



# RADIO GUIDE

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

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## Do We Pay? - Yes We Do!

During the startup history of Radio Guide we have, from time to time, paid writers for their technical articles. It's been sporadic at best. Not because of any lack of appreciation for your efforts, but simply, the bucks weren't there all the time.

Thanks to your continued efforts, you have helped Radio Guide to establish itself as an effective (young maybe) player in the broadcast publication field. We've still got a long way to go, but I feel we've established the Radio Guide on a solid foundation. After all, the foundation of any endeavor is what really counts. In the publication industry, it should be the readership. It seems that, over the years, many publications drift from their original intent. Sometimes that's a natural evolution, and is in the best interest of their readers. Other publications have not been so fortunate.

Radio Guide will always be just what it has been -- a technical forum for broadcast engineers. The number of pages you see, are in direct proportion to the number of technical articles we receive. Personally, I would like to see the Radio Guide increase its page count. I know that there's a lot more technical information out there. Please get your ideas on paper and mail or fax them in. If you want to see more of a good thing, then more of you are going to have to realize that you are the one I'm talking to, and that your technical information is needed by a lot of engineers out there.

From the start, I've tried to be realistic about your technical article contributions. Many of you have expressed that you will gladly do it for nothing. I'm happy to hear that, but I don't think that's good enough - it simply isn't equitable. The Radio Guide owes its existence to your involvement, and we're finally in a position to do something about it!

Starting with this issue, Radio Guide will pay you for your articles upon receipt! The day we receive an article from you, is the day your payment will be sent. This will give you the timely compensation you deserve, and allow us flexibility in publishing your article.

Help to make Radio Guide the publication you've always wanted. Together, we can make Radio Guide the best engineering publication ever. It is possible -- and it's up to us!



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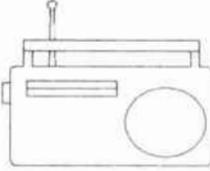
## Product Information Service

Starting with this issue, Radio Guide is establishing a Product Information Service. You've probably seen reader service cards in other publications, where you circle the number for information from advertisers. It was great for the advertisers, but not so great for you. If you needed, say, a cart machine, you'd only get info from the one manufacturer you circled. Well, Radio Guide is taking that a step further.

In this issue, you will find a blue postage-paid reply card. Take a look at it and fill it out. You'll be pleased with the results. And hey -- we even pay the postage for you.

When we receive this card, we will notify manufacturers and distributors nationwide of your equipment needs, and where you want the literature sent. Please note that this is not just for the manufacturers found in the Radio Guide pages. You will receive product information (and calls if you wish) from distributors and manufacturers nationwide!

You will get the product information you need, without the hassle of making phone calls and writing letters around the whole country. This is a true information service -- the first of its kind in the broadcast industry. It can only work if you take the time to fill out the card and send it back to us.



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# FCC Grants STL Reprieve

Broadcasters now have until July 1, 1993 to meet the FCC's notification requirements for STLs. The old date of July 1, 1990 has been waived. Below, you find the complete text of the FCC release on this matter.

On Page 3&4, you will find information from each STL manufacturer detailing the procedures to follow to get your existing STL transmitters in compliance with FCC notification requirements. Give them a call if you have any questions.

I'm not minimizing the roll that the SBE and NPR played in this, but the FCC did state that the main reason that the delay was granted was that STL band congestion simply had not developed to the extent that they thought it would. If we think that they are going to grant another reprieve on July 1, 1993, we would be sadly mistaken! Basically -- we lucked out this time!

Let's not treat this extension as a time to sit back and relax. Call the STL manufacturers and do what you need to do to get your unit in compliance.

We've been given notice and enough time to do it. There shouldn't be any complaints in 1993 . . . editor

Before the Federal Communications Commission  
Washington, DC 20554  
DA 90-37

In The Matter of:

Notification of Broadcast Auxiliary studio-transmitter-link/inter-city relay (STL/ICR) transmitters

ORDER

Adopted: January 12, 1990

Released: January 18, 1990

By the Chief, Mass Media Bureau

1. On October 31, 1985, the Commission adopted a Report and Order in MM Docket No. 85-36, which required that, effective December 16, 1985, studio-transmitter-link/inter-city relay (STL/ICR) transmitters to be operated in the 944-952 MHz band, possess a grant of notification prior to being marketed. Transmitters marketed prior to the effective date of the new rule were to be "grandfathered" for a five year period ending on June, 1990. On or after July 1, 1990, all STL/ICR transmitters must have received a grant of notification. This requirement was adopted to ensure that all STL/ICR transmitters would meet long-standing (and unchanged) technical standards, and to encourage the production of STL/ICR equipment capable of using narrower bandwidths. The latter effect was considered particularly important in view of increasing demands being placed on STL/ICR spectrum, particularly in larger urbanized areas.

2. On November 8, 1989, the Commission received a letter from Booth, Freret and Imlay, counsel for the Society of Broadcast Engineers (SBE). The letter notes that, traditionally, new technical rules will "grandfather" existing equipment from compliance, but that this was not done in MM Docket No. 85-36 because of the expectation of extreme STL band congestion. However, SBE notes that, with few exceptions, new users of the STL band have been accommodated without recourse to the narrowbanding provisions adopted in MM Docket No. 85-36. SBE also indicated that 40% of stations use STL equipment, most of which is pre-1985 manufacture, that the cost of bringing each of these stations into compliance with the notification requirement would be roughly \$2000 per station, and that STL equipment manufacturers would not be able to upgrade all of the equipment by July 1, 1990. Finally, SBE argues that while the broadcast industry would be adversely affected by strict adherence to the equipment notification requirement, it will not receive any benefit from it. Noting that licensees will still have the responsibility to prove at all times that their STL systems are functioning properly, SBE requests that the Commission suspend the STL equipment notification requirement for three additional years.

3. On December 19, 1989, the Commission received a similar request from National Public Radio (NPR) for an indefinite "grandfathering" of STL equipment or, at a minimum, a three year delay in the effective date of the equipment notification requirement. NPR provides limited statistics suggesting that roughly 70% of public radio stations use STL links and that there may be an average of 1.6 STL transmitters in use per station (many stations have backup equipment). NPR estimates the cost of bringing each station into compliance with the equipment notification requirement to be \$4573. This expense would need to be met largely from funds made available from NTIA's Public Telecommunications Facilities Program, and these funds will be inadequate unless equipment upgrade can be spaced over a three or four year period. Like SBE, NPR argues that because unforeseen developments in the broadcast marketplace have led to less congestion than originally anticipated, giving these broadcasters the requested relief would not harm others. NPR also expresses belief that the proper use of antenna systems, transmitter combiners and tuning procedures are more likely, than the application of the Commission's

equipment authorization program, to avoid or correct any cases of interference which may develop. According to NPR, where such equipment causes interference, provisions in Part 74.535(c) of the Commission's Rules will continue to require licensees to take whatever steps are necessary to correct the problem. Thus, because the economic hardship in complying with the notification requirement will be great, and because no significantly adverse consequences will result from the Commission's granting the requested relief, NPR requests a waiver of Part 74.550 or, in the alternative, a three year postponement in the effective date of the rule.

4. The arguments of the SBE and NPR have been repeated in recent letters and telephone inquiries by both public and commercial broadcast licensees.

5. It appears that only recently did many broadcasters using STL/ICR equipment begin to investigate the costs associated with the upgrades required as a result of the equipment notification requirement, and that much of the current concern is due to their lack of planning. By the same token, the STL band congestion has not developed to the extent anticipated back in 1985. This circumstance, more than any other, persuades us that a delay in the effective date of the equipment notification requirements in Part 74.550 is not likely to have any significant adverse impact on STL/ICR service. Nevertheless, we wish to emphasize that, while we will grant the requested delay, all existing STL/ICR equipment must comply with the current technical standards, and must be notified by July 1, 1993, if it is intended to be used after that date. Consequently, this delay should not be interpreted as modifying our intent to require licensees to use more spectrum efficient bandwidths in congested areas where there is need to accommodate new STL/ICR service entrants. In sum, while the equipment notification requirement will be deferred, the other rules adopted in MM Docket No. 85-36, which are intended to foster more efficient use of the STL/ICR spectrum, are being retained and will continue in full effect.

6. Accordingly, pursuant to the authority contained in Section 0.283 and 0.61 of the Commission's Rules 47 C.F.R. Part 0.283 and 0.61, the requirement contained in Part 74.550, that operation of 944-952 MHz equipment not approved under the equipment authorization program may continue until July 1, 1990, after which such equipment must be approved, IS WAIVED until July 1, 1993.

FEDERAL COMMUNICATIONS COMMISSION

Signed: Roy J. Stewart

Chief, Mass Media Bureau

## Appendix:

47 CFR Part 74 is amended to read as follows:

1. The authority citation for Part 74 continues to read as follows:  
Authority: 47 USC Sections 154 and 303

2. Section 74.550 is amended by revising the date in the first sentence to read as follows:

### Section 74.550 Equipment Authorization

Each authorization for aural broadcast STL, ICR, and booster stations shall require the use of notified or type approved equipment, except that operation of 944-952 MHz equipment which has not been approved under the equipment authorization program may continue until July 1, 1993, after which equipment must be approved.

## Free Classified Ads!

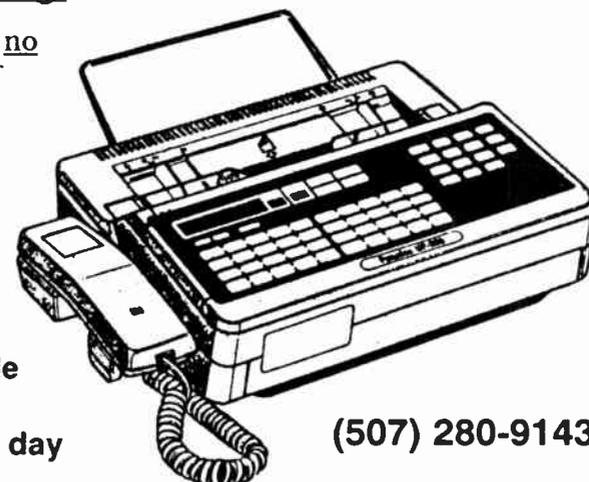
In this issue, we have integrated the classified ads into the main body of the Radio Guide. The extra costs of producing the separate yellow publication were not justified. In fact, many of you said the yellow section was missing from time to time.

By placing the classified ads in the main body of Radio Guide, we save money. So . . . you guessed it, you don't have to pay anymore! Any classified ads you wish to have published in the Radio Guide will be free of charge, from now on!

There will still be no limit on the number of words you can use to describe your gear. In addition, you can now FAX your equipment list to Radio Guide at (507) 280-9143.

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# How to Make Your STL Legal

Radio Guide called each STL manufacturer, and asked them to submit, in their own words, what they are doing to resolve the STL situation. Starting on this page, and continuing on page 4, you'll find their responses . . . editor

## Marti STL Type Acceptance

From Dan Rau - Marti Electronics

Thanks for the opportunity to respond to Radio Guide about the STL Type Acceptance controversy and FCC Rule 74.550. At Marti Electronics we have always had the best interests of our customers at heart, and have taken care to make certain that all of our STL equipment and boosters are Type Accepted and legal for use now, and past the July, 1990 deadline. (This date has been extended by FCC to July 1, 1993 - editor) As a matter of fact, Marti is the only company that has fully complied with FCC Rule 74.550 since it was put into effect in 1985.

It might interest your readers to know that with the introduction of the STL-8, in 1970, we attempted to have it Type Accepted. All the proper documents and engineering data were submitted to the FCC, but they declined to Type Accept the STL-8 because it wasn't required for STLs at that time. Broadcasters using STL-8 equipment can rest assured that they are in full compliance. Although we can't supply new labels with the FCC ID for the STL-8 transmitters, stations operating STL-8s should record the FCC ID for reference in the event of an FCC Filed Engineer questioning the equipment authorization.

The FCC ID numbers for Marti STLs and boosters are:

Model	FCC ID #
STL-8	BEN9EZSTL-8-950
STL-10	BEN9EZSTL-10-950
MW-500	BEN9EZMW-500

## TFT Poised to Help With FCC Deadline

From TFT Inc.

TFT, of Santa Clara, California, has advised Radio Guide that all the STL transmitters it has been shipping throughout the years now have FCC Type Notification.

If you are operating a 7700B, 8300 or 8600 transmitter, write a letter to:

**TFT Customer Service**  
**3090 Oakmead Village Drive**  
**Santa Clara, CA 95052-8088**

This letter must contain the model and serial numbers of the transmitters in use. Further, it must also contain certification that the transmitters were put into service as received from TFT without alteration or modification. TFT will then issue you the appropriate FCC ID tag to affix to the rear panel of your transmitter. There is no charge for this service.

Should you be using a 7700 (no suffix letter) transmitter, a factory update is required at \$1,500 COD or prepaid. This involves the inclusion of an output filter, new power supply board, and the change of certain components. In return, you will have Type Notification on your unit supported by a computer generated test data sheet.

TFT has also indicated that it is making available a new STL transmitter model 9000, at \$2,995. Typical specs are THD of 0.02%, SNR of 82 dB, separation of 60 dB. We were told TFT would allow a \$505 rebate on any brand composite STL transmitter and, if there is not a measurable improvement in audio performance, the 9000 may be returned in 30 days for credit.

For further details on the TFT "STL Rescue" program, call them toll-free at (800) 347-3343.



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**Solid state quality and efficiency.** TTC's new FMS-Series FM Transmitters are available in 1kW, 2kW, 4kW and 8kW models. Broadband, efficient power amplifiers are transparent to the high-spec TTC Exciter.

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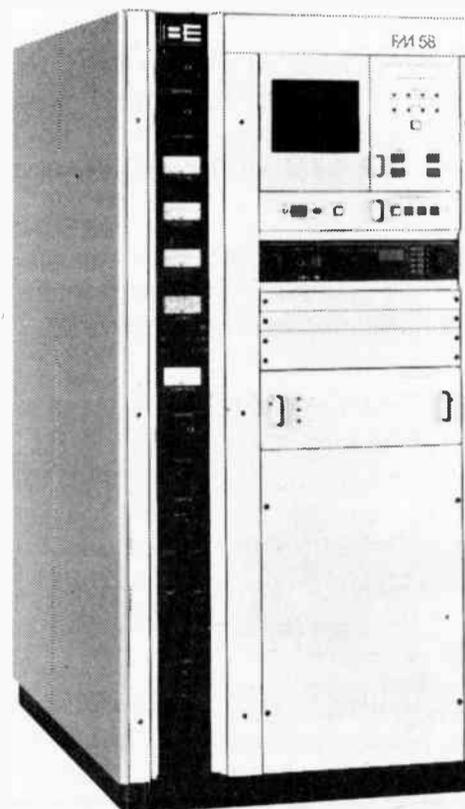
**Made in U.S.A.** For details on our full line of AM and FM transmitters and translators, call TTC: Television Technology Corporation, Phone: (303) 665-8000 FAX: (303) 673-9900

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4100 N. 24th ST., P.O. BOX 3606, QUINCY, IL 62305, (217) 224-9600, TELEX: 250142, FAX: (217) 224-9607

## Moseley STL Type Acceptance Info

From Dave Chancey - Moseley Associates Inc.

Since returning from the recent SBE convention in Kansas City, the telephone has been ringing non-stop with questions concerning the requirement, in Section 74.550 of the FCC Commission's Rules, that all STLs in use after July 1, 1990 (*this has been changed by the FCC to July 1, 1993 - editor*) be notified pursuant to FCC equipment authorization rules.

After numerous discussions between ourselves and the FCC, it was decided that a massive recall of all the STLs we produced since 1985 (when the rule was enacted) was inappropriate. The end user will receive an FCC Identifier label for their Moseley transmitters.

### Moseley STL Transmitter ID Numbers:

PCL-606 (FCC ID CSU9WKPCL-606-SEC)

PCL-600 (FCC ID CSU9WKPCL-606-SEC)

PCL-6010 (FCC ID CSU9WKPCL6010)

Post 1984 PCL-505 (FCC ID CSU9WKPCL505)

All a station has to do is call us and request an FCC Notification kit. After receiving the packet, nothing more is required other than the end user complete a certificate of maintenance statement and return the form to Moseley.

To date, we have mailed over a hundred labels to stations that have followed this course of action. In order to comply with an FCC operational temperature spec, PCL-505 users need to install 2 divider chips, which we provide with the FCC label, in the Buffer/Divider module.

PCL-505 transmitters shipped between 1973 and 1984 can be upgraded to the Notification standard. Our information packet gives detailed information on how to accomplish this.

However, we require that pre-1984 PCL-505s be returned to the plant for modification and spectrum analyzer check of the transmitter output. FCC specifications require spurious to be 60 dB down out to the 10th harmonic. Over the years, we have found that a small percentage of older generation STLs, no matter who the manufacturer is, can develop spurious problems. This may be due to component aging or end user adjustments to get that extra watt, in an attempt to overcome fade problems. Not only can this cause interference problems for neighboring broadcasters in an area, but the third harmonic falls in the FAA radar band for commercial airports. Before attaching any FCC label, and assuming a liability of such importance, it will benefit the industry at large to, at least, run a spectrum analyzer check.

In addition, for users looking at replacing an aging STL system, we have initiated a trade-in allowance of \$750 for customers returning a PCL-101, PCL-303, or PCL-505 against the purchase of a new PCL-6000 or PCL-606 system or transmitter only. The FCC package mentioned earlier has all the details.

It is worth mentioning that stations can do the Notification tests and file to the FCC individually. Perhaps Radio Guide can publish an article on how to accomplish this. (*Sounds like a good idea. We'll do it in a future issue - editor*)

We are a manufacturer who took the narrow banding of the STL channels described in Rule 74.550 seriously, and went to a great deal of design effort to be sure our current equipment operates in the adjacent channel environment the rule creates. We feel broadcasters in a panic to get an FCC label for a transmitter are not looking at how the older generation receivers will stand up to interference when and if the FCC follows through with their plans to relieve FCC congestion.

Personally, it's been interesting talking to everyone, and listening to different rumors and opinions everyone has on the subject.

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Now in our 20th year  
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3CX3000A7

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4CX3000A

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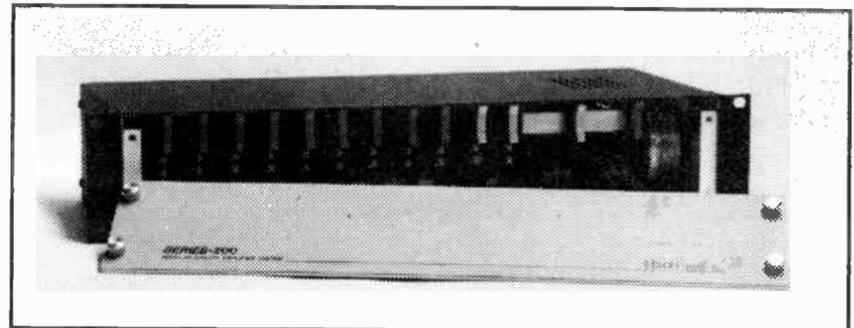
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xL82S shown

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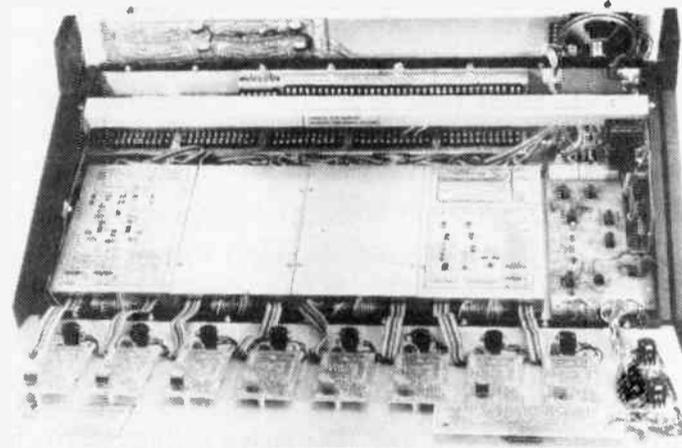
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7. NINE INPUTS ON LAST CHANNEL.
8. 2 WATT CUE AMP.
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10. MONITOR SELECT/GAIN CONTROL. Prog1/Prog2/External.
11. PHONES SELECT/GAIN CONTROL. Prog1/Prog2/External/Cue.
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23. REMOTE START/STOP OPTION. Programmable for operation from in/out select switches or mixer pot-up start & mixer pot-down stop.
24. COMPLETE INTERNAL LABELING. All labeling for in's & out's, gain adjusts, programming, levels, etc., is provided internally for easy installation.



## 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.  
OUTPUTS: Balanced low impedance, +25dBm max into 600 ohms. May be used balanced or unbalanced. Stereo sum balanced out. Program outputs factory set for +8dBm but may be recalibrated for

any other level.  
METERING: Expanded scale, 4" solid state tri-color with VU ballistics. 2 each on single channel units & 4 each on dual channel models.  
MONITOR: Stereo, muted monitor outputs @ +4dBm. External 20 watt stereo amp included. Three position selector for PROG1, PROG2 & EXTERNAL in.  
CUE: Mono-sum to 2 watt internal amp & speaker and phones. Switch programmable speaker muting.  
S/N: Mic level in @ -50dBm & +8dBm

out; -68db. High level @ 0dBm in & +8dBm out; -75dB (typically -78dB).  
DIST: Below noise floor. Typically .009%.  
RESP: 10Hz-20kHz; ±1dB  
CROSSTALK: PROG1 to PROG2; -70DB.  
SIZE: xL4..19"W x 8.5"H x 17"D.  
xL6..25"W x 8.5"H x 17"D  
xL8..30"W x 8.5"H x 17"D  
POWER: 115VAC, 50/60HZ, 40W. 230VAC available at additional charge.  
FINISH: Polyurethane Carbide black, Linear white, Ramko Grey.

## MODELS & LIST PRICES:

xL41S	\$1395	xL81S	\$2650	LF6	Contact factory
4 mixer single channel stereo		8 mixer single channel stereo		Linear faders; Available 6/89	
xL42S	\$1650	xL82S	\$2950	LF8	Contact factory
4 mixer dual channel stereo		8 mixer dual channel stereo		Linear faders; Available 6/89	
xL61S	\$1975	RSS4	\$225	PS230B	\$50
6 mixer single channel stereo		Remote start/stop (xL4)		230VAC power source	
xL62S	\$2375	RSS6/8	\$325		
6 mixer dual channel stereo		Remote start/stop (xL6 & xL8)			

# Cart Mis-Cue Solution

By Tim Verthein - KOZY/KMFY  
Grand Rapids, Minnesota

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 1kHz tone, and stopping the cart. What was needed was a way to let the tone build somewhat gradually onto 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 ten 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 PPL detectors, so keep this in mind should the mis-cues haunt you.

# Roughing Up AN MR-2

By Kyle D. Dickson, CE - WCRJ-FM  
Jacksonville, Florida  
(904) 636-0507

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 okay 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 that they had just lost their gripping action, so I got a small piece of very fine sandpaper 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.

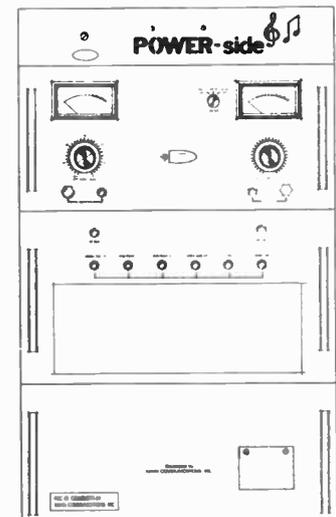
This fix won't save a whole lot of money (the drive roller are only about \$6.00 each), but it will keep the PD off your back while waiting for shipment -- and it's simple.

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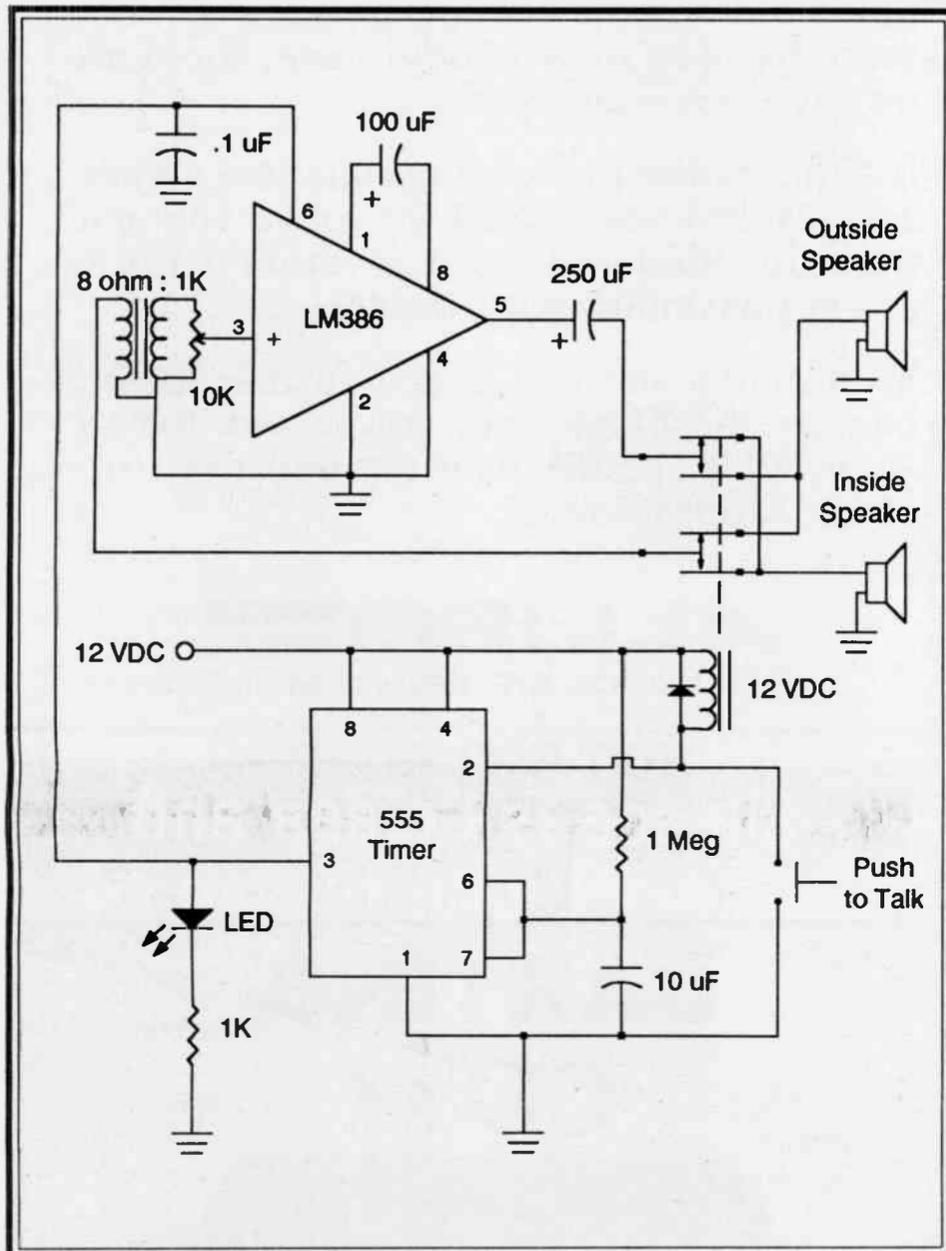
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# Door Intercom System

By David Drlessen - WGBA-TV  
Little Chute, Wisconsin

We often get deliveries after 5 p.m., and the door bell 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 weather proof speaker outside which also acts as a microphone. It is surprisingly sensitive, picking voices up from six 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 also 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. You should probably bypass the 12 volt supply with 100 uF too. 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.

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# Using the Gentner EFT-900 as Telco Interface

By George Whitaker-KSSA  
Dallas, Texas  
(214) 528-1600

Mr. Whitaker is also the author of "Radio Engineering for the Non-engineer," a home study course for managers or beginners.

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. By 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 jocks 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 turn 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 could 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.

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## SMC Solenoid Fix

By Mark Young - WJON  
St. Cloud, Minnesota  
(612) 251-4422

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 exact same problem.

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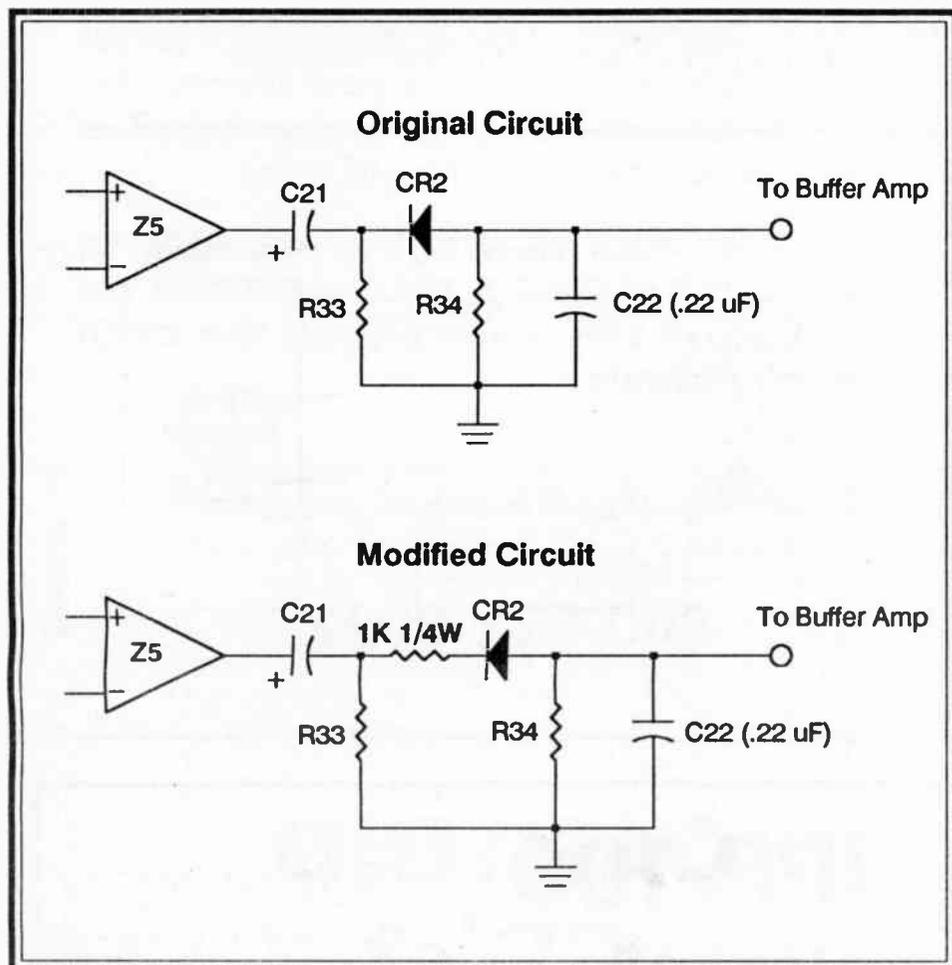
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# TFT 724A Monitor Click Fix

By Bruce Macmillan - WCUW-FM  
Worcester, Massachusetts

Our TFT Stereo Monitor has worked flawlessly for 11 years, but recently began having a random "click" noise in the audio outputs -- predominately 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 opamp 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 opamp (Z5) through coupling cap C21 (see diagram).



At negative signal peaks, the diode conducts and essentially connects C22 across the opamp output - the opamp 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 opamp 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

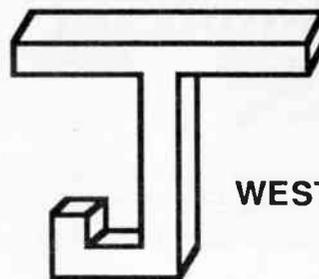
By Tony Wortman - WJAG/KXEL  
Norfolk, Nebraska  
(402) 371-0780

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 type 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 any further problems.

If you have this transmitter and harmonic filter setup, I would monitor it from time to time for this problem.



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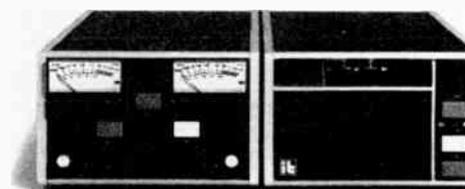
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# High Performance Compression Amplifier

By Frank Berry - WQYK  
St. Petersburg, Florida

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 of 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.

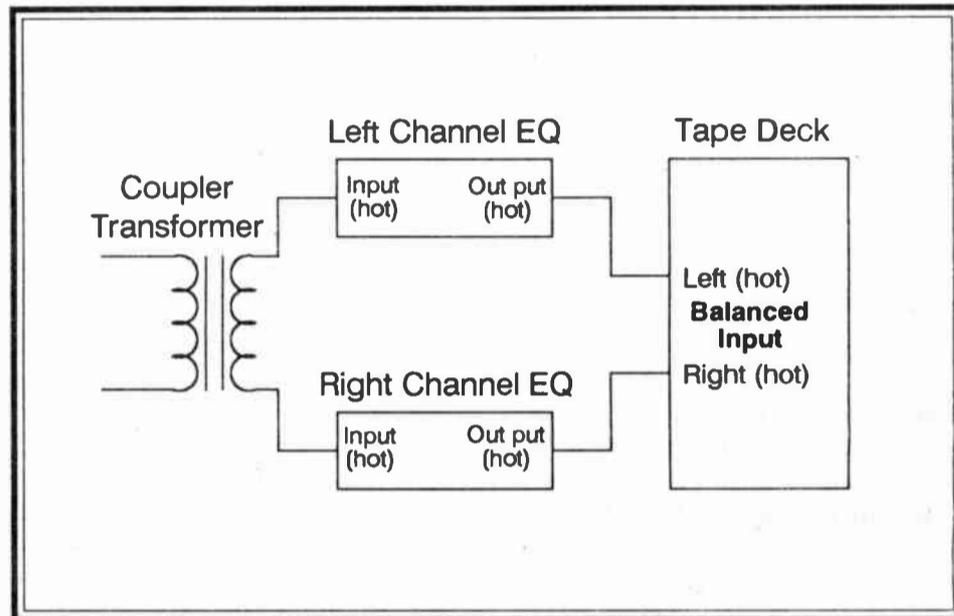
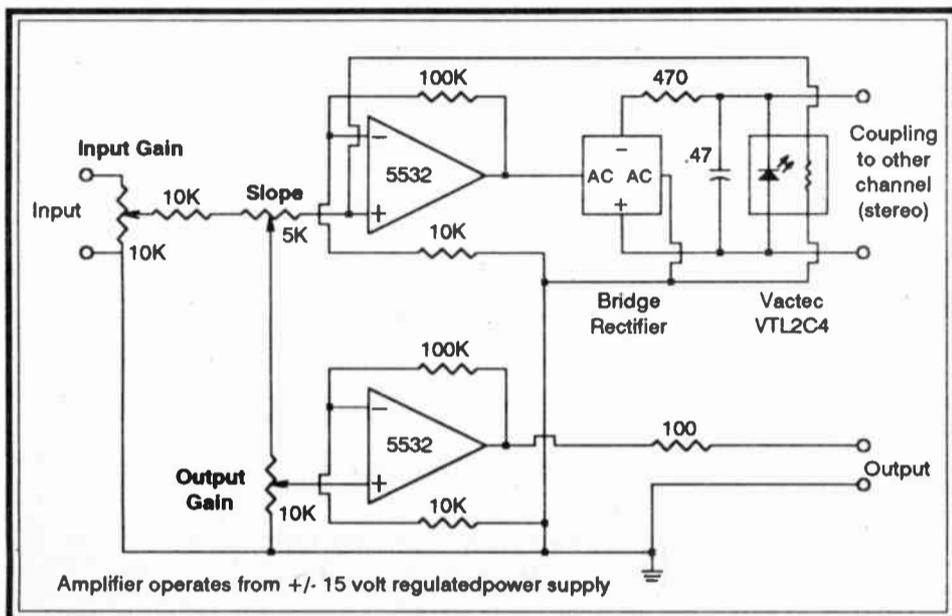
The amplifier operates from a +/- 15 VDC supply. The supply should be well filtered and regulated.

# Low-Cost Equalizer Interface

By Rick Pitchford  
University of Wisconsin  
Oskosh, Wisconsin  
(414) 424-3138

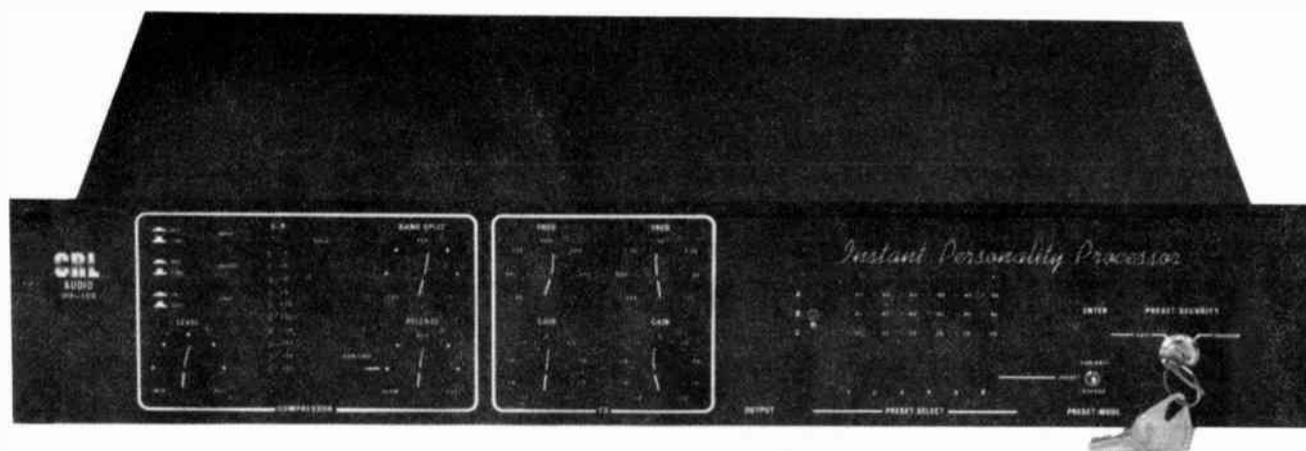
In Fall, 1988, we began broadcasting a 30 minute dial-up-delivered daily news program. We needed an equalizer to make it more listenable and, being a non-commercial student run station, it needed to be inexpensive. The equalizer, an \$80 consumer unit, was cheap enough, but an active interface into and 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 and the low side to the right unbalanced input hot (see diagram). 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.



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# Nautel Amfet-5 Overload Fix

By Hal Kneller - WKII  
Port Charlotte, Florida  
(813) 639-1112

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 an eighth of an inch 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 inch 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 fans were about 900.

## Excess Wow & Flutter in Cart Decks

By Paul Jellison - WLW  
Cincinnati, Ohio

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 found 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 is as 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 disassemble 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 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.

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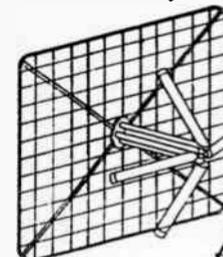
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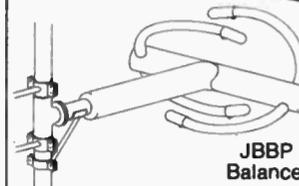
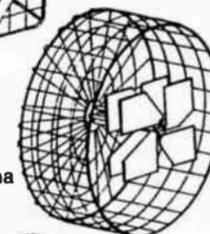
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# Standby Generator Maintenance Tips

By Ralph M. Hartwell II - KGLA  
Jefferson Louisiana  
(504) 733-9281

Most stations have some sort of emergency generator system for handling commercial power outages. Management usually takes very little interest in how the system works. They simply feel that there will be no problem with power failures since the emergency generator will take care of things . . . However, as we all know only too well, Murphy reigns supreme.

At one time or another, many broadcast engineers have had a nasty surprise - when the lights went out, they stayed out - the station's emergency generator failed to operate properly. When this happens, you usually find that management suddenly becomes very interested in how the generator works - or rather why it didn't work, and just why you failed to keep it in operating shape. Never mind that, when you ran the generator the last time, it ran just fine; it did not work when your station needed it. You did test it just last week, didn't you?

When the commercial power finally returns and things calm down a bit, it's time to make a careful investigation into just why the emergency generator failed to do it's job. Better yet, why not set up a comprehensive routine maintenance program to prevent this disaster from happening again.

Over a period of some 30 years, I have found that many broadcast engineers are not aware of the complex high-maintenance nature of the emergency power generators they are responsible for. Some of the maintenance suggestions in this article may make life a bit easier for you when the lights go out. While this information is aimed at gasoline engine powered generator sets, most of the information is applicable to natural gas or LPG fueled engines as well as diesel engines.

It's important for you, as an engineer, to make management aware that the time you invest in routine testing and inspection of the emergency generator will pay off in on-the-air time when commercial power fails. After all, the reason they invested in that generator in the first place was to be able to keep the station on the air when the power fails. Unless you keep it in good repair, the generator cannot be depended upon to perform its function when needed - any more than you would expect a car to start up and make a cross country trip if you had left it stored in the garage for a couple of years with no care or maintenance.

## LET'S GET STARTED

First of all, make sure that you have the manufacturer's instruction and maintenance manuals for the engine and generator. If you are in a remote location where it will be difficult for a serviceman to get to the machine in the event of a breakdown, make sure you also have the complete shop overhaul manuals for the engine and generator. You can't have too much information on hand when equipment fails!

The need for an ongoing maintenance program on standby emergency generators is better understood when you realize that standby generator systems are complex machines containing an engine, an alternator (generator), and control circuits to regulate the engine, control the generator output, and transfer the generator power to the load. In addition to these components, a fuel supply and a set of batteries to start the engine are required. There may also be a battery charger installed to keep the batteries fully charged. Each



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additional component increases the possibility of failure.

A failure in any of these subsystems can render the generator set just a useless pile of metal. To prevent this from happening, you have to check everything on a regular basis, preferably weekly, but at the very least, monthly.

This article will address the most common failure of the generator set - the engine either will not start or won't run properly. This can usually be prevented by running the engine on a regular weekly schedule. The preferred test method is to run the engine with a load, but in some cases, this may not be possible.

## SPARE PARTS

Look in the engine and generator manuals for the manufacturers recommended spare parts lists. Find out how hard it will be to obtain spare parts for the engine and generator in case of a failure. If there is a reliable source of supply locally, or within 24 hours delivery time, you probably don't need to keep too many spare parts on hand.

(continued on page 13)

**I**NTELLIGENT DIGITAL REMOTE CONTROL. The ITO177 from Hallikainen & Friends, allows fully automatic operation of a Moseley TRC-15 remote control equipped with a TEL171 Digital Telemetry Adaptor. The ITO177 plugs into the memory expansion port of a Commodore-64 personal computer and to the TEL171 data port. Automated transmitter site control of the TRC-15 and access to the meter reading displayed on the TEL 171 is by BASIC statements and functions built in to the ITO 177. An "auto-boot" feature allows the control program to re-load and run in the event of a power failure. 2K of nonvolatile memory saves information from power loss. Make the intelligent choice today based on time tested tradition.

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Remember, the further away you are from the parts depot, the more parts you should have on hand. Be sure that you make management aware that not having a gasket or some other item could make the difference between being on the air or having their listeners turn to another station in an emergency.

Identify any potentially hard to locate parts and consider stocking these as on-hand spares.

If there is not spare parts list, I suggest that, at a minimum, you keep on hand the following items:

- \* Tools to service the engine and generator.
- \* Battery hydrometer.
- \* Any parts which have a higher than normal probability of failure and which may be difficult to obtain on shore notice.
- \* A carburetor overhaul kit.
- \* A set of spark plugs.
- \* A fuel filter.
- \* An oil filter.
- \* Enough oil for one engine oil change.
- \* 2 gallons of antifreeze, or as needed for filling radiator.
- \* Fuses for generator and engine control circuits.
- \* Fuses for generator main line fusebox.
- \* Spare relays for the control circuits.

#### WEEKLY INSPECTION

**CAUTION** - Before making any hands-on mechanical inspection on the generator, always be sure to disable the automatic start system to prevent the engine from starting in the event of a power failure. If some part of your body is drawn into moving parts when the engine accidentally starts, you could be seriously injured or even killed. Remember to restore the generator set to automatic operation after the inspection.

Before you run the engine, make sure that the oil and water are

at the recommended levels. Make sure that there are no fluid leaks. Check the fuel supply for contaminants, and drain any water from the fuel tank, filters and sumps.

Inspect the starting batteries and make sure they are not leaking. If any acid has escaped, clean it up and determine the cause. Look for any corrosion on the battery terminals. If there is any, clean it off. If necessary, remove the leads to the battery and clean the posts and connections. Make sure the battery charger is holding the battery at the proper float voltage. Check the electrolyte level and add distilled water if the electrolyte level is low.

Check the fan belts for proper tension. Make sure the belts have not started to crack. Inspect all the hoses and rubber parts. Remember that rubber parts and belts deteriorate with age, and belt failures usually occur without warning. A broken belt will quickly cause a damaged engine, unless the engine over-temperature shut-down operates first.

Start the engine and let it run a few minutes to warm up. Listen for any unusual sounds coming from the engine or generator. After you have run the engine a few times, you will become familiar with the normal sound of the unit when it is running properly.

Listen carefully to the exhaust system for any leaks. These are usually detected by a popping sound which will become louder when the engine is loaded more heavily.

Listen to the sound coming out of the open end of the exhaust pipe. Sticking valves or intermittently missing spark plugs can be detected by a roughness in the exhaust sound. If you've never heard what a missing cylinder in an engine sounds like, just pull off one spark plug wire and start the engine. A properly running engine has a smooth purring sound. Becoming familiar with the sound of the engine is one of the best ways to catch a problem before it becomes serious and causes a failure.

**NOTE** - Be sure to ground the loose end of the spark plug wire to prevent damage to the ignition system due to the high voltage caused by the disconnected plug. This is very important if the engine uses a magneto.

(continued on page 14)

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## Generator Maintenance . . . (continued)

Look for any smoke coming from the exhaust pipe. Black smoke usually indicates a too rich mixture, and blue smoke usually indicates oil burning. A slight amount of smoke immediately after engine start up is to be expected, but if it continues for very long, you should investigate the cause.

Check the generator output voltage and frequency. If the generator has a manual voltage control as well as an automatic voltage control, try them both. Make sure that, when switching to the automatic mode, the voltage settles to the correct voltage without excessive surging or fluctuations. Verify that all meters read correctly without sticking.

If you can switch the generator to a load, do it at this point. Make sure the generator takes the load properly, without the engine stumbling or hesitating. Check the exhaust sound again for any unevenness in the sound which may indicate the need for a slight carburetor adjustment, new spark plugs or wires, or an engine valve adjustment.

Observe the generator output voltage and frequency while running under load. Allow the generator to run until the engine reaches normal operating temperature. Usually this will take from 15 to 20 minutes.

If you cannot switch the generator to a load, then you will have to make do with a no-load test. Make sure the engine sounds right and that the engine temperature and oil pressure readings are OK, and that the generator's output voltage and frequency are correct. After the engine reaches normal operating temperature, shut down the engine and restore the automatic starting controls to automatic operation.

If the generator set has a built in battery charger, make sure it is charging the battery properly while the engine is running.

If you are running the generator on a load, and you are satisfied that everything is running correctly, transfer the load back to the commercial power mains and shut down the generator set. Make sure the system is all set for automatic start in the event of a power failure.

Write down any problems discovered during this testing, and correct them at the earliest opportunity.

### MONTHLY INSPECTION

Check everything listed in the weekly inspection.

Measure the battery voltage and make sure it is correct. Adjust the battery charger output voltage if necessary. Remember that as the starting batteries age, their terminal voltage will decrease. This will necessitate lowering the charger voltage over the course of a few years to avoid overcharging the batteries.

Visually inspect the generator commutator segments and slip rings for any evidence of scoring, arcing, or pitting. A normal condition is evidenced by evenly colored segments with no pits in the surface and no evidence of arcing. If it appears that the surfaces are damaged, it may be necessary to have the surfaces of the slip rings or commutator segments refinished.

Start the generator set and observe the brush action and commutator/slip ring surfaces while the generator is supplying power to the load. **CAUTION:** Don't get shocked. Remember, that generator packs more power than your transmitter. Excessive arcing is evidence of a problem that needs to be corrected.

Visually inspect the control system and fuses or circuit breakers for any damage or deterioration. Look carefully for any evidence of overheating, especially after an actual power outage where the generator has had to supply power to the station.

### ANNUAL INSPECTION

Perform everything listed in the weekly and monthly inspections.

Drain some of the coolant and, with the aid of a flashlight, inspect for any corrosion in the radiator. If there is any, clean and flush the cooling system and refill with the proper coolant according to the engine manufacturer's specifications.

(continued on page 15)

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Change the engine oil if it has not been done this year. Most generator engines do not get run long enough in a year to require an engine oil change on an accumulated hour basis. However, even a small amount of engine operation will put combustion products, acids and condensed water, into the oil. If these materials stay in the oil, they can cause engine damage; especially if the engine is run infrequently and for short periods. Oil is cheap - engines aren't.

Do a load test of the starting batteries and replace them if necessary. A set of batteries should last about 3 to 4 years in properly adjusted float service. ("Float" service is where the batteries are constantly being charged just enough to replace the energy lost by self-discharge in the battery, plus any power used by the load connected to the battery.) It may be necessary to have a serviceman from a battery distributor come out and check the batteries if you do not have the proper battery tester.

Clean off the engine and generator. Dirt and dust on equipment help raise the operating temperature and can lead to early failure of components. Dust and dirt can also cause management displeasure. A clean machine may not actually run any better, but human nature being what it is, most people (including management), feel it will run better if it is clean.

Make a careful inspection of the exhaust system, including the muffler and all connection pipes. Check for any rusted through areas, or rapidly spreading rust. Replace any defective components immediately. Remember that carbon monoxide gas is odorless and deadly.

Tap any suspect areas on the muffler and exhaust pipes with a small metal object. Solid metal will have a metallic ringing sound, while a rusted out spot will have a very dull sound not unlike tapping a cardboard box. In making an exhaust system repair, beware of using flexible exhaust pipes. These are not airtight, and will allow exhaust gasses to escape into the building.

If you have not been able to make a load test of the generator this year, try to arrange with management for a time when the station is off the air or during a time when a loss of air time would cause the least disruption. Remind them that if you don't know that the generator will switch to the load and power it properly, their expensive machine may well be useless when they need it the most.

#### FUEL SYSTEM MANAGEMENT

Gasoline is supposed to stay clean and burn without any problems, but as anyone one who has ever had to clean out a lawnmower engine carburetor and gas tank after a couple of years storage can confirm, fuel sometimes causes severe problems!

#### MOISTURE CONTAMINATION

Fuel can become contaminated by several means, but the most likely cause is atmospheric moisture. Gasoline used for emergency generators is usually stored for long periods of time in vented fuel tanks.

As the outside air temperature rises during the warmer part of the day, the air within the tank warms, expands and escapes through the tank vent. Later in the evening, as the outside air temperature drops, the air inside the tank cools and contracts, creating a partial vacuum inside of the tank. The moisture condenses on the tank walls and runs to the bottom of the tank where it collects beneath the fuel.

This moisture will also cause the exposed tank walls and tank top to begin rusting. Soon, rust flakes begin to fall into the fuel and settle to the bottom. This "rust fallout" causes more rust to begin forming on the tank bottom. If the rust becomes severe enough, the tank begins to leak and must be replaced.

Some of the moisture becomes dissolved in the fuel and when it is drawn into the engine, it can cause corrosion of components in the engine fuel system and carburetor. In severe cases, enough water can collect in the carburetor to stall the engine.

The biggest problem with moisture in the fuel occurs when bacteria start to form in the water standing in the bottom of the tank. These bacteria live in the interface between the fuel and the water layer. They actually eat the hydrocarbons in the fuel and leave a gummy residue called "varnish", which will not readily dissolve in

(continued on page 16)



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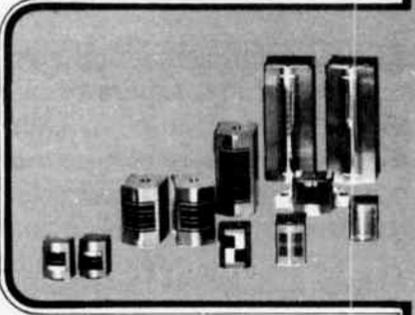
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## Generator Maintenance . . . (continued)

the fuel. Instead, it settles out on everything, forming a brown, smelly, tarry mess. When this varnish gets into the engine fuel system, it can cause blockage of the fuel filters, carburetor clogging, and fouled spark plugs, among other things.

Note that moisture condensation does not generally occur in totally sealed, airtight tanks which have been filled with clean dry fuel.

### CONTAMINATION PREVENTION

Fuel tanks should be installed with a drain fitting in the bottom of the tank to allow any condensed water to be drained from the fuel tank.

The fuel tank vent should always be placed outside of the building so that fuel vapors cannot enter the building or be ignited by any source of ignition, such as electrical equipment. The outside end of the vent line must have an explosion proof vent cover on it. The vent should not be placed near any moisture source, such as an air-conditioner water tower, a rain gutter, etc.

Make sure the fuel tank is placed so that it is protected from anything which would cause large changes in temperature in the tank. This reduces expansion and contraction of the air in the tank. If the tank is placed in the sun, paint it with a high reflectance white paint. Don't use aluminum paint. Aluminum paint absorbs infrared energy very well and gets quite hot in the sun.

Remember that all fuel tank installations must meet the local and national fire protection codes. If in doubt, check with your stations insurance agent or the local fire department.

Each month (or more often, if necessary) drain a small amount of fuel into a clean transparent container and inspect it for any water. If water is present, continue to drain fuel out of the tank to remove as much as possible of the water. You can then separate the clean fuel from the water and pour the fuel back into the tank.

### ADDITIONAL FUEL TIPS

Be sure to buy your fuel from a reputable supplier. If you can, filter the fuel before putting it into your storage tank. Adding an extra disposable fuel filter ahead of the engine fuel pump will be a great help in keeping small particles out of the engine fuel system and carburetor. Keep a spare filter handy. Remember, most of the trash that clogs a filter will be drawn from the fuel tank when the engine is under full load. This means the greatest chance of a fuel line clog will occur when the generator is running the station during a power failure!

Wait about 24 to 48 hours after filling the tank to allow any water present to separate from the fuel and settle to the bottom of the tank. Then you can drain the water from the tank. Keeping the fuel tank full will help to prevent moisture accumulation in the fuel tank since there will be less air above the fuel to expand and contract and bring fresh outside moisture into the tank.

### FUEL ADDITIVES

**CAUTION** - The following information applies to gasoline fuel systems only. Do not add any additives to diesel fuel unless specifically recommended for such use. Diesel engines are easily harmed by contaminated fuel or improper additives.

While fuel additives are usually not necessary for proper engine performance, they may be useful in climates where the humidity is very high. An additive such as alcohol may be added to the fuel to prevent water from accumulating in the tank. These additives absorb the water and allow it to be burned in the engine. The main component of these additives is alcohol.

Over the past 20 years, I have found that 100% Isopropyl alcohol works very well as a water absorbent in gasoline. This is commonly known as "rubbing alcohol." However, don't use common drug store rubbing alcohol, as it is already diluted with 30 to 50% water. That certainly won't do your fuel any good!

Other possibilities for moisture removal include Methyl alcohol and Ethyl alcohol, however, each of these have drawbacks. Methyl alcohol can corrode metal fuel systems components and attack

(continued on page 17)

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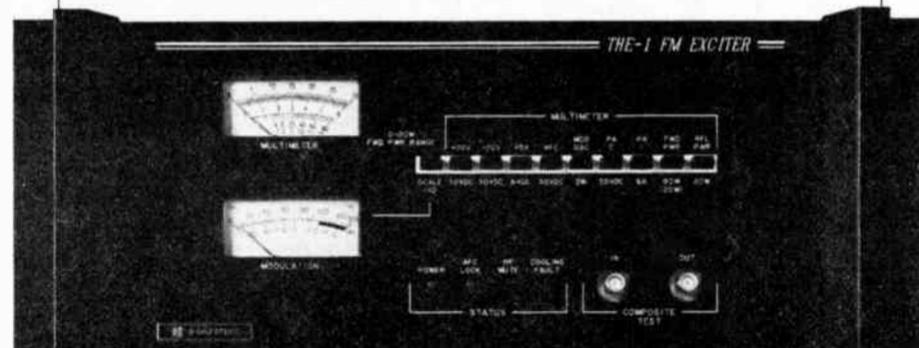
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rubber fuel lines and carburetor gaskets. Ethyl alcohol works well, but it is expensive and has high taxes on it since it is the drinking kind of alcohol.

Isopropyl alcohol can be obtained in gallon jugs for about \$12.00 per gallon from chemical supply houses. The industrial purity is fine; if you buy the CP (chemically pure) grade, it won't work any better and will cost you lots more.

I have found that adding about a quart of Isopropyl alcohol per 50 gallons of gasoline works quite well. Isopropyl alcohol can absorb roughly half its volume of water and still burn properly in the engine. That means a quart of alcohol will remove a pint of water and still burn well in the engine. The alcohol also has the effect of raising the octane rating of the fuel slightly.

The alcohol will mix throughout the fuel over a period of a few days and remove the water dissolved in the fuel. Be sure you drain any condensed water from the tank before adding the alcohol. I have had some fuel stored for over 15 years this way. It still is clear and smells OK, and it burns well in the engine.

#### STORAGE BATTERY MAINTENANCE

No matter how well maintained your generator set is, the engine will not start if the storage battery is bad. (In-depth storage battery maintenance will be the subject of another article.)

In order for a storage battery to do its job, it needs to be filled with the proper electrolyte, be fully charged, have clean, solid connections to its terminals, and be kept clean and placed in a reasonable environment.

Storage battery manufacturers state that more storage batteries are damaged by overcharging than by undercharging, so it is quite important to make sure that the battery charger is properly adjusted.

A fully charged storage battery will not require much charging current when on standby. A new storage battery will have a terminal voltage that is slightly higher than the terminal voltage of an old storage battery. As the storage battery ages, this reduction of the terminal voltage, as well as the increased internal losses of the storage battery, will cause the battery charger to send more and more current into the battery in an attempt to keep it fully charged. This gradual increase in charge current will eventually cause overcharging of the battery, leading to its failure.

To prevent this, as the storage battery ages, you should gradually reduce the charger output voltage. Usually, an annual adjustment is all that is required. If the storage battery requires adding water to it more than a couple of times a year, you probably have the charging voltage set too high. The storage batteries should never be warmer than the ambient air when they are on standby.

**SAFETY NOTE** - Remember that the hydrogen gas given off by the battery during the charging process is extremely explosive. Be careful of accidental short circuits and sparks around the battery. A battery explosion can be dangerous, and will usually splatter sulfuric acid all over the room. It is a good idea to wear safety glasses or a full face shield, for protection when working on batteries. **SAFETY FIRST!**

If your generator set uses several storage batteries in series to crank the engine, measure the voltage across each battery every month and make sure they are equal. Unequal voltages are an indication of improper charging or the possibility of an impending failure. The voltages should be the same within about 0.05 volts per cell.

If you use several storage batteries on your generator set, when the time comes to replace them, you should change them all at the same time, and get them from the same manufacturers lot, if possible. This helps assure that they will age evenly. If one storage battery in a set fails within a year of installation, it is usually OK to replace just the failed battery.

Storage batteries should be kept clean and dry. Sulfuric acid which may collect on the top of the battery will cause corrosion of the terminals and increase the self discharge rate of the storage battery if the acid bridges the terminals. Wipe it off, and neutralize any spills with a solution of bicarbonate of soda and water.

Never add any battery additives to the electrolyte in a storage battery. They may cause a short-term increase in the power output, but it will likely cause the rapid failure of the battery.

Unless acid is spilled from the battery, the only thing you should ever have to add to the storage battery during its life is pure distilled water. Tap water is not good for storage batteries since it contains trace elements such as iron and chlorine which will poison the storage battery in short order. Adding tap water to a storage battery can reduce its operational lifetime by 75% in some cases.

(continued on page 18)

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## Generator Maintenance . . . (continued)

In case a storage battery happens to lose a large amount of its electrolyte (for instance if the battery case is damaged or the battery is accidentally overturned), immediately refill the battery with distilled water and then charge it completely until the specific gravity stops rising.

Next, dump out all the electrolyte from the battery, and refill it with fresh electrolyte, which is obtainable from storage battery suppliers. Have the supplier adjust the specific gravity to the value specified by the battery manufacturer for the particular battery you are filling. Place the storage battery back in service.

Do not allow the plates of a battery to dry out. They will be permanently damaged.

Keep the battery terminals clean and the terminal connections tight. Remember that lead is a soft metal and over-tightening the connections will distort the terminals, leading to eventual poor connections and the possibility of acid leakage.

Storage batteries should be placed in a cool, dry location if possible. Do not expose them to heat sources unnecessarily. If you use multiple storage batteries in series, be sure they are all exposed to the same temperature. Remember that storage batteries are a chemical system, and raising the temperature of the storage battery increases the speed of the chemical reactions and hastens the aging process.

### CONCLUSION

Each generator set will have its own set of maintenance procedures and problems, however the points mentioned here are common to most standby power systems. Careful attention to these items will help you keep your station's standby power plant ready to go whenever its needed.

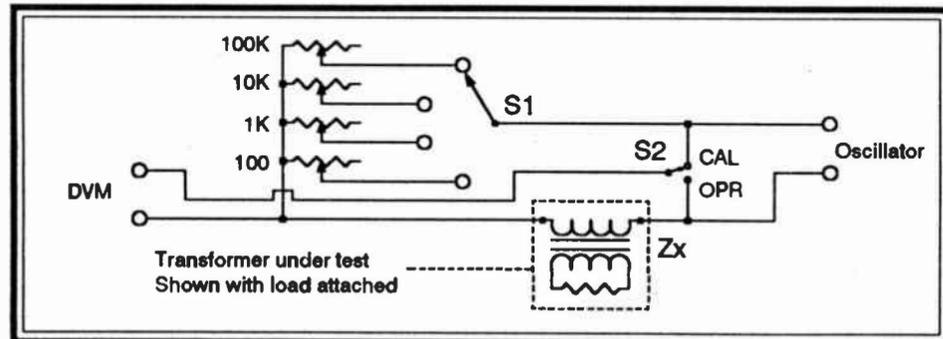
Remember, your emergency power plant may be called on at any time to provide power for your station. Don't leave it to chance - check it out and be sure it really works. One of the nicest sounds you can hear is your well-maintained emergency generator humming merrily away when the power goes down.

## Emergency Transformer Impedance Testing

By Howard Enstrom - FM Technology Associates  
Mount Dora, Florida  
(904) 383-4077

**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 1,000 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  $Z_x$ .

**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.

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## NFR is Noise-Free Radio

About two years ago, I got the wild idea of substituting narrow band frequency modulation for amplitude modulation, on the medium-wave (AM) broadcast band. The experiment worked, but left a lot to be desired. It was not completely compatible with existing AM radios. And, while there was some improvement over AM when the signal was received on a narrow band FM radio, it was still inferior to FM reception.

Next came the idea of combining narrow-band frequency modulation along with amplitude modulation. That was compatible with existing radios. Using a specially designed NFR receiver, it was possible to approach the fidelity and noise reduction qualities of FM broadcast receivers. An experimental low power "transmitter" and NFR receiver have been demonstrated to broadcaster groups, ham radio clubs, and finally to the SBE National Convention in Kansas City in October, 1989.

These demonstrations used a "transmitter" with the amplitude modulation limited to 90% on both the positive and negative peaks, and FM deviation limited to  $\pm 3$  kHz. For an NFR receiver, we used an AM tuner that was modified by retuning the IF transformers from 455 kHz to 428 kHz. This 428 kHz signal, with 3 kHz deviation, was then processed through a series of frequency multipliers where the signal was multiplied 25 times. This resulted in a new IF signal of 10.7 MHz with a deviation of 75 kHz. This signal was then injected into the IF channel of a standard FM broadcast receiver for demodulation.

Sound too good to be true? It did sound good, but there was some cross-talk between the FM and AM signals. To reduce the cross-talk, it was necessary to limit the FM deviation to about 2 kHz. That led me to what may be the final improvement.

The "new" model under construction has transmitter deviation of only 1 kHz, which will be multiplied 75 times in the receiver IF. This is accomplished by multiplying the 455 kHz IF signal 75 times to 34.125 MHz, heterodyning that signal with a crystal oscillator on 23.425 MHz to produce a 10.75 MHz  $\pm 75$  kHz signal to be injected into the IF of the FM broadcast receiver.

On November 16, 1989, the FCC held an open hearing with all seven commissioners present, to discuss the many suggestions being offered to improve the viability of the AM band. I submitted my comments outlining the NFR experiments we have been conducting, and suggesting the FCC look favorably on requests by AM licensees for permission to conduct "on the air" experiments with NFR or other modifications of Standard Broadcast Band transmitters and receivers; modifications that could result in a more effective broadcast service. Authorization for such experiments should require a detailed report of results achieved in the experiment.

On December 10, WQYK, Seffner, Florida submitted a request for permission to conduct NFR tests over a period of 6 months. Other stations, including two 50 kW clear channel stations have expressed an interest in participating in such experiments.

Your comments and suggestions are welcome.

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Until March 30, 1990 when you trade in **any brand** of non-compliant 950 MHz band aural STL transmitter on the purchase of a new TFT Model 9000 transmitter, you'll get a full \$505

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Frequency Synthesized	944 to 952 MHz
Signal-to-Noise	82 dB
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Stereo Separation	60 dB
Power Output	7.5 watts
Warranty	2 years
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Our new Model 9000 STL transmitter will give you measurable improvements even with your existing receiver or you can return it within 4 weeks of shipment. Act now. This limited time

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RF meters, used and tested  
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New "Aluma" mobile van towers,  
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B&K Model 2125 precision oscillo-  
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IGM RAM/NTI Automation System.  
Excellent condition.

IGM 48-tray Instacart. Mono, excel-  
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1) 3-bay Continental type G5CPM  
circular polarized FM antenna at 107.1  
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300 foot Windcharger tower. 18"  
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300 foot Andrew 1-5/8" transmission  
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Moseley PCL-303 STL system.  
Transmitter, receiver, new crystals at  
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RCA BTF-10D transmitter. In use  
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Wegener Satellite receiver with cards  
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Texar RFC-1 Optlmod #5 card. Mint  
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Fairchild DART-384 15kHz dual audio  
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1974	RCA BTA-5L	5kW AM
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Equipment is used, but cannot be  
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SMC Model 452 (series 800) stereo  
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RCA BTA-1M AM transmitter. 1000/  
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Bendix weather radar, complete from  
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Fairchild Model 667B reverb. \$100

Metron Modulation monitor (model  
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Harris FMXL-2E Signal Star low  
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**Digimax D-1200** 9-digit frequency counter. Brand new, never used, with manual. \$299.95 plus UPS collect.

**Wayne Kerr RF bridge.** 15kHz to 5mHz. As is. \$50 plus UPS collect.

**Precision/Paco E-200-C** RF signal marking generator. Good condition with manual. \$75 plus UPS collect.

**Broadcast Electronics AM-400** compressor limiter. Working when removed, with manual. \$225 plus UPS collect.

**Wilkinson LCG-1 Limiter/AGC unit.** Working when removed, with manual. \$225 plus UPS collect.

**Akai 4000D** reel to reel tape recorder. Stereo 3-3/4 & 7-1/2, works, no manual. \$75 plus UPS collect.

**United Transformer power supply** chokes. 1)CG-104 and 2)CG-44. Values unknown, unused, new. \$150 for all plus UPS collect

**Ohmite, Memcor, IRC.** High wattage resistors, vitreous enameled, slide adjustment. 6-3/4 inches long, various wattages, current ratings and resistances. 300 total pieces. Make an offer.

**Ampex 6-input mike mixer.** \$150 plus UPS collect.

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**Lloyd Spivey**

**WLLS AM-FM**

**Splinks Shopping Center**

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**502-298-3268**

**Collins 831G transmitter.** 20kW, 90% complete but could use new cabinets. Dinged up in shipping. Low time, needs new LPF and some other parts. As is \$11,000.

**Mike VandeVort**

**Route 3 Box 214**

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**515-628-1724**

**Jampro JSCP-4 antenna** tuned to 102.1 mHz. \$500 you pay shipping.

3) 85-foot reels of Andrew LDF-50A 7/8" (new). \$200 each of \$500 for all, you pay shipping.

**Dick Warren**

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**Background Music System Includes:**

6) Tape-Athon 702-10 tape decks

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1) Custom pause controller

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30) Reels of misc. music

Lots of spare parts

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**CRL AM Limiters.** APP-400, PMC-300A, SEP-400B, SPF-300. NRSC compliant, very good condition, in service 2-1/2 years. \$2500

**Michael Tracy**

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**RCA BTF-20E** new & used spare parts.

**Engineering Dept.**

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**IGM 12-tray Instacart.** As is. \$1200

**Shafer 903 Automation system** Includes:

3) Reel to reel decks

3) Carousels

2) Printers

1) Remote control

3) Racks

Encoded logging

Extra source cards

Every Option

\$6800 or best offer

**ITC RP cart recorder** with tones. \$850

**ITC WP cart player, mono.** \$500

**Eumlg FL-1000** microprocessor cassette deck. \$450

**Shafer 903 "brain"** and power supply. \$3500

**Shafer 8000 Computer Automation** Includes:

1) CRT terminal

2) Printers

4) New Tascam 32 reel decks

2) SMC Carousel decks

Encoded logging

All Options

Complete extra brain, 4 racks.

Complete system for \$5800

(Extra Carousels available for \$500 each)

**Otarl 5050B** reel recorder. Super clean, low hours. \$1650

**SMC 721** dual cart player. \$350

**Harris MS-15** exciter. Includes 100 RF amp. \$2500

**TTC FM-300J** solid state transmitter with exciter. Brand new. \$7500 or best offer.

**Ampex 440** stereo reel playback deck with Shafer stereo electronics. \$200

**SMC Carousel 250.** Factory reconditioned, less than one hour since reconditioning, looks like new. \$750

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**Wilkinson AM-1000** transmitter. 1300 kHz, currently in service. \$2000

**Texar AM audio processor.** \$250

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**WWCH**

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**814-226-9310**

**Nems-Clarke 6-tower phase meter** (pre-acceptance). Never used, in original box with original manual. \$250

**Gates/ERI 3-bay FM antenna** (CP) on 95.9 mHz with de-icers. Model #FM39CP. \$3500

**Andrew phase monitor.** One of the first made. As collector item. \$150

**Antenna Specialists 7-element yagi** on 450.950 mHz. \$75

**Frederick R. Vobbe D.E.**

**Great Northern Broadcast Company**

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**Lima, OH 45802**

**419-228-4199**

5) **Scully 270** stereo 15" reel reproducers. \$500 each.

2) **Sparta AS-30** 5-channel stereo consoles. \$350 each.

1) **Sparta AS-30** 5-channel mono console. \$250

1) **Sparta 4510** mono cart player. \$250

1) **Ampex 601** record electronics. \$50

1) **RCA attenuator panel.** \$50

1) **Harris AM processor** model #994-7059-002. \$200

2) **Sparta 800 RP** cart record/play. \$200 each.

1) **Sparta 400RP** cart record/play. \$150

1) **Sparta 800CP.** \$100

2) **McCarta/IGM** cart record/play with sec. tone. \$125 each.

1) **Revox A77** record/play with remote control. \$500

1) **CBS Net Alert** decoder III. \$250

1) **Shively 6813** 4-bay CP antenna on 101.7 mHz. Offer.

1) **SMC Carousel** cart machine. \$400

1) **Russco distribution amp** (2x8) new. \$225

1) **Martl remote control** system. \$500

1) **Moseley TFL-280** limiter. \$250

2) **Ampex record electronics.** \$150 each.

4) **Spotmaster** cart players (2 for parts). \$200 for all.

1) **Electro-sound full-track** reel recorder in rollaround cabinet. \$700

**Wang 2200 Computer Mainframe** Includes:

3) terminals

2) modems

2) printers

For traffic and accounting system.

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**Orban Optlmod 8100A** (s/n 1408910). Used less than one year. Pristine with all accessories. \$4000 firm.

**S. Schweiger**  
**WLXO-FM**  
146 Worcester Center  
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**Phasemaster Model T-7500** rotary phase converter. Input single-phase 230 volts. Output 3-phase 230 volts. One year old. \$3000 FOB.

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**Harris 9003 Automation Includes:**

3) Instacarts  
2-5) Revox PR-99 reel decks  
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Double disk drives  
Control & production terminals  
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Option to buy 2) ITC triple decks

**Just removed from service, ready to ship. 100% working condition. Make offer.**

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**Autogram drawer type diode circuit** double Carousel random control for two RAS Carousels. \$150

**Hallikainen TXA-161** time announce control. \$100

**SMC double play mono cart deck.** Little use, good condition. \$400

**Potomac/RCA WX-2D** field strength meter with book. New batteries, good condition. \$500

**Moseley SCG-8 and SCD-8.** Like new, both for \$1500.

**Dorrrough DAP-310** AM processor. Complete, working when removed. \$245

**Austin ring lighting transformer.** 30 years old, not used, new in crate. \$400

**Mountain Media**  
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208-344-0947

**Pacific Recorders and Electronics**  
**BMX II Includes:**

2) Mic input modules  
8) line input modules  
1) remote line selector panel  
Stereo audition and program line amplifiers  
1) Telco/mono mix module with meter

**TD-2** digital time of day clock  
**DT-4** digital "up" counter with remote panel  
Control room monitor module  
Power supply  
Spare parts kit, crimp tool/connector kit, and complete manual.

**Also includes the following remote control interfaces:**

1) CI-2 for ITC premium cart machine  
1) CI-2A for up to 3 ITC Delta/99B series cart machines  
1) TT-3 turntable interface  
1) WL-2 warning light relay interface  
1) TI-2 tape interface

**Studio Accessories Include:**

Gentner SPH-3 telephone hybrid  
Custom monitor speaker fuse panel  
Crown D-75 monitor amplifier  
2) Electro-voice RE-20 mikes  
2) Electro-voice 309 shock mounts  
2) White lights microphone arms with risers  
2) ATI P-100 stereo turntable pre-amps  
ITC Delta I stereo cart machine  
2) Electro-voice Sentry 100A studio monitor speakers  
Six-foot equipment rack  
ATI DA-208 audio distribution amplifier  
ADC Pro-Patch T-R-S patch panel (2 rows X 24 jacks)

**Other Items Include:**

Custom oak studio furniture with recessed turntable cut-outs for Technics SP-15 turntables/SH-15 B1 turntable bases and custom oak copy stand.

Otari RK2B rack mount for Otari MC5050BII reel deck

Various AC outlet strips  
Various filler rack panels

**Wegner satellite receiver** and dish/LNB system for Satellite Music Network Pure Gold format (can be re-tuned for other formats and dish may be re-located as well).

It should be noted that this studio is completely wired for use and can be disassembled, removed and reassembled with minimal time and effort. Studio wiring is fully numbered and documented. All wiring (audio, remote, AC, etc.) remains in place and was done "first rate" including heat-shrink wire numbering and the like. All audio and remote connectors remain in place. This studio was custom constructed in Colchester, Vermont, and NOT by console manufacturer.

**Howard M. Ginsberg**  
**WXXX-FM**  
45 Roosevelt Highway  
Colchester, VT 05446  
802-655-9530

**Wegner Model 1602** sub-carrier receiver frame with model 1619 card for CNN 6.3 MHz sub-carrier and FM modulator card for cable system transmission. \$500 for entire package.  
Harris Model 5115 Delta Gain 3-meter dish with sub-reflector assembly and fixed mount. \$800

**George Schank**  
**KXYZ**  
P.O. Box 87190  
Houston, TX 72287  
713-472-2500

**Gates Model BC-1F** AM broadcast transmitter tuned to 1380 kHz. Needs new tubes but works on those included. Buyer to move. Best offer considered.

**L.W. "Bubba" Reding**  
**KBOP**  
215 N. Main St.  
Pleasanton, TX 78064  
512-569-2194

**Pioneer RT-7070** reel to reel record/play machine. Works. \$150  
**Gates "Producer"** board. 4-channel mono, solid state, it works. \$200

**IGM 700 Automation Equipment**  
**Includes:**

Monitor control  
Audio chassis  
Network switcher  
Programmer  
Automatic logger with thumbwheel cart encoding electronics  
Rack-mount accessories, all manuals, cables, as-is. It worked prior to disassemble and storage. \$300 for all.

**Maynard R. Meyer**  
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Madison, MN  
612-598-7301

**Moseley SCG-8** subcarrier generator. 92 kHz, in use about 6 months, newly new. Best offer or will trade for ITC-750 deck and some cash.

**Kurt Browall**  
**KTRZ-FM**  
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307-856-2922

**Used Equipment:**

2) Sparta DCU 25Hz & CSU  
1) Gates ADC control center  
1) Gates ACC-2 power supply  
2) Ampex 440 with mono elt./heads  
1) BE Spotmaster mono  
1) Ampex 350 mechanics  
1) Sparta Time Machine  
1) Ampex 440C with servo  
1) Advent noise reduction NR100  
1) Record elt. Ampex 4020257-25  
1) 440 elt. 260-03

**RF Parts:**

2) Phasor for 550kHz, 2-tower  
1) 10kV vacuum cap VCSXF 1200  
1) 5kV vacuum cap CVCD 1000pF  
Mica caps - .0012/20kV, .002/10kV, .0003/20kV, .004/8kV

Several RF ammeters including TCA-5/10

1) Current transformer TCT-3  
3) Used but good 8438/4-400A tubes  
Various large air variable caps

**Tower Stuff:**

12" face tower sections  
Many tower guy wire insulators  
Approx. 300' 1/2" Heliac  
1) Staked Yagi for 170 mHz  
1) Crouse Hindes dual beacon  
1) Roll radial wire  
7-strand guy wire - lots of it  
1) Time Star sign light controller - still in box (9400-2)  
2) Wide sign lights (F400-D)  
1) Onan K5000 generator - barely used

**Tom Tidwell**

**WAYR**  
2500 Russell Road C-209  
Green Cove Springs, FL 32043  
904-272-1111

**BE cart machines:**

1) Model 2100 RPS stereo record/playback. \$1750  
3) Model 2100 PS stereo playback. \$1050

1) Model 3200 RP/DL mono record/playback with delay. \$1750  
Each is in perfect condition with less than 25 hours playing time. As close to new as you can get without paying full price. Manuals available. Make offer on two or more machines.

**Also have one Audlometrics 8X2** stereo distribution amplifier with individual channel gain controls. New, never used, with manual. \$250

**Gary Jones**

**Southwest Mediacast Inc.**  
P.O. Box 229  
Uvalde, TX 78802  
512-278-1545 or 512-367-4587

**Audio Processing Equipment:**

Orban XT2 6-band limiter accessory for use with 8100A/1. With book, new condition, factory carton. \$1700  
Koss digital delay/reverb effects system. Rack mount, as new. \$300  
Eventide FL201 Instant Flanger effects system. As new, with book. \$400  
Sansui QSE-5/QSE-1E 4-channel encoder/decoder system. Rack mount, configured for broadcast and recording, with impedance match box and manuals. \$700 for complete system.  
Dolby 334A/FM stereo audio processor with Type 66FM peak limiter module. With manual. \$800  
Harris MSP-90 AGC. Stereo, with manuals. \$1000

**Antennas and Feedlines:**

ERI/Continental G4CPH/37CP-5 high power circular polarized 5-bay antenna. Optimized for leg mounting or side mount with brackets listed below. Includes manual, now on 106.5 mHz. \$4000

Continued on Page 24

Set ERI stainless steel custom mounting brackets for above antenna on large angle member self supporting tower. Make offer.

Jampro LA8A, 8-bay antenna. 8.39 power gain, 28kW maximum input, on 106.5 MHz. With four spare feedthroughs, factory manual. \$500

#### Remote Pickup and Two-Way:

McMartin TBM-100R dual channel VHF highband rack mount receiver. Very good condition, with book. \$600

Motorola "Expo" 2 channel micro-HT. VHF/high with desktop charger. \$200

2) Motorola "Maxar" single channel transceiver. 10-watt VHF/high. \$200 each.

#### Audio Tape Recorders:

2) Scully 280-2 stereo recorders. 7.5-15 ips, auto lifters, late model. Includes new spares, manual, one remote control panel. In Ruslang rollaround cabinets with overbridge. \$1500 each.

4) Scully 270-2 stereo playbacks. 7.5-15 ips reversing. Late model, factory manual. \$3000 for all.

Ampex AG350-2 stereo recorder. 7.5-15 ips, with book. \$1250

Ampex AG-440B electronics chassis. Less plug-in cards, blemished. \$100

Telex 4-channel slow speed logger system consisting of two decks, four electronics channels, change over panel. Current model. \$2000

Viking "Studio 96" 10-1/2" stereo recorder. 7.5-3.75 ips, factory manual, very good condition. \$750

Tape-A-Thon "Programmer III" continuous music playback system. Four 10-1/2" playback decks, master and sub-controllers, clock, line & monitor amps in attractive self-contained 7' locking rack. Typically employed in SCA and background music applications. Unused, current model. \$5000

#### Audio Consoles:

Harris/Gates Diplomat. 10-pot, dual channel mixer. \$1500

Collins 212V-1. 8-pot dual channel mixer. Similar to Autogram IC-10. With manual. \$1500

RCA BC7A. 10-pot stereo mixer in custom walnut formica console with engraved remote panel. Includes extras and manual. \$1750

#### STL Equipment:

Moseley PCL-505/C composite stereo STL system. Factory updated, 947.5 MHz. Very good condition with manuals. \$4000

Anixter-Mark dipole assembly/support members for P-9120GM 10' dish or custom system. As new. \$200

#### E.R. Stolz

##### KWOD Radio

1425 River Park Dr.

Sacramento, CA 95815

916-929-5000

Fax 916-929-5781

## Equipment Wanted

Wanted: Orban 8000As and 8100s.

ITC Cart decks of all types.

#### Hall Electronics

John Hall

1712 Alled Street

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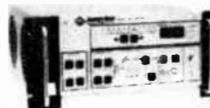
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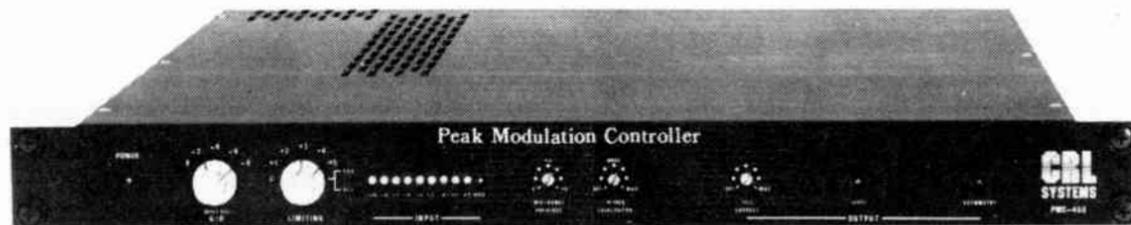
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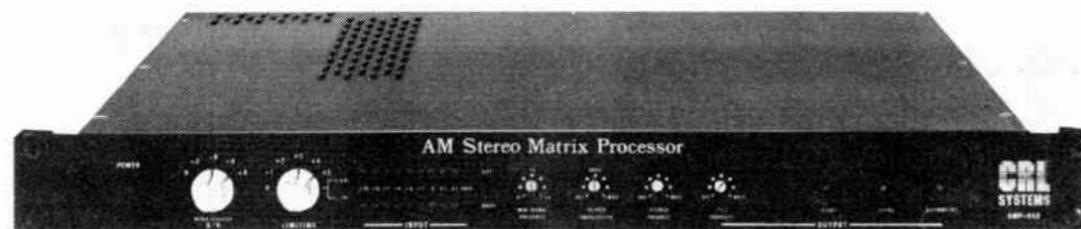
# NRSC Conversion Products from CRL

## PMC-450 Tri-Band Peak Modulation Controller



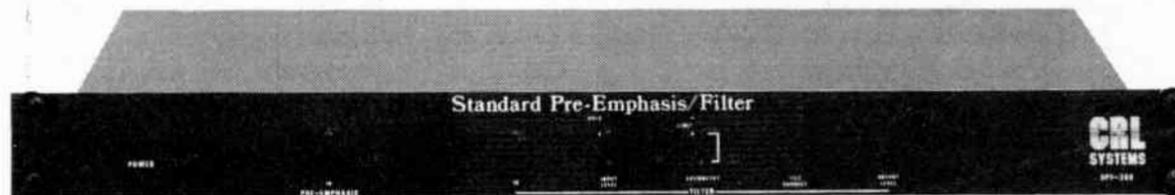
The CRL PMC-450 Tri-band peak modulation controller incorporates many unique designs originally developed for AM stereo. This unit offers state-of-the-art circuitry coupled with precise implementation of the NRSC standards for the loudest, cleanest signal on the AM dial. The PMC-450 consists of a powerful input compressor, followed by a tri-band limiter section and NRSC compliant low-pass filter. The flexible design of the PMC-450 allows it to be used as a stand alone processor, or in conjunction with various audio AGC's and pre-processors.

## SMP-950 Tri-Band AM Stereo Matrix Processor



The CRL SMP-950 Tri-band AM STEREO MATRIX PROCESSOR offers state-of-the-art circuitry coupled with precise implementation of the NRSC standards for the loudest, cleanest signal on the AM dial. AM Stereo is quite different from FM and requires special techniques to provide full stereophonic fidelity while maintaining full monophonic compatibility. The CRL patented matrix processing circuitry is designed specifically to meet this criteria.

## SPF-300 Standard Pre-Emphasis/Filter for AM Broadcast Transmission



The CRL Standard Pre-Emphasis/Filter contains all the functions necessary to convert virtually any monaural audio processing chain to meet the NRSC (National Radio Systems Committee) Voluntary National Standard of January 10, 1987. This transmission standard defines specific pre-emphasis and filtering requirements which are intended to help solve many of the technical concerns in AM broadcasting. The pre-emphasis curve was developed to allow receiver manufacturers to employ a complementary de-emphasis characteristic in wideband radios while improving the frequency response of narrower and medium-bandwidth radios. The filter specification, which limits transmitted audio bandwidth to 10 kHz, is intended to greatly reduce much of the interference between stations by reducing the conditions that cause "splatter" effects.

## MDF-400/800 De-Emphasis/Filter for AM Monitors



The CRL Monitor De-Emphasis/Filter provides all the functions required to update any AM modulation monitor or wideband monitor receiver for the recently approved voluntary transmission standard. This allows easier setup of audio processing equipment by emulating the audio characteristic of the best-possible commercially produced radios. Additionally, the unit has features which can reduce interference typically heard in the station air monitor.

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