in parts vs $200 for a good card with exchange from the manufacturer), but didn't solve the problem of preventing the failures.

Installation of a Square-D three-phase surge protector ($40-$50) on the power line going into the transmitter, seems to have worked. We haven't had a power bump related failure since the installation of the surge protector (that's 3-4 years). I still shotgun the electrolytics once a year (as recommended by Continental) and keep a couple of spare cards on hand, sealed in plastic to keep the electrolytics from drying out so quickly; it's pretty arid at 9300 feet in the mountains of Utah.

I also highly recommend the new filament voltage regulator. It appears that we're going to get a return on our investment of approximately $200, out of the extended filament life of the first new PA tube (4CX10,000D) we've installed since using the new regulator. It has run for over a year at 100% forward power on the initial setting of the filament voltage at 6.75 VAC. Prior to the new style regulator, we were getting sometimes a year, usually less, out of a PA tube.

Does anyone have any ideas about broadbanding the IPA plate to PA grid tuning in this transmitter?

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Radio Guide will provide space here for contract engineers wishing to expand their business. To be listed here, just give me a call at (507) 280-9668. This list is not a recommendation of any engineer.

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305-775-1351

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Boyd Broadcast Tech. Svc.
Tualatin, Oregon
503-692-6074

Mike Brown
Portland, Oregon
503-245-4889

Lee Freshwater
Blue Ridge Consultants
Flat Rock, North Carolina
704-693-1642

Chuck Gennaro
Wisconsin Rapids, Wisconsin
715-423-6763

Kirk Harnack
Memphis, Tennessee
901-278-1306

Richard A. Hyatt
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Gardiner, Maine
207-582-4192

John Morton
Durango, Colorado
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Don Musell
Broadcast Engineering Svc.
Mouth of Wilson, Virginia
703-579-4461

Mark Pallock
Marandee Broadcast Eng.
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818-882-9475

Ransom Y. Place III
Westport, Massachusetts
508-673-6831

John Ramsey
West Hartford, Connecticut
203-243-4703

Lee Soroca
Soroca Electronics
Syracuse, New York
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419-483-2511

Dave Hebert
Pasco, Washington
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Dave Biondi
The Radio Service Company
Houston, Texas
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Bud Stuart
STURADCO
Susanville, California
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Ronald J. Dot'o Sr.
Salem, Oregon
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John L. Nix
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503-581-4056

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503-928-8318

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Sampieri Engineering
Huntsville, Alabama
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Don Roden
Roden Engineering
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Don Haworth
Haworth Engineering
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Jim Taylor Engineering Svc.
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Mike Tosch
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301-289-4545

Howard M. Ginsberg
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Frank Hertel
Newman-Keys Freq. Meas.
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812-963-3294

Anyone Else?

Radio Guide

June, 1989 Volume 2 - Issue 6

Mail to: Radio Guide 511 18th Street SE
Rochester, MN 55904

Fill out the information below, and then circle the number of any manufacturer from which you would like additional information.

1 - Television Technology
2 - Broadcast Audio
3 - CRL Systems
4 - Inovonics
5 - RAM Broadcast
6 - Ramko Research
7 - Kahn Communications
8 - Econco
9 - Delta
10 - JRF Magnetics
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31 - Freeland Products
32 - Brentlinger Broadcast

Name _____

Company _____

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City _____

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RADIO GUIDE

A Forum for Radio Engineers

Ray Topp Editor/Publisher (507) 280-9668

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Check Your Files

How many of us have worked endless hours on a piece of gear, only to find that there had been a manufacturer's tech-note or update sheet released on that very same problem? It happens a lot!

For whatever reasons, the information is not getting to many of the people who need it. Most manufacturer's tech-notes do get distributed, but the distribution is, many times, limited to only the people whom the manufacturer believes has their gear. What with the exchange of used equipment and the turn-over of station engineering personnel (not to mention the emergence of a large number of contract engineers), getting the tech-notes and equipment updates into the hands of the appropriate person is not an easy job.

I will offer space in the Radio Guide for publication of any tech-notes and updates regarding any piece of gear, that you may have. This will allow those of you who would like to contribute to the Radio Guide, a way to do so without having to actually write an article. Sooner or later I know you will write an article. But for now, submitting any equipment tech-notes and update information, that you have in your files, can be a initial step.

I would suppose that much of this information has a copyright of sorts, so I will run it past the original manufacturer just to keep things straight. This will also help to eliminate any mis-information regarding older equipment updates that may have been updated themselves. Why do I ask station engineers, rather than manufactures, for this information? The Radio Guide is a Broadcast Engineers forum, and any published technical information will always be submitted from engineers themselves.

I would hope that manufacturers would welcome this opportunity to allow their tech tips, modifications and equipment updates, to be disseminated to all broadcast stations in the country. Every engineer I have talked with, has said the same thing - - equipment problems are not the problem! The trouble is not being able to find the already existing information on a specific piece of gear.

So dig into your files and send in those pieces of paper. Maybe we can all save a few late night hours in the process.

How Important Is It?

Thanks to all of you who have sent in technical tips and articles. I have received numerous calls from engineers, thankful for the information. Complicated or simple - - someone, somewhere, will always find a use for it.

It's not important that you try to analyze the appropriateness of your articles. What is important, is that you send them in. Radio Guide does not have a staff of writers nor does it have a large backlog of articles for publication. That's the way it started and that's the way it will continue. I need information from people actually working in the field. It's the only way that I can be sure that the Radio Guide serves its readers.

We do pay, anywhere from $5 to $30 for tips and articles, so you may want to keep that in mind. As long as you are willing to contribute to the success of Radio Guide, it seems only fair that you should get more than a pat on the back. You won't get rich, but your technical information will get published! Fair enough?

I would like to establish and continue a section in the Radio Guide, that deals with technical help wanted. If you have a question regarding a technical problem, a troublesome project or just can't find a part for a Collins 300G, let me know and we'll publish it in the Radio Guide. You will be amazed at the response you'll get. Put your ego in your back pocket and give it a try. Your job is to fix equipment - - no one ever said you had to know it all!

In This Issue . . .

Harris FM-20H3 Tips

By Charles Benner - WUSL
Philadelphia, Pennsylvania
(215) 483-8900

First, if anyone has replaced the TE-3 exciter with a BE FX-30 and was not totally content with the VSWR as read on the FX-30 reflected power meter, may I suggest the following:

Replaced 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 could 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.

Revox PR-99 MKII Capstan Motor Lubrication

By 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 manufacturers 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 ¼-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 2½ years when the problem surfaced. Now, the station's other two PR-99s have been lubricated in anticipation of the same problem occurring.

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

Automatic EBS Msg. Recording

By Ronald F. Balonis, CE - WILK
Wilkes-Barre, Pennsylvania
717-825-9898

On paper, the Emergency Broadcast system (EBS) is a simple system. But in actual practice it becomes much more complex. At radio stations, it must interface with the usually chaoic broadcasting activities. Within this operational framework the specific 'in-the-rules' EBS procedures must be followed, and the EBS equipment must work for the EBS system to function as planned, flawlessly. Even so, inspite all that can go wrong, at most stations, most of the time, it works, as intended

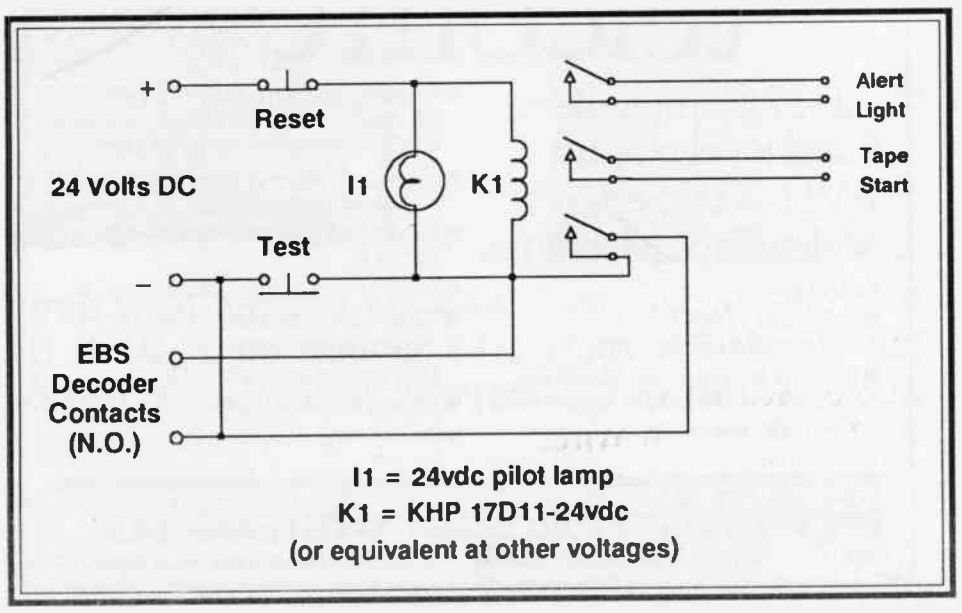
But there are times at every station when the equipment works and everyone knows the procedures and what to do and the system fails because of a 'software' fault: It can fail in the confusing and tense what-to-do moments after the EBS ALERT sounds.

Not accounted for in either the EBS rules and procedures or the EBS equipment is the fact that in the typical radio station, the announcer or operator has many tasks to juggle at the same time. It comes with the job. Waiting around for an EBS ALERT is only one of them. Getting the EBS message taped or written down for re-broadcast, on a drop-everything-else-moment's notice, can be a weak link in the EBS message distribution daisy chain.

The solutions to the problem range from finding fault with the system, the procedures, or the equipment to conflicts about it with the announcers and operators who have the moment-to-moment EBS responsibility. There is, however, a technical solution for this EBS weak-link. That is to set up the EBS equipment so that on an alert, any and all alerts, the EBS DECODER automatically records the EBS messages on a cassette tape recorder. A cassette tape is available to 'back-up' the operator.

The diagram shows an EBS message tape recorder control circuit--one of several ways to accomplish automatic message EBS recording. In this one, the relay electrically latches ON when the EBS decoder detects the two tone Emergency Action Notification (EAN), and it remains ON until manually RESET, even when the EBS decoder has been reset. The tape recorder's (cassette) input connects to a "live all the time" audio point in the EBS receiver, or to another receiver that's tuned to same station. The normally open contacts (NO) of the electrically-latching relay connect to the remote start of the tape recorder (that way the cassette records even when the decoder is reset). The circuit also enables TESTing of the EBS Message tape recorder and the circuit. It's a simple circuit, it can be assembled from almost any combination of junk-box or on-hand parts.

Automatic EBS message recording, however, is not free. In a way it adds another level of complexity to the EBS equipment system of a station: The tape recorder and the control unit must be checked and tested so that they don't also become a weak link. And, there is another button for the announcer or operator to press to RESET the EBS equipment after an alert. But, it is insurance against the weak 'software' EBS message link, and, it provides a recorded record of the weekly EBS tests that are received, so that the reason for the ones that aren't logged can be logically determined.

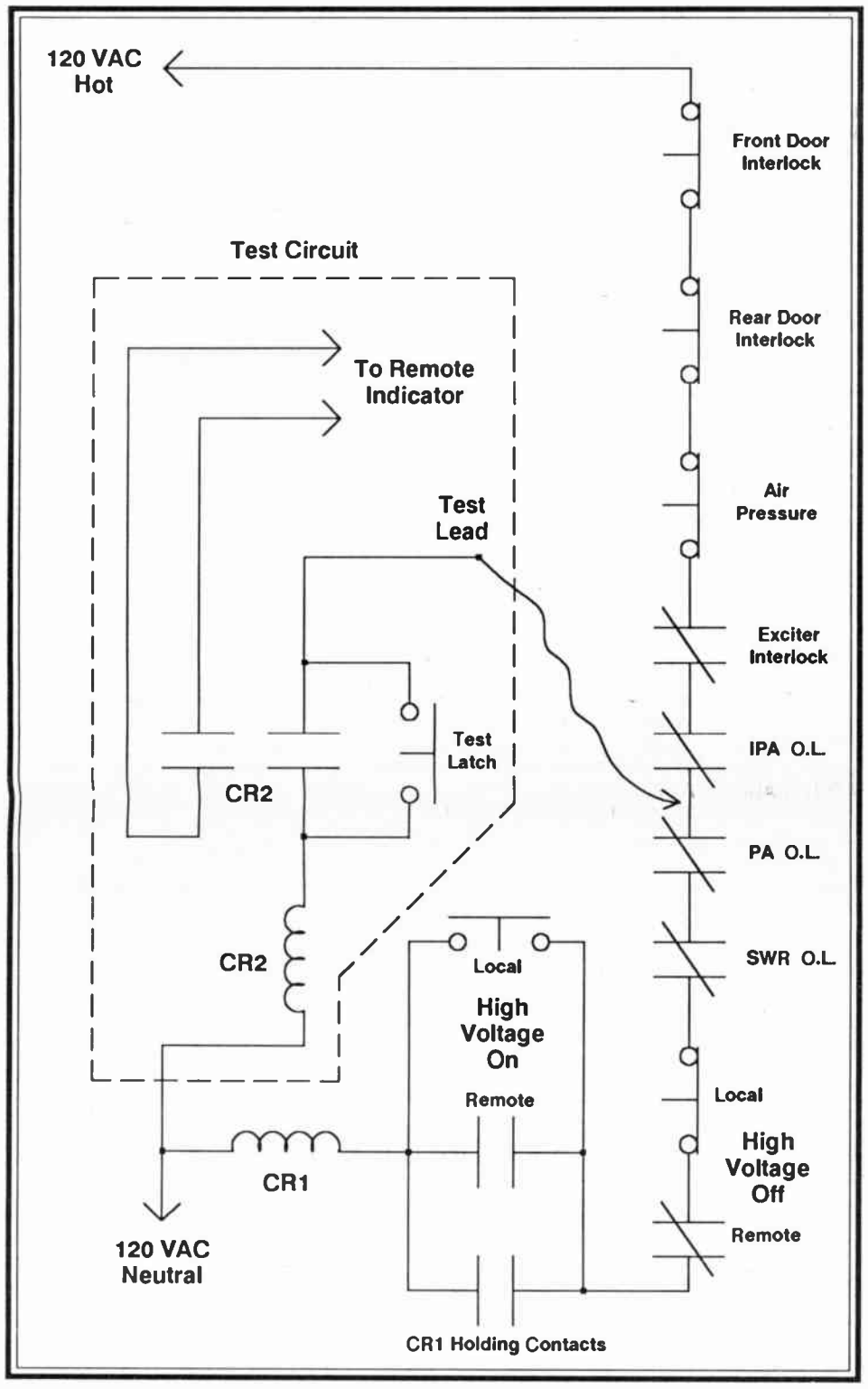


I1 = 24vdc pilot lamp
K1 = KHP 17D11-24vdc
(or equivalent at other voltages)

Control Ladder Testing

By George R. "Bob" Howe - WBGL
Champaign, Illinois
217-359-8232

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 it's 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.

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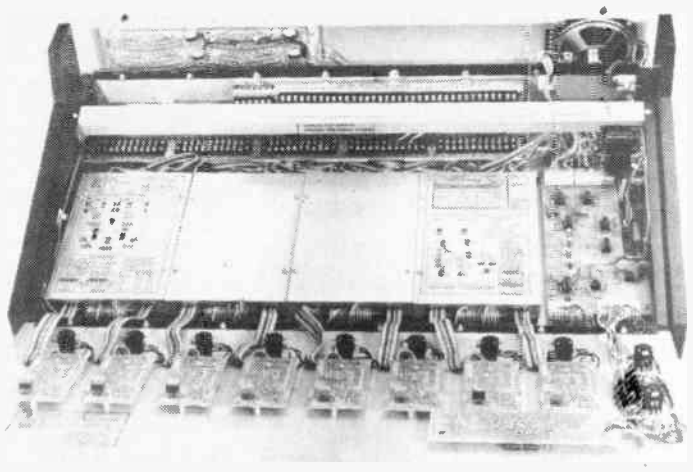

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INPUTS: Two per channel except the last channel which has nine. Balanced bridging 1k ohms in mic mode & 150k ohms high level. Input #1 of each channel programmable mic thru high level. Input #1 of each channel may be strapped for mono or stereo feed.
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Consumer CD Interfacing

By Jim Turaville - KWOX
Woodward, Oklahoma
405-256-4101

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 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 closed when jumpered. The same test is true of PAUSE, PLAY, STOP, SKIP, etc.

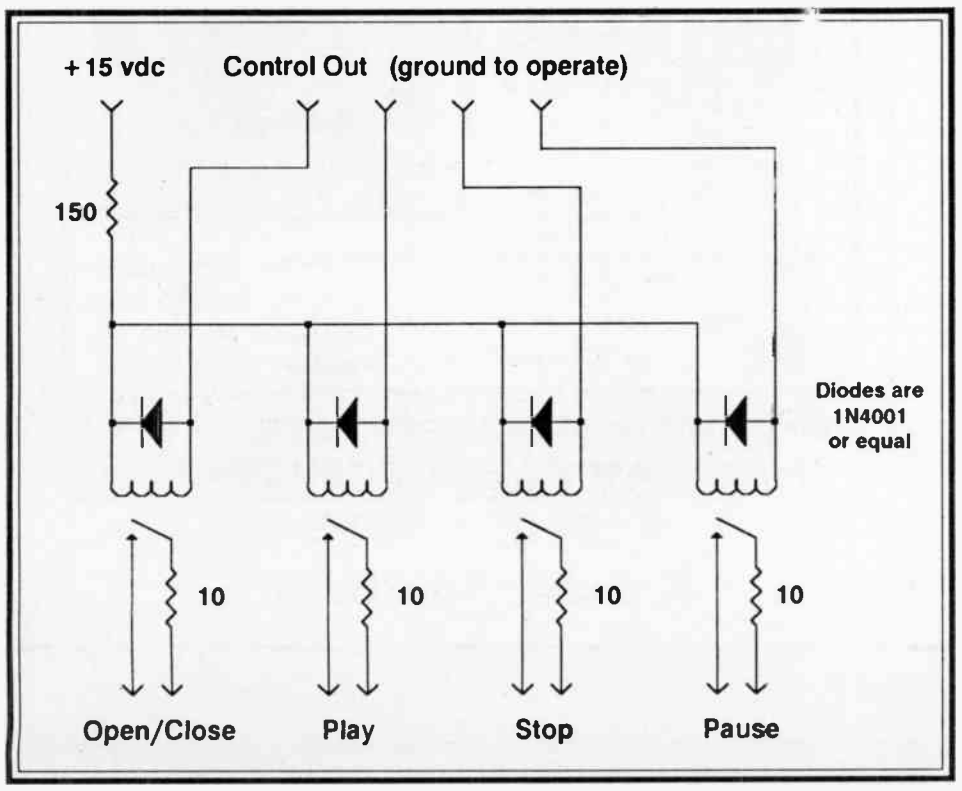
I use a 12 volt DC reed relay to do the remote switching. The reed relay is used because the coil resistance is about 1050 ohms on the 12 volt model, and offers the least amount of current drain to the unit's power supply. On the last unit I interfaced, I actually soldered the contacts of the relay directly to the back of the front panel PC board.

(Continued on Page 7)

Consumer CD Tips . . . (continued)

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! You will need this to keep spikes off of the unit's power supply, that may be caused by the inductive "kickback" 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.



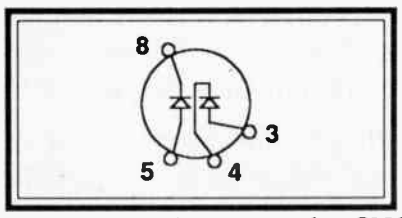
Solid-State Replacement for Gates Tube-Type Ammeter

By 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. Figure one 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

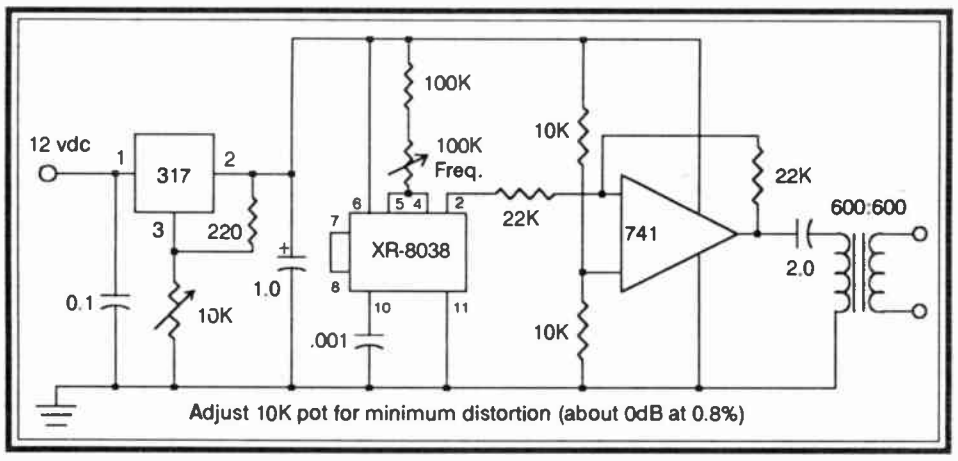
By Robert Hensler - KCFR
Denver, Colorado
303-871-9191

At KFCR we use a slate tone in all of your 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 it gave up the ghost, I was left with the problem of replacing it. My choices were to buy a new one off the shelf or build one myself. For this purpose, I only needed a fixed frequency at constant level. I felt that buying one was more 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 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. The XR-8038 IC will run on a single power supply from 10 to 10 VDC. It will produce a highly stable and sweepable square, triangle and sign-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 sign-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 this IC was about $25.00.



The diagram shows the circuit as I built it, for a constant 1 kHz 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.

Equipment Guide

June 1989

Box 7001 Rochester, MN 55903 (507) 280-9668 Ray Topp - Editor

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Auditronics 218 Console Fix

By Bill Harris - KMJI
Englewood, Colorado
303-741-5654

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 it wasn't something unusual patched in, I found that the noise was only on the program, audition and mono busses. 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 ±24 VDC main supply read ±24 volts at the connector to the console mother-board and on the mother-board main voltage distribution buss. 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 buss was cross-talking into the audition buss, only a half dozen dB down. Time to look at the program and audition line amplifiers. Each module has it's own on-board ±18 volt regulators. There was -18 volts, but no +18 volts. Moreover, there was no +24 volt input to the regulators!

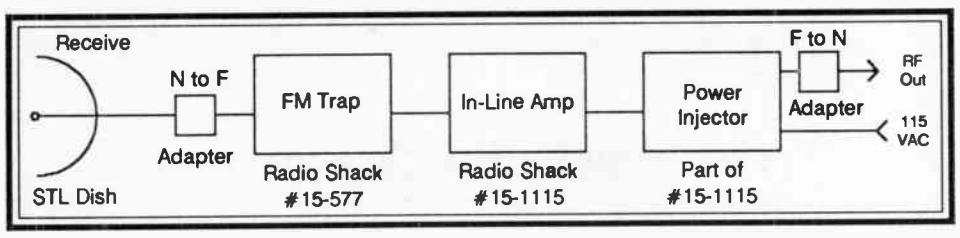
The program, audition, and mono line amplifiers, in this board, plug into a "daughter-board" of sorts, mounted next to the main mother-board. There is only one ground connection between these boards - - a short piece of solder-filled braid. When I started moving connectors and wires around, the hum quit 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 re-soldered 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 Filter

By Mike Worral - KCMT
Chester, California
916-258-4300

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 pokes it's 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. (Note: The STL receive antenna is mounted on the same tower as the FM transmitting antenna - - indeed, within the transmitting aperture)

Open Delta Three Phase
Broadcaster Beware

By Rob Yaw - KOJM/KPQX
Havre, Montana
406-265-7841

Figure 1 shows the very popular, delta-primary / wye-secondary, method of providing a consumer three-phase power service. Most broadcasters, and other consumers using delicate equipment, use this method for their primary service.

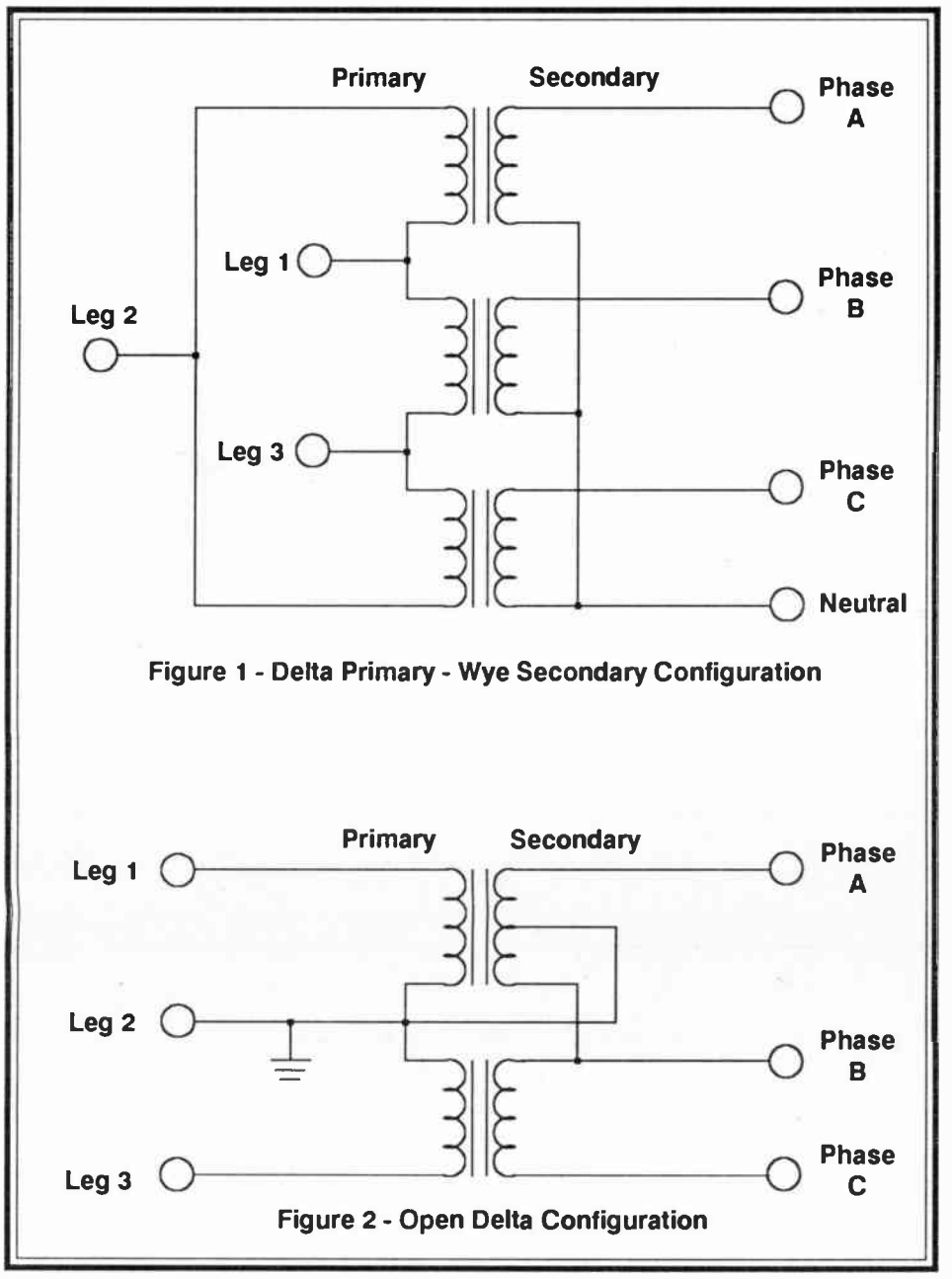


Figure 1 - Delta Primary - Wye Secondary Configuration

Figure 2 - Open Delta Configuration

Figure 2 shows, what is known as, the open delta three-phase system, that uses two phases operating against ground. It is advantageous only from the standpoint that it requires less wire and only two transformers. These advantages are far outweighed by the problems this system may cause the broadcaster.

The open delta system has numerous problems that are simply inherent to it. The line voltage, for example, is very load dependent. If the load on the system changes, as it will during transmitter power-up, the line voltage changes too. The voltage will eventually stabilize, but this may take several seconds to do so. Another problem with this system, is the rather large voltage and phase imbalances that may be present between phases. The system also exhibits poor voltage regulation and high transient propagation. Phase C, with reference to ground, is often referred to, in the electrical industry, as the "wild leg." It could not have been more appropriately named. The voltage on this phase can be practically any value under a no load condition and eventually stabilize to approximately the same values as the other two, under load.

A little over a year ago, I was hired, on a consulting basis, to do a technical appraisal of an AM/FM facility in the eastern part of the state. The facility was being sold and the new owner-to-be wanted an engineering opinion of the equipment and an overall status report of the entire facility.

(continued on page 11)

Open Delta . . . (continued)

On arrival at the station, the AM was off the air and had been off all morning. "It does this all the time," I was told. "Sometimes it will come back on, if you wait long enough."

Arriving at the transmitter building, I found a 5 kW Continental 828-E1 transmitter that appeared to be in showroom condition. It wouldn't run, but it looked good. I also noticed a large pile of RF driver cards in the corner. Going right to the RF driver in the transmitter, the problem was soon discovered. All the power transistors were shorted from emitter to collector. Replacing all the transistors had the transmitter up and running. Next morning - - it was the same thing all over again.

At this time, the open delta configuration never crossed my mind. After all, nobody in broadcasting ever uses it so why even think about it? I recommended power line conditioning devices of various sizes, shapes and prices, and continued my inspection of the facility. After a thorough inspection of the transmitter, I was convinced that it was in as good a condition as it appeared. Something had to be coming in on the power line.

The problem continued for this station. Large supplies of RF driver transistors were kept on hand, along with my phone number. My home base is over 300 miles from this station, so we spent considerable time on the phone.

One day, last July, a phone call from the plagued station brought the news that the high-voltage transformer had literally burned up. A new one was on the way, but something had to be done about this situation.

The only person at the site, with any technical knowledge, was the air-conditioning technician. I asked him if he could read the voltages at the transmitter disconnect switch. He said he could - - and did. I couldn't believe what he had to report. One of the phases was 80 volts higher than the other two. He didn't seemed concerned. This was normal for a "wild leg" system. I asked him to go out and look at the power pole and count the transformers. He soon returned and reported that were two transformers on the pole. Finally, the mystery started to unravel.

The power company confirmed that the system was indeed an open delta. It had been that way since day one. The original owner wanted it that way. The service was immediately changed to a delta-primary / wye-secondary. The troubles have ended.

There is no question that the open delta system can provide adequate service for some applications, but is is very questionable as to whether it is the service for the broadcaster.

Tech Manuals Are Available

By Stephen D. Crum - WARM
Cincinnati, Ohio
(513) 241-9898

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.

Please-We Need Your Help!

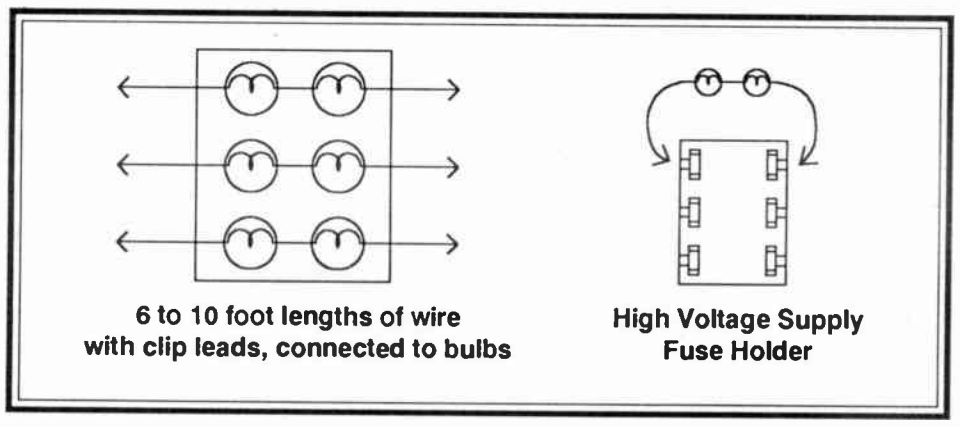
If you have any short tech-tips, send them in or better still, call me at (507) 280-9668 and we'll talk about them. Remember, it doesn't do anyone any good if you keep that information to yourself. Don't assume that everyone knows about your special technical tip. Send them in - - they'll be printed in the next issue.

Transmitter Soft Start Circuit

By 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 & 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.

ITC 3D Part Tip

By Larry Fiebig - WBLZ
Cincinnati, Ohio
513-742-3600

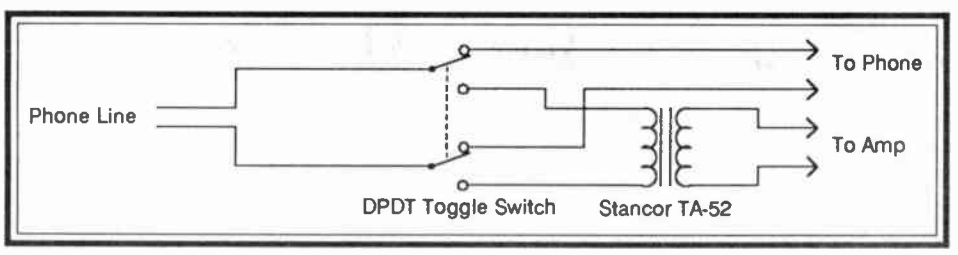
On ITC cart decks, if you get a "rattle" from the run relay and the cart won't run, replacing C206 on the cue card fixes the problem every time.

While your at it, replacing all the 10K level control pots will save you trouble down the road.

Telco Tip

By 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

By Steve Fluker - WMFE-FM
Orlando, Florida
407-273-2300

The article written in the April Radio Guide, concerning the SP10-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%.

Teac SX-3300 Tip

From Ralph Messer - WTZE
Richland, Virginia

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.

Thanks Ralph . . . Editor.

Continental 816R-1A Card Fix

By Lewis Downey - KRCL
Salt Lake City, Utah
801-363-1818

KCRL uses the Continental 816R-1A (10kW) on Farnsworth Peak, west of Salt Lake City. The site is a 1½ hour 4-wheel-drive trip, for maybe three quarters of the year, and a $400-$500 helicopter ride or ½-day on skis/snow-shoes in the winter. We used to be able to count on gating card problems after power bumps, so you can picture the frustration.

Our symptom of gating card failure has been driver plate supply breaker trips. A pre-failure symptom is bumps in the power change as you take the transmitter power up and down in manual power control. We discovered, by trial and error, that the small SCRs on the gating card (2N2323/AD114) were being destroyed, presumably by transients accompanying power bumps. The gate-cathode junctions of the little SCRs were opening up. This knowledge made the repair of the gating card much more cost-effective ($15 in parts vs $200 for a good card with exchange from the manufacturer), but didn't solve the problem of preventing the failures.

Installation of a Square-D three-phase surge protector ($40-$50) on the power line going into the transmitter, seems to have worked. We haven't had a power bump related failure since the installation of the surge protector (that's 3-4 years). I still shotgun the electrolytics once a year (as recommended by Continental) and keep a couple of spare cards on hand, sealed in plastic to keep the electrolytics from drying out so quickly; it's pretty arid at 9300 feet in the mountains of Utah.

I also highly recommend the new filament voltage regulator. It appears that we're going to get a return on our investment of approximately $200, out of the extended filament life of the first new PA tube (4CX10,000D) we've installed since using the new regulator. It has run for over a year at 100% forward power on the initial setting of the filament voltage at 6.75 VAC. Prior to the new style regulator, we were getting sometimes a year, usually less, out of a PA tube.

Does anyone have any ideas about broadbanding the IPA plate to PA grid tuning in this transmitter?

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Radio Guide will provide space here for contract engineers wishing to expand their business. To be listed here, just give me a call at (507) 280-9668. This list is not a recommendation of any engineer.

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Radio Guide

June, 1989 Volume 2 - Issue 6

Mail to: Radio Guide 511 18th Street SE
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Fill out the information below, and then circle the number of any manufacturer from which you would like additional information.

1 - Television Technology
2 - Broadcast Audio
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