



## Stern Fines May Hinder Infinity Station Purchases

by Randy Sukow

**WASHINGTON** FCC Commissioner James Quello confirmed a flurry of daily newspaper reports published late last month that approval of Infinity Broadcasting's acquisition of three radio stations—WPGC-AM-FM Washington and KRTH(FM) Los Angeles—has been delayed by pending indecency complaints against Infinity.

The Dec. 31, 1993, edition of the New York Times reported that the FCC put the license transfers on "hold," pending review of two recent indecency complaints (filed in late 1993) tied to on-air comments from Infinity's controversial morning personality, Howard Stern.

An aide in Quello's office said the delays should not be considered permanent or punitive and that it is standard operating procedure for transfer applications to be delayed while indecency complaints are processed. The applications could be delayed further by petitions to deny the WPGC and KRTH transfers filed by interest groups to protest the Stern broadcasts.

"I suppose that if there had been no further indecency complaints filed, (the transfer applications) probably would have been granted by now," the Quello aide said.

The delay may not be permanent, but it

could be a de facto indefinite delay if the FCC does not act on the indecency and transfer issues in January.

Incoming FCC Chairman Reed Hundt recused himself from the Infinity case because his former law firm represents Beasley Broadcasting, current licensee of KRTH. Commissioner Ervin Duggan is scheduled to leave the FCC soon to become president of the Public Broadcasting Service (PBS).

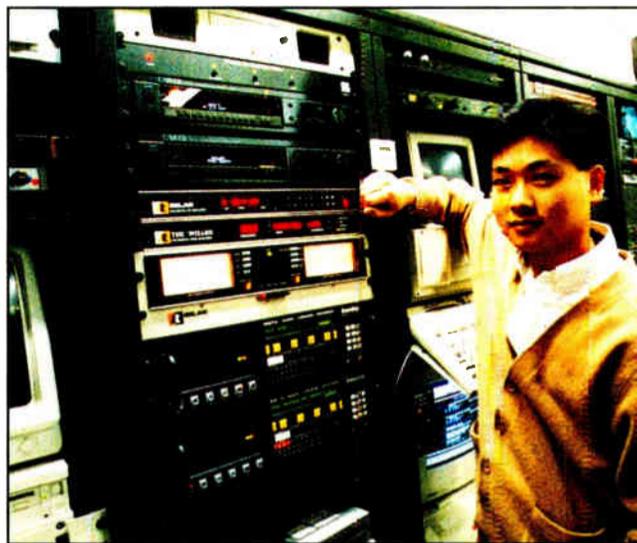
The remaining two commissioners, Quello and Andrew Barrett, could not form a quorum to rule on the applications.

Stern's show is distributed nationally to Infinity stations and to other affiliates, including stations in most of the nation's top ten radio markets.

Infinity stations have so far compiled \$1.2 million in FCC fines since mid-1992 for a series of alleged Stern indecency violations dating back to 1987.

Stern's critics claim that he has repeatedly violated the commission's regulations, which limit the broadcast hours of "indecent material," defined by the FCC as: "Language or material that, in context, depicts or describes, in terms patently offensive as measured by contemporary community standards for the broadcast medium, sexual or excretory organs or activities."

An Infinity attorney had no comment.



Belar's Wizard (pictured left at Hong Kong facility) is among this month's Buyer's Guide featured products for Test and Monitoring. See pp. 39-60.

## Video DJ's Technical Abilities Vital to Radio Show Production

### 'Technical Junkie' Relies On ISDN and ProTools

by Dee McVicker

**NEW YORK** Just about everyone who watches MTV knows about the entertainment side of Adam Curry. He's unconventional, ultra-cool and on top of the charts as the video jock of MTV's "Top 20 Countdown," "Rock Videos That Don't Suck," and "Most Wanted." Curry also hosts his own syndicated radio program.

But few know that in addition to being a VJ for MTV and a radio host of several syndicated programs, Curry is a technical junkie. "I definitely come from the technical aspect of things, and once the computer age hit and it was possible to do much more right at your desktop, I really got into it deep," he confessed.

Just how deep is deep? Curry uses a Macintosh computer, complete with DigiDesign ProTools multi-track digital system, to record takes of his two nationally syndicated radio shows. He's also a regular on Internet, the data superhighway, which he is using to relay album reviews, gossip tidbits and even portions of his radio shows to others logging onto the system with their computers. He is, in his own words, "a computer nerd with hair."

### Radio shows

Some of Curry's best work includes a weekly radio show, "The Top 30 Hit List With Adam Curry," and a twice-daily Entertainment Radio Network feature, "The Buzz," both of which reach more than 200 stations throughout the

United States and are recorded from his home studios. Curry has a studio at his home in New York and another at his home in Amsterdam, each with Macintosh-based ProTools, 1.2 GB of hard-disk storage, a Shure SM-7 mic, and monitor speakers.

### Look—no hands

"I literally just swing the mic boom right around in front of the (computer) monitor. I can even read my script straight from the screen while ProTools is running in the background. I don't touch paper, razor blades, anything," said Curry, who got his start in the United States as a DJ for New York's WHTZ-FM. Even his scripts are sent to him via computer, over E-mail, which he edits on computer.

For his radio work, Curry said he uses a 44.1 kHz digital sample rate instead of 48 kHz to free up as much space as possible on his hard drive, where he stores show segments and sound bytes useful to his recordings.

In a typical recording session, Curry uses one track with ProTools set at half speed. This setting makes it possible to play back at double speed, a boon for Curry's hectic schedule, which includes not only his MTV and U.S. radio show gigs but also a Holland radio show called "Rave-Radio." Soon, Curry will be adding two television shows to his hectic schedule. "On The Road With Adam Curry" and "RAVE": both will be syndicated in the United States.

To get vocal recordings to a syndicate studio in Los Angeles, Curry recently installed an ISDN line at his home studio

continued on page 12 ►

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# NEWSWATCH

## NAB Opposes Taxes on Lobbying

**WASHINGTON** Several groups that lobby Congress including the National Association of Broadcasters (NAB) have mounted a court challenge to new lobbying tax laws.

The groups filed a recent complaint for declaratory and injunctive relief in U.S. District Court for the District of Columbia. The challenge was filed because of changes in the tax law requiring that associations pay a special tax ("proxy tax") on any amount of money spent on lobbying activities, or

that they inform their members that a proportion of their dues may not be deducted. The tax law also requires associations to pay special taxes on monitoring and research that may be used in lobbying, and that the groups must comply with stringent records and reporting requirements.

Jeff Baumann, vice president and general counsel for the NAB, said the new tax on monitoring provisions puts the NAB "in peril." He said it creates "a serious incentive against becoming actively involved in any issue we have been monitoring."

Although the NAB conducts extensive

research on new broadcasting technology, marketing and advertising, ratings research and improvement, station sales, personnel statistics, Baumann said the new law "discourages" the association from sharing the information with the government."

Because NAB members may not be able to deduct their dues to the NAB, Baumann said some radio station members, operating on a small or no profit margin, may forgo membership in the NAB.

## ABC, In-Flight Announce Deal

**OAKBROOK TERRACE, III.** ABC Radio and In-Flight Phone Corp. have announced an agreement to offer airline passengers up to twelve channels of live

news sports, entertainment and music programming.

The ABC-fed programming will be transmitted to airliners by In-Flight's FlightLink On-The-Air, a digital audio service. In specific, the program will include ABC News and Sports, Live Talk Radio, Country Coast to Coast, Urban Gold, Classic Rock, StarStation, Hot AC, Pure Gold, The Touch, Stardust. The talk programs will come from WABC-AM, KABC-AM and WLS-AM.

## Crystal Radio Awards' Nominations Needed

**WASHINGTON** The NAB is seeking entries for the Crystal Radio Awards that will be awarded during the 1994 NAB convention in Las Vegas.

The Crystal Radio Awards were established in 1987 to recognize radio stations for their commitment to public service in

continued on page 6 ▶

When looking for a digital audio system for automation of satellite programming or live assist, there would appear to be many choices. But if you're looking for a system which is flexible enough to give you total control without sacrificing your sanity, there is only one choice. The Phantom by RDS.

You will see the difference as soon as you see the Phantom in action. The display provides you with all of the information you need to see in a clean, concise manner, without the crowded look that you'll find in other systems. If you are familiar with the most popular software on the PC, then you may already know how to use the Phantom. The Phantom's pull-down menus guide you through all of the steps involved in setup and daily operation, from creating and scheduling clocks to creating and editing logs.

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can create reports to keep you informed on a number of topics, from a list of expired spots to an analysis of potential mistakes in your log. The Phantom also maintains a history of system activity.

The Phantom has the features that others would want you to believe are theirs exclusively. The Phantom remains *completely* functional during recording, sensing relay closures and starting breaks as easily as it does when it is not recording. The Phantom can fill incomplete breaks with spots from a list you specify without ruining product separation.

While other systems tie your hands and limit your flexibility by only offering 3 or 4 inputs, the Phantom gives you 6 stereo inputs, using its AMX-84 solid state switcher, with the option of increasing the number of inputs to 14 or more. If your station is News/Talk, you know how important this can be.

The Phantom allows you to change the sampling rate, digital format, and stereo/mono settings at will to meet your needs for an individual spot. The Phantom offers a number of digital formats, including the new Dolby AC-2 format, as an option.

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# Chinese Studios Mirror Western Facilities

by Bill Ford

**BEIJING** In my travels to communist and formerly communist nations, I have had many opportunities to study the professional audio and broadcast markets. My most recent foray was to some of the leading broadcast facilities in Beijing.

All Chinese broadcast facilities are under the authority of the Ministry of Broadcast, Film and Television. The individual broadcast companies—always government owned—run day-to-

day operations, but funding comes from their respective administrative (city, state or federal) level.

## Popular FM

Beijing Music Radio is a popular FM station (97.5 MHz), particularly with the 15-30 age group. This station plays a lot of international pop music, and has a number of airshifts that are "all request." No doubt, this helps to fuel the boom in bootleg music cassettes of popular Western artists, which are plentiful most

anywhere in China for less than \$2.

China Broadcast Co., also located in Beijing, is one of the major forces in

UltraHarmonizer, Aphex Aural Exciter, Klark-Teknik DN-780 digital reverbs, dbx limiters and the latest Dolby noise

**The equipment used includes much of the same leading-edge technology found in many top studios in Europe and the U.S.**

Chinese broadcasting. As the equivalent of a network headquarters, this station has complete studio facilities for recording everything from pop bands to radio plays with full orchestra to commercial spots.

## Top-notch gear

During my visit, I had the opportunity to take a back seat in the control room during a vocal overdub session. The equipment used includes much of the same leading-edge technology found in many of studios in Europe and the U.S.

An automated Amek Mozart 40-input console fed Otari MTR-100 24-track and Studer A820 two-track tape machines, while an assistant engineer also monitored a Sony DAT machine. Signal processing devices available included an Eventide HR-3000

reduction. Micro-phones were all high-quality brands such as Neumann, Sennheiser and Sony.

Radio Beijing was an interesting setup. This shortwave powerhouse (500,000 watts) is a competitor to the Voice of America (VOA) and the British Broadcasting Corp. (BBC) in markets worldwide. Broadcasting in 43 languages, Radio Beijing has a staff of 1,500 employees, all housed in one sprawling parliamentary-style building built by the Russians in 1955.

Radio Beijing maintains reciprocal agreements with other stations around the world which allows each to rebroadcast the others' programs. Outside programming is carefully edited.

Radio Beijing's audience relations

continued on page 6 ▶

# Studer Makes Changes

by John Gatski

**MENLO PARK, CA.** As Studer Revox AG is in the midst of worldwide reorganization as part of a "streamlining" process, the U.S. Studer subsidiary has mainly undergone a name change.

The professional products operations of the former Studer Revox America is now under the auspices of Studer Editech in Menlo Park.

According to Studer, several operations of the Studer Revox America structure have been consolidated at the Menlo Park Studer Editech headquarters. Existing branches in Los Angeles, Los Angeles, Nashville and New York will remain unchanged, other than they will not bear the Studer Revox name, but the Studer Editech badge.

The Los Angeles location is still the west coast sales office, and New York is the eastern sales office. The Nashville office remains the service/shipping/logistical facility as well as the midwest sales office.

Studer Revox, a Swiss conglomerate, has made quality professional and semi-professional audio products for many years. Tape recorders, CD players and the popular Dyaxis digital audio work-

station are frequently used products in broadcast and production facilities.

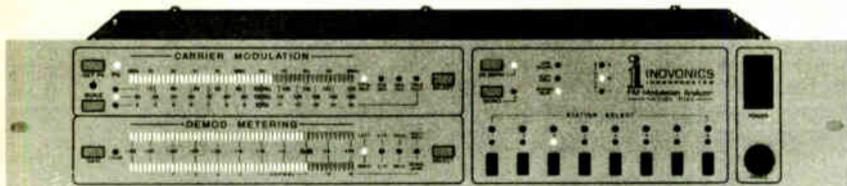
The Dyaxis workstation, which has been produced in three versions, is made in the U.S. more than 250 units have sold worldwide, mostly in the U.S. and Germany, according to Studer Editech CEO Guy McNally.

McNally said that Studer's changes worldwide reflect a shift to "not being fat," a reference to Studer's parallel operations in Europe that often unnecessarily duplicated sales efforts.

Under the new structure worldwide, Revox-Pro semi-professional equipment will be integrated into the Studer professional product range to ensure "a clear demarcation" of its consumer products as Revox. The manufacturing operations for the semi-pro line will be moved from Loffingen, Germany, to Regensdorf, Switzerland.

Studer France Sarle, Revox France Sa, Numisys Sa and Studer Digitec Sa will be merged to form a new company called Studer Sa, to be located in Chatou, France. In England, Studer Revox will cease operations in Thatcham—with the Revox activities being integrated into the Studer operation in Borehamwood.

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# U.S. Radio Business Impacts World

**WASHINGTON** You cannot help but notice the decidedly international flavor of the articles in this installment of *RW*. I was pondering whether this was a good or bad thing for the "domestic" edition of the newspaper, and realized that in at least two instances, the articles talked about U.S. companies successfully exporting products to broadcasters in China (both mainland and Hong Kong).

And as more and more U.S. companies tap into that international marketplace, I think you'll notice a continued increase in the number of success stories from abroad that are really success stories



from home. Expect to see more of these datelines creeping into the paper.

What is interesting, too, is that in many cases, it is not only that broadcasters overseas want to buy U.S. products, but in many instances they are embracing some of the concepts pioneered in the U.S. and are making them their own.

For example, Radio World International Editor Alan Carter passed along an interesting tidbit from one of his correspondents in Milan, Italy, Andrea Rivetta. It seems that the government-run public broadcasting entity, Radiorai, has learned that the secret to great ratings is to give the listeners what they want to hear!

Raiorai consists of three channels. Radiouno (radio one) is essentially an all-news channel. It features news broad-

casts every half-hour, with longer newscasts in the morning, at noon and for evening drive. Radiouno also features a permanently open listener call-in line.

But the really fun part of this radio network is on at night (and it is so decidedly Italian). One hour of programming is dedicated to truck drivers, "Radio-camion." It features truck drivers talking directly via their CB radios. There also is an hour of programming dedicated to the "Lonely Hearts," a program for "night people." Night people? Yes...and in Italy that means: "Night watchmen, prostitutes, cabdrivers and nightshift workers."

Not to be outdone, Radiodue (radio two) will carry more popular programming, including fiction, soap opera highlights, talk shows, and scandal and crime news.

It is like having audio versions of "Sixty Minutes," "Cops," "Oprah," "A Current Affair," and "Entertainment Tonight" all rolled into one with a little "BJ and the Bear" thrown in for fun.

The third radio channel will cater to the classical and cultural tastes of listeners.

★ ★ ★

Speaking of companies and ideas from the U.S. that are flourishing abroad, Arrakis recently received rave reviews for its DigiLink automation system from British Columbia. SILK-FM in Kelowna is running full CD-automation 17 hours per day, with live-assist in the morning and evening drive times.

Bottom line though, is SILK-FM placed number one in its market in the last ratings period (using the above outlined automation scheme). The station told Arrakis that one of its competitors did not realize SILK-FM was automated until one of the AEs told them! Nice job.

★ ★ ★

Most companies in the U.S. know that one of the best ways to cultivate success is to take care of your customers. The folks over at Audio Broadcast Group

(ABG) recently put their money where their mouth is and sponsored a mini-trade show (look for Dee McVicker's coverage in the next issue).

I wanted to mention it because I think it is the kind of activity that can help a company go a long way—to say nothing about the countless and very tangible benefits it can provide to its customers. In a nutshell, ABG pulled together a one-day event that drew more than 100 station engineers and general managers and afforded them the chance to bone up on the latest in digital audio product offerings.

The event, held in Chapel Hill, N.C., featured hands-on demonstrations of more than 50 digital products, including digital workstations, editors, telephone hybrids, DATs and digital cart machines.

ABG invited three SBE local chapters and radio stations within a 150 mile radius to attend, and six factory representatives were in attendance to answer broadcasters' questions. The company considers the event to have been a big enough success to merit repeating this year.

Most importantly, the event was designed to expose the small-budget radio station executive to many of the noteworthy technical developments that are on display at the big trade shows. Many small-budget radio stations simply cannot afford to send their people to shows like the NAB. Kudos to ABG for thinking of them.

★ ★ ★

Just recently we had a visit from International Tapetronics Corp.'s Charlie Bates, right here in our humble offices on Columbia Pike. We had a pleasant chat. We got to show Charlie the process we go through that results in a newspaper, and he shared with us some of the news from ITC. For starters, he has taken over the marketing efforts of ITC. Interestingly enough, Charlie hails from the engineering side of things, and has worked at ITC for

many years in that capacity.

ITC is putting the finishing touches on its strategy for the future, and as Charlie will be helping to spearhead that strategy, he will perhaps become more widely known to many of you.

Something that ITC already is doing is enhancing its direct sales efforts. The



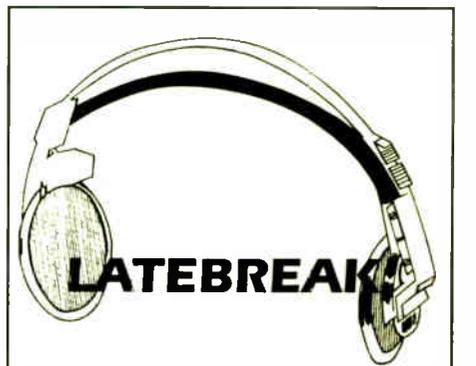
Charlie Bates

company is pulling back from distributing product through dealers, and is reverting to direct selling. To that end, Charlie recently expanded the sales staff to three, with more probably to come as the company continues to grow.

★ ★ ★

Kudos also to Dorrough Electronics for the citation it just earned from the Academy of Motion Picture Arts and Sciences for Best Technical Achievement in Audio for its audio loudness monitors.

The loudness monitors simultaneously display three dimensions of program material content. Peak, average power and compression are displayed on a large, color-coded 40-segment LED scale.



CCA Electronics named Bill Brinegar to the post of vice president of operations/engineering. He brings a background of technical design and management positions from Rockwell Collins and Scientific Atlanta to the post.

CCA also named Ron Coble director of operations at CCA. Coble brings 25 years of experience from Rockwell Collins and Texas Instruments to the position.

Tommy Brigman also was appointed to a new post at CCA. Brigman was named director of engineering for CCA. His background includes work in product design and development in many areas of RF transmission, for both Harris Corp. and Scientific Atlanta.

Peter Kehoe, former Siemens Audio eastern region manager, has joined AT&T Digital Studio Systems as central/eastern U.S. regional manager.

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The LX-1 will run loops around traditional alternatives like patch panels and relay switchers. With configurable line levels, 100 dB isolation, and common mode rejection that exceeds 110 dB, the LX-1 can actually improve your air chain quality. And the LX-1 is especially easy to interface with existing studios and a variety of remote control configurations, including those from Burk.



Place the Burk LX-1 in your audio chain and you're getting the best mix of features, reliability, and performance. All at a price that truly pushes the right buttons for the 90s. Stow the old patch cords away. And take the first step toward putting the LX-1 to work for you. Call Burk Technology at 1-800-255-8090 (in Massachusetts: 508-433-8877).

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# READERS FORUM

If you have comments for Radio World, call us at 800-336-3045 or send a letter to Readers Forum (Radio World, Box 1214, Falls Church, VA 22041 or MCI Mailbox #302-7776). All letters received become the property of Radio World, to be used at our discretion and as space permits.

## Word imperfect

Dear RW,

It's fascinating, even amusing, that a journal devoted to the public communications industry would lapse into usage of so many incorrect terms.

I suppose that if an incorrect term is used frequently enough it becomes acceptable and the true meaning of the user is understood. But I just want to set the record straight on two of the worst cases.

The term "R-DAT" was developed by its promoters to differentiate rotary-head digital audio tape systems from the competing stationary-head digital audio tape systems (S-DAT), which never got off the ground. Since R-DAT is the only surviving format of the two, every manufacturer (and most if not all other publications) have dropped the R. Just look at any DAT machine, DAT tape or catalog listing the many DAT machines now available.

The new tape-based digital recording format has its own designation, DCC (Digital Compact Cassette), and is targeting the compact cassette (analog) in its marketing. It has a stationary head, but the new designation eliminates the need to add the S prefix.

The only surviving stationary-head system from the 1980s (and survival might be a subjective term here) would be the reel-to-reel DASH (digital audio stationary head) system.

Even more confusing is the widespread adoption of the term "data compression" to describe the new digital transmission and recording system algorithms.

Data compression is a method of reformatting digital data to take up less space or transmission time. It has been used quite successfully in the computer world for some time. Files are passed through a compacting program, and the output file is smaller than the input, with possibly several input files contained in a single output file.

A suffix—".pak," ".zip," ".cpt" or ".stf"—is added to the file name, depending on the compression software. The suffix tells the user which program to use to

"explode" the file to its original size. This "explosion" step differentiates data compression from what happens to digital audio and video systems.

Data compression is roughly analogous to taking a double-spaced, type written page and removing the extra spaces between lines so that it takes up fewer pages for storage. At the head of the page, you place a note that this page is to be printed double spaced. When it is printed, the extra blank spaces are added and the original is restored exactly.

Digital recording and transmission algorithms are data reduction. They involve throwing away some of the original data, never to be restored. The algorithms are meant to find the datum that may be removed without being noticed by a listener or viewer.

To do this, vast amounts of research must be done on human perception. Even then, it is an economic trade off. The more you throw away, the lower the bit rate and system bandwidth.

The question is, "How much reduction will a listener/viewer be able to tolerate?" While the data is compressed too, that's not the part of the system that is causing all the concern. You must dispose of some data to accomplish the goal of reducing the bit rate of transmission.

The success of the algorithm depends on our perceptual systems not noticing or not caring that the data is missing.

Jim Addie, AddieTech Inc.  
LaGrange Park, Ill.

## Cable counts

Dear RW,

I read Tom Vernon's article "Proper Cables Key to Ideal Studio" (RW, Nov. 23, 1993) with great interest. As an ex-broadcast engineer now working for Belden Wire & Cable, I am amazed by how much time is spent selecting appropriate pieces of equipment with little or no thought to wiring. As Tom points out, choice of wire can be a major, sometimes critical, factor.

Tom mentions stereo cable with two shields and one drain wire such as Belden 8723. Many installers are now using dual-audio cable such as Belden 1504A where each pair has individual shields and drain wires. The zip-style jacket can be separated with the jacket intact on each pair reducing the need for heat shrinking or other laborious preparation.

I echo Tom's attempt to segregate mic cable from install, foil-shielded cable. I have often seen installations with 1,000-foot runs of mic cable. A short run of flexible mic cable going to a junction box and foil-shielded cable for the rest of the run at lower cost and higher performance, is the way to go.

Using the foil-shielded audio cable in flexible situations (such as mic booms) leads to disaster, as Tom says. This is one reason Belden brought out 1804A, a micro-mini quad mic cable, for times when small size, flexibility and low noise are required.

However, Tom did not mention plenum cable. Plenum variations of many audio cables are available where an installation must be fire rated for use without conduit in drop ceilings or raised floors. The

## A Call to Action

Health care, Bosnia and the latest revelations about President Clinton's Arkansas business and social contacts understandably occupy much of the administration's time. But when it gets a chance, perhaps it could move on some communications-related appointments and issues.

At deadline, a prominent radio group, Infinity Broadcasting, appears to be blocked for an indefinite period of time from completing a multi-million-dollar deal to acquire three stations because there are too few FCC commissioners available to rule on pending indecency-related complaints and petitions to deny.

Settlement of the case appears to depend on a rapid administration nomination to fill at least one of the two vacant FCC seats. The prospects of this are not encouraging, based on the administration's first year in office.

The outrages to the First Amendment in the Infinity case are bad enough, but the evident governmental inefficiency is most irksome. It suggests that the administration does not care about communications issues.

For example, there was a 10-month gap between the inauguration (simultaneous with the resignation of former FCC Chairman Al Sikes) and Reed Hundt's installation as FCC chairman.

As Hundt was being sworn in late last November, administration officials and Congressional Democrats deplored that his nomination had been "kidnapped" by Senate Republicans for partisan purposes. The record actually shows that the so-called kidnapping lasted about a month. Before that, it took the White House nine months to send Hundt's name to Capitol Hill.

Meanwhile, Congress has taken the lead in writing regulation for the next generation of broadcast, cable, telephone and electronic publishing under the umbrella concept of the "communications superhighway."

As important as the superhighway questions are, radio still has some comparatively low-tech matters to settle in the next two years, such as DAB, AM band expansion and new RF radiation regulations (not to mention regular daily operations, like review of station transactions).

There is no reason to be sure that these simpler issues will be delayed by the same forces stalling administration action on the big questions. On the other hand, as the Infinity case shows, even license transfers have become potentially long-term projects. The Administration needs to move now on its communications-related appointments and issues.

—RW

National Electrical Code is voluntary; your local building inspector will advise you if plenum-rated cables are required.

If you are shipping AES/EBU digital audio around, you should be aware that standard audio cables will only work for short runs, as the cable needs to be impedance-specific (110Ω) and low-capacitance. (After all, you are not shipping three-megabit or six-megabit square waves, which is pretty different from analog audio.)

Belden has a whole line of AES/EBU cable from single pair (1,800 A), to plenum, dual zip style, through multi-pair snake. They can be used for analog now and digital later, thus future proofing your installation.

Stephen H. Lampen, Field Salesman  
Belden Wire & Cable, San Francisco

## DDD on line two

Dear RW,

I was most interested in Judith Gross' article "Laying Down Tracks by Phone" (RW, Nov. 23, 1993), but was disappointed that the article did not mention any service provider alternatives, especially since we happen to offer a very good one.

IDB Broadcast provides a service known as "DDD-2," which stands for direct-dial digital, offering two-channel full duplex 20 Hz-20 kHz capability. Our service permits any customer to dial directly to another customer without the hassles of equipment leases, expensive T-1 lines or reservations in advance.

The heart of our system is a digital codec/six-line inverse multiplexer manufactured to our specifications by Audio Processing Technology (APT) of Belfast, Northern Ireland, and Los Angeles. The IDB system features zero-degree phase shift when used for stereo, or dual mono for two separate sessions with two discrete customers at the same time.

Additionally the DDD-2 offers separate time-code with accuracy to within one sub-frame and lockup within one field in three seconds. Digital studios will appre-

ciate the system's AES/EBU digital interface in addition to balanced analog XLRs. Our DDD-2 codec employs the same apt-X100 compression technology that was recently used in premium theaters showing the feature film "Jurassic Park."

IDB's DDD-2 service is offered to customers using inexpensive ISDN or Switched 56 lines (which IDB orders on the customer's behalf and provide at cost). This allows DDD-2 users to dial up each other as often as they like, without reservations, with costs consisting solely of monthly rental charges for our equipment, plus actual connect time charges for use.

Bi-directional discrete stereo or dual mono service costs the user about \$1 per minute at the peak of the business day; less on nights and weekends. Charges for single mono service and/or lesser frequency requirements (e.g., voiceovers) are proportionately less. Because we use ISDN, carrier rates vary with distance and time of use in a manner similar to conventional telephone service.

We also utilize codecs manufactured by CCS and Telos for other applications with great success (such as radio remotes), but have found that the DDD-2 system offers the best combination of features and convenience for demanding high-fidelity requirements on a dial-up basis.

With 40 locations on line with DDD-2 service at present and more being added every day, we thought your readers would be interested in an alternative offering many advantages.

Dave Anderson, Vice President,  
Operations and Engineering  
IDB Communications Group  
Culver City, Calif.

## Correction

In the Dec. 22, 1993, issue on page 16, an incorrect phone number was listed for audio distributor Manley Laboratories, which sells Langevin microphones. The correct phone number is 909-627-4256.

**Radio World**  
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—PRINTED IN THE USA—

**Next Issue of  
Radio World  
February 9, 1994**

# Chinese Radio Approximates West

► continued from page 3

department received more than 10 million letters last year. Many listeners

actively selling time slots.

At this writing, the market is very young and advertisers are mostly



Radio workers "enjoying tai chi" at 5 a.m. before going to work.

write to comment on the programming, while others do so just in the hope of receiving a "QSL card" with a Chinese stamp on it.

## Advertising

In keeping with the government's recent "open market" philosophy, Radio Beijing accepts advertising and program sponsorships. Spots are inserted at the top, quarter and half hour. I was quite surprised to hear that a shortwave operation was also

Chinese, although United Airlines and a few hotel chains that cater to international travelers have bought time.

One popular announcer told me that many employees perform dual, triple or even more functions. It is not uncommon for someone to function as writer, producer and technician as needed.

In the past, most employees have been neophytes right out of college, with no training whatsoever. Most recently, Radio Beijing has held job fairs at colleges in

order to find talent for programming, copywriting, traffic, sales, foreign language announcing and more.

New engineers are recruited from the Beijing Broadcasting Institute, where it takes a student eight years to complete the program. In each of the past three years, more than 1,200 applicants have taken a series of "Radio Beijing acceptance exams"; five of them will actually get jobs with the station. They are eligible to make about the equivalent of \$50 per month at Radio Beijing.

## Self-taught engineers

So far, only a few manufacturers and dealer/agencies have initiated operation and service training for the Chinese market. Consequently, most service needs are performed in-house by a select group of largely self-taught engineers who read and understand manuals written in English.

Station management has standardized certain types of machines to provide for operator/technician familiarity, and as a method of keeping spare parts stock from getting too large.

The recording studios at Radio Beijing were by far the best equipped of any radio station I visited. Engineers were eager to show their latest studio installation, the centerpiece of which is a DDA DCM-232 48-input, 24-bus console. New Otari MTR-100 24-track and MTR-15 two-track machines were coupled to the ever-present Dolby XP Series noise reduction cardframe. Crown Mono-Tech 600 amplification drives a pair of large JBL 4345 monitors. A host of outboard gear includes processing by Yamaha, Sony, Orban, UREI, Klark-Teknik, ART and others.

The editing room was outfitted with two Studer A80s, two Otari MTR-12s, a seasoned Studer B67, Philips DAT machine, Sony cassette deck, Studer B791 turntable and a Studer 14x4 broadcast mixer. All quarter-inch tape is of Chinese origin, while Ampex 456 is used for larger format machines.

The on-air studios were almost sparse in comparison—but the caveat here is that there are 27 of them, all similarly equipped. These studios each have four Otari MX-55 two-track machines feeding

a Carvin MX-122 mixing console with built-in EQ. Sennheiser 421 mics are the choice for announcers, while most stories and interviews are recorded to a Sony pro cassette deck.

The government is financing a state-of-

**It is not uncommon for someone to function as writer, producer and technician as needed.**

the-art facility, currently under construction on the outskirts of Beijing. Scheduled for completion in 1995, the new headquarters will provide all 1,500 employees with much-needed working space, in addition to increasing the number of studios.

□□□

Bill Ford is national sales manager for Carver Professional.

## NEWSWATCH

► continued from page 2

their communities.

The 1994 entries must cover only community service efforts that occurred in 1993. The entry fee is \$50 for NAB members, and \$75 for non-members. They are due by Feb. 7. The awards will be presented March 22 during the convention.

For more information, contact B.J. Cohen at the NAB Radio Department, 202-775-3510.

## ISDN/Switched 56 List Available From DIGIFON

**NEW YORK** DIGIFON is offering DIGITAL Dial-UP List, a worldwide sources database of studios, producers and artists who use the ISDN/Switched 56 public dial-up phone network for transmitting audio or video.

The list will be faxed to anyone wanting it for \$19. Those who want to get on the list can do so at no charge. For more information, call 212-242-2534; or fax 212-727-0953.

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# DATStation Enhances Digital Editing

by Phil Wilton

**BASINGSTOKE, U.K.** In the past decade, the most successful digital audio product in the professional ranks, other than CD players is digital audio tape (DAT). In just five years, 25,000 Digital Audio Tape (DAT) machines have found themselves in use in the professional audio environment in an increasingly diverse range of applications.

Reasons for the technology's success are threefold: The DAT cassette is removable and compact; it has a very high storage capacity (a two-hour DAT tape holds about 1.3 GB, equivalent to 12 120 MB hard disks); and the media cost is only about \$15 for a two-hour tape.

## Technology angle

Requirements in a broadcast environment are essentially acquisition, (location or studio recording) post production (subsequent editing), and transmission (final playout). DAT meets the first and third requirements very well due to the price performance ratio and the range of features available on current professional DAT machines.

The area that has not been so well supported is the post-production or editing stage. Some dedicated hardware-based DAT editing systems exist, but they have not been well received for several reasons.

This has left the DAT user with two choices. Either transfer to analog and cut with a razor blade or transfer to some sort of workstation and edit. Both alternatives are inefficient and time consuming, while negating the advantages of DAT.

In view of this, Sony has developed the PCM-E7700. Nicknamed the DATStation, it is a completely self-contained, portable DAT editing system that includes player and recorder decks and an edit controller.

While this may seem a novelty concept to the casual observer, the excitement lies in the speed and style of operation. Traditional audio editing concepts require the user to concentrate on one edit at a time and then place sections of tape into a sequence or copy across a segment to a record machine until the next edit point is reached.

This is a slow process and is, in a sense, destructive, in that if you make a mistake and want to go back and change something, you have to undo all previous work.

The PCM-E7700 DATStation uses a concept borrowed from the video industry called "Edit Decision List" (EDL). This

involves the operator in identifying, trimming and marking all the designated edit points on the player. Using this technique, the operator builds up a list of required edit points that will be used to compile the final edited version of the program.

## Using the EDL

At any time during this process, the operator can play any segment or cut or even rehearse a transition between two segments or cuts. It is also possible to select transition times or cross fade times between any two segments or cuts in the range of one millisecond to three seconds, in one millisecond steps. Gain and balance adjustment can be carried out on any segment in order to match levels.

To select and roughly mark edit points, the operator has a wealth of features at his or her disposal. First, it is possible to uti-



Sony DATStation

lize all of the "Start IDs" and "Program Nos" that can be written by any DAT machine. The operator can supplement this by asking for accurate locate points specified by either time code or absolute time (A-Time).

(The PCM-E7700 requires the source tapes in the player to have either time code or A-Time recorded on them. If not, tapes recorded in the field can be post striped with time code in the machine.)

A shuttle facility is provided so that an operator can shuttle or cue forward or backward through the tape at up to 16

times real speed while the machine is reproducing audio.

Finally, the PCM-E7700 has the capability of real-time jog from tape. This is the same as scrubbing or rocking and rolling an analog tape to accurately mark the edit point. This is an extremely powerful feature—with existing systems, you have to pre-load a RAM buffer memory before you can scrub to mark the edit point.

**The PCM-E7700 uses a concept borrowed from the video industry called "Edit Decision List."**

Thus, if you have a six-second RAM memory, it will take between six and nine seconds to load the memory before you can attempt to scrub.

Due to the fact that the PCM-E7700 DATStation works by compiling an EDL, it is, in essence, a non-destructive system such that at any time the operator can go back to any edit point or segment and remark or trim the edit. In addition, there are a whole host of keys that enable direct and instant manipulation of the EDL. This includes functions such as Move, Delete, Divide, Copy, Space and Recover.

Once the operator is happy with the EDL, the system can be asked to automatically compile the selected segments to the record tape. This process can be achieved in real time or at twice real speed, including off-tape confidence monitoring with built-in error checking on the player and recorder tapes. Options at the head of the tape, which can be automatically inserted prior to the start of program material, include test tones, periods of silence and a section to insert spoken narration that would identify who was doing what, where, when and with whom.

Even after compilation the system remains non-destructive, such that the EDL can easily be amended and the sys-

tem will automatically recompile the tape in the recorder from the amended edit.

While this all may sound rather strange to somebody from a traditional radio broadcast environment, be assured that it is straightforward and simple. To aid the non-technical operator in this process, the PCM-E7700 DATStation uses a very simple keyboard layout and indicates segments or cuts via simple bars on an electro-luminescent screen.

Non-technical people have used the PCM-E7700 DATStation to edit a radio interview after only one to two hours training.

For more information on the now available Sony DATStation, contact Sony at 800-635-SONY.

□ □ □

Phil Wilton is product manager for Sony Broadcast International in the U.K.

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World Radio History

# 1993 Radio Ad Analysis Shows Growth

**NEW YORK** November 1993 proved to be a banner month for the radio industry, with combined national and spot radio ad spending posting a 10 percent increase over November 1992. National spot revenue propelled the increase with a double digit growth rate of 14 percent over the same period in 1992.

Local radio revenue, which accounts for more than 75 percent of radio ad spending, posted a 9 percent increase for the month.

In a release, RAB President Gary Fries said: "Radio growth rates continue to outstrip those of just about every other medium, and projections for the first quarter of 1994 look just as strong."

with the East and Midwest regions posting a 7 percent growth rate.

The accounting firms of Miller, Kaplan, Arase & Co. and Hungerford, Aldrin, Nichols & Carter provide the local and national spot revenue data on the more than 100 markets the RAB uses to calculate its revenue index.

News of radio's continued

recovery comes on the heels of positive projections for the

Advertising agency. In a presentation to the PaineWebber

**Overall, every region of the country posted increases for 1993.**

industry from advertising forecaster Bob Coen of the McCann-Erickson Worldwide

Media Outlook Conference last month in New York, Coen presented his 12-month outlook for

advertising expenditures.

Coen's numbers post a more modest growth for radio for 1993 than the RAB figures, with a combined network and spot increase of 6.9 percent for the year.

The outlook for U.S. advertising is "clearly brighter" than it has been, according to Coen. He projects the economy will experience another year of improvement and that total national advertising expenditures in 1994 will increase by 6.5 percent to \$85.5 billion.

Year-to-Date January-November 1993 vs. January-November 1992	
<b>Local Revenue—Jan.-Nov. 1993</b>	
All Markets	9%
East	8%
S East	12%
Midwest	7%
S West	15%
West	8%
<b>National Revenue—Jan.-Nov. 1993</b>	
All Markets	8%
East	5%
S East	6%
Midwest	11%
S West	13%
West	8%
<b>Combined Revenue—Jan.-Nov. 1993</b>	
All Markets	9%

The figures are based on the Radio Advertising Bureau (RAB) Radio Revenue index of more than 100 markets.

Local and national spot radio growth rates are keeping pace with one another for the period of January through November 1993. Local spot posted a January-November growth rate of 9 percent and national spot 8 percent over the same period in 1992. Overall, every region of the country posted increases for the year, according to the RAB.

Said Fries: "This is an exciting time for the radio industry and its advertisers. There is a tremendous amount of change and opportunity in the air, and optimism is high for the coming year."

November's 14 percent increase in national spot revenue represents a significant increase from October 1993's 6 percent increase. All five regions of the country posted double digit gains in November, including a very healthy rebound for the West, which climbed from a 5 percent drop in revenue in October (compared to October 1992) to a 17 percent increase in November. On the local revenue front, three of the five regions posted double digit growth rates,

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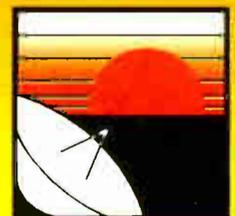
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**PRODUCT EVALUATION**

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by **Bruce Barlett**  
with **Jenny Bartlett**

**ELKHART, Ind.** Small nearfield monitors are great. They're easy to carry, easy to install, and they reduce the effect of room coloration. But they lack deep bass. If you're using such nearfields and you want to hear all the bass you're putting on tape, consider adding a subwoofer.

A subwoofer is a cabinet-mounted woofer that covers frequencies below the range of most small speakers. Typically, a subwoofer can reproduce sounds from 20 or 40 Hz up to 150 Hz. More expensive subwoofers can reproduce sounds as low as 10 Hz. Since we don't localize frequencies below about 150 Hz, the subwoofer can be placed almost anywhere in the

woofer operates in an acoustic suspension configuration. The woofer has a dual

Product Capsule: **Design Acoustics CLW Subwoofer**

Thumbs Up	Thumbs Down
<ul style="list-style-type: none"> <li>✓ small, compact size</li> <li>✓ high-pass filter</li> <li>✓ ample bass</li> </ul>	<ul style="list-style-type: none"> <li>✓ consumer-grade construction</li> <li>✓ no banana plug connectors</li> <li>✓ response is resonance peak</li> </ul>

For more information, circle **Reader Service 158**; or call Design Acoustics at 216-686-2600

voice coil: one per channel. The woofer cone fires down at the floor, so it is unlikely the cone can be accidentally damaged.

Another feature, that was intended mainly for home theater applications, but also works in a professional audio environment, is the woofer's magnetic shielding. Such shielding means you can lay tapes on top of the cabinet. This actually happened at a recording session I did recently with the CLW, but with no audible effects on the tape.

Thanks to the clearly labeled, spring loaded connectors and well-written manual, connecting the CLW to your nearfields is simple. You run a pair of speaker cables from your stereo power amplifier to the subwoofer, then run a pair

from the subwoofer to each nearfield monitor. The spring connectors are suited primarily for normal gauge speaker wire.

### Measurements

Inside the CLW is a crossover which filters out frequencies below 150 Hz from your nearfields. This reduces their I.M. distortion. You can turn them up louder without distortion because their woofers ignore anything below 150 Hz. Their cone excursion is reduced as well.

As for the rated specifications, the frequency response is claimed to be 40 Hz to 150 Hz. During my measurements, the microphone was placed very close to the woofer to obtain the half-space response. System resonance was at 72 Hz and sloped off sharply above and below that. The useable frequency response is 40 Hz to 250 Hz +/- 6 dB.

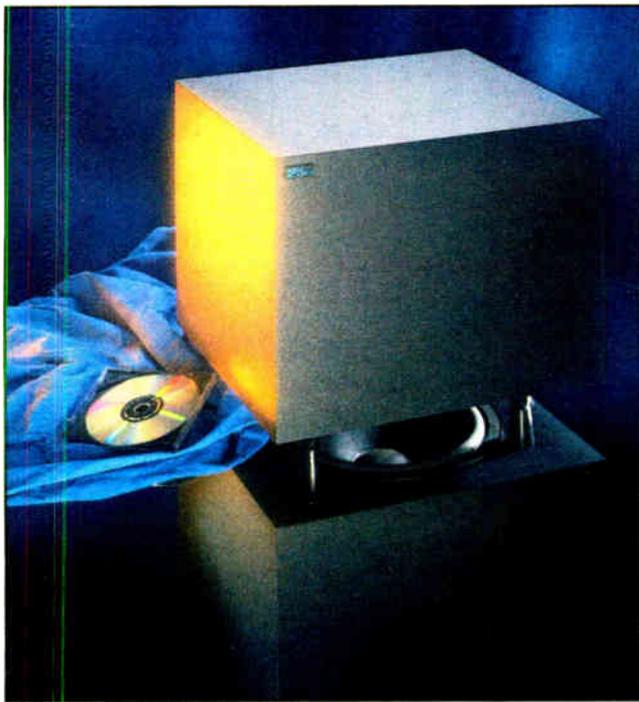
The company recommends you use an amplifier 15 to 150 watts per channel. Maximum sound pressure level (SPL) is 105 dB, which is plenty for radio station

monitoring. Sensitivity is rated as 89 dB/W/m, which is average. Impedance is eight ohms nominal and five ohms minimum—no problem to drive.

For the best tonal balance, your

nearfields should have about the same sensitivity as the CLW. If that's not the case, you might want to power the subwoofer and nearfields separately with two

continued on page 16 ▶



Design Acoustics CLW Subwoofer

room; you still hear all the sound coming from the small speakers.

For the radio studio engineer, a subwoofer can enable you to hear unwanted low-bass problems, such as breath pops and piano-pedal thumps, that might escape detection on small speakers. Another advantage of a subwoofer: if you produce commercials at your station, the deep lows really impress clients.

A subwoofer well worth a listen is the Design Acoustics CLW, retail priced at \$249. Although intended for the consumer market, it has features that pros can embrace.

### Features

The attractive, satin black finish subwoofer is surprisingly light, small, and portable. The CLW measures just 12.5 inches high, 14.5 inches wide and 12.5 inches deep. It weighs 24 lbs. Sitting on four short legs, the CLW can fit almost anywhere.

A 10-inch long-throw, dual-voice coil

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# Video Jock's Technical Talents Vital to Radio Show Production

► continued from page 1

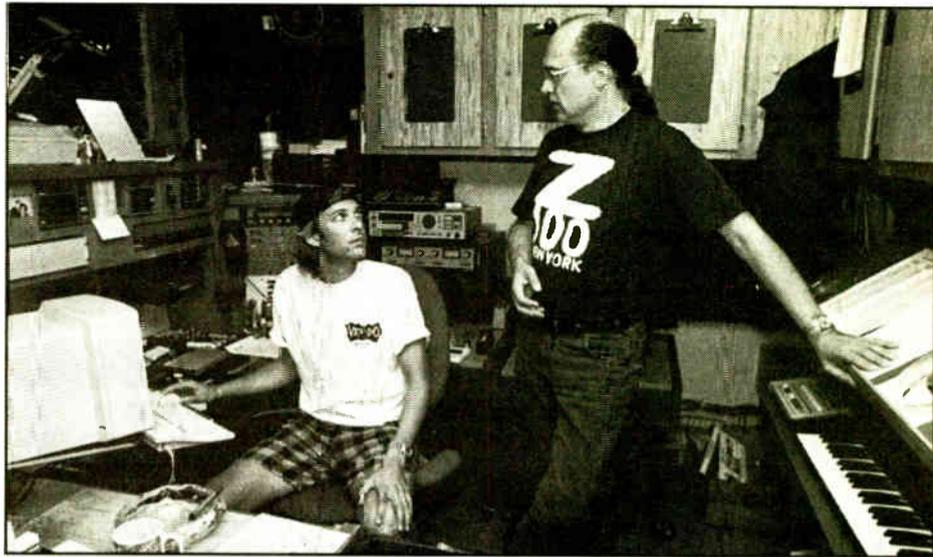
in New York. Prior to the digital line, he had been recording onto DAT and sending via Federal Express delivery to the syndicate studio, where final production of the "Top 30 Hit List with Adam Curry" is done.

At the syndicate studio, engineer Dave Fox, whom Curry calls the "puzzle man," assembles the week's top 30 songs and inserts Curry's voice track using a digital workstation. "He's literally looking at eight tracks and piecing together

like a puzzle a mix of the entire segment," Curry said.

Curry and Fox began experimenting with digital five years ago. Today, Curry said, computerized recording has totally changed how they work and has brought the entire creative process to the desktop, where it's more accessible.

"That's exactly what happened to desktop publishing. The power of publishing was put into the hands of creative people. This is what's happening not only with audio, but with video as well," he



Adam Curry in the WHTZ-FM studio in New York.

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World Radio History

said. "It's just a matter of how to distribute it."

Curry soon hopes to do phone-in takes of his video productions—much like he does for his audio productions. The likely byway for high-bandwidth applications like video will be Internet, a massive thoroughfare of T3 and T1 circuits used by banks and other industries to shuttle data from point to point. Currently, mounting traffic on Internet is

**Curry has a studio at his home in New York and another at his home in Amsterdam, each with Macintosh-based ProTools.**

making throughput slow, as Curry knows all too well from first-hand experience.

In a recent "Wall Street Journal" write-up, Curry's use of Internet to post gossip tidbits and reviews of his MTV shows was cited as one example of how traffic jams are caused by "rubbernecking"—or the equivalent of driving by the scene of an auto accident. The gridlock was apparently caused by Curry's gossip tidbit on Madonna's private life.

To accommodate the on-lookers and to ease traffic through the system, Curry recently canceled Internet connection through a host computer service and set up a direct Internet address from his own Sun computer. His new Internet address is MTV.COM, where computer correspondents can call up his Cyber Sleaze Report, among other documents, free of charge. "I encourage everybody to drop by and see what's going on," Curry said.

In the next decade, broadcasting information will become more creative, more multifaceted and far more accessible to people than ever before, Curry predicted. The computer, he said, will radically change broadcasting as we know it today.

□□□

*Dee McVicker is a regular contributor to RW and a freelance writer for the broadcast industry. She can be reached at 602-545-7363.*

PRODUCT EVALUATION

# Symetrix 601: A Cut above the 528

by Ty Ford

**BALTIMORE** With the 601 Digital Voice Processor (\$1,995 List), Symetrix brings the concept of single rack-space mic processing at least two levels above its own 528 analog processor.

Like the 528, the 601 has two balanced analog inputs (one mic, one line) and 48V phantom power. Unlike the 528, the 601 has a selectable front end allowing line, mic and line, AES/EBU or S/PDIF inputs. However analog and digital inputs cannot be combined. From there on, the ride is all digital (see Figure 1.) with a three-band parametric EQ, de-essing, expander, gate, AGC and a two-section stereo delay.

**Sounds good**  
The 18-bit, 64x oversampled Delta-Sigma A/D converter sounds good. The balanced analog outputs are always available. The digital output is switchable between AES/EBU or S/PDIF. The mic preamp circuit in the 601 uses the "instrument-grade" SSM 2017 chip which is an upgrade from the SSM 2015 op-amp used in the 528. Both are more to the "bright" and "hard" end of the spectrum than the "soft" and "warm" end.

**Sounds good**

The mic and line inputs allow a noticeable amount of audio to pass, even when they are attenuated. So unless you expect to use both mic and line inputs at the same time, it's better to switch to the

tings (soft/medium/hard), the manual offers a list of 128 preset programs with brief descriptions. These programs are burned in and cannot be erased. Using them as a starting place, you can quickly

build your own programs and save them by number to any of 128 other locations.

For those highly MIDI-literate, the manual provides comprehensive MIDI documentation, including a

section on how to interface to the Lexicon MRC MIDI controller. If you have a device capable of recording MIDI, you can periodically dump or load

circuit.

Each of the three bands of the parametric EQ covers from 31 Hz to 21.11 kHz. The "Q" width range is 0.05 to 3 octaves. Filter frequencies are 1/10 octave standard, with additional power-line harmonic frequencies. The first and third bands can also be used as simple high and low shelving filters. Maximum boost is +18 dB, maximum cut is -50 dB.

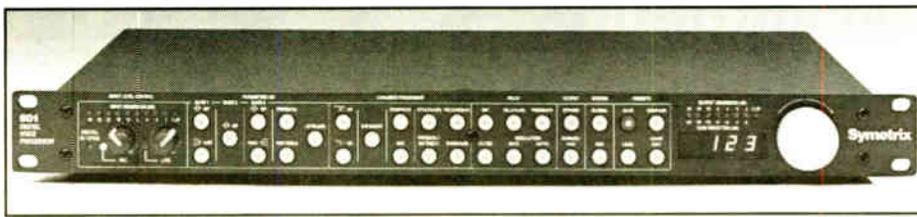
**Parametric paradise**

Getting back to the "Below Clipping" concept: all of the threshold parameters in the dynamics section are relative to the full-scale clipping level. If you're used to setting threshold by the amount below nominal signal level, you'll have to do some arithmetic. If you normally think in terms of gain reduction and the

Product Capsule: **Symetrix 601 Digital Voice Processor**

	<b>Thumbs Up</b>		<b>Thumbs Down</b>
✓ analog/digital I/Os		✓ no stereo reverb	
✓ digital processing			

For more information, circle **Reader Service 71**; or call Symetrix at 206-282-2555



Symetrix 601 Digital Voice Processor

the current program or the entire memory via the MIDI ports on the back of the chassis.

Several design features of the Symetrix 601 aid in making the search for better settings more effective. You can compare your newest creation to the original preset (or at least the last saved set of parameters) by using the "COMPARE" button on the front panel.

There also is a "bypass" switch on the front panel that pulls all of the DSP functions off-line, but continues to pass signal through the A/D and D/A converters. In addition, each section of the processing can be taken out, including each of the three EQ bands. The unit has a battery backup that will hold settings while the unit is powered down. The 601 offers three levels of lock-out security: None, Partial and Maximum.

I like Symetrix's use of "Below Clipping" figures. The thought here is that, to get the best sounding digital audio, you should be using the highest levels possible so that all 18 bits are used. The digital compressor/limiter allows you to push the levels up without fear of exceeding the headroom of the

actual sound of the circuit, forget you read the last two sentences.

Not all of the dynamics circuits are usable simultaneously. The noise reduction (N/R) and de-esser blocks share parts of the same circuit. Because of this, you can choose either N/R or de-essing, but not both. The Comp/Limiter and AGC blocks work the same way. Only the Expander is independent. Attack rates for all sections can be adjusted to as fast as 100 microseconds with the quickest release time of 100 microseconds.

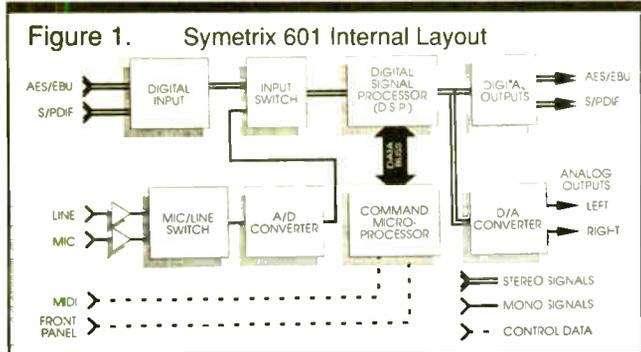
As stated in the manual, the dynamic Noise Reduction block uses a variable frequency low-pass filter to perform single-ended noise reduction. The manual also explains how best to set the resting frequency, absolute and relative thresholds of the circuit.

The de-esser, which uses the same dynamic block, operates around a fixed 5 kHz crossover frequency. Sibilant sounds above the adjustable threshold are attenuated. Although the attack and release controls on the front panel are not functional, changes to these values may be made via MIDI or the real-time editor.

Many of the de-esser circuits I've tried have been unable to trim the sibilance without noticeably reducing the natural brightness. The 601 really worked well.

The expander also works well and has

continued on page 16 ▶



mode that allows one or the other. My studio condenser mic caused the input to display a signal at just 24 dB below clipping with the mic pot fully attenuated. The unused analog inputs also add noise if they are activated.

In addition to mic/line analog processing, the AES/EBU and S/PDIF I/Os also allow the 601 to be used as a digital stereo processor with digital level and balance control. While the internal-generated sample rate is 48 kHz, the 601 can be switched to accept 44.1 kHz or 32 kHz from an external clock source during analog input operation. The 601 doesn't do sample rate conversion.

**Front panel control**

It doesn't take long to get use to only one numerical LED display and one value changing wheel on the front panel. In fact, the 601 has one of the nicest interfaces I've used lately. My only problem was making sure I hit the right button before adjusting the parameter.

For those few adjustments that aren't easy, like expander/compressor knee set-

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## DIGITAL DOMAIN

# Understanding, Eliminating Jitter

by Mel Lambert

**LOS ANGELES** In last month's column, we learned that jitter is the timing relationship between a "perfect" sequence of data bits, running at some multiple of the basic sample rate, and one that periodically or spontaneously speeds up and slows down can have a devastating effect on reliability of digital interfaces.

In the worst case, the connection fails; the receiver cannot track the variances in the incoming bitstream, synchronism is lost, and the circuit defaults to its quiescent, silent mode. In the less traumatic

situation, where the jitter might be less than 10-20 nS (nanoseconds), we often encounter, dependent on a number of subjective and objective criteria, a "veiling" in the audio quality, or some other less than attractive audio effect.

## It's all timing

In layman's terms, jitter is often defined as the minute timing differences between the location that a data bit should occur and where, because of timing anomalies in digital I/O driver circuits, transformers and cable impedances, the actual data cell occurs.

As I mentioned in last month's col-

umn, a major contribution to bad-performing digital I/O connections results from bandwidth limiting. Hence, always specify high-quality, low-impedance, balanced 110-ohm digital audio cables.

Again, because they specify high input/output levels, robust connectors and enhanced-quality cabling, AES3-format I/Os are normally more reliable for long-distance transmissions than consumer-type ports.

Of the many flavors of jitter that we might define mathematically, there are two types that are probably more useful than others: Sample Frequency (Fs)

Jitter, Data Jitter, and Intersymbol Interference.

Sample Frequency Jitter is normally related to the AES-format I/O fitted to the sending equipment, rather than cable type and impedance. We can measure Fs Jitter by examining a transition in an AES3-format signal that has been purposely chosen to be as long as possible after any data-related transitions—thereby eliminating effects caused by data modulation.

Data Jitter is normally correlated with the effects of lengthy or poor-quality cables, or badly designed I/O drive circuits. We can measure Data Jitter by examining the data transitions within a digitized audio signal, and are they being modulated by the varying data bits. Normally, Data Jitter often varies according to the type of audio data being encountered during a measurement.

## Jitter analysis

Intersymbol Interference enables Data Jitter to be measured in a way that's independent of the audio data carried across the connection. Because cable-related modulation will shorten short-duration pulses and lengthen long ones, we can determine Intersymbol Interference by measuring the duration of a short pulse in the AES3-format preamble that follows a long pulse.

Having determined the sampling rate, our measurement technique can measure how long the short pulse should be, and then display the degree of diminution both in nS (and even, with the correct test equipment, as a percentage of that correct length).

Is there an absolute value of jitter that might be worth using in "good/bad" determinations? Is there a number that can be considered as a threshold of performance? Given our current understanding of the mechanisms by which jitter is produced, and the interrelated objective and subjective effects it produces, I suspect that the answer is "no, not yet."

At least one manufacturer of test equipment has examined the AES3-1992 Recommended Practice, which, unfortunately, contains little discussion about jitter performance and tolerances. The manufacturer interpreted the document as allowing 40 nS of peak-to-peak jitter and a similar amount of Intersymbol Interference reduction.

The majority of jitter measurements, generally speaking, feature a background "noise floor," of between 300 and 500 pS (0.3 to 0.5 nS). As a result, measurements that fall within the area less than these types of numbers are often considered as being of little consequence.

## Consumer standards

I remain very suspicious of the consumer-audio media, which considers jitter values only in the region of 100-200 pS to be of major significance. If we do hear subjective difference between, let's say, different CD players equipped with S/PDIF or AES3-format outputs, I think that there may be a number of other, complementary mechanisms at play, one of which might very well be a jitter component.

Variations in jitter-timing transitions are often measured by comparing the signal to an accurate timebase pulse regenerated by a very stable phase-locked loop (PLL). By varying the PLL's roll-off frequency

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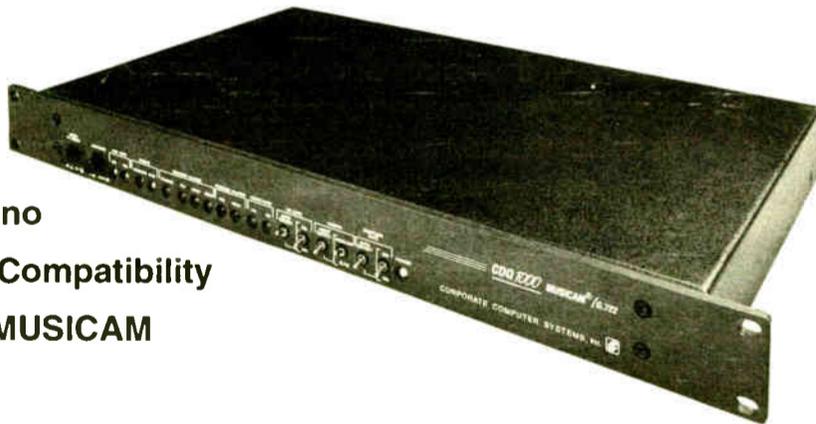
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# Documentary Post-Work Can Go Several Ways

## PART IV of V

by Steve Rowland

**NEW YORK** Post-production is the phase when all of your radio documentary ideas, concepts and experiments will come together and become a living program. Once it is done, and out on the air, you won't be able to go back and fix it.

The first step is to make very detailed logs of each tape. You can sit and listen back to them in real time, and try to take as many notes as you can. Alternatively, you can have each tape transcribed verbatim. This is the best option, but is very labor intensive. If your budget allows, the tapes can be sent out to a typist.

It is important that you make an indication of absolute time or tape-counter markers, so that you can easily find particular segments later. If at all possible, all of this work should be done on a computer. A large percentage of writing the script will involve cutting and pasting the interview sections you select. Expect to make a lot of revisions as well. Having your transcriptions done on a computer will save you hours of time.

### Scripting

Next you should make a very detailed list of each and every element that could possibly go into your program. This will help you design the outline for your script.

I write my scripts by selecting the interview segments, or actualities, first. Then write the narration to introduce and provide context for the actualities. As you read back the transcriptions, highlight the sections that help tell the story. Or copy and paste them into a new folder. As the script begins to take shape, you can write the narration.

While the script is being written and revised (I usually go through five or six rewrites), you can begin to "cut tape," editing.

At the moment, there are two basic choices for editing. The first option is to transfer material to quarter-inch tape, and cut it with a razor blade. This

is the time honored tradition that has worked well for many years.

The other option is to transfer your material into a digital workstation and edit digitally. This method is becoming more and more commonplace. There are advantages to each method, but without doubt, the balance is tipping towards digital editing.

### DAW plusses

The biggest advantage of a digital audio workstation (DAW) is that you can make better edits. First of all you can try many versions of an edit until you find one that works best. Secondly, most DAW's will allow you to do crossfades at the edit point, which can fix rough transitions, and other things that would normally be considered "bad" edits.

Short sections of ambiance can be "looped" and placed behind tracks, or at edit points. In addition, there are many things that one can do with the edit decision lists (EDLs) in these systems. The EDL provides a sophisticated file management for your cuts, so that they can be retrieved or played back in any order.

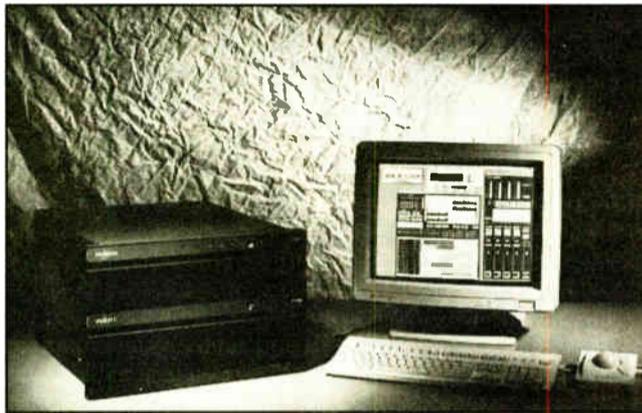
One important decision to be made here, is on the storage medium and the mixing format. Here's why. Let's say you have access to a DAW for editing, but not for mixing. Well, if you are to mix analog, then how will you lay your edited actualities and narration segments onto your multitrack? If your DAW is in the same studio, or can be moved and you have enough hard disk space to hold all of your edited material, you could just transfer directly to your multitrack. This would be an ideal arrangement.

If you are not so lucky and you need to download to tape, you will probably want to keep your signal digital and transfer to DAT, right? Maybe not. Most DAT machines do not have an instant start, and

you won't be able to get clean entries as you transfer to your analog machine.

If you want to use DAT, you will need something like Sony's PCM 7010 DAT. This machine has a three second RAM memory, which allows instant access playback. Otherwise, you will have to download from your DAW onto quarter-inch tape. Now you have your actualities on a format that will give you instant playback and will allow last minute edits, if necessary.

There are some important advantages to



Steve Rowland does his radio documentary post-production on a Studer Dyaxis II workstation.

tape editing, particularly if your mix will be done on analog machines. Once you transfer to tape, you edit right there, and you do not need to transfer back, as you often do from a DAW. Your reels are ready to go into your mix session, and because you will be playing them back from a two-track machine, you will get instant start on your tracks. You also will be able to make last minute cuts without having to go back to a DAW.

### The DATStation

One other method still on the horizon is a new system developed by Sony. The now-available DAT editing unit, the PCM-E7700, is nicknamed the DAT Station. The unit looks something like a laptop computer. It is not battery operated but is designed to be transportable. The top opens up and has an LCD screen. The main housing has two DAT bays. The unit supports both A-Time and SMPTE

time-code, double time, full frequency DAT dubbing, RAM for instant start, and EDL editing with crossfades.

I'd like to point out here that a good two-track analog tape machine will provide you with superb sound. If it is equipped with DBX noise reduction, even better, and if you get Dolby SR, you've got about the best. I have had some students shy away from analog editing because they were concerned about the sound quality. Some were convinced that the sound from a \$500 consumer DAT recorder would be better than that of a \$3000 two-track machine. They were wrong.

Learning to cut on tape is important, if for nothing else than the conceptual sense one develops, and should be strongly encouraged. Working in the digital domain provides great sound quality, and you lose no "generations" as you do when you make analog transfers, but the real attraction to me of working digitally is the level of flexibility which is gained in the creative process.

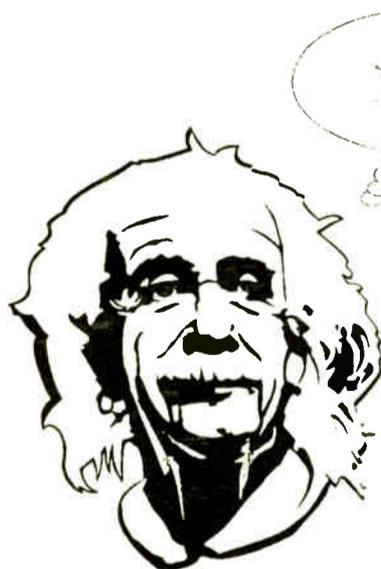
For me, the Studer Dyaxis I has worked very well. The Dyaxis hardware has received much acclaim for its sound quality and the software provides a superb editing environment. There are currently two Studer 2-track systems: the Dyaxis I and the Dyaxis Lite. Both use the same processor and the same software, the difference is just that the Dyaxis I offers DSP functions (including digital EQ and time compression) while the Lite does not. The software is Macintosh-based and very easy to learn. It is so easy that it works well in radio station environments where there are a number of users sharing one system.

The Dyaxis systems will do mixing, so they can double up as mixing DAWs quite adequate for small projects like radio spots, PSAs and short news features. For a full-length documentary you will need to go to a multitrack system.

In the final installment of "Producing a Radio Documentary," I will tackle the mixdown process.

□ □ □

Steve Rowland is a principal in the production company, the Music Makers in Philadelphia. He can be reached at 215-843-4388.



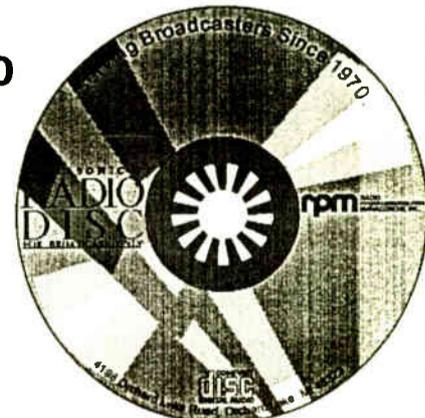
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# CLW Subwoofer Augments Response

► continued from page 11

stereo amplifiers, and put an electronic crossover ahead of the nearfield amp to remove lows below 150 Hz. Or use nearfields with a useful low-frequency response extending only to 150 Hz.

## Listening tests

In auditioning the CLW, I first set up a pair of Radio Shack Minimus 7s. They are very small speakers with a four-inch woofer and one-inch tweeter; they have little response below 120 Hz. I put the CLW under my mixer and wired it to the Minimus 7s.

Sure enough, the bass that was missing

**The bass that was missing came to life when I added the CLW.**

in the small speakers came to life when I added the CLW. The system was much more pleasant to listen to: full and warm instead of thin. I felt that the CLW blended well with the Minimus 7s. All the sound seemed to be coming from them.

When I played the CD "The Road to You," by the Pat Metheny Group (Geffen CEFD-24601), the bass notes were mostly uniform in volume, in spite of the measured response. I heard the same effect when I used the CLW with a pair of small Audix nearfields.

The CLW's bass went fairly deep but did not really plumb the depths. I played "The Firebird Suite" on Telarc (CD-80038), which has a very low bass-drum roll at the beginning. When I played the 7s alone, the drum roll was absent, but it was easy to hear with the CLW added. However, the roll was not ominous and powerful as you would hear it on a speaker that is flatter to 40 Hz and lower. But at least it was audible.

On a variety of pop-music records, the bass transient response was impressive. For example, on "Kamakiriad" by Donald Fagen (Reprise 9 45230-2), the bass was pretty tight. Not the best I've heard, but not bad. The closer the sub is to you, the cleaner the bass sounds.

## Summary

Subwoofers that are bigger (and more expensive) than the CLW can give a sense of power—like a diesel locomotive. The CLW does not put out such gut-shaking bass, but it does make tiny loudspeakers sound like big bookshelf speakers. I think

the tradeoff between the CLW's lack of extreme deep bass and its small size and portability is well worth it for most radio applications. It fits well in small production studios, and it gives you enough bass

to do the job. Highly recommended.

□□□

Bruce Bartlett is a microphone engineer and technical writer for Crown International, and the author of "Practical Recording Techniques," published by Howard Sams. Jenny Bartlett is a technical writer. Bruce can be reached at 219-294-8388.

# Symetrix 601 Processor

► continued from page 13

an adjustable slope rate from 1:1 to 1:8. In situations where the complex nature of the ambient noise made the gate flutter, I found that adding the noise reduction circuit pulled out enough noise to stabilize the gate. If you're using a mic with excellent bass response, or if you've increased the low frequencies with the parametric equalizer, you may find the expander hard to set without fluttering.

## EQ features

Since the EQ section precedes the dynamics section, you can use the first band of the equalizer to roll off some of the problem-causing ambient bass frequencies. Then use the other two bands to shape the voice.

The compressor/AGC block can be adjusted between up to a 10:1 ratio with 100 microsecond attack and 100 microsecond release times. The delay block allows you to create single or

double delay, chorus and flanging. Delay, feedback, filter, rate, depth and mix are adjustable.

With a few adjustments, or by using one of the many presets, you can create a nice super-wide "stereo" sound. Just be sure to check it in mono to guarantee that your efforts haven't caused any major cancellations. While delay is an okay thing to have, I would have preferred a nice stereo reverb. According to John Bosaw at Symetrix, stereo reverb would have meant adding another DSP chip, meaning a more expensive unit.

The Symetrix 601 is not for the beginner, but you can certainly add it to the growing list of well thought-out analog/digital devices that are paving the way to digital audio's future.

□□□

Ty Ford's recently published "Advanced Audio Production Techniques," is available by calling Focal Press at: 800-366-2665.

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# PRODUCT GUIDE

Companies with new product announcements for Studio Sessions Product Guide should send them to Radio World, c/o Studio Sessions Editor, 5827 Columbia Pike, Suite 310, Falls Church, Va. 22041

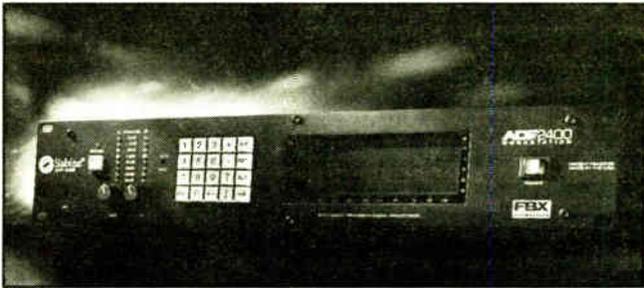
## Sabine Digital Processors

Sabine's ADF-1200 (single channel) and ADF-2400 (dual channel) Workstations contain fully adaptive digital filters designed for audio engineering.

The workstations' features include an array of programmable functions including: 12- or 24-band digital parametric filtering, digital shelving filters, digital delay, noise gate and 31-band real-time analysis.

The units use equalization technology that automatically detects feedback and then assigns a very narrow notch filter to filter out the ringing frequency.

For more information, contact Sabine at 904-371-3829; or circle Reader Service 128.



## BASF Recordable CDs

BASF's CD-R Master line recordable CDs has been developed for recording studios and broadcasters.

Available in 63- and 74-minute recording times, each "Orange Book" disc contains Absolute Time in Pregroove (ATIP) time information.

For more information, contact BASF at 212-362-2906; or circle Reader Service 192.



## Shure Beta 87 Microphone

The Shure Beta 87 super cardioid microphone is said to ensure unprecedented power and clarity of live vocal performances.

The unit features internal shock mounting, three-stage pop filter, and dent-resistant steel grill. There is also a wireless version.



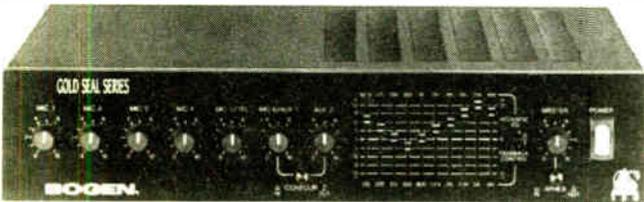
For more information, contact Shure Brothers at 800-25-SHURE; or circle Reader Service 68.

## Bogen Gold Seal Amplifiers

Bogen Gold Seal Amplifiers are versatile, multi-use amplifiers well suited for background/foreground, public address/ sound reinforcement, telephone and microphone applications.

The amplifiers are available in 35, 60, 100 and 150 W configurations and feature the Aphex Aural Exciter. Frequency response is rated within -1 dB from 20 Hz to 20 kHz, distortion is 0.5 percent and signal-to-noise is 94 dB or better.

For more information, contact Bogen Communications at 201-934-8500; or circle Reader Service 219.

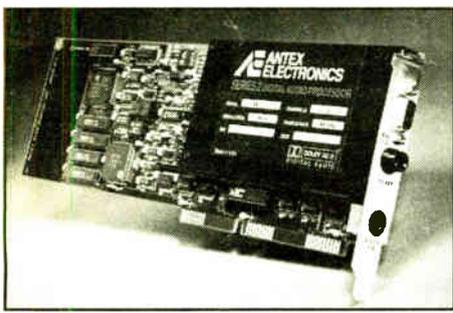


## Antex SX-22 Dolby AC-2 Board

The Antex SX-22 is an advanced digital audio board with the Dolby AC-2 coding that provides real time, compressed professional broadcast-quality stereo audio.

The board is compatible with PCs, PS/2s and compatible computers. It also contains an EEPROM-based elaborate security system.

For more information, contact Antex at 310-532-3092; or circle Reader Service 49.

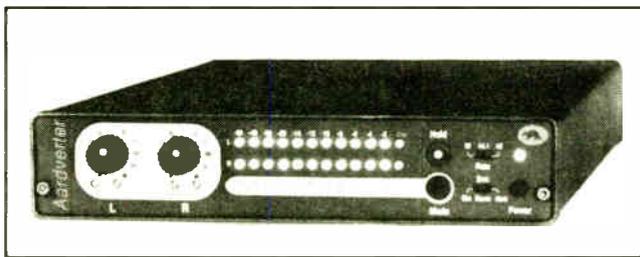


## DGS Pro Audio Connectors/Cables

Gotham Cable of Switzerland and Deltron Connectors of England have formed an American company, DGS Pro Audio, to distribute professional audio cables and connectors to the U.S. market.

Products will include the Deltron 7000 series, a die-cast metal, screwless connector for broadcast and video; and Gotham's flexible, low-capacitance audio cables that use double-reussen, braided shielding.

For more information, contact DGS Pro Audio at 800-292-2834; or circle Reader Service 163.



## Aardvark A/D-D/A Aardverter

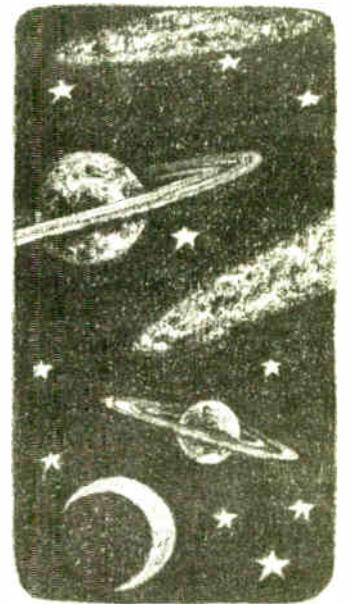
The A/D-D/A Aardverter offers professional-quality digital audio in an economical,

compact package, according to the company.

The unit uses high quality delta-sigma Crystal converters and a RF-ruggedized analog front-end to ensure transparent conversion. Distortion is rated at .001 and the noise floor is 96 dB. The Aardverter also contains on-board DSP.

For more information, contact Aardvark Computer Systems at 313-665-8899; or circle Reader Service 85.

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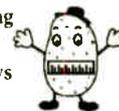
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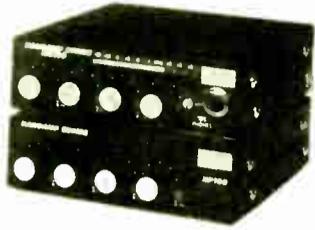
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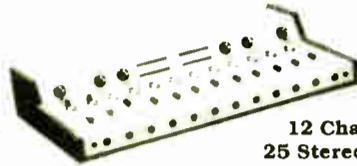
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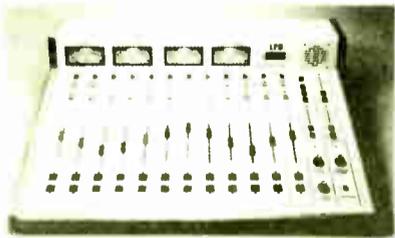
SCPC-2000E SCPC Satellite Receiver - \$1875

AVCOM's Single Channel Per Carrier Receiver, model SCPC-2000E, has been developed for the reception of FM SCPC signals from satellites operating in the 3.7 to 4.2 GHz band. The SCPC-2000E is a complete receiver that can tune up to 4 specific crystal controlled audio or data channels from a given transponder and adapt to a variety of de-emphasis requirements. The SCPC-2000E is available in either wide or narrow band models and may be used with the SS-1000 (\$1027) Slave for simultaneous reception of additional channels.

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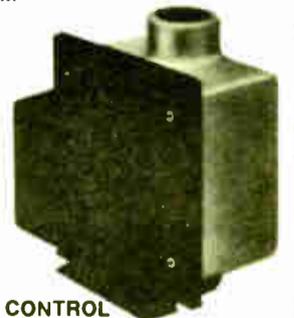
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## SIGNAL-TO-NOISE

# Some Choice New Headphone Buys

by Frank Beacham

**NEW YORK** When recording in the field there's only one way to really know what's going down on the tracks. Yes, I mean monitoring with headphones (and the amplifiers that drive them). They often are overlooked devices, but oh so important in the quality of the final recording.

I'd like to recommend three new "in your ears" advancements for field monitoring. One is a pair of high-end earphones that really block out background noise while the other two offer major improvements in the sound quality of virtually any professional headphones.

The ER-4 series Canal Phone by Etymotic Research of Elk Grove Village, Ill., (\$330 list) is a very lightweight (one ounce) ear phone pair that fits tightly into the ear canals. Although reminiscent of the cheap ear "buds" sold with many portable stereos, the Canal Phones set a new standard for audio quality in this design with a low-frequency response that remains virtually flat down to 20 Hz.

## No noise

The feature that makes the Canal Phones so unique for field monitoring is the 20 to 25 dB exclusion of external noise. These little devices fit into the ear canals, sealing the canals with soft-flange eartips or optional custom-fitted earmolds. The resulting noise exclusion allows the listener to hear the full dynamic range of the sound without excessive levels. Canal Phones are perfect for working in noisy environments like stadiums, arenas, airports and on the street.

One caveat. Make sure the ear canal is tightly sealed. If not, the phones become tinny-sounding with no low end. But when the seal is obtained, these phones come alive and are hard to match with any headphones at any price. Etymotic encloses two types of sealing devices: the pointed flange and a bulkier foam fitting that expands when placed in the ear. I found the expanding foam to be most effective and comfortable for my ears.

The other two notable achievements in headphone technology come from Shure Brothers, Evanston, Ill., and HeadRoom Corp., Bozeman, Montana. Even though each has introduced headphone amplifiers that achieve new levels of sonic quality, I don't consider them competing products. Each has its niche and those who use headphones in serious applications might want both.

The Shure FP22 (\$375 list) is a one-pound, battery-powered stereo amplifier that's sort of the Swiss Army knife of headphone monitoring. You can input about anything (monitors up to three audio sources) and output about anything (it has a pair of quarter-inch or mini-3.5 mm stereo jacks for phones). It has loop-through quarter-inch stereo phone jacks, which can be internally switched to become separate left and right inputs, and loop-through mono XLR connectors that are mic/line switchable.

## Excellent sound

Although the FP22 can do a list of tricks that would take a couple of pages to outline, one of its most significant achievements is in sonic quality. Part of a new generation of super quiet Shure electronics, this headphone amp is 16 dB quieter

than its predecessor, the mono FP12. Here's a utility headphone amp so quiet that you can take it home for serious headphone listening on your hi-fi system.

The HeadRoom portable amplifiers (from \$199 to \$399 list) are designed for audiophile listening with good quality headphones. Each of the three models attacks the inherent problem of missing spatial localization in headphone listening.

Through a circuit called an "Audio Image Processor," HeadRoom processes the audio to recreate the natural delays and equalization one normally hears with a pair of speakers. Rather than simply

sending the left channel to the left ear and the right channel to the right ear, HeadRoom's circuit provides a cross-feed delay and EQ signal path between channels.

In a "white paper" explaining its technique, HeadRoom is quick to point out that it does not solve the "in-head localization" problems of headphones. "To do this you must recreate all localization cues," the company said. "But HeadRoom does correctly 'lateralize' the audio image."

For all the technical talk, HeadRoom is a clear advancement to serious headphone listening. The Audio Image Processor

offers a subtle, yet distinct, sonic improvement. The sound is fuller and more natural with a vivid sense of depth. And there's not a trace of fatigue after sustained listening. HeadRoom amps make a cost-effective, high quality personal listening station in the studio, at home or on the road.

For more information about these products, contact Etymotic Research at 708-228-0006; Shure Brothers at 800-25-SHURE; and HeadRoom Corp. at 800-828-8184. HeadRoom, through its Perfect Portables division, also is a dealer for the Etymotic Canal Phones.

□□□

Frank Beacham is a writer, director, producer and consultant. His address is 163 Amsterdam Ave. #361, New York, NY 10023.

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World Radio History

STATION SKETCHES

# Finding the Path to AM Modulator Repair

by Tom Vernon

Part I of II

**HARRISBURG, Pa.** A properly functioning modulator section is important to maintaining the efficiency of an AM transmitter.

Failures in this stage can range from

employ about 10 dB of feedback. Beyond the feedback loop are the modulator tubes, modulation transformer, modulation choke and blocking capacitor.

**Open circuit**

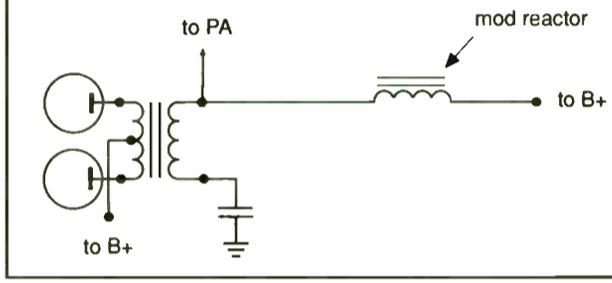
The choke acts as a short circuit to average plate current and an open circuit to audio. The blocking capacitor, on the other hand, passes plate voltage and acts as a short circuit to audio. A simplified diagram of these components is shown in Figure 1.

Beginning with a thorough visual inspection saves a lot of time. Check for overheated components or loose connections to the transformer, reactor and mod capacitor. Also check carefully for cold solder

connections on the feedback ladder if it has been disturbed before.

The problem should be quickly isolated to one of three areas of the transmitter: the feedback ladder, the modulator itself or the rest of the transmitter. Problems in the feedback ladder seem to be the most common source of difficulty. Often

Figure 1. - Simplified diagram of modulator in conventional high-level plate modulated AM transmitters.



subtle (sometimes not-so-subtle) degradation of noise and distortion figures to tripping overload relays that cause a total transmitter shutdown.

It is best to isolate the problem to one part of the transmitter before beginning detailed troubleshooting.

The modulator is nothing more than a large audio amplifier, with a negative feedback loop running from the primary of the modulation transformer back to the secondary of the input transformer. This feedback has the effect of reducing noise and distortion and improving linearity, which it does at the expense of reduced gain.

Most high-level, plate-modulated transmitters

Figure 3a. - A shorted secondary on the modulation transformer can be circumvented with this arrangement. Note that connection for the PA is now between mod capacitor and reactor.

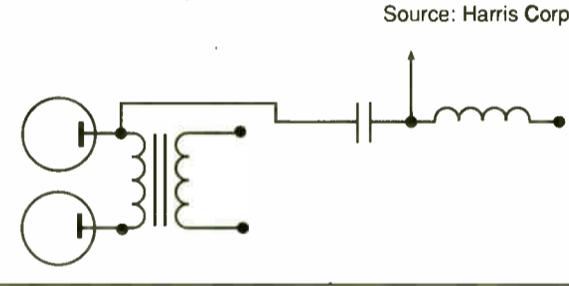
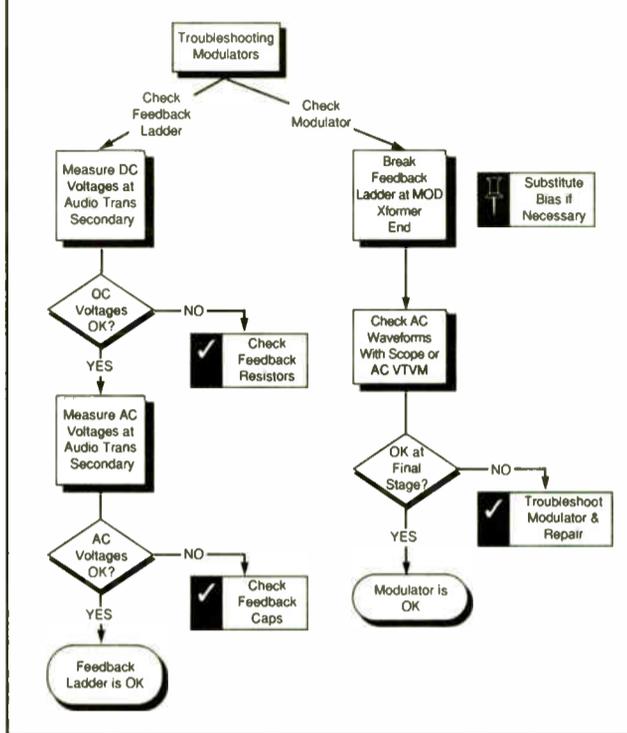


Figure 2. - Pictorial representation of steps in troubleshooting modulation.



modulation, and then check the AC voltages at these same points. Differences of more than 2 percent here point to a bad capacitor. Substitute a known good capacitor if one is available.

You also may make a quick check for feedback problems by measuring the audio input level for 100 percent modulation at 1 kilocycle. Typically this is around +10 dB. If 100 percent modulation occurs with +7 dB or less, this also suggests feedback problems.

When investigating modulator problems, always remember that while there are two feedback paths, they are not isolated from one another. This is due to

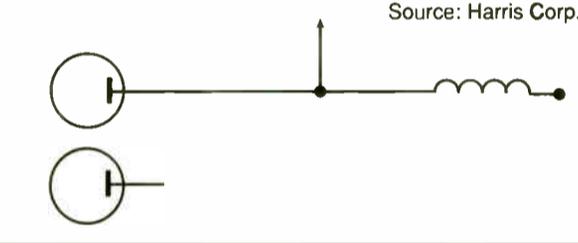
resistors will drift out of tolerance or capacitors will open or short.

**Measuring DC**

Begin by measuring the DC voltages from ground to the point where the feedback ladder connects to the input transformer. These two readings should agree within 2 percent. If they do not, check the feedback resistors one by one. It may be necessary to lift one end of the resistors if capacitors are paralleled across them.

The next step is to modulate the transmitter with a 1 kHz tone at 50 percent

Figure 3b. - With this arrangement, the transmitter may be operated with an open modulation transformer primary.



autotransformer action by the modulation transformer. Problems may appear to be in the left side of the modulator but are actually on the right side. Do not be fooled—check components on both sides.

**To the modulator**

When the AC and DC feedback voltages are correct, move on to the modulator itself. Begin by breaking the feedback ladder at the mod transformer end. Check the schematic to see if the first audio stage is biased by the feedback ladder. If so, a bias box or a small power supply will have to be substituted.

Modulate the transmitter at 100 percent, being careful to reduce the audio input level to compensate for increased modulator gain. Use an AC voltmeter or oscilloscope and check voltages/waveforms on each side, looking for differences between the two. Do not be overly concerned if the DC voltages are different, in an AC coupled circuit this is normal.

If you get to the last audio stage and voltages and waveforms match up, check the modulated waveform again. If it is distorted, the problem is outside the modulator feedback loop. A pictorial representation of these steps is shown in Figure 2.

Outside sources include the modulator tubes (which you should first check by substituting with a new set), the modulation transformer secondary, HV power supply, mod reactor or capacitor or PA stage.

An inefficient transmitter has to work continued on page 33 ▶

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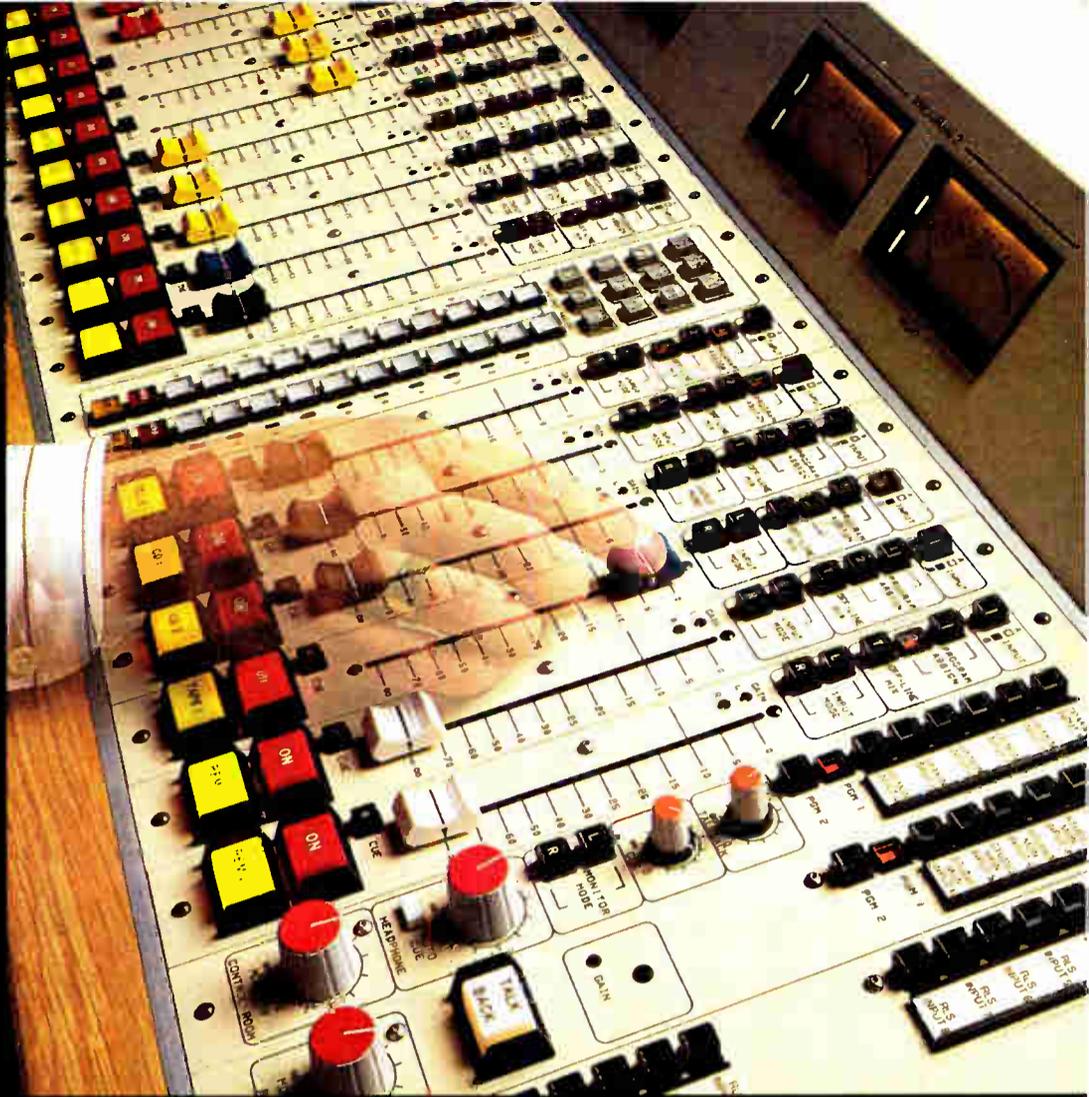
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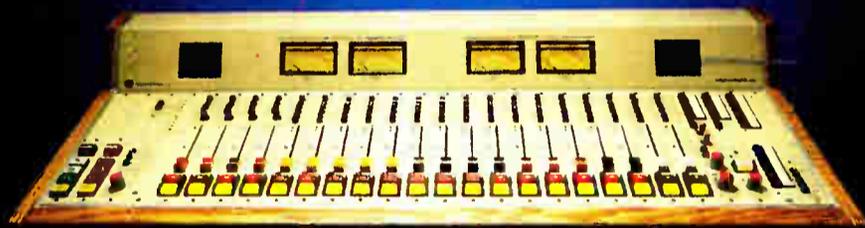


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*The Digilink screen above is in Japanese, one of the many languages that Digilink 'speaks,' and is reprinted with the permission of Otaritec*

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# WORKBENCH

## Circuit Helps Produce Quality Air Checks

by John Bisset

**FALLS CHURCH, Va.** Most stations have an air-check recorder to capture those golden comments from the air staff. For most stations, the air-check machine is an inexpensive piano-key-controlled cassette recorder, with its motor wired through the normally open contacts of the studio muting relay.

This system works, as long as the jocks don't "swerp" their first words by keying the mic too quickly and not giving the motor enough time to come up to speed. Art Crane, a contract engineer in Arizona, had a station where the general manager wanted to solve the problem by hooking up his high-quality stereo cassette as an air-check machine.

Unfortunately, higher-quality machines that use soft-touch controls are not directly compatible with the mute relay. The mute relay provides a continuous contact closure, as long as the mic is on. The more expensive deck needs a pulse to start the machine, and another pulse to pause.

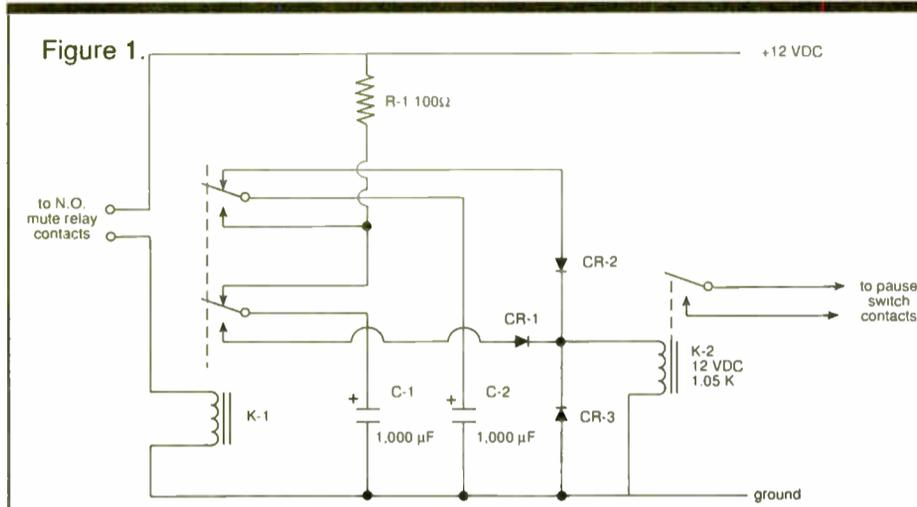
An edge-sensing, one-shot trigger circuit solves the problem. This circuit generates a momentary contact closure when the console mute relay is energized

(mic turned on), and another momentary closure when the mute relay is de-energized (mic turned off). This momentary closure circuit should be wired in parallel with the "pause" switch if there

is no remote-control plug. The circuit shown in Figure 1 uses two relays. Capacitor C-1 charges up through a normally open contact set on K-1 almost immediately, though it is current-limited by R-1. When the console mute relay closes, K-1 energizes. This allows C-1 to

discharge through K-2, a reed relay with 1,050 ohms of coil resistance. This combination assures that the reed relay will close for approximately one second.

With K-1 energized, C-2 charges up.



is no remote-control plug.

When the mute relay opens, K-1 drops out and allows C-2 to discharge through K-2, generating another one-second pulse. CR-1 and CR-2 isolate the K-1

When the mute relay opens, K-1 drops out and allows C-2 to discharge through K-2, generating another one-second pulse. CR-1 and CR-2 isolate the K-1

contact sets from each other.

Remember that if the mic key is pressed and then released in less than one second, the leading and trailing edge pulses will overlap, creating only one pulse of something less than two seconds duration. This will throw the start/stop sequence of the pause control out of sync.

Art Crane can be reached at Desert RF Engineering, 602-453-3546.

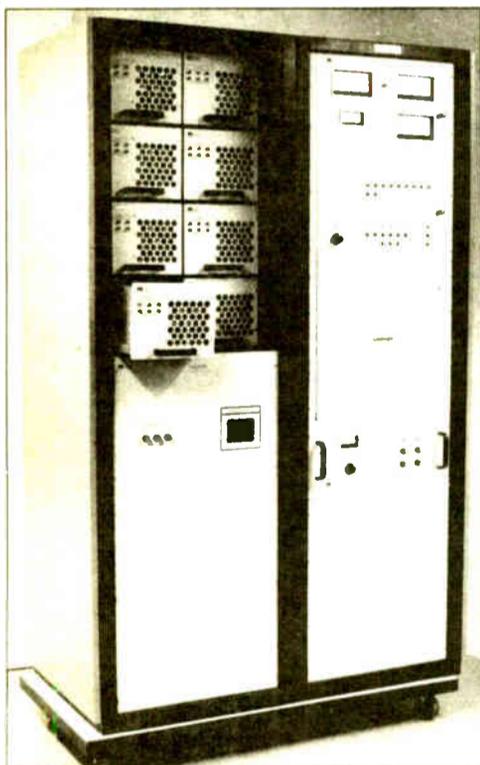
★ ★ ★

Art's circuit reminds me of a similar application from one of the Metro Traffic engineers. A remote traffic reporter needed a way to start her own cart machine via the radio loop feeding the recorder. A touchtone keypad was wired into her mixer and samples of the audio feeding the cart recorder were fed into a PLL decoder circuit.

She was instructed to press a certain key on the keypad and hold it for two seconds. She could start her report when she released the key. The output of the decoder circuit was fed to a relay coil, which, when recognizing the proper tone, pulled in the relay. The contacts were wired so that the wiper of this relay ran to an electrolytic capacitor.

When the relay pulled in, the wiper was continued on page 35 ▶

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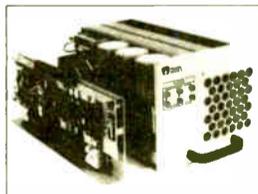
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## KEYBOARD CONNECTION

# COMDEX Displays Software Solutions

by Barry Mishkind

**TUCSON, Ariz.** If you think 50,000 people crawling around the spring National Association of Broadcasters Convention is a crowd, you should try 200,000, which is how many showed up for the annual COMDEX computer show, also in Las Vegas. Last fall's show gave new meaning to the word "zoo."

But as menageries go, this one was especially useful, especially for those looking for the latest computer software products and upgrades.

The trend toward "suites" or packages of related programs was one of the big

stories at COMDEX. Combination word processor/spreadsheet/databases, sometimes including presentation graphics or e-mail, are among the packages available.

Microsoft's Office 4™, Lotus' SmartSuite 2.1™ and the Borland Office 2.0™ incorporating WordPerfect™ 6 are three examples.

The main advantage of a suite is easy interaction between applications. The combined price is often less than half the total of the separate programs. For information, contact Microsoft, 800-426-9400; Lotus, 800-343-5414, or Borland, 800-336-6464.

Swfte's three Typecase™ collections can help spice up your letters and presentations. Each has 100 to 130 type fonts along with a font management utility. The price is about \$30—a CD-ROM combines two sets at cost of about 13 cents per font.

Swfte also produces computer card games and an interactive Civil War game. For information, contact Swfte at 302-234-1740.

Microsoft Works™ is a less-complex, but excellent package. It combines competent word processing, spreadsheet, database and telecommunications capabilities.

Microsoft also unveiled a re-engineered Microsoft Mouse at COMDEX, which is guaranteed to be more comfortable. Otherwise, you can take a vacation from mouse and keyboard with the Microsoft Windows Sound System™. Its Voice Pilot allows you to command your computer by voice recognition.

If you have ever been burned by a wrong-format disk, Pacific Micro's Mac-In-DOS™ (available for DOS or Windows) allows any PC to read diskettes written on Apple Macintoshes. For information, contact Pacific Micro at 415-948-6200.

DeLorme, producers of Street Atlas USA™ and MapExpert™, have upgraded both programs and added Global Explorer™ to their line. These programs can be used to determine distances and angles between locations, create street and coverage maps, and locate destinations before you leave the office. For information, contact DeLorme at 207-865-1234.

DCA showed Crosstalk for Windows™ 2.1, a new version at a lower price, meant to solve the problem of high-speed communications from inside Windows. Another enhancement is "QuickPads," an easy way to set up custom buttons and icons to do repeated tasks. QuickPads will set up your own personal menu and launch other programs at will.

The sales department might be interested in Software Publishing's Harvard Graphics™ 2.0 for Windows, which lets you add sound, even music to your sales presentations. Harvard Graphics is designed to be easy to use. If you get stuck, there is a live "Advisor" available to answer questions on design or layout. The system also automatically provides

interactive advice features, such as a "5-Minute Coach" and a program to give interactive tips with options at each point.

Another SPC product, Superbase™ 2.0, will interest those in your facility who develop databases. Superbase makes it easy to design applications where you link a picture or sound to a file. Cataloging sound effects, spots, musical intros and hooks are possible applications. For information, contact SPC at 408-968-8000.

With all the Windows-intensive products (COMDEX was stuffed with multimedia programs and applications), you might want something to speed up graphics displays. The Volante Warp 20™, part of NDI's line of graphics accelerators, will zip things along. For information, contact NDI at 800-253-8831.

Many start a new year by resolving to be more organized and efficient, and purchase those pocket calendars, appointment books, portable electronic calendars and notebook computers. Pretty soon, all of that stuff is just more clutter on the desk. Desktop and laptop computers can be a more effective alternative.

DacEasy uses the familiar Rolodex® file as the basis for Rolodex Live!™ (for DOS) and Instant Rolodex™ (Windows). You can scroll through a name list and update it right on the screen, and quickly find any specific person or pattern of persons. It also prints out address labels and envelopes, and even dials your phone. For information, contact DacEasy at 800-877-8088.

PackRat displays your free time on any given day, and prints out a list of the appointments for the day or week. It also links to your word processor and sends faxes to anyone on your list. The latest version (5) hooks into the new business card readers, which automatically enter information from cards into the database. For information, contact Polaris at 619-592-7400.

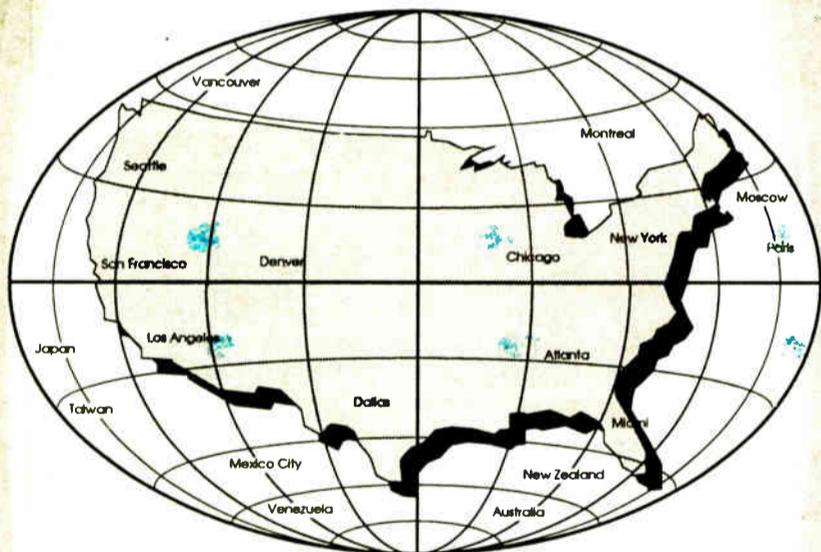
PS-SIG's current CD-ROM shareware (version 12), carries no less than 39 calendar programs, as well as several dozen low-cost scheduling and contact manager programs. PC-SIG also publishes Shareware Magazine, which features product reviews and comparisons. For information, contact PS-SIG at 408-730-9291.

□ □ □

Barry Mishkind, can be reached at 602-296-3797 or on FidoNet at 1:300/11.3 or "barry@coyote.datalog.com" on Internet.

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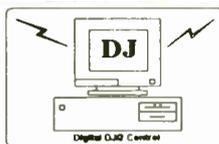
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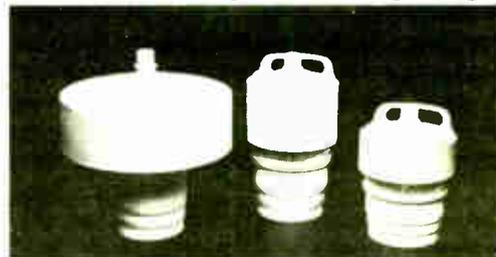
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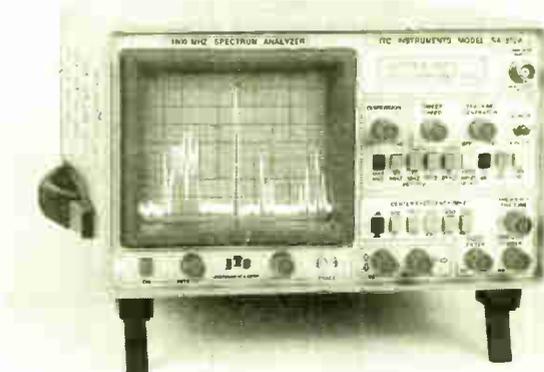
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READER SERVICE NO. 164

# Easy IFB Solution for Switched 56

by Andrew Ellis

**SAN FRANCISCO** Switched 56 (S/56) systems provide two-way broadcast quality audio on 56 kilobits per second (kbps) (or faster) digital phone lines. The remote site still must make a separate phone call to set up the broadcast. A simple solution to this is to use Interruptible Feed Back (IFB).

essential to making the system work. Anyone who has ever shouted himself hoarse trying to get the attention of someone who promised that "I'll be listening in cue" can testify to this.

### System operation

Figure 1 shows a block diagram of the system. The S/56 line connects to a Digital Service Unit (a DSU), which oper-

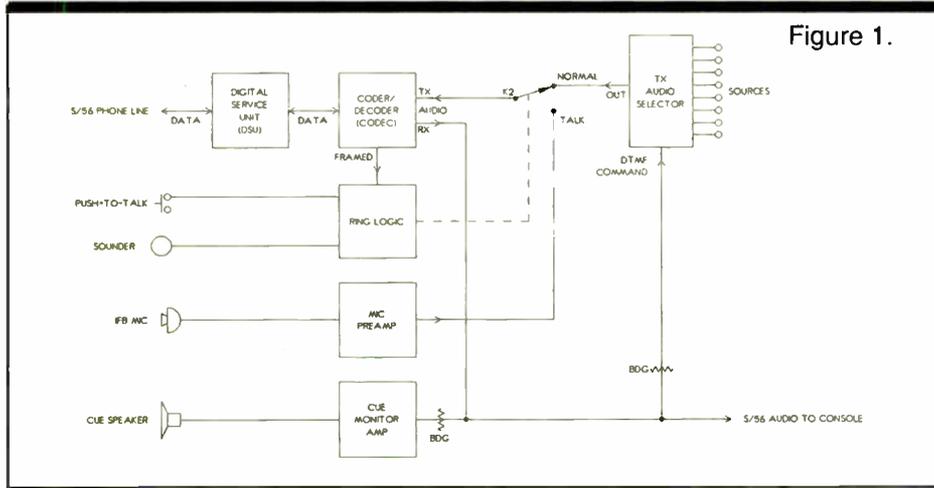


Figure 1.

Widely used in television, IFB makes a single audio channel from studio to remote site serve two purposes—two-way communications and program cue return.

At KCBS(AM)-KRQR(FM), we have several S/56 and ISDN (the big brother of S/56) lines. They connect with remote S/56 sites at our local news bureaus, ballparks and entertainment venues. Our

ates like a modem to provide dialing, answer and disconnections. Two-way data flows between the DSU and the codec, which converts it to separate transmit and receive audio paths.

The transmit audio selector uses DTMF tones from the remote site to choose which audio the studio sends back to the remote. You can build or buy DTMF-

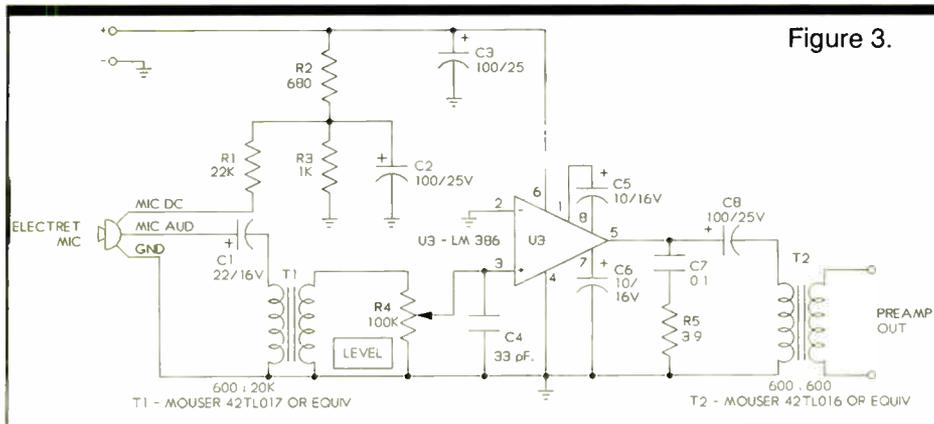


Figure 3.

heavy use of S/56 demanded that the systems be easy to use. We also wanted setup communications to be on the systems themselves rather than on separate phone calls.

Since S/56 provides two-way connections, it is easy to send pre-delay or mix-minus audio to the remote site for cuing. At KCBS-KRQR, we use a DTMF-controlled audio switcher to do this, allowing the remote user to select his or her own return audio. However, this does not address the requirement for two-way conversation between studio and remote talent.

We designed a small IFB system to address this need. It allows the studio producer to interrupt the S/56 return feed and talk with the remote site. For two-way conversation, the producer simply listens to the incoming S/56 audio in cue.

Because users are most comfortable with familiar systems, we built the IFB to operate like a telephone: When the remote site connects with the studio, the interface "rings" until the producer "answers" by pressing the talk button. In reality, the call is connected even before the ring, but it ensures that the call will get the attention of the newsroom staff. While the ring may seem trivial, this kind of signaling is

Figure 2 shows the schematic of the "ring" circuit and audio switching, while Figure 3 shows the microphone pre-amp. IFB does not need a broadcast quality microphone and pre-amp since they are only for cuing and communication.

As shown, the IFB system has only one control point and serves a single S/56 system. At KCBS-KRQR, a more elaborate version allows multiple IFB control points and simultaneous multiple S/56 conversations. However, most stations probably will find this version adequate. Anyway, it's easy to expand either the number of control points or S/56 systems as needed.

In Figure 2, the "framed" contact closure

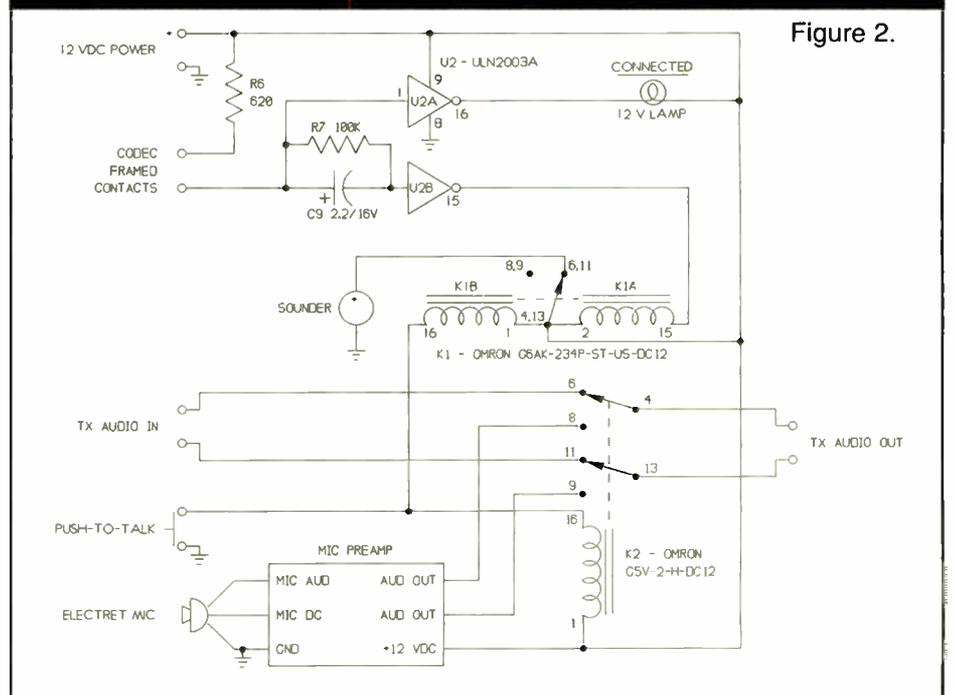


Figure 2.

drives the inputs of U2A and U2B high. Driver U2A lights the "connected" indicator light to show that the system is in use. C9 differentiates the high at the input of U2B and sets latching relay K1, which beeps the piezo sounder. K1 may be any suitable dual-coil latching DIP relay. We used a Mallory SC616CP sounder, which features a chime tone, but other types are suitable.

### Simple pre-amp

When the push-to-talk button is pressed, it pulls in K2, substituting microphone audio for the selected S/56 transmit source. It also resets K1, silencing the sounder. While earlier versions of this system used CMOS logic throughout, latching relays have several advantages: they are inexpensive, non-volatile and can drive lamps or other large loads directly.

Figure 3 shows the simple microphone pre-amp. A commercial unit would work just as well. T1 can be any common

microphone transformer. An LM-386 amplifier is set to a gain of 200 by C5. Network R1-R2-R3-C2 provides filtered power for the electret microphone. Some electret elements have three wires—ground, audio and DC power—while others have only two. Jumper the audio and DC connections together for two-wire elements.

Gain control R4 may be a screwdriver-adjust type. It is set so average speaking voices come out at comparable level to the program audio they replace.

We built the system (including the microphone) in a 4-inch by 4-inch by 2-inch metal enclosure of the type sometimes derisively known as a "Buck Rogers Box." A small wall plug, like those used for calculators, provides power. A supply rated for 12 VDC at 200

mA or more should be adequate.

Though we designed this circuit for S/56 lines, it can also work with RPU systems or other types of two-way program links. Using a single link for communication and program simplifies operation and saves money.

Remember the "I" in IFB: When the studio person is talking, the remote talent's cue audio is interrupted. Studio staff must be careful not to interrupt the outgoing cue audio just as the anchor throws a cue to the field reporter. Still, with judicious use IFB can help S/56 deliver on its promises of audio quality and operational ease.

□ □ □

Andrew Ellis is assistant technical supervisor of CBS-owned KCBS(AM)-KRQR(FM) San Francisco. In addition to a B.A. from Stanford University, he has earned a senior AM/FM engineer certification from the SBE. He can be reached at 1025 Ordway St., Albany, CA 94706.

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## CONTRACTOR'S FORUM

# Radio Stories from a Veteran CE

by Thomas Osenkowsky

## Part I of II

**BROOKFIELD, Conn.** I have had a number of experiences with various aspects of AM and FM broadcast transmission equipment and methodology. In a somewhat random order, here are a few related stories that the reader might find insightful.

When I took the reigns as a chief engineer of a non-directional AM and Class A FM station some years ago, I noticed that the 2.5 kW FM transmitter had sustained several lighting hits. A melted plate voltmeter and power outmeter were the most noticeable damage.

This poor FM transmitter had no air filter installed, but I felt that the lightning hits were unrelated to that.

The AM ATU, as it turned out, was operating with a "Hillis Holt," home-brew static drain coil. An old timer named Hillis Holt made a number of these coils, which were half-inch copper tubing wound around a garage can, supported by four Plexiglass legs. Tower lighting wires and directional antenna sample lines were placed inside the tubing.

As the old saying goes: "A static drain coil is only as effective as the ground it is connected to." In this case, the ground strap connected to the bottom of the coil was blown off by lightning. The ground strap was soldered to the coil using plumber's acid core solder.

After the ground was repaired, no further lightning damage occurred at this station.

**Spurious radio**

In another case of improper grounding, I was recently called to investigate spurious radio from a Class B FM station using a "hot" 500-watt AM tower. The problem was that the FM station was appearing not only at its carrier frequency, but at two frequencies located plus and minus the AM station frequency.

The usual remedy for this condition is to use double-shielded coaxial cable from the stereo generator output to the RF exciter input.

In this case, the FM station used two separate Optimod 8100As which fed two separate 10 kW FM transmitters. One exciter was a Harris MX-15, and the other a Gates TE-3. Both experienced the same problem. Most modern stereo generators have balanced or floating composite outputs while the modern exciters have likewise balanced composite inputs.

The station installed two runs of double-shielded cable, and the spurious emissions dropped from -61 dB to -65 dB, exceeding the FCC limit of -80 dB. In fact, when I disconnected the composite cable from either exciter input, the problem remained. The spurious emissions would only cease when the AM plates were shut off.

Investigation of the tower base revealed a properly installed isocoupler, but the ATU was found to be mission one key connection—a ground strap to the main radial ground ring at the tower base.

Without a good connection to the main ground system, the RF was grounded by the RF transmission line outer sheath back to the transmitter and then back out to the tower via the transmitter's ground strap.

Station personnel connected a ground

strap and spurious emissions dropped to -93 dB. Needless to say, the input impedance of the ATU changed as evidenced by a difference in the transmitter's loading.

I once installed an AM stereo system at a station that had been dark for several months. (As a matter of fact, it was the same station where back in 1975 I first took on the duties of a chief engineer.)

The station sounded very good on the stereo modulation monitor. However, on a car radio in the parking lot and on a portable radio around the station, the signal was crackling and noisy. But it wasn't showing up on the scope connected to the transmitter output, so the rig was not at fault.

The noise was easily heard on stereo car radios out to a quarter of a mile from the station. Using an FIM to track down the culprit, I found that the station's central air conditioner was causing the problem.

The main air supply was ducted to the various rooms using a single main output buffered by an accordion-like vibration dampener. This bellows is made of cloth and is non-conductive. Placing an RG-8 braid across the bellows stopped the noise completely. Apparently some of the ductwork was acting as a reradiator, causing the wideband noise.

It was a cheap solution to a bizarre problem. It reminds me of another story I heard a while back.

A local HAM operator notified an AM station of harmonic radiation he was receiving at his home. The station CE measured his harmonics at the station and found none to exceed FCC limits. The frustrated HAM called the FCC, which sent an inspector to his home.

Sure enough, excessive harmonic radiation from the AM station was measured. The inspector then went to the station, where the surprised CE asked to see the harmonic measurement demonstrated in his presence. Guess what... no excessive harmonics.

Again, there were plenty of measurable harmonics on second visit to the HAM's residence. In the end, the problem was found to be caused by a neighbor's loose rain gutter. The spout was acting like an antenna, making intermittent contact (diode effect) and reradiating the signal.

**More harmonics**

There are two schools of thought on harmonics and spurious radiation. One says that you should measure for harmonic radiation at the transmitter output terminals. The other school says the entire transmission system should be tested.

I believe the entire transmission plant should be thoroughly tested for harmonics and spurious radiation. Your safest way to insure cleanliness is to perform the check both ways.

I was once called by the CE of station located about 20 miles from one of my client stations. The CE claimed that our signal was splattering into his on a radio in a car dealership located close to my client.

The claim proved to be correct. The splatter, 30 kHz from our carrier, was being caused by an intermittently arching common point input coil in the phasor. Once the coil contact was cleaned and lubricated, the splatter disappeared.

Another case of splatter, this one all over the AM band, was caused by a new modulation transformer installed in an older transmitter.

The new mod transformer was not bolted

to the floor—it depended on gravity to keep it still. Electrostatic charges arched to the cabinet and thus the transformer "sang" with the music radiating its garbage all over the band bolting the transformer properly in place solved the problem.

What happens when you design an AM

directional array and everything goes wrong? Are there easy, inexpensive methods to deice FM transmitters? Those questions are answered along with a description of a novel use of a "remote" telephone repair system in the second half of this column, coming soon.

□□□

Thomas Gary Osenkowsky is an SBE certified senior broadcast engineer and NARTE first-class certified engineer. He can be reached at 5 Beachwood Grove, Brookfield, CT 06804.

## FROM THE TRENCHES

by Alan Peterson



## Life in Radio's Fast Lane Remains Just the Same

Dear Luci,

First bit of correspondence for the New Year. Thrilling, isn't it?

Things got quite interesting last month here at the WINK Wadio Wanch. Besides the normal complement of holiday hoopla, we gave away a genuine "Wayne's World" autographed guitar (too bad I couldn't keep it), collected over three hundred thousand pennies in a pickup truck (all donated to charity), and were greeted on the morning of Dec. 14 by a tent set up on our front lawn.

When a jock camps out, it's usually on the station's billboard where he can draw the most publicity. Only, this time none of our jocks had a camping trip planned.

When the tent flap opened, it was the start of a truly *From the Trenches* kinda day. The regional promotions manager for MCA Records, of all people, was who crawled out. His mission: to camp on our lawn until we agreed to add two of his company's releases.

Smaller stations with crummy or nonexistent record service could only wish for a guy like this. Having PD'd and MD'd some real coffee pots in the past, I would have loved some attention.

A rep camped out on the lawn to sell some songs was very different. It made me almost nostalgic for the days ten years ago when some of my friends chained themselves to the fences of nuclear power plants.

This MCA guy was sharp. He was a former Las Vegas station PD and knew what buttons to push to attract attention. The freebie-and-concert-ticket schmooze had become routine, so he needed something else.

Flying banners behind airplanes might have worked, but nearly getting arrested in a red dome tent on the front lawn of a radio station—freezing his li'l record rep rump off in the glorious Capital of Pennsylvania, until WINK 104 saw the wisdom of his ways—turned out to be the plan.

What was he planning for an encore, chaining himself to our STL tower?

Before long, "his" lunch arrived, and Good Golly Miss Molly, what a spread: three large pizzas, hot wings from hell, chicken fingers, liters of soda and a garmongolous cheesecake, all good, healthy foodstuffs right out of the Radio Personality's Basic Food Groups textbook.

He evidently ordered too much (surprise), and invited us to gluttonously lay waste to the smorgasbord laid before us. Ah, the decadence of it all.

Was this enough to convince us to add his songs? Well, actually, we had planned to add one of his company's tunes anyway. But seeing a real, enthusiastic pro put in all of that effort was just too much to resist.

(Personally, I'd have held out for a five-year lease on a '94 BMW, but I suppose that might have been hard to explain to Washington.)

Happy with his job, the jolly outdoorsman pulled up stakes and moved on to his next station, leaving several satiated jocks and office support staff embalmed with cholesterol and hot sauce.

Readers who aren't regularly treated to surprises like this may be wondering about the legality of this fellow's methods. Doesn't it come dangerously close to the "\_ola" word?

Don't worry. Promotions people do far more than this hysterical (though relatively simple) stunt, and it's all perfectly legal, but a killer on the arteries and waistline.

Up-and-coming junior record reps are encouraged to study this madman's methods. May they shower loads of pizza on every station that reads *RW*, and may 1994 be good for all of us.

Until next (burp) month,

-Al

□□□

Al Peterson is production rat for WNNK-FM Harrisburg, Pa., 17110. He appreciates your calls regarding his new gig, VP of PAR Broadcasting in San Diego, but thinks you meant to reach consultant Al Peterson of Peterson Media, who really got the job. Thanks anyway.

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World Radio History

# Doping Can Be Positive—or Negative

This revised course offers an introduction to the theory and practical application of active electronic devices. The course will give examples of how the devices work as well as ideas on how to use them.

Continuing Education Units will be offered to all who register with Northern Virginia Community College. You will be required to read all of the articles and participate in an exam that will be mailed to you at the completion of the course. You can register for the class any time while the series is running in RW.

To register, contact the Community Education Office, Annandale Campus,

8333 Little River Turnpike, Annandale, Va. 22003. The fee for the course is \$30.

Please make every effort to secure all of the articles yourself. Northern Virginia Community College and RW are not in a position to supply readers with back issues.

by Ed Montgomery

Part II of VIII

**ANNANDALE, Va.** Solid state devices work on the principals of controlling the flow of current through, or the application of voltage to semiconductors. Silicon and germanium, the two

most commonly used semiconductors, are crystals that must be manipulated to perform as active devices.

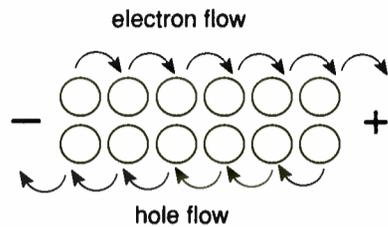
When semiconductors are developed in a controlled environment, they are "doped" to contain an excess or deficiency of electrons. This is done by adding a small amount of impurity to the mix when it is baked in an oven.

The impurity can either add a few electrons to the mix to create a material with

it is added to silicon, an extra electron is produced that will not be part of the covalent bond of electrons already in the crystal. The extra electron can freely move about the crystal permitting it to act as a current carrier.

If boron is added to silicon, it will act as an "acceptor." The outer shell of the boron atom contains only three electrons

Figure 2.



and will take one of the silicon's electrons away. With one electron missing, the silicon acquires a positive charge.

Crystals with excess electrons are known as "N-material" and crystals with a deficiency of electrons are known as "P-material." This is illustrated in Figure 1.

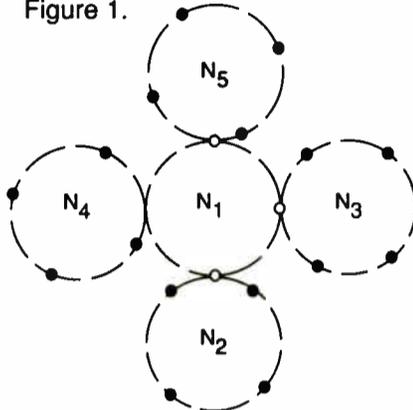
Doping semiconductors requires very small amounts of impurity, sometimes as small as one part per million or billion. Only a trace of impurity, in the range of three to five electrons, enters or is removed from the semiconductor.

Electrons act as the carriers of current in N-material, while the absence of electrons, also known as a "hole," carries the current in P-material. What is actually taking place with P-material is a movement of electrons when voltage is applied. The acceptor takes some electrons out of the material, creating a charge imbalance.

If the electrons move in one direction, the absence of electrons will move in the opposite direction, developing a positive current flow. This is illustrated in Figure 2.

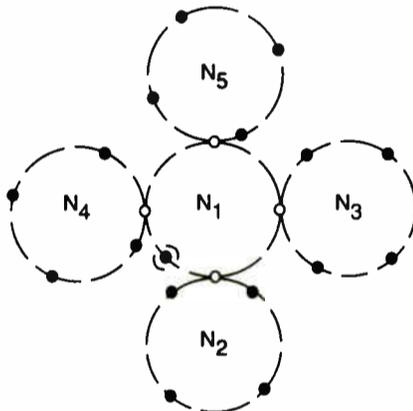
Semiconductor material can not be made absolutely pure. Unwanted holes are produced in N-material and unwanted electrons are present in P-material. These defects, known as "minority carriers," produce a very small current that flows in the opposite direction of the intended current flow. This is a characteristic of semiconductors that is not present in the vacuum tubes they replaced.

Figure 1.



Above: An example of N-material with an extra electron added to the valence, or outer orbit, of atom N<sub>1</sub>.

Below: An example of P-material with one of the four electrons removed from the valence of atom N<sub>1</sub>.



a negative charge, or it can take away a few electrons, resulting in a positively charged element.

Arsenic is known as a "donor." When

continued on page 36 ▶

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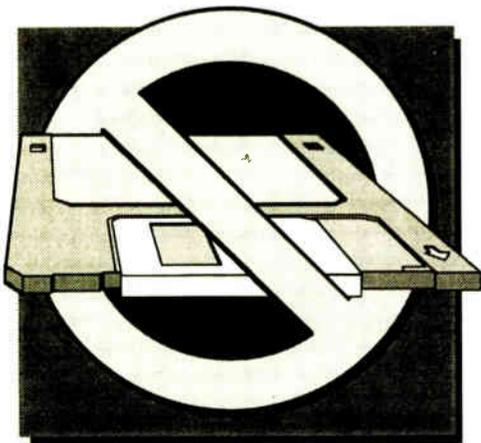
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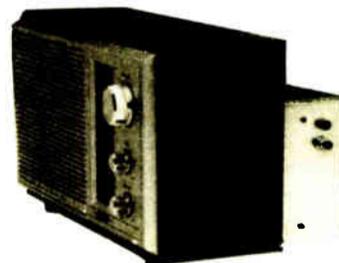


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- ON THE AIR:** Shows 'I WONDER WHY' by STIGERS, CURTIS. A large digital clock displays '24'. Below this, it shows 'Time: 4:06', 'Intro: 28', and 'End: F'. A callout box notes: 'ENDINGS ARE CLEARLY SHOWN AS Cold (C) OR Fade (F)'. Another callout points to the clock: 'LARGE COUNTDOWN clock SHOWS THE EXACT TIME BEFORE THE VOCAL BEGINS! It CAN'T BE WRONG!'.
- READY TO AIR:** Shows 'Raid Max' by DCS. It includes 'DIGITAL AUDIO' and 'Mode: STEREO'. It also shows 'Spot: 7021', 'Sked at: 02:51P', and 'Sked on: 01/04'. Below this, it shows 'Time: 0:29', 'Intro: 00', and 'End: C'. A callout box notes: 'TOTAL TIME, INTRO LENGTH, ELAPSED TIME, AND ALL IMPORTANT INFORMATION IS ALWAYS CLEARLY SHOWN.'
- NEXT TO FOLLOW:** Shows 'CERTS' by DCS. It includes 'DIGITAL AUDIO' and 'Spot: 7036'. It also shows 'Sked at: 02:51P' and 'Sked on: 01/04'. Below this, it shows 'Time: 0:30', 'Intro: 00', and 'End: C'.
- System Panel:** A purple box on the right contains 'System AUTO | SEGUE', 'LOADING: 1', 'LOGGING: ON', and 'TIME UPDATE'. A callout box notes: 'GET HELP AT ANY TIME WITHOUT INTERRUPTING ANY PART OF THE PROGRAM'.
- Function Keys:** A list of function keys is shown: 'F1 Help', 'F2 Manual', 'F3 View Events', and 'F4 Edit Events'. Callout boxes explain: 'Switch TO MANUAL play if you NEED OR CHOOSE TO STOP THE PROGRAM' (pointing to F2) and 'EDIT EVENTS ALLOWS ACCESS (CAN BE PASSWORD PROTECTED) TO SCHEDULE TO FIND SONGS BY TITLE, ARTIST, OR LENGTH ON THE FLY IN REAL TIME WITHOUT INTERRUPTING play.' (pointing to F4).

At the bottom of the interface, it says 'Copyright 1990 - 1994 TM Century, Inc. Dallas, Texas'.

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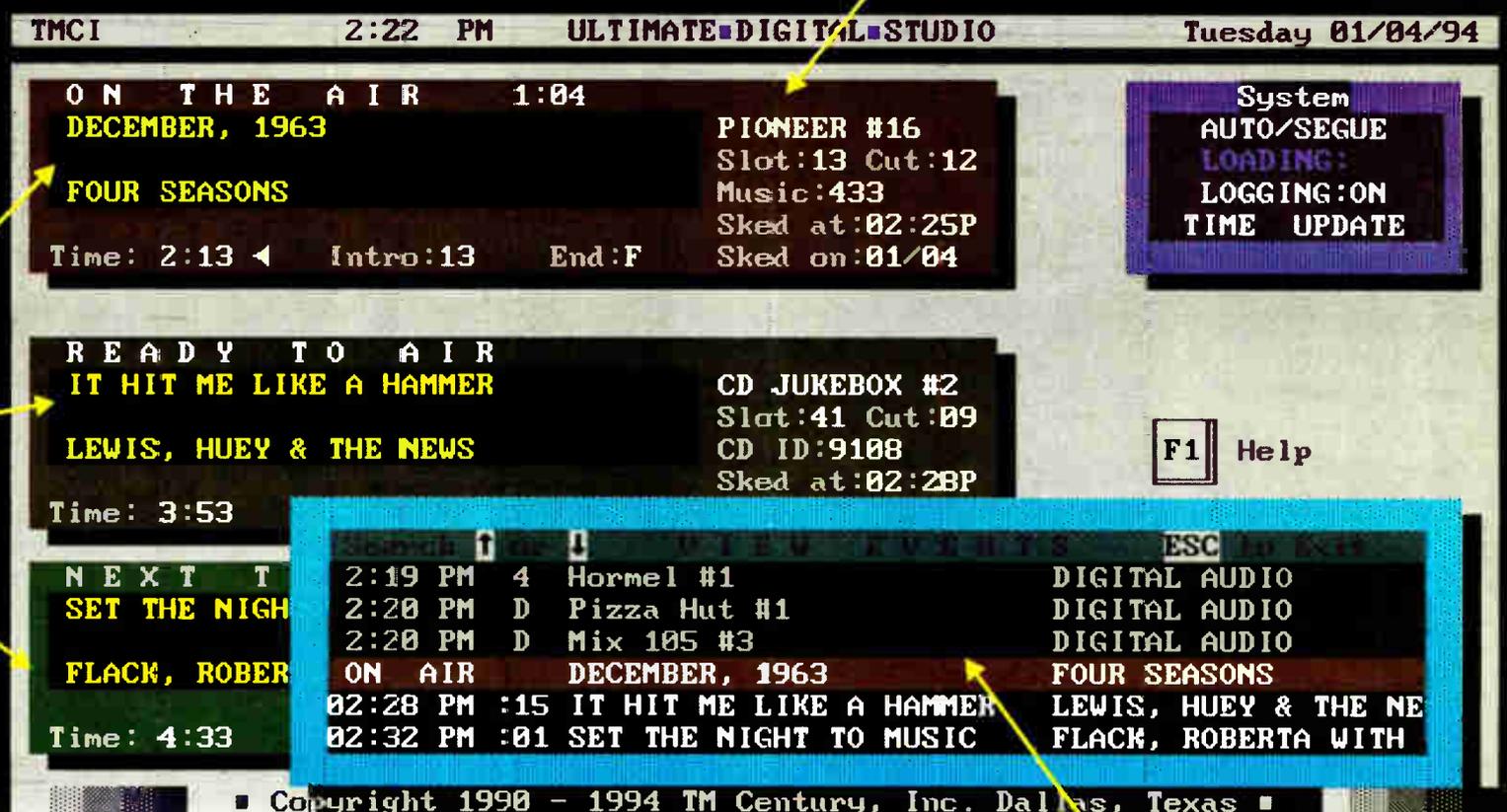
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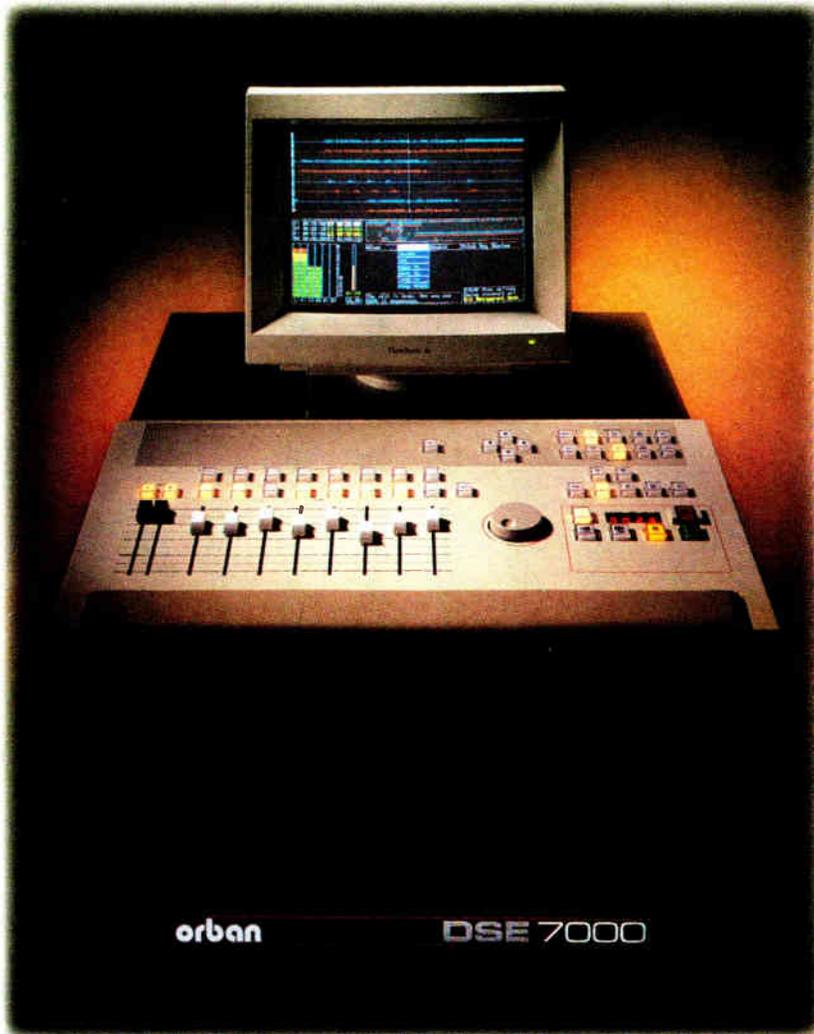
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Pepsi's got a lot to give...Wake Up,  
Maggie, I think I've got something to  
say to you...Peace is at hand...Bye, Bye,  
Miss American Pie...I am not a crook...  
I shot the sheriff...Plop Plop, Fizz Fizz...  
Tramps like us, baby we were born to...  
Hi, I'm Jimmy Carter...Ah, Ah, Ah, Ah  
Stayin' Alive, Stayin' Alive...No  
Nukes...Are you better off than you  
were four years ago?...Have a Coke  
and a smile...She's got, Bette Davis  
eyes...Where's the beef?...Beat it!...Beat  
it!...Four more years...What's love got to  
do with it?...Gorby! Gorby!...We are the  
world, we are...The ultimate driving  
machine...The Dow fell over 500 points  
today...I'm Tom Bodette for Motel  
Six...we'll leave the light on for ya...  
That's "potatoe" with an "E"...You got  
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# Block Background Hum From Mics

► continued from page 23

connected to +24 VDC. When the tone ended, the relay dropped out and the wiper contact moved to the normally open pair of contacts. A 24-VDC relay coil was connected to ground through these contacts. This second relay provided the "cart-start" contact closure, which occurred as the capacitor discharged through this second relay coil.

The system worked flawlessly. In fact, it performed so well that the air talent stopped checking the carts after they were recorded, to make sure the report sounded fine. That all changed the Thursday morning when the traffic reporter accidentally ended her report by giving a competitor's calls and slogan—and it wasn't even April 1.

★ ★ ★

Christopher Scherer at WDOK(FM) Cleveland writes about some otherwise excellent Shure and Electro-Voice mics that tend to pick up background hum. Chris found that the metal case of the microphone, as well as the metal windscreen, were connected to the ground pin of the XLR connector for shielding.

As a mic ages, the mechanical connection for a solid ground weakens. A poor ground connection to the metal wind-



screen turned out to be the problem with Chris' mics. He disassembled them and used a wire brush on the inside threads of the windscreen. Chris got rid of his oxidation problem using the wire brush, but further oxidation was not arrested.

I spoke to Diane James at Caig Laboratories regarding application of Caig's new DeoxIT® to minimize further oxidation. DeoxIT was designed for just this kind of problem.

Caig Labs has agreed to send some DeoxIT wipes to Chris at no charge to try with his mics. We'll look for a follow-up report later this year. Christopher

Scherer can be reached WDOK by calling 216-969-0123.

★ ★ ★

Robin McDaniel, chief engineer at KJRG(AM) Newton, Kan., sends a creative suggestion. Robin uses a clipboard as a third hand when soldering. The clipboard works better than vise grips or a rubber band wrapped around a pair of needle-nose pliers. The clipboard spring is strong enough to hold the parts firmly, but not strong enough to damage the parts you are soldering.

I took Robin's idea a step further and added a couple of Velcro strips to the back of the clipboard and affixing the mating Velcro to the workbench top. Now the clipboard doesn't move around when soldering, but it can be moved in case I need to solder away from the workbench.

Robin McDaniel can be reached at 316-283-5150.

★ ★ ★

If you are a contract engineer that visits smaller-market stations, you know the look—the junior technicians almost begin drooling as you break out your shiny new DVM or oscilloscope, tools of the trade that we take for granted. Oh, to own a clip-on ammeter!

If you have a tight budget, Fluke has the Model 30 (list price \$99), which will withstand a six-foot drop. It measures AC current up to 400 amps and up to 600 VAC. The meter has tapered jaws for easy access in crowded junction boxes. In addition to improved accuracy, a "hold" button freezes the display for easier interpretation.

For information, contact Fluke at 800-87-FLUKE; or circle Reader Service 213.

★ ★ ★

With all the static that emanates from Capitol Hill, you may wonder why anyone is living in the Washington area. If you're an AM broadcaster, one attraction is an electric company that is very aggressive when it comes to complaints about RFI from power lines.

Potomac Electric Power Co. (PEPCO)

## AM RF Troubleshooting

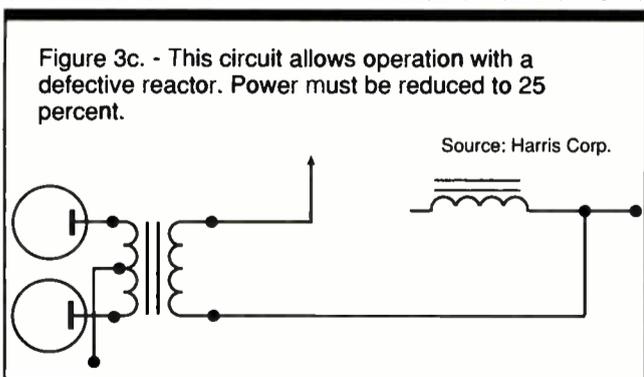
► continued from page 20

harder to make 100 percent modulation, and this can reveal itself in the form of degraded modulation waveforms.

An open or shorted mod transformer or reactor is often a source of trauma, especially if there are no replacements on hand. However, it is no reason to be off the air. If the transformer shorts to its case, it is a simple matter to isolate it from the transmitter cabinet with a block of wood until a permanent replacement can be obtained.

A shorted secondary on the mod transformer can be circumvented with the arrangement shown in Figure 3a. Here the modulation capacitor is connected between one side of the primary and the feed going to the PA. Use the circuit in Figure 3b to stay on the air with a defective primary winding of the modulation transformer.

A defective modulation reactor requires more drastic steps. Power has to be reduced to about one quarter. Take both the reactor and capacitor out and wire the free end of the modulation transformer to



the HV supply, as shown in Figure 3c. None of these arrangements will result in ultimate quality audio, but it is better than a dead spot on the radio dial when your station is off the air.

□ □ □

Tom Vernon divides his time between consulting and completion of a Ph.D. He can be reached at 717-367-5595.

has an entire department devoted to tracking down and solving RFI/TVI problems. Michael Martin, PEPCO's chief interference investigator, told a recent Society of Broadcast Engineers gathering that they handle about 500 power-line interference complaints a year.

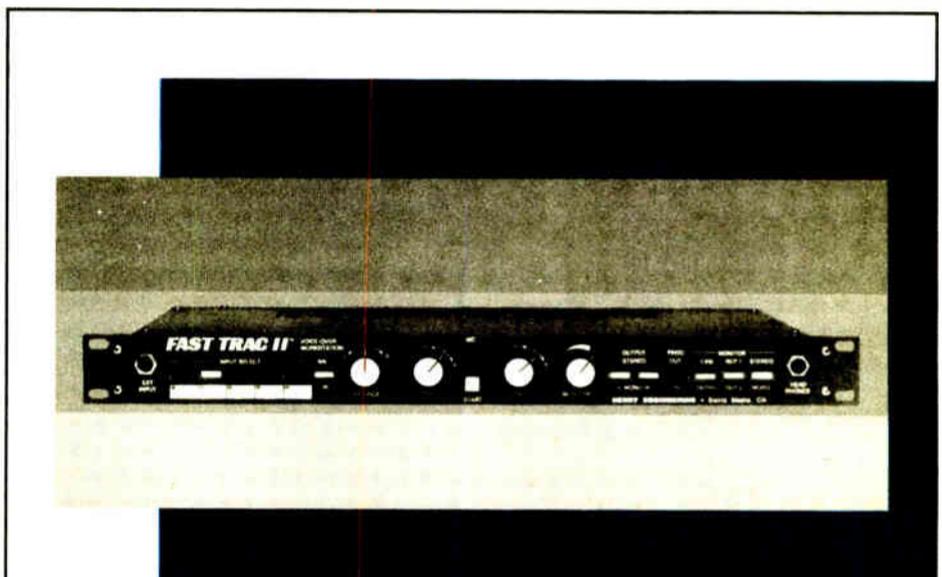
Only 20 percent of the complaints actually turn out to be caused by power lines, Martin says. Another 5 percent are caused by CB/amateur/commercial transmissions, and the rest were problems caused by the customers' own equipment: light dimmers, electric blankets, bad air conditioner contactors and even aquarium heaters.

Mike has prepared a paper on procedures for troubleshooting RFI/TVI caused by power lines, based on PEPCO's experience. It might be helpful to station engineers, or to pass on to your local electric company. A written request will get the paper to you quicker. Write Michael Martin, PEPCO, Substation Test Electronics Division, 3300 Benning Road N.E., Washington, DC 20019.

For more information, circle Reader Service 197.

□ □ □

John Bisset is a principal in Multiphase, a contract engineering and projects company. Workbench submissions can be mailed to RW, or faxed to his attention at 703-998-2966. Published submissions qualify for recertification credit for all levels of SBE certification.



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# BURK

TECHNOLOGY

Circle (102) On Reader Service Card

# Mind the 'Ps' and 'Ns' of Doping

► continued from page 28

Minority carriers are usually not a problem. However, when the semiconductor heats up, the minority current flow can increase causing other electrons to break from their covalent bonds, causing "thermal runaway" which, if not

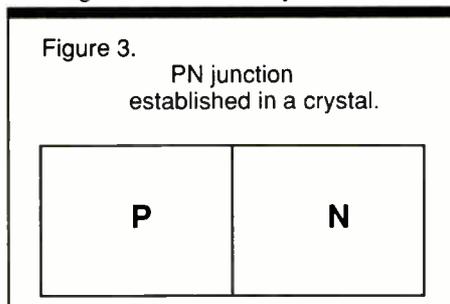
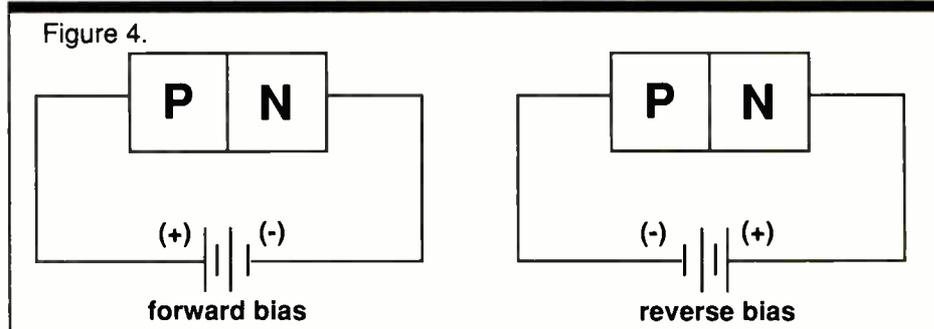


Figure 3. PN junction established in a crystal.

corrected, will destroy the device. When semiconductors are manufactured, they are made on one piece of material, doped P or N. During this process, the excess electrons in the N-material and the holes in the P-material will be drawn together to make a junction.



tion. Electrons line up on the P-side of the material and holes line up on the N-side.

There are no free carriers left once the "PN junction" has been created. See Figure 3.

To make the junction operate, voltage must be applied. At first the barrier to current movement set up by the junction must be overcome. An application of about 0.3 V<sub>s</sub> can reposition the electrons and holes.

Figure 4 is an illustration of the two

ways voltage can be applied to the device. Figure 4a illustrates forward biasing, where, according to the laws of static charges, the holes and electrons are forced to close together at the junction. This lowers the resistance of the semiconductor permitting current to flow quite freely.

Figure 4 illustrates reverse bias. Electrons and holes, following the law of charges, are drawn away from the junction increasing the resistance of the semiconductor and limiting current flow.

Minority carriers permit a minute amount of current to flow in the opposite direction, but they will be of no consequence if the device is operated within its prescribed temperature limits.

□□□

*Ed Montgomery is a communications teacher at Thomas Jefferson High School for Science and Technology. He has taught broadcast engineering at Northern Virginia Community College and worked as a broadcast engineer for several radio stations. He can be reached at 703-750-5090.*

## The Dictaphone 400 Is A Workhorse of a Logger

by John Buckham

**SAN FRANCISCO** If you need a good, reliable logger, but are on a strict budget, KOIT-AM-FM's solution may be for you. At KOIT we have used a Dictaphone 400 reel logger for well over fifteen years, with virtually no trouble.

The 400 is a standard reel type logger. It was available in a number of configurations—our unit is a two-pass, two-channel unit that records our AM and FM stations simultaneously. It also was available in a single-channel, four-pass unit and a four-channel, single-pass configuration.

Unfortunately, the Dictaphone 400 is now out of production, but Dictaphone does offer the 5600, which is virtually the same unit. Used 400s, however, are readily available.

### Record 12 days

You can opt to run the machine at 15/16, 15/32 or 5/16 IPS by adjusting the capstan belts and motor pulley. The speed is not selectable from the front panel and is generally factory set, but field speed changes are easily accomplished. Depending on the thickness of the tape, speed and track configuration, an impressively long run time can be achieved.

For example, with 0.5 mm tape (7200 feet) a four-pass, single-channel machine, running at 5/16 IPS, can record for over 12 days. Two dedicated reel motors handle fast forward and rewind duties.

Audio quality from the 400 is surprisingly good. The Dictaphone uses a three-head design. Audio quality can be monitored while a program is recorded, as on any three head machine, through a small front-panel speaker. We also use a standard cassette deck with the Dictaphone

machines for dubbing purposes.

As with any magnetic tape recorder, the slower speeds produce a more attenuated high end frequency response. At the slowest speeds, it is important that high quality tape be used (at KOIT, we use Scotch 8206 1 mm tape). And tape heads should be cleaned each time a new tape is mounted. At these speeds even the smallest amount of stray oxide on the tape head ruins the recording.

### Time code

An optional time code generator/reader is available, which adds a sub-audible time code to each channel of the tape to aid in the rapid retrieval of program material. Other options include voice operation, automatic gain control (AGC) and fail-safe relay operation.

Simplicity in design adds to the long life of the machine. Maintenance is a snap. The transport tilts out of the rack for service and the electronics pull out for adjustment. The various circuits are on easy to replace plug-in circuits.

An excellent service manual and great parts availability have always helped us keep our machines up and running.

The machine is not fancy, but it is a good solid down-to-earth logger. It has been time tested in radio stations throughout the country.

The addition of a logger to your station is a good way to keep tabs on a morning zoo show and to document spots for clients, especially with the time code reader.

□□□

For information on Dictaphone products, contact Robert Qamar in Connecticut at 203-381-7000; fax: 203-386-8597; or circle Reader Service 82.

## The Jitter And Digital

► continued from page 14

between, for example, 700 Hz and 3 kHz, jitter that falls below a pre-designated frequency is ignored.

Why 700 Hz as the lower boundary? Simply because LF sampling jitter produced by A-to-D converters is masked by other components, and is inaudible; or the threshold of audibility, conveniently, lies at approximately 700 Hz.

Although most measurement techniques attempt to measure only Interface Jitter—that is, jitter produced on an AES3-format or related I/O by the interface circuitry and timing references—some jitter will be produced within the device itself. Some units that include servo-controlled circuitry, such as DAT recorders, may also produce a far smaller jitter component.

However, assuming that the digital interface circuitry is well designed (and currently operating correctly), measuring jitter with a very short cable attached can throw some light on the amount of internally-produced jitter. It is safe to say that any measurements of short-cable Fs Jitter that produce results of more than, let's say, 5 nS, might very well indicate internal jitter problems.

□□□

*Mel Lambert is principal of Media&Marketing, a Los Angeles-based consulting service for the professional audio industry. He can be reached at 818-753-9510.*

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## COLE'S LAW

# FCC Tries to Undo Allotment Mistake

by Harry Cole

**WASHINGTON** The FCC is not perfect. It makes its share of understandable mistakes. But that doesn't explain some of the (how shall we describe it delicately?) lamebrain decisions the commission sometimes makes.

One of the most outstanding examples of this is playing itself out right now, as the FCC tries to undo an FM channel allotment in San Clemente, Calif. Commissioner Ervin Duggan described it as "the allotment that wouldn't die."

Oddly enough, the FCC's current proposal appears to make sense. But it comes several years too late.

## Into the soup

The first hint of trouble in this case was back in the early 1980s when somebody proposed that Channel 285 be allotted to San Clemente.

As early as 1966, the commission knew this allotment could be a problem, because the only apparent way Channel 285 could fit in San Clemente was if the transmitter site was located on the grounds of the Camp Pendleton Marine

Corps compound. Some years later, a "camp official" indicated that use of the compound for a commercial radio tower might not be prohibited.

That was enough for the FCC. It approved the allocation in 1985.

The Navy and Marines responded almost immediately, making it clear to the FCC that it could not approve construction of a broadcast tower on the camp's grounds. Interested parties sought reconsideration of the allotment right away.

But by this time, things were starting to get out of control. The commission already had 12 applications for the channel by the time it began to act on the petitions for reconsideration in 1986. All but one of the 12 specified sites on the Camp Pendleton grounds.

The FCC decided to leave the channel in place, and let the other 11 applicants amend to the one non-camp site. That decision was affirmed in 1987.

It was not long before it became clear that the one supposedly non-camp site also would not work. A dispute arose over the exact location of the site, with some alleging that it actually was with the

grounds of Camp Pendleton. In any event, the company which had supposedly agreed to make the site available later withdrew its agreement.

Thus, that site became unavailable, leaving the Commission back where it had started in the 1960s, with a vacant FM channel, but no transmitter site consistent with the rules.

## Wrong turn

It would have been smart to pull the plug right there by dismissing all 12 applications and announcing that it had all been an unfortunate mistake. Admitting mistakes, however, does not seem to be one of the commission's strong points.

The allotment of the channel was affirmed again for the second time in 1988. "It would be inequitable to the applicants" to delete the channel for which they had applied, the FCC ruled.

Instead, applicants were allowed to seek waivers of the technical rules to operate with a short-spaced facility. For its part, the Commission promised, "in view of the unusual circumstances of this case," to give "careful consideration" to the waiver requests. It also said the waivers in question involved short spacings in the range of 4.1-6 kilometers, distances that were "within the range that have been waived in the past."

Things appeared to be looking up. The FCC recognized that it had pointed everybody in the wrong direction from the start and seemed ready to cut the applicants a fair amount of slack.

Well, not exactly. The applicants underwent a full hearing on their waiver requests, and an administrative law judge denied all of them. The review board and, ultimately, the full commission affirmed those denials. All the proposals, it was judged, would

have led to excessive interference.

The commission finally denied all of the applications in May 1993, eight years after the channel was first allotted.

## Cold comfort

Last month (December 1993), the FCC proposed deletion of the channel. But in proposing the deletion, the commission still holds out the possibility that it might start the whole process up again, if someone demonstrates that some suitable non-Camp Pendleton site exists.

Comments and reply comments on this proposal are due in early 1994. It is possible that the tenth anniversary of the addition of the allotment will mark the order to delete it.

This might all seem pretty amusing, if it were not for the plainly avoidable waste of time, energy and money the FCC caused, and then prolonged. Once it was clear that a mistake had been made, there was no sense in letting it go uncorrected.

This mistake cost not only time and money, but also some measure of the FCC's credibility. The FCC, faced with the fact that there were no non-short-spaced sites in 1988, put its administrative arm around the applicants and in a nice, grandfatherly way, and allowed them to continue to pursue their applications. Five years later, having allowed them the privilege of slugging it out in a multiparty hearing and two levels of appeal, denied them anyway.

The FCC now tells us that just maybe the whole allotment was a mistake from the beginning. Such an admission is little comfort when it comes about eight years too late.

As individuals, we are all accountable for our mistakes, but who is accepting complaints on this one? The FCC, in many respects, is accountable to no one.

□ □ □

Harry Cole is a partner in the Washington-based law firm of Bechtel & Cole, Chartered. He can be reached at 202-833-4190.

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USER REPORT

## Belar's Wizard Works Modulation Magic

by Robert N. Palitz  
Engineering Director  
Metro Broadcast Corp. Ltd.

**HONG KONG** With the help of the Belar FMMA-1 "Wizard" digital modulation analyzer, Metro Broadcast has established tight modulation control over our 28 FM transmitters at seven different sites. We also have been able to track the other signals in our market.

Hong Kong is a prosperous territory of nearly six million people, control of which shifts from the United Kingdom to the People's Republic of China in 1997.

frequencies, providing coverage to the entire territory. With our alternate/main transmitter setup, we have a total of 28 exciters needing to be monitored.

Our system design and equipment selection policy is to go digital only when digital makes sense: We don't buy digital just for the sake of having digital. Because only three of our transmitter sites are accessible by car or truck, remote digital modulation monitoring was a necessity. It keeps our staff at a reasonable size, and it helps to maintain quality control.

In its basic form, the Wizard is a digital

The companion RFA-4 frequency agile FM RF amplifier—also occupying one rack unit—is a modern version of the tunable front end/preselector frequently used with modulation monitors. It connects to the Wizard chassis with ribbon cable and a BNC jumper.

**Complete control**

Connecting any IBM-compatible PC or any Hayes-compatible modem to the Wizard's single RS-232 port provides complete access to all composite readings and remote control over all parameters. Duopoly or LMA operations can control two Wizards through the single port. We have one such setup at our studio and at each of our transmitter sites.

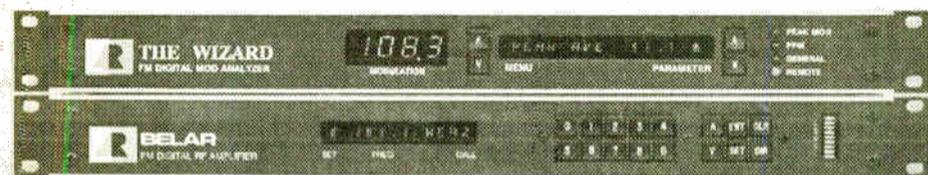
When configured in this manner, the Wizard has 10 programmable frequency memories. You can dial directly any desired frequency. Total peak modulation, average modulation, average-to-peak ratio, deviation, minimum modulation, pilot injection and pilot modulation are all accessible too.

Peak weighting can be set to reduce response to transient peaks as you wish. The adjustable count and modulation thresholds on the peaks-per-minute counter help visually track your compliance with the rules.

Of course, precision is useless if the measurements are inaccurate due to poor-quality RF samples. Multipath, adjacent channel interference or anything else that adds noise, such as a weak signal, increases peak readings beyond that of actual modulation. No modulation

monitor I have encountered has the sensitivity or selectivity of a good tuner, nor should it.

A rotatable wideband directional antenna, such as a log periodic, helps ensure  
continued on page 45 ▶



Belar's Wizard helps keep 28 exciters in Hong Kong within prescribed modulation limits.

In 1991, our company was granted a license to establish one AM and two FM program services. We were the third radio broadcasting operation in Hong Kong, following the government stations and another commercial station.

**Twenty-eight exciters**

Metro Broadcast's FM program services—FM Select, easy listening music in Cantonese and English, and Hit Radio, music, conversation and information in Cantonese—are each broadcast over seven

modulation analyzer accepting composite audio at its input. A precision demodulator/calibrator accepts the long-used Belar standard of 650 kHz intermediate frequency, and it installs in a single rack unit. The demodulator output drives, through rear-panel BNC jacks, both the Wizard's composite input and a conventional Belar FMS-2 stereo monitor. The pilot output of the FMS-2 is connected back to the Wizard to relay information on pilot injection and modulation. An optional SCA monitor may be similarly attached.

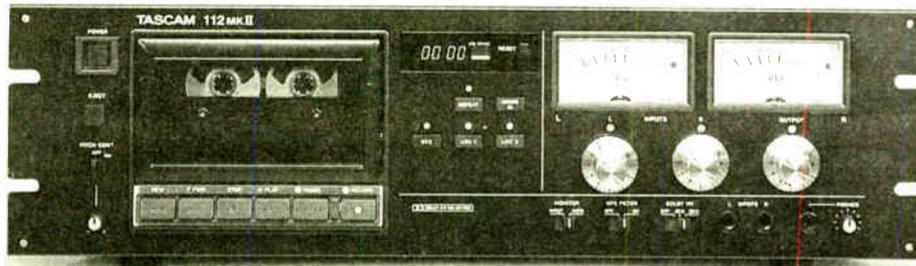
## This could be the last cassette deck you'll buy this century.

Since cassette decks are still standard equipment in any studio, it makes sense to turn to a deck that you can rely on both now and in the future: the TASCAM 112 MK II. Because even on the worst of days, the 112 MK II will be the one thing you can always depend on to work right. No prodding, kicks or angry swats needed.

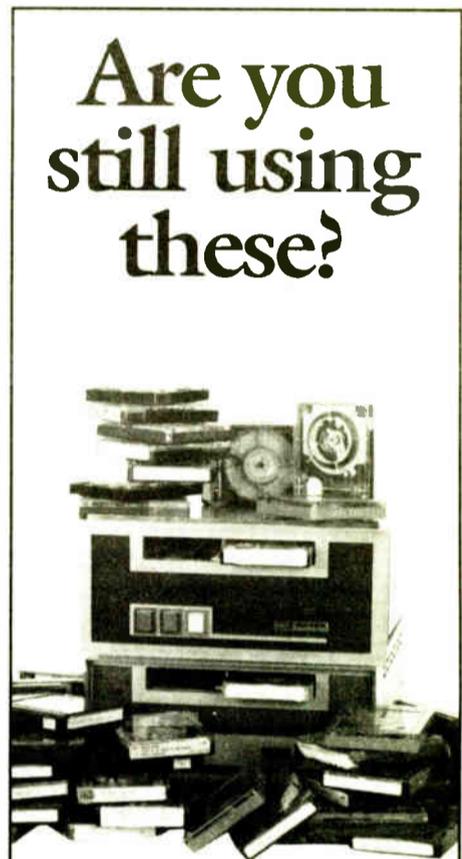
Of course, the 112 MK II offers you key features like three locate points, cue and review and an optional easy-to-install kit for adding +4dBm balanced XLR inputs and outputs.

It's rugged. It's reliable. It's powerful. What more could you ask for from a professional stereo cassette deck that takes its job just as seriously as you do — and is bent on outliving most of the other equipment that you have in the studio. Pick up a 112 MK II today and make it the last deck you'll buy this side of the 20th century.

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**HARRIS ALLIED**

USER REPORT

# From Colorado, NSN Keeps KERI Legal

by Mike McCutchan  
Station Manager/Chief Operator  
KERI(AM)

**BAKERSFIELD, Calif.** KERI(AM) is a 50 kW-D, 10 kW-N, station with two different patterns. We use a Nautel solid state transmitter. For the past 43 years, KERI has been staffed full-time by licensed operators, fulfilling the FCC rules and regulations about transmitter control and EBS requirements.

We wanted to be able to walk away from the transmitter for long periods of time while remaining FCC legal. We

needed to be able to monitor the parameters of the transmission system and fulfill the EBS requirements. Upon investigation, I found that transmitter control during unattended operation was relatively simple, but keeping the station EBS legal was much more difficult.

### Walk-away time

I looked at several services that would watch our transmission system for a nominal fee each month, but the EBS monitoring still required someone having a receiver/decoder and tape recorder at her or his house, ready to go on the air at

a moment's notice. I wanted walk-away time, not an EBS unit under the bed at night.

**National Supervisory Network (NSN)**, based in Avon, Colo., provided KERI with the answer to both needs.

NSN watches our transmitter and provides us with national, regional and local EBS monitoring. If necessary, NSN can interrupt our air chain and go on the air, "live" from Colorado, to update our audience on an emergency without station personnel being immediately involved.

It is 100 percent FCC legal, and the system works.

NSN provided us with an NEC Nextar System 3 VSAT with a 0.95-meter antenna, an NSN 386SX computer system with satellite interface card, the NSN basic service software, the NSN EBS interface unit and a Burk ARC-16CI remote control unit with computer interface and relay panel. All of the equipment was shipped to KERI in advance of the installation date, arriving with time to spare.

### Lease or buy

We had the option to lease the equipment or to buy it outright. We chose to purchase it, and after a year of running unattended overnights and much of the weekend, we have saved nearly the total cost of the equipment.

NSN provided the personnel to install the gear, and in less than a day our unit was up and running.

KERI broadcasts with different patterns day and night. The pattern changes are made from Colorado and are done efficiently. The Burk unit monitors two tow-

ers during the day and three towers at night. The computer tracks the actual readings and compares them with the upper and lower limits. If something is out of tolerance, it trips an alarm, alerting NSN. NSN then notifies KERI personnel of the problem, and it gets fixed.

When the local CPCS station broadcasts an EBS test, the decoder/receiver at KERI is triggered. The computer automatically logs the test, and it makes a telephone call to Colorado, alerting NSN of the test. NSN then listens to the on-air audio of the CPCS station to determine if the alert is just a test or an actual emergency.

If it is only a test, NSN logs it by hand in Colorado—in addition to the computer automatically logging it at KERI—and the receiver/decoder is reset from Colorado. It is a similar procedure when KERI originates the test.

Last winter, a dam broke in the mountains just east of Bakersfield. NSN fed all of the alert information to us about the situation, and our announcers went on the air reading warnings directly from the computer screen. The system worked beautifully.

The personnel at NSN really seem to care about their service to their clients and potential clients. I was treated kindly and courteously from the very start.

Although it took us a little while to decide between the leasing or buying of the equipment, NSN stayed in touch but never got impatient. NSN even set us up with the leasing company and provided an information conduit in the early stages of the lease discussions. I was impressed with NSN's attitude.

The installation of the equipment at KERI was done in a single day. It was a long day, but we accomplished what needed to be done. I think two days might have been better, but our schedule did not allow that luxury.

continued on next page ▶

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USER REPORT

# Thermal Sentry Stands Guard over Nashville

by Carl N. Pedersen  
Chief Engineer  
WPLN(FM)

**NASHVILLE, Tenn.** Numerous transmitter parameters can be monitored by measuring the temperature rise caused by the heat given off in the power amplifier. The exhaust temperature varies greatly with changes in input air temperatures. Output temperature variations can be canceled out by measuring the difference between the input and output temperature of the transmitter cooling system.

Differential temperature is a direct indicator of the thermal output of the PA. Thus it makes a very good indicator of efficiency changes due to component tolerance changes, mistuning, power supply and bias voltage changes. Small changes in these parameters result in differential temperature changes.

### Design and use

WPLN(FM) recently purchased and installed a **Sine Systems Thermal Sentry** for the transmitter site. The Thermal Sentry is a differential thermometer packaged in a 19-inch rack panel. The Sentry includes one set of calibrated thermal sensors, which can be mounted at the air

intake and the exhaust vent of the transmitter. The differential temperature (from 0 to 199.9 degrees Fahrenheit) is displayed on the Sentry's front panel.

The Thermal Sentry is designed with auxiliary analog outputs for intake, exhaust and differential temperatures. These outputs can be connected easily to a remote control system for off-site monitoring. In addition, the Sentry has an alarm contract-closure that activates at a preset differential temperature.

### Double duty

WPLN uses two Continental 816 20 kW FM transmitters operating in a main/main configuration. We purchased an additional set of temperature sensors to monitor both transmitters. A relay was installed to switch between the active transmitter's sensor outputs and the Thermal Sentry input. Status from the transmitters' control/status monitor energizes this relay when a transmitter changeover occurs. In addition, a bypass switch was installed to change the Sentry's sensors to the transmitter that is in standby mode.

After installing the Sentry, the differential temperature of the transmitter was

continued on page 45 ▶

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## USER REPORT

# Potomac Upgrade Leaps to the Edge

by Edwin Bukont  
Chief Engineer  
Multiphase Consulting

**FALLS CHURCH, Va.** A staple of most broadcast engineering shops since the early 1970s, Potomac Instrument's (PI) audio test set Model AA-51 audio analyzer and AG-51 companion generator made performing an audio proof a somewhat tolerable—if not actually fun—experience.

But over the years, many shops have invested in expensive software-based generator/analyzers, and the Potomac equipment may have been set aside. Even if you have decided to switch to computerized gear, don't trade in your Potomac "twins" just yet.

Potomac now offers updates to the AA-51 analyzer that bring both units back to the forefront of state-of-the-art test gear. For engineers on a tight equipment budget, the ability to upgrade present equipment, instead of buying new, is always welcome. And the features of the upgrades make good engineering—as well as economic—sense.

In developing the Potomac equipment, hours of market analysis were spent deciding whether to offer the equipment as a combined generator with analyzer, or as separate, stand alone units. Having a separate analyzer and separate generator make this equipment more useful than comparable "one box" systems. A separate generator and analyzer simplify the troubleshooting and testing of RF plants, STL and remote systems. And, as the industry moves toward LMA and duopoly stations, where one studio may feed several transmitter sites, this feature becomes more important.

You can cost effectively use the Potomac product by upgrading one analyzer first, and shuttling it around the company. As funds become available,

other analyzers can be upgraded, or new analyzers purchased.

For a multi-function site on a budget, you might consider putting less expensive oscillators at the send end of circuits, and PI's new analyzer at the receive end.

Whether you use PI's audio generator, a less expensive oscillator or even the NAB test CD for your audio measurements having to manually adjust the null for distortion measurements was time consuming, and required some technical expertise.

One of the upgrade features is an "auto-null" distortion circuit, which electronically nulls the fundamental, giving another 10 dB improvement in distortion measuring capability. This translates into a full scale measurement of 0.03 percent rather than 0.1 percent.

## Counter and connectors

The analyzer upgrade includes installation of an accurate and stable frequency counter, which alone makes the PI equipment competitive with other test packages. The counter operates quickly, and is easy to read—even when viewed from an angle.

The balanced and RF-suppressed inputs work well, even when measuring noise and making distortion measurements

next to a 5 kW AM transmitter. The enhanced distortion analysis may prove useful on debugging problems related to digital processing and digital compression, since the switch-selectable low-pass and high-pass filters can assist the engineer in determining if an unusually high THD figure is due to low frequency hum or high frequency aliasing artifacts.

## RF-proof connectors

The new analyzer still uses RF-proof Switchcraft connectors instead of XLRs. Given PI's involvement in RF, and the superior shielding characteristics of this Switchcraft connector, it is obvious why no change was made. If you haven't already, order a few extra connectors and make your own test cables with TRS or XLR ends. It beats trying to keep the alligator clips on the XLR pins, and in high RF environments, takes full advantage of Potomac's excellent shielding.

If PI added a push button 600 ohm termination for checking impedance mismatch problems, it would be nice—especially with the profusion of low-impedance, active outputs that have difficulty driving long lengths of unterminated line.

Also, the audio monitor could be louder and have a gain control. My ears were

strained a bit using this amp with headphones next to a noisy transmitter.

Except for these two minor points, the new analyzer performs well and is a credit to its manufacturer.

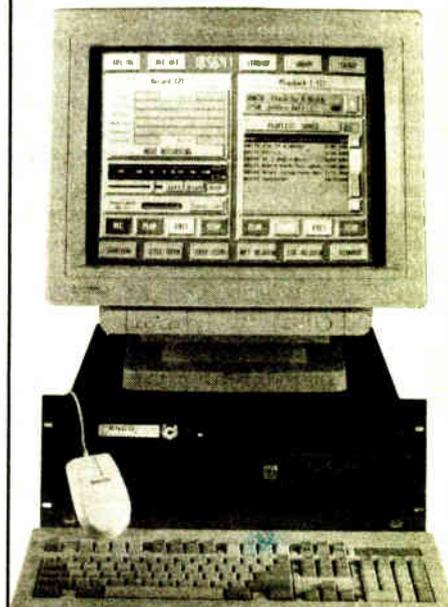
For a company to release a new product is not unusual. For a company to release a new product, and to permit all of the new product's improvements to be adapted into existing models shows that Potomac understands the economic conditions to which we engineers are being forced to adapt.

Besides, in my opinion, PI's AA-51 audio analyzer sports the most accurate metering of any audio test device using analog metering.

□□□

For information, contact David Harry in Maryland at 301-589-2662; fax: 301-589-2665; or circle Reader Service 159.

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## NSN Keeps KERI Legal

► continued from previous page

In the days that followed the installation, I learned how to set up the computer with transmitter parameters. NSN provided plenty of assistance and suggestions via telephone and a computer link. As we worked through all of the little problems that come with the installation of a new system, I always felt my questions were received with the same courtesy I received when we were only a potential client.

Over the months, KERI has suffered those times when the transmitter wanders out of tolerance, and NSN has been right there to alert me to the problem. The operators at NSN give me enough information to determine what the problem is and to make my decision about what to do. Without NSN, I would have to drive 60 miles round trip before I would know what the problem was and how to deal with it.

NSN provides us with weekly reports on the activity of the transmission system for our files.

□□□

For information, contact Bill Sepmeier in Colorado at 800-345-VSAT; fax: 303-949-9620; or circle Reader Service 215.

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## USER REPORT

# Eventide Provides Reliable Logging

by Gray M. Kinney  
Engineer  
KAAM(AM)-KZPS(FM)

**DALLAS** One of the most important, but least talked about aspects of a radio station, is the need for a reliable, consistent audio logging system. I would like to tell you a bit about my experience with Eventide's VR240 RDAT audio logging system.

Depending on the configuration you choose, you can order the VR240 with one or two tape drives, with up to 24

inputs, and multiple units can be linked together. A playback-only model, the VPB240, is also offered. We ordered the VR240 with two DAT drives and we use it to monitor four of the available eight channels.

## Light show

When the VR240 arrived, I removed it from the shipping carton and plugged in the unit. It performed an impressive light show, displaying a lot of helpful status information on an easy to read LCD display. After a few moments, it was ready to go to work.

First I had to decide how many channels needed to be logged, and then entered the information into the logger. The VR240 allows you to label each channel, to select the type of logging desired (i.e., continuous, voice or never) and to select the sample rate for audio quality. The VR240 even has automatic gain control (AGC) on all inputs, allowing for a wide range of levels.

A standard 90 meter DDS (data grade

tape) yields approximately 10.5 days of a single channel, recording 24 hours a day—of course, this is only 3.4 kHz



The Eventide VR240 RDAT logger provides KAAM (AM)-KZPS (FM) reliable and consistent audio logging.

response. The higher the sample rate used, the less time available per tape. With our system, the VR240 records roughly four to four-and-a-half days worth of material.

After choosing the correct set-up and

sampling rates, I decided to subject the unit to a "shock test." I disconnected the machine's power supply to see if it would lose the information I had entered. I was pleasantly surprised that the unit did nothing—not even the slightest cough or sputter. The internal uninterruptable power supply (UPS) took over immediately. Kudos to

Eventide for the foresight to include such a feature.

After watching the unit operate without external power applied, an alarm began to sound and the unit then shut

continued on page 48 ►



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## INDUSTRY ROUNDUP

# The Future of Test Gear Is A Process of Fine-Tuning

by T. Carter Ross

**WASHINGTON** "Fine tuning" appears to be the key phrase in the field of test and monitoring equipment, according to several equipment manufacturers. Instead of broad new advances, the trend in test and monitoring equipment is toward more precision and easier control and operation.

"All that's going to happen in the future is equipment will become more accurate," said Art Constantine at Modulation Sciences Inc.

David Harry at Potomac Instruments said, "Testing equipment has always been seen as a necessary evil, but most general managers don't see it affecting

their bottom line. Until general managers become aware of the long-term importance of quality test gear, we're unlikely to see any big new developments."

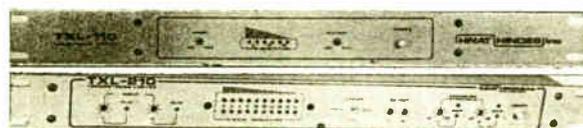
Joseph Novak at Delta Electronics also does not see any great leap forward. "I don't see it changing at all very rapidly," he said.

Constantine said, "Test equipment always needs to be better than gear it is testing."

In response to this, Constantine sees a trend toward self-calibrating equipment. "Equipment will no longer be constrained to analog drift. In the old days, you had to calibrate modulation monitors prior to taking a reading, now the trend is toward self-calibration,

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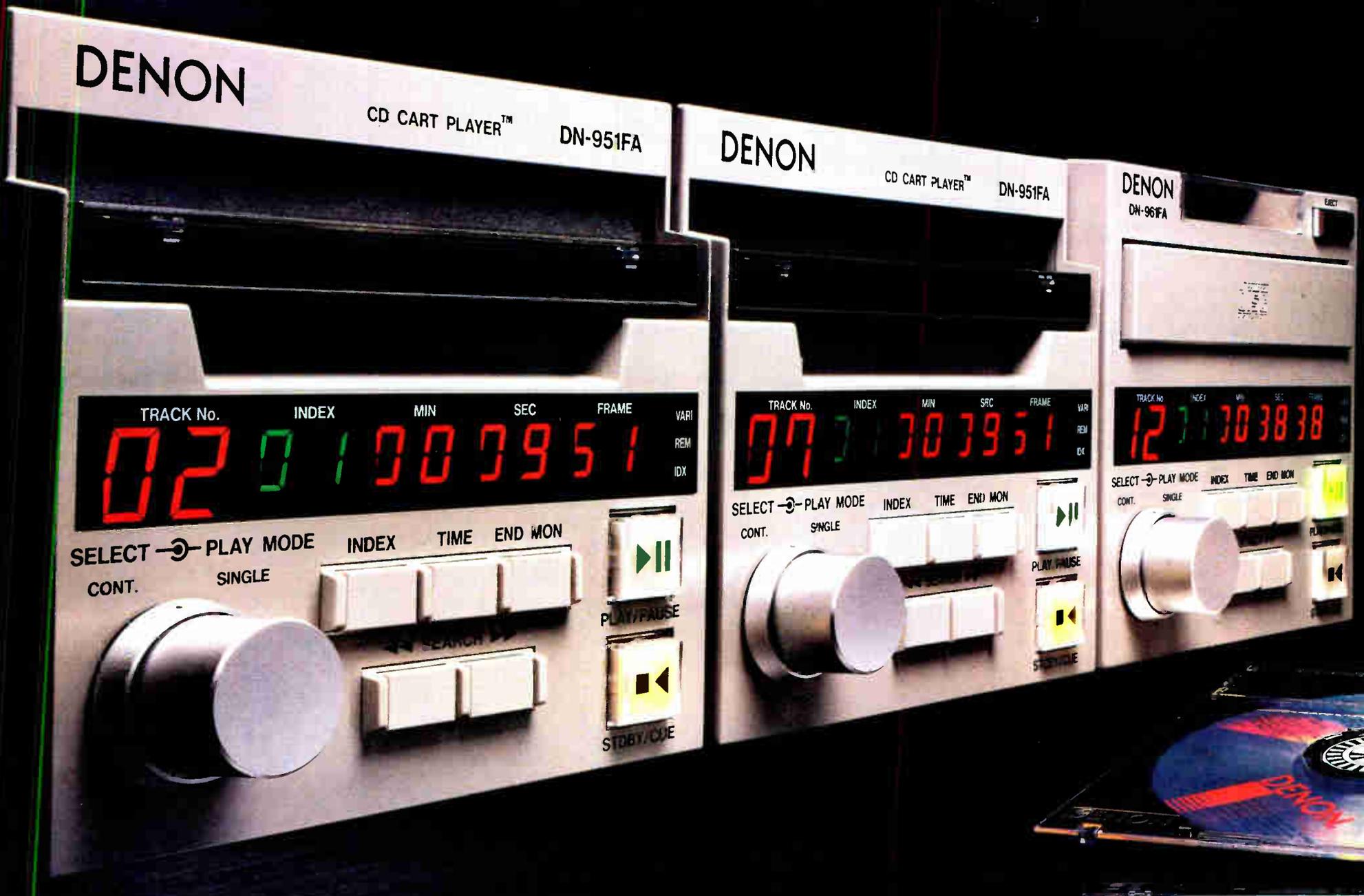
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World Radio History

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Most importantly, both the DN-961FA Drawer Loading model and the DN-951FA are from Denon, who for 83 years has been serving the needs of audio professionals and for 21 years has been advancing the art of digital audio.



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# Wizard Casts Spell Over Hong Kong

► continued from page 39

the integrity of the off-air sample. By monitoring pilot modulation, the Wizard makes it easy to rotate the antenna for the best possible sample quality. If there is no multipath and no composite clipping, you should have zero pilot modulation. In a real world, urban environment, we are generally satisfied when we can get it below 2 percent.

## Direct connection

For direct connection to the transmitter's modulation monitor sample, we use coaxial cable with good shield coverage. This assures that the sample comes from the source, not from leakage due to high RF fields.

Wizard offers loophrough control and monitoring of the composite signal

between your stereo generator or composite STL receiver. Two independent composite signals can be run through Wizard, and the gain of each is remotely adjustable by  $\pm 10$  percent. The audio level of each loophrough signal can be monitored in a manner similar to main modulation monitoring.

Belar's Wizard software works well, although its controls and graphics may not be what you would expect in the Windows/VGA era. However, it is sufficiently generic to get you up and running quickly on almost any PC configuration. I used it in a live-via-modem demonstration of modern modulation measurement techniques for the local government telecommunications regulators. If you are ambitious, you can write your own program; Belar includes all

the remote communication syntax in its manuals.

## Histogram

One of the interesting displays available is the histogram, showing the percent of time a signal spends at each different level of modulation. It can be an effective

LOGASCII program.

The file includes: a header showing the start and end time of the data; the accumulation interval between lines (we set ours to 1 second); and, on each line, the highest, average and lowest peak occurring during monitoring.

For analysis and display, I import that file into a Lotus 1-2-3 for Windows spreadsheet and perform the data distribution function on the information. The 1,800 lines of data are graphed, for a dis-

# Sentry Keeps Nashville From Becoming Too Hot

► continued from page 40

measured at 61 degrees Fahrenheit (16 degrees Celsius). We then checked the PA blower fan and observed a small amount of dirt in the concave portions of the impellers. The fan was removed and cleaned. The temperature differential was then measured at 56 degrees Fahrenheit (13 degrees Celsius), a drop of 5 degrees.

The amount of dirt on the impellers was insignificant compared to many blowers I have seen in operation, but I was sur-

ters, duct backloading due to outside wind, tuning errors, blower problems, antenna problems, antenna icing, efficiency changes due to component failures, power and bias supply changes and filament voltage problems.

The analog output of exhaust temperature should also be monitored. Air supply to the transmitter may become restricted or air conditioning may become inoperative, resulting in excessive heat buildup in the building, which may lead to damage. Exhaust temperature measurement can detect this condition effectively.

The Sine Systems Thermal Sentry has provided WPLN with an inexpensive and accurate transmitter monitor.

□ □ □

For information, contact John Pate in Tennessee at 615-228-3500; fax 615-227-2367; or circle Reader Service 154.

**Differential temperature makes a very good indicator of efficiency changes due to component tolerance changes, mistuning, power supply and bias voltage changes.**

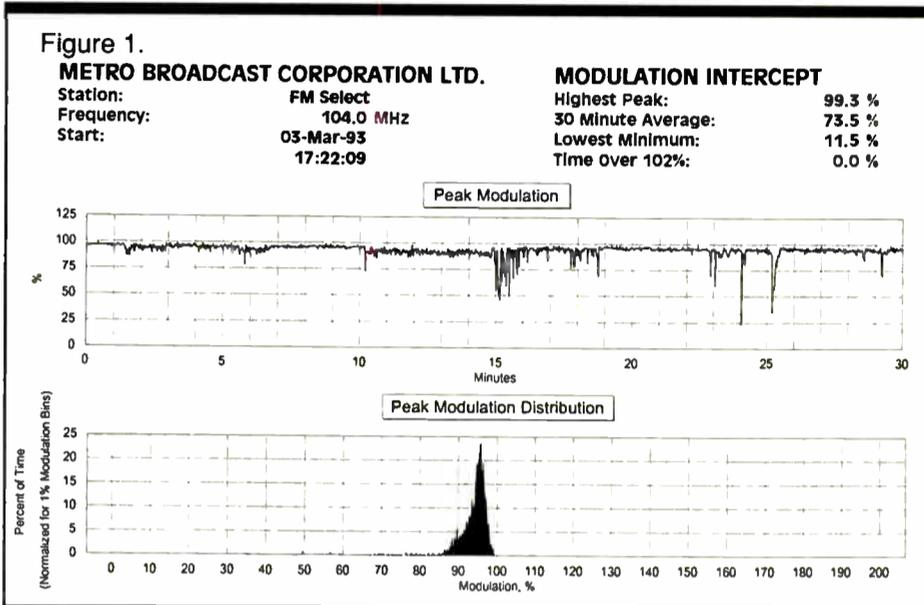
prised that this small amount of dirt resulted in a 5 degree temperature increase. After establishing a baseline for the normal transmitter differential, we have observed temperature variations caused by extremely small tuning changes.

Some transmitter manufacturers provide data for air temperature differential from air intake to output in their service manuals. This data is useful in determining proper operation of the transmitter, especially if the transmitter has been in service for many years and has undergone significant component replacement and changes.

## Other uses

We also connected the Thermal Sentry analog outputs to our transmitter remote control system and our telco dial-up remote system. Alarm functions for out of tolerance conditions are now observed on both systems, with the dial-up remote paging the engineer.

The Thermal Sentry is also useful in indicating many other improper operating conditions, including: dirty air-fil-



play of the monitored station's performance (Figure 1). The only problem we have had with our eight Wizards was the failure of a DIP relay used for calibration. Our units self-calibrate automatically and agree exactly to the modulation specifications determined by Bessel function tones and a spectrum analyzer.

Hong Kong travels a narrow path between two broad extremes: the British way (little or no processing) and the American way (as much processing as possible). The Belar Wizard helps us track our progress along the middle way.

□ □ □

For information, contact David Hirsch in Pennsylvania at 215-687-5550; fax: 215-687-2686; or circle Reader Service 156.

## Most common use

Apart from the setup and maintenance of the transmitters at our remote sites, our most common use of the Wizard is for logging modulation over time from our technical operations center. We record 30 minutes of modulation data on a PC that is connected to the Wizard. The data capture file is converted to ASCII by Belar's

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DYNAMAX COBALT Cartridges provide excellent high frequency response, high sensitivity and increased head room, and are ideal for top quality reproduction from a digital audio source.

The AUDIOMAX 4000 offers premium quality as well as phase and bias compatibility with more expensive Type AA-4 cartridges and is suggested for stereo applications requiring elevated recording levels.

The MASTER CART yields maximum performance at standard operating levels and is well suited for general purpose stereo recording.

The MODEL 300, workhorse of the broadcast industry for thirty years, this cartridge is intended for monophonic use at standard recording levels.

DYN-400X Professional Back Lubricated Recording Tape is a low noise mastering tape for use at standard recording levels and is available on NAB hubs or 7 inch reels.

### Magnetic Erasers

The DYNAMAX ESD10 uses dual full-track erase heads to ensure deep cart erasure of 75 dB or more. The patented splice detector which requires no sensitivity adjustments rapidly locates the splice and positions it perfectly before recording.

The BLANK-IT hand held eraser is molded of rugged plastic for light weight, easy to handle, quick and accurate tape erasing in any setting.

The MODEL 400 table-top eraser features a hardwood case, scuff resistant laminate top and removable aluminum pivot pin permitting erasure of audio, video or computer tape reels up to 11 inches in diameter x 1 inch wide.

### Other Accessories

Fidelipac offers CARTRIDGE STORAGE SYSTEMS in numerous configurations including a 25 slot vertical wall rack, a 200 slot mobile carousel rack mounted on heavy duty casters, and table-top units which hold 96 cartridges or up to 48 cartridges (as shown above).

Fidelipac's world standard WARNING LIGHTS are available in eight different languages plus custom versions on request. Back illuminated brilliant red letters on an opaque black foreground command attention and visibility.

In addition, other useful accessories (not shown) include alignment cartridges and precision gauges for head insertion and right angle zenith calibration.

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World Radio History

## USER REPORT

# Goodrich Serves McMartin Gear in the Field

## As a Former McMartin Design Engineer, Charlie Goodrich Keeps Older Monitors Working Well

**David P. Hebert**  
Proprietor  
**Dave Hebert & Associates**

**PASCO, Wash.** Although it is no longer in business, McMartin Industries still is a well known name within the broadcast industry. At one time McMartin was a major supplier of broadcast equipment. Fortunately, parts and service support for McMartin transmitters and monitoring equipment is still available, and doing quite well.

My experience with McMartin Industries began in 1979 with the purchase of a 25-kilowatt FM transmitter and a complete compliment of McMartin FM modulation monitoring equipment.

### Support gear

Headquartered in Omaha, Neb., Goodrich Enterprises provides factory expertise and component support for the many McMartin units still in operation. Charlie Goodrich, formerly a main project design engineer for McMartin, is just a telephone call away when a McMartin monitor winds up on the test bench. Goodrich can also be a source for other RF equipment, including reconditioned monitors.

**Goodrich Enterprises had the right components on the scene in a timely fashion. Obviously, the word "emergency" means something to this firm.**

McMartin Industries was a pioneer in SCA broadcasting, which was reflected in the precision of its line of monitoring equipment.

McMartin equipment is designed to be repaired with readily available components. Once in a while, a hard-to-find component fails. Not to worry though, Goodrich usually has the parts needed to get the equipment up and running fast. He can supply everything from small components to complete circuit boards and, as needed, crystals, meters and power transformers.

### Modulation monitor

Occasionally, you need to buy a modulation monitor, either to augment transmitter monitoring facilities or to replace a failing monitor. Again, Goodrich can help. The line of McMartin modulation monitors, includes: AM modulation monitors; FM modulation monitors with and without internal RF amplifiers, stereo monitors and SCA monitors; RF off-air amplifiers, and even TV aural monitors. They are also attractively priced.

McMartin modulation monitoring

equipment is usually trouble-free. However, power supply failures can plague these units, keeping them on the sidelines. McMartin power supplies were designed to provide the maximum circuit isolation required for accurate audio measurements.

Unfortunately, on occasion, the resistors providing isolation and regulation require repair. But due to the relatively simple resistor networks providing the

isolation, repair is usually a simple process.

### In the field

For many of us in the field, some of Goodrich's unusual products and services can be a real lifesaver. Recently, one of my clients in Oregon needed a correct frequency RF amplifier board for a new installation. Federal Express managed to get the old board to Goodrich in time for him to change the frequency (the new crystal was in stock), realign and return it for when we needed it.

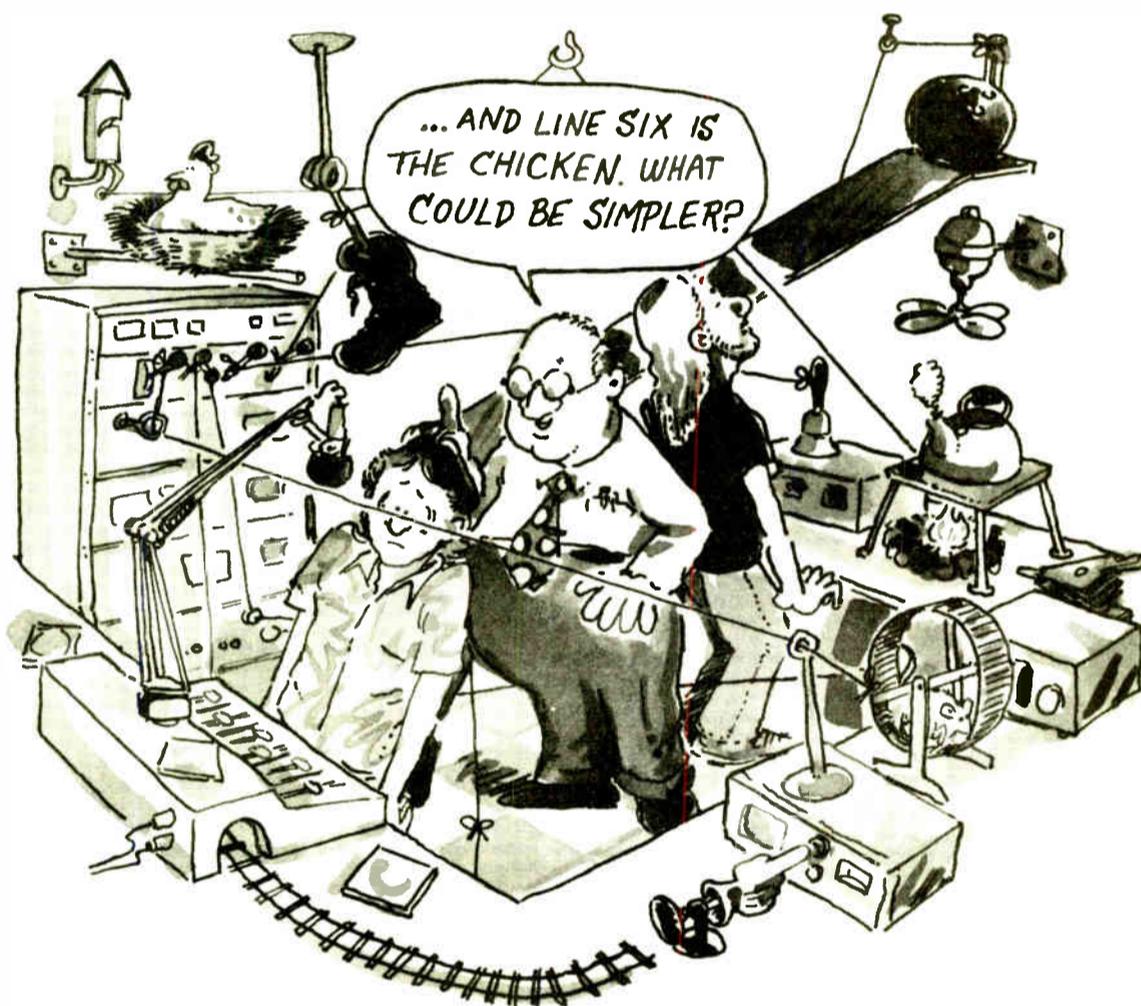
Another local client suffered a melt-

down of a McMartin 25 kW FM transmitter. Again, Goodrich Enterprises had the right components on the scene in a timely fashion. Obviously, the word "emergency" means something to this firm.

Goodrich Enterprises also can advise enterprising engineers of circuit refinements that may improve the performance of their McMartin monitors.

□□□

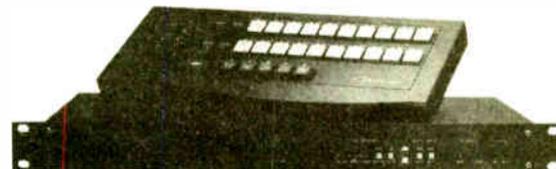
For information from Goodrich Enterprises, contact Charlie Goodrich in Nebraska at 402-493-1886; fax: 402-493-6821; or circle Reader Service 53.



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## USER REPORT

# J.N.S. Tone Alarm Gear

by Ken Caldwell  
Senior Consulting Engineer  
Australian Broadcasting Corp.  
Radio

**ULTIMO, Australia** The J.N.S. Electronics Continuity Tone Alarm System has been in service with the Australian Broadcasting Corp. on its FM network for some years. This program, originating from the Adelaide studios in South Australia, is broadcast from 56 transmitters distributed across the country.

The system employs a very low level (65 dB below alignment level) 15 kHz tone on both left and right audio channels. These

tones are in phase quadrature with the left channel leading. The continuity tone is injected at the output of the Adelaide Network Switching System, monitored in the master control rooms of the other states and finally at the transmitters.

### Path continuity

The continuity tone detectors check for audio path continuity on both left and right channels as well as left to right transpositions or single channel phase reversal.

At major transmitting sites the detector can cause an automatic change to an alternate program source or, failing that,

an apology announcement and stand-by program from cassette.

Each network can be designed to suit specific network needs, using the following components:

The TG.1002 tone generator is located at the source studio, and inserts the 15 kHz signal onto the program line. An oscillator generates a square wave signal at 30 kHz, which is then divided into two 15 kHz signals with a 90 degree phase shift between the right and left channels.

Transformers, tuned with high tolerance capacitors, are then used to couple the signal into the audio line. Insertion is made in series, with the program source presenting an extremely low source impedance. For AM stations, a 10 kHz tone generator is also available.

### Tone detectors

TD.1003 tone detectors are located at various points throughout the network and at transmitter stations. The TD.1003 samples the level of each 15 kHz tone and indicates a fault condition when the level decreases from a preset value by 6 dB or more. The relative phase of each channel tone is also compared and a reversal of phase on one channel or a transposition of left and right channels also will cause a fault condition.

The TS.1006 tone stripper is used when it is necessary to remove the tone from a program line. The stripper consists of a notch filter to attenuate the tone without unduly affecting the normal program. Similar to the TS.1006 is the LPF.8191 low pass filter. It also removes the tone without unduly affecting the normal program. Outgoing material from a studio using the TS.1006 or the LPF.8191 must feed through a local tone generator to reinsert the signal.

The CAC.1004 circuit alarm card is located at the transmitter station and is used together with tone detectors to provide switching to achieve either transmitter or program line changeover in the event of a detected equipment failure.

□ □ □

For information, contact John Leonard in California at 408-729-3838; fax: 408-926-1003; or circle Reader Service 160.

## RDAT Logger Suits Texan

► continued from page 42

itself down gracefully without losing any logged data in memory. Once I re-applied power, it automatically began recording where it left off.

### Menu features

A series of menus are used to enter information and to retrieve recorded data. These menus change according to what function is active. For instance, you may select the upper drive or lower drive to record or playback information. If one drive is recording, you can cause the other to begin recording and stop the first. Another useful feature is a relay contact that can be programmed to activate a light or another external piece of equipment.

Along with the front lighted display, headphone jack, internal speaker and front loading drives, there are a series of buttons resembling a reel-to-reel player. These buttons can control the drive not recording, possibly for locating and playing back previously recorded information.

On the right side of the front panel is a 10-button keypad. This is used in conjunction with various menus to locate specific points on either tape drive for playback.

For those needing the exact WWV time on the tape, there is an external time code input on the back.

### Operating manual

These functions (and more) are all described in the owner's manual. I found some of the manual to be a bit cumbersome. But the only time it is a problem is when I forget how to do something and need a short "cheat sheet" to use as a guide. Eventide is planning to develop such a guide, but in meantime, the LED display gives an error code to aid in troubleshooting. The features of the logger far outweigh any shortcomings in its manual.

When we first installed the unit, we did have a few problems. One channel became overloaded with a nominal +4 dBm input, but all the others were fine. When I opened the case, I found a jumper in the wrong place. This was easy to fix.

Also the upper tape deck periodically would not switch to the lower automatically. The problem was solved by replacing the DAT drive, which was fairly straight forward and quick. This seems to have fixed the problem.

□ □ □

For information, contact Gil Griffith in New Jersey at 201-641-1200; fax: 201-641-1640; or circle Reader Service 51.

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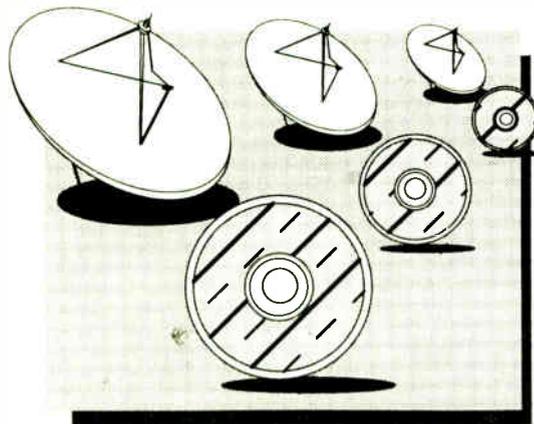
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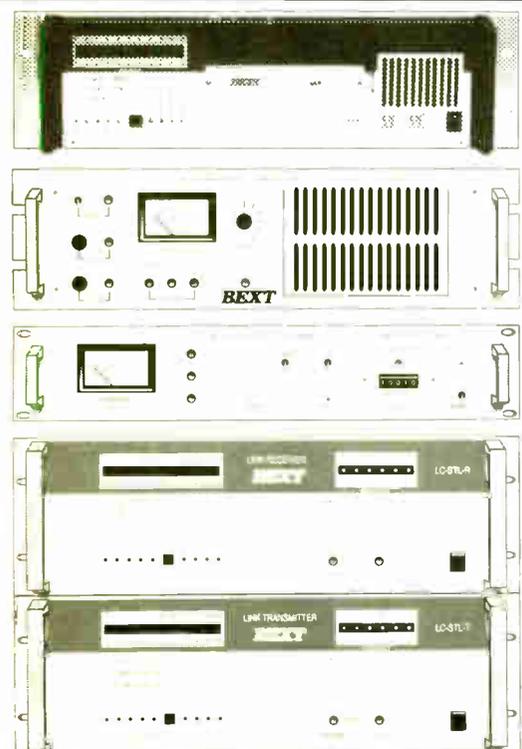
Talk to Svetlana today about your requirements for standard and custom-designed power tubes. Broadcasters, call 800-239-6900 for sales; OEMs, distributors and volume purchasers, call 415 233-0429.



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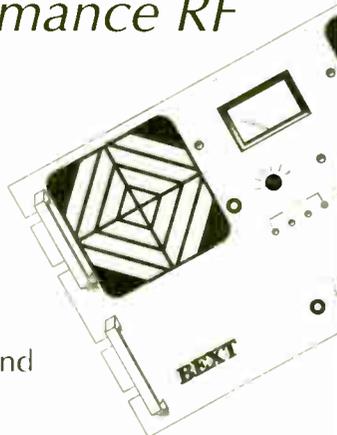
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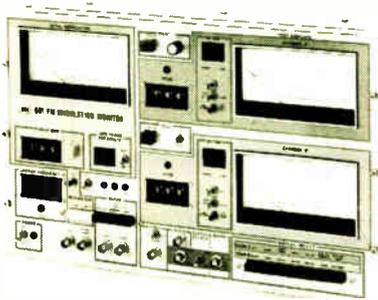
# TECHNOLOGY UPDATES

QEI

## The QEI 691 Modulation Monitor Uses Bessel Null Calibration for Accuracy

**WILLIAMSTOWN, N.J.** An FM modulation monitor is the single most important element in determining a station's modulation limits.

The QEI 691 modulation monitor owes its accuracy to Bessel null calibration. This assures the monitor's accuracy, eliminating any question about its performance. The 691 includes circuitry to convert any X-Y input oscilloscope into a spectrum analyzer to determine if an RF sample will provide useful data.



The baseband portion of the 691 contains a total modulation meter, which is switch selectable to display either positive or negative modulation peaks. The peak mod thumbwheel peak flasher and peaks-per-minute numeric LED display provide accurate peak modulation indications from 1

percent through 199 percent, in 1 percent increments.

The addition of the QEI variable peak duration test option (VPDPTO) allows the 691 to display peaks weighed by a combination of duration of the peak or by an adjustable number of total number of peaks within a 5 millisecond window. Settings are DIP switch selectable and the VPDPTO can be switched in and out of the circuit from the front panel.

The baseband portion of the 691 contains the carrier frequency thumbwheel, RF level indicators, power switch, mute switch and baseband test output. These outputs include BNC connectors to drive the oscilloscope as either a spectrum analyzer or vectorscope.

The 691 also contains a signal sampler that handles up to 50 W of RF. Simply connect a suitable load to the rear panel BNC and an exciter to the RF input. The 691 is ready to troubleshoot the exciter.

The stereo and SCA portion contain all the necessary controls, meters and outputs for measurements and tests. Two large meters are grouped vertically for quick eye scan and are switched together for ease in common stereo measurements. By switching to autorange operation, a quick check of separation, crosstalk or noise may be accomplished.

With an optional SCA monitor card installed, the 691 monitors one or two SCA channels. In addition to 67 kHz and 92 kHz SCA monitoring frequencies, the 691 SCA card also can monitor 57 kHz RDS/RBDS and other custom channels.

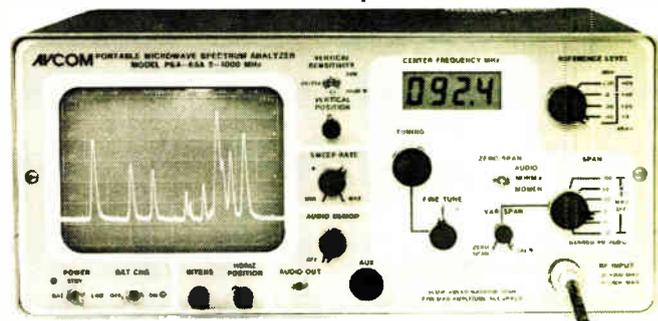
For information, contact Jeff Detweiler in New Jersey at 800-334-9154; fax: 609-629-1751; or circle Reader Service 12.

AVCOM

## Portable Spectrum Analyzer from AVCOM of Virginia Has Expanded Capabilities and Accessories for Multiple Uses

**RICHMOND, Va.** The PSA-65A from AVCOM of Virginia Inc. continues to be a versatile, powerful and cost-effective portable spectrum analyzer. The PSA-65A covers the frequency range from 2 MHz to greater than 1,000 MHz, with a sensitivity of -95 dBm. With a built-in rechargeable battery pack and weighing only 18 pounds, it is a truly portable spectrum analyzer. The PSA-65A is the perfect instrument for field testing RF systems, classroom instruction, satellite system alignment, electronic countermeasures, cable TV maintenance, cellular and production use.

AVCOM expands the capabilities of the PSA-65A, allowing operators to tailor it to specific applications with a line of accessories and options including: an FM demodulator, 10 kHz resolution bandwidth, an oscilloscope interface, an AM detector, frequency extenders, a log periodic antenna, a preamplifier and, new in 1994, a broadband noise generator—Model BNG-1000A.



The BNG-1000A broadband noise generator adds to the capability of spectrum analyzers like AVCOM's PSA-65A by allowing them to perform frequency response measurements similar to using a tracking generator. The BNG-1000A noise source is useful for sweeping coaxial cables, tuning filters and characterizing amplifiers.

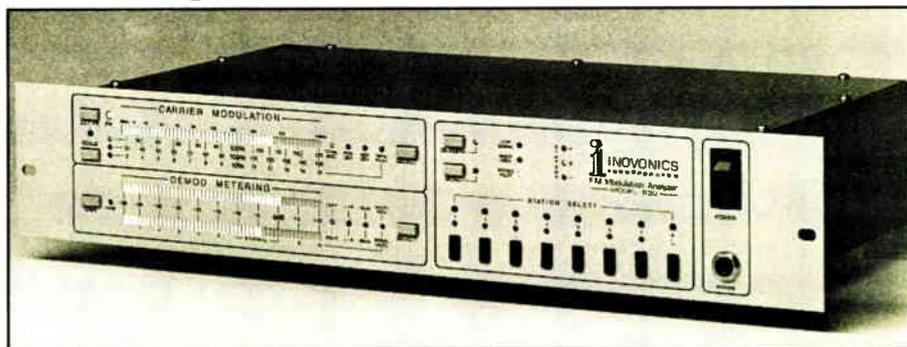
Integral RF switching allows the noise reference level to be displayed on the spectrum analyzer. A front-panel switch places a device under test (DUT) into the network, and its response can be observed immediately. Insertion loss also can be measured with the flip of a switch.

Owners of the PSA-65A, many of whom have never used a spectrum analyzer before, find their technical horizons expanded and their diagnostic and analytical skills enhanced as they become skilled in its operation. The PSA-65A is listed at \$2,855.

For information, contact Charlie Odom in Virginia at 804-794-2500; fax: 804-794-8284; or circle Reader Service 78.

INOVONICS

## The Sentinel from Inovonics Is Off-Air Modulation Monitor With Eight Tunable Presets



**SANTA CRUZ, Calif.** At the 1991 NAB show Inovonics introduced the Sentinel, an all-mode broadcast monitor receiver with extensive program audio diagnostics. The product generated a good deal of attention, with its profusion of LED displays rivaling all but the brightest Las Vegas casinos. But the most-asked question at the show was, "Can I use this as a modulation monitor?"

The Sentinel does incorporate a total modulation readout, but it is meant for comparative measurements only, with neither the accuracy nor the resolution to serve as a primary indicator of total carrier modulation.

What became clear at the '91 show was the real need for a simple, affordable, yet trustworthy FM modulation monitor.

Heading the list of features deemed desirable by broadcast engineers was frequency agility—a modulation monitor should be tunable. Other requests included the usual amenities common to FM monitors, but with the constant admonition: "Keep it simple!"

The new Model 530 from Inovonics is an off-air monitor with eight tunable presets. The user's own signal is assigned to Memory 1, and can be either off-air or directly coupled. Total modulation is read from a peak-hold bar graph display with selectable peak integration and one-percent measurement resolution. Demodulated left and right program channels are separately metered, along with L+R, L-R, 19 kHz pilot and 38 kHz residual. Signal strength and

multipath effects are constantly monitored to validate the measurements, and may be displayed to help aim a directional receiving antenna.

Balanced program audio, carrier-loss and dead-air

alarms, the peak flasher and all panel displays appear at a rear-panel connector for full remote control ability. The 530 is in production and available now.

For information, contact Jim Wood in California at 408-458-0552; fax: 408-458-0554; or circle Reader Service 38.

For information, contact John Plattner in Washington state at 206-734-4323; fax: 206-676-4822; or circle Reader Service 201.

CONEX

## New Concept from Conex

**BELLINGHAM, Wash.** The RG-22 from Conex Electro Systems Inc. is a new concept in audio frequency generators.

With the RG-22, a user can program up to 20 arbitrary frequencies, each with a programmed level from -24 to +24 in 0.1 dB increments. Each frequency can have a programmed duration from 1 millisecond to 65 seconds in 1 millisecond increments. The RG-22 also can provide a linear or logarithmic sweep between any two frequencies.

In burst mode, the RG-22 provides a tone burst of any frequency to the next integral cycle for any programmed duration from 1 millisecond to 65 seconds.

Other features include: a built-in RS-232 interface; a digital attenuator for setting audio levels; a manual attenuator for adjusting the audio output level; and a sync pulse, to synchronize an oscilloscope.

For information, contact John Plattner in Washington state at 206-734-4323; fax: 206-676-4822; or circle Reader Service 201.

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From the AUDISK DS100 to the DS2002 system, all are expandable and upgradeable to meet your specific needs.

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AUDISK is the future of radio technology brought to you exclusively by the broadcast digital audio pros at Harris Allied.

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**Fax 317-966-0623**

AUDISK is a user-friendly system that replaces carts and cart machines with high quality digital audio.

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The AUDISK system is simple to operate and can pay for itself in a matter of months, no matter what your format.

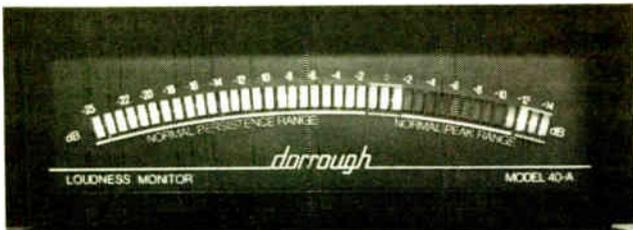
You've probably been thinking of making the move to digital but aren't sure which system is best for your station. We urge you to take a look at AUDISK. It's a complete digital

Some systems charge you for every feature. They're included with AUDISK. Need two points of control from a single system? No problem with AUDISK. Want to run an AM/FM production room from

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**DORROUGH****Dorrough Model 40-A Monitors Loudness with LED 'Eyebrow'**

**WOODLAND HILLS, Calif.** In response to today's demand for a more competitive sound, broadcasters are dis-



covering that **Dorrough Model 40-A** loudness monitors can help. Dorrough monitors provide a more comprehensive means of monitoring program content.

The loudness monitors simultaneously display three dimensions of program material content. Peak, average power and compression are displayed on a large, color-coded 40-segment LED scale. The monitors are easily viewed at a glance and from a distance.

Other characteristics that can be recognized quickly on the Model 40 series monitors include clipping, limiting, stereo phase error (difference function) and stereo sum level.

Available in a traditional "eyebrow" scale, the loudness monitors also can be supplied with vertically or horizontally mounted linear bar graph type normal or expanded range scales.

Dorrough Electronics also recently introduced a digital AES/EBU compatible version of the loudness monitor. This version features selectable 3-second hold, indefinite hold or real-time display of peaks. A no-hassle one year warranty is standard on all Dorrough products.

For information, contact Kay Dorrough in California at 818-998-2824; fax: 818-998-1507; or circle Reader Service 27.

**MODULATION SCIENCES****Self-Calibrating ModMinder from Modulation Sciences Helps Increase Modulation**

**SOMERSET, N.J.** The ModMinder® modulation monitor/analyzer from **Modulation Sciences Inc.** employs state-of-the-art digital technology to improve the accuracy of an FM station's modulation readings by over 500 percent.

The Model FMMM-2 comes complete with a factory-installed and calibrated internal demodulator. Calibration is traceable to the National Institute of Standards and Technology, and is guaranteed accurate to  $\pm 1$  percent for two years. Calibration is unaffected by RFI or vibration and is accurate from 0 to 50 degrees Celsius (32 to 122 degrees Fahrenheit).

ModMinder is shipped from the factory to conform to the FCC-approved response time of 900 microseconds. The ModMinder ignores faster program peaks, which make faster-response modulation monitors read higher. Consequently, you can increase modulation and remain legal. The increase in modulation depends on the amount of processing employed, but increases of 1 to 3 dB are typical.

Stations with subcarriers receive an added benefit from ModMinder. Conventional modulation monitors exaggerate the impact of subcarriers on total modulation: The more subcarriers in use, the greater the impact. Because of the ModMinder's digitally controlled insensitivity to the additional random peaks created by subcarriers, the impact of subcarriers is minimized.

For information, contact Art Constantine in New Jersey at 800-826-2603; fax: 908-302-0206; or circle Reader Service 73.

**FLUKE****ScopeMeter Test Tool from Fluke Combines Multimeter And Oscilloscope into One**

**EVERETT, Wash.** The Fluke ScopeMeter Test Tool combines a powerful, easy-to-operate 50 MHz, 25 megasamples per second digital storage oscilloscope (DSO) with a feature packed, 3,000 count digital multimeter in a ruggedly sealed hand-held package.

The ScopeMeter allows you to see the input's waveforms, and the digital meter displays simultaneously, making it well suited for detecting noise, waveform distortion, intermittent failures or just checking signal quality. Battery operation, combined with its light weight, mean that it is easily taken to the point of measurement. It also features a backlit LCD display so readouts can be easily seen in almost any environment.

The ScopeMeter is very user friendly. Pop-up menus and five function keys make choosing among the tool's options easy. Switching between scope and meter functions is as simple as the touch of a key.

There are three members of the ScopeMeter family to choose from, one to fit almost any application and budget.

For information, contact Fluke in Washington state at 800-44-FLUKE; fax: 206-356-5962; or circle Reader Service 125.

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## ASACA/SHIBASOKU

**Asaca/ShibaSoku AM51A Audio Analyzer Measures a Variety of Characteristics**

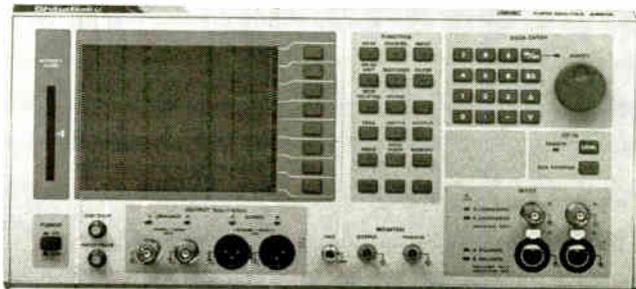
**LOS ANGELES** Asaca/ShibaSoku Corp. of America, founded in 1975, supplies the radio, television and commercial industries with a broad variety of quality audio and video test, monitoring and systems products.

Asaca/ShibaSoku's AM51A audio analyzer is designed to measure various audio characteristics in a single unit. The unit contains a two-channel oscillator, 10 Hz to 100 kHz and a measurement input section with balanced and unbalanced outputs. Among its many measurement functions, the AM51A provides superior distortion measurements, by utilizing noise reduction and harmonics analysis, down to -120 dB at levels of 1  $\mu$ V.

The audio analyzer checks distortion and other characteristics of all types of audio equipment, including recorders, generators, amplifiers, radio receivers, CD players, etc., as well as for characterizing D/A converters and other components.

The measuring functions of the AM51A include: level, level ratio, signal-to-noise ratio, relative level, harmonic distortion, IM distortion, SINAD measurement, frequency, phase difference and PCM dynamic range.

The unit includes several built in filters, including HPF, LPF, "A" weighting, etc., as well as two filter option slots for custom filters, and an external filter connection.



Panel settings can be saved in 99 internal memories, and also may be stored on an IC memory card, and for automated testing, full-function remote control is provided via GP-IB.

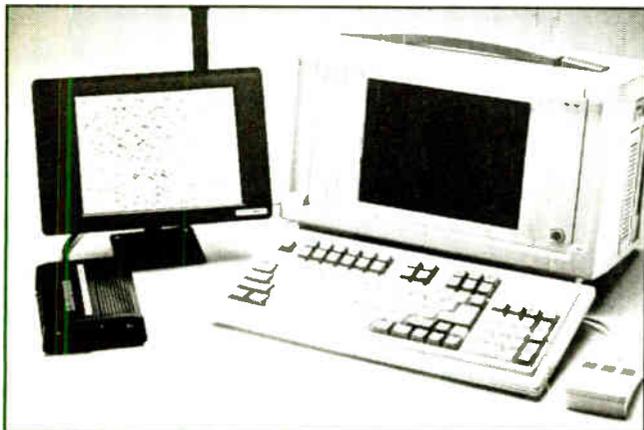
Additional features of the AM51A include: variable noise reduction for distortion and level measurements, harmonic analysis and a built-in printer driver.

For information, contact Teresa Baker in California at 310-827-7144; fax: 310-306-1382; or circle Reader Service 92.

## STI

**Survey Technologies Inc. Portable RF Signal Coverage Analyzer Suited to Mobile Environment**

**PORTLAND, Ore.** The STI-9000 RF signal coverage analyzer from Survey Technologies Inc. provides personal communication system engineers a fast, simple and accurate means of measuring and analyzing signal data throughout a coverage area.



The STI-9000 incorporates state-of-the-art GPS and computing technology to provide a new method of analysis based on measured data. Contour plots quickly displayed by the STI-9000 simplify large amounts of data and improve visualization of signal parameters (antenna patterns, signal-to-noise ratio, bit error rate, etc.) over a measured area.

In the field, the responsive 486 Windows-based system displays real-time information as data is recorded by an application specific receiver. A large 10-inch LCD touch screen facilitates data acquisition with easy to read prompts and touch screen simplicity. This compact unit is ideally suited to the mobile environment and installs easily into most any vehicle.

For information, contact William Peek in Oregon at 503-591-5986; fax: 503-591-5986; or circle Reader Service 116.

## IFR

**IFR Portable Spectrum Analyzer Has Many Features**

**WICHITA, Kan.** The IFR A-7550 is a low-cost, portable, digitized spectrum analyzer that includes two powerful microprocessors, menu driven display modes and single function keyboard entry. To further enhance the operational simplicity of the analyzer, the microprocessor system automatically selects and optimizes the analyzer's bandwidth, sweep rate, center frequency display resolution and the rate of the frequency slewing keys.

A few of the standard features included in the A-7550 are: a frequency range of 10 kHz to 1 GHz, vertical raster scan CRT display, digital storage, automatically scaled electronic graticule, automatic amplitude calibration, video filters, line, bar, average and compare display modes.

An internal battery, 1 GHz tracking generator, FM/AM/SSB receiver and quasi-peak detector are offered as options to further enhance the capabilities of the analyzer.

For information, contact Tom Dideum in Kansas at 316-522-4981; fax: 316-524-2623; or circle Reader Service 205.

## FLASH

**SMART System from Flash Keeps Tabs on Lights**

**BRENTWOOD, Tenn.** The Flash Technology FTS 2100 SMART System incorporates self-evaluating equipment with corrective action capabilities. Our System Monitoring and Reporting Telemetry (SMART) is the only obstruction lighting system that monitors its own operations for reliability and performance.

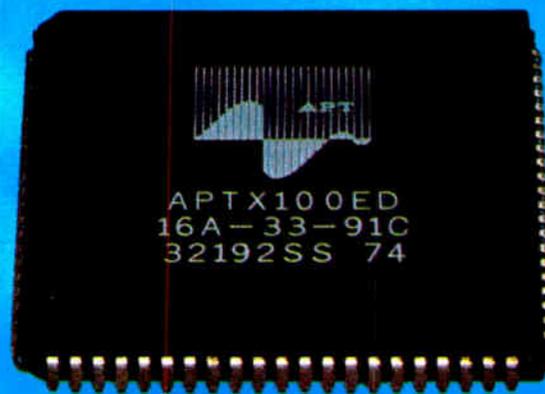
When the system's key components—an FTC 121 controller and 4990 timing and trigger board—are teamed with a new or existing ElectroFlash obstruction lighting system, all of the control, monitoring and alarm functions specified by the FAA Circular Advisory 150/5345-43 are achieved.

In addition, the controller routinely issues commands to the lighting units, and checks them for existing or stored status information on all vital system functions.

An optional factory-certified monitoring service provides 24 hour monitoring of alarm conditions while adding remote diagnostic capabilities via a modem connection. Full customized system set-up and on-site maintenance from Flash Technology's field service department is also provided.

For information, contact Larry Montuori in Tennessee at 615-377-0600; fax: 615-377-2383; or circle Reader Service 181.

# WHEN QUALITY COUNTS



**It has to be apt-X100 - the only true single chip audio compression solution - adopted by the world's leading manufacturers of broadcast equipment.**

In professional broadcast, telecommunications and recording applications, the benefits of APT's predictive audio compression system are clear. Higher resistance to tandem coding errors, lower coding delay and a higher immunity to data errors mean less noise - so if you need to exploit the advantages of compression without risk - you'll be using the most appropriate solution. For details of both single chip and board level solutions - call APT.

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## SSAC

### Electronic Light Alarm Relay from SSAC Inc. Senses Lamp Failures on Radio Towers

**BALDWINVILLE, N.Y.** SSAC Inc. introduced the SCR430T, an electronic light alarm relay used to sense a lamp failure on radio towers and other tall structures. It is a universal product that can be adjusted to meet all requirements.

The SCR430T detects the loss of one lamp out of up to four lamps either steady burn or flashing. It accommodates up to four 620 W flashing beacons or up to four 116 W side lamps. Selection of the number of lamps and their voltages are made via six switches located on the face of the unit.

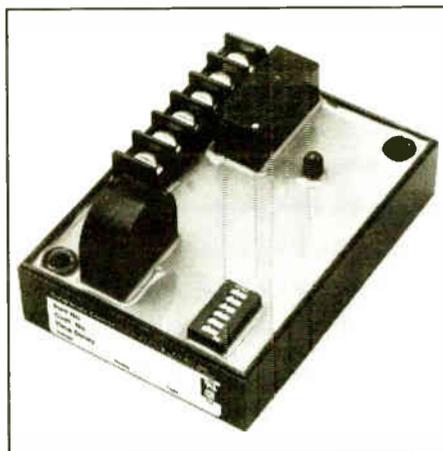
Passing the current carrying conductor (wire) through the hole of a toroidal transformer on the SCR430T allows it to sense the current to the lamp. When a lamp fails, the current drops and the SCR430T gives an output that can either turn on a spare lamp or an alarm.

There are two outputs. A solid state line voltage output to operate a spare lamp (up to 125 W) or an alarm. The other is a single pole double throw isolated relay rated at 10 amperes that can sound a remote alarm.

The SCR430T operates from 120 V AC 50/60 Hz, and has a red LED indicator

lamp that signals a lamp failure.

For information, contact Dave Eastwood at 315-638-1300; fax: 315-638-0333; or circle Reader Service 46.



## TFT

### The TFT Model 923 Monitors AM Modulation

**SAN JOSE, Calif.** The TFT Model 923 AM modulation monitor is a precision broadband demodulator that permits extremely accurate proof-of-performance measurements for an AM transmitter. Model 923 allows distortion measurements in the 500 kHz to 40 MHz frequency range.

Two large front panel meters are standard for simultaneous display of positive and negative modulation. The right meter can be switched to measure signal-to-noise ratio or frequency response.

Model 923 contains three peak flashers for quick visual monitoring. These indicators "catch" modulation peaks that normally would not register on the modulation meter. The positive indicator is factory set to flash when modulation exceeds +125 percent. Also, the positive and negative indicators are digitally programmable from the front panel to flash at peak modulation. This can be set from 50 to 150 percent in 1 percent increments.

TFT's microprocessor-based peak modulation duration differentiation (PMDD) circuit measures true modulation peaks and separates peak modulation from transients for accurate measurement and display.

The addition of an optional preselector module allows off-air monitoring of the 500 kHz to 1,990 MHz frequency range. The module is tunable digitally from the front panel. The module does not require external RF amplifiers, only an antenna.

Other features include a built-in 50 dB attenuator and a built-in-modulation calibration circuit.

For information, contact Darryl Parker in California at 408-727-7272; fax: 408-727-5942; or circle Reader Service 107.

## RADIO SYSTEMS

### Radio Systems Super Clock Line Counts in Many Ways

**BRIDGEPORT, N.J.** The Super Clock line from Radio Systems now includes a full line of digital master clocks and up/down timers.

Each component can stand alone or function in any slave/master configuration. Because the units sense if they are connected to the serial digital link, an infinite number of clock/timer configurations can be created without special ordering hundreds of different models.

The line is available in clock/timer combinations or separate clock or timer displays in table-top or 2-inch high display wall mount units. Any timer functions as a down timer with the addition of an optional key pad to enter and preset down times.

Other options include: TCX super stable time base, long battery backup and WWV receiver. Standard features include external time reference, top of the hour reset, full remote control and the ability of any unit, analog or digital, to interconnect and share time base reference.

For information, contact Dan Braverman in New Jersey at 800-523-2133; fax: 609-467-3044; or circle Reader Service 54.



*Perfect tools for professionals:  
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STUDER*



The new professional D730 and D731 CD players hold several trump cards. The operating concept is identical on both the desktop and rack-mount version. Not only are the RED book standards implemented, but also important parts of the ORANGE book standard. A special scan function allows the user to play CD-Rs on which the TOC has not yet been written: Once the TOC has been created, coded skips are correctly processed. In addition, the remaining time is displayed with great accuracy. This is of special benefit in the intro mode with its high-precision count down.

Safety features are an integral part of both models: The status preservation which guarantees that even after a «power down», the laser is repositioned exactly on the last address; a quality indicator that provides information on the CD playability; program-controlled customization of all operating procedures, comprehensive remote facilities, integrated optional interfaces for special functions, and, what is more, access to all CD sub-code information via the AES/EBU output for advanced data processing.

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Toronto, Ont M3B 2M3  
(416) 510-1347/Fax (416) 510-1294

## OPTOELECTRONICS

## Optoelectronics Decoder Reads Multiple Tones

**FORT LAUDERDALE, Fla.** The Model DC440 communications decoder from Optoelectronics Inc. reads 50 sub-audible (CTCSS) tones, 106 digital (DCS) tones and 16 Touch-Tone (DTMF) characters simultaneously.

The DC440 monitors the demodulated audio output of a communications receiver, service monitor, scanner or interceptor. CTCSS tones and DCS code are automatically detected along with DTMF characters and displayed on a two-line alphanumeric LCD screen.

Applications include two-way communications testing, repeater monitoring and updating older service monitors.

A serial data jack allows the DC440 to connect to a PC serial port via the model CX12 RS-232C interface. A complete set of control codes permit remote operation from a PC.

When connected with an Optoelectronics Model R10 interceptor, the DC440 can be used as a complete communications test system for CTCSS tones, DTMF characters, FM deviation, signal level and audio quality.

The DC440 is 1.8 inches high by 4.5 inches wide by 4 inches deep. Three front panel push button switches are used for Power, Mode and Recall. Optional internal NiCad batteries provide up to five hours of portable operation.

For information, contact Francis Wertz in Florida at 800-327-5912; fax: 305-771-2052; or circle Reader Service 166.

## SESCOM

## Sescom Field-Pro Series Makes for Smooth Remotes

**HENDERSON, Nev.** Modern radio stations are doing more and more remotes than ever before. Remotes are used to get an edge on competitor stations, and events like high school sports and mall sales are great opportunities for local radio stations to increase their visibility.

The Sescom Field-Pro Series is designed for these applications and can take the sort of abuse that is typical in the field. They are designed with recessed controls and simple 9 V battery operation, which is easy to change without any tools.

There are 11 devices to help get the job done quickly and efficiently, with minimum set-up time and confusion. The series has useful controls and is easy to operate, even for novices. The devices feature modern circuit designs to obtain the best sound possible to the studio.

The series includes devices to transmit and receive, listen, mix, split, combine and distribute audio.

For information, contact Franklin Miller at 702-565-3400; fax: 702-565-4828; or circle Reader Service 144.

## NARDA

## Thermocouple Sensors from Narda Vary Sensitivity to Delineate RF Radiation Danger and Source

**HAUPPAUGE, N.Y.** Radio frequency radiation is a topic of increasing concern to the broadcast community, and the FCC is making it clear that workplace safety is important enough to possibly affect license renewal.

Accurate measurements require sensors that yield true RMS readings. Thermocouple sensors are true RMS sensors. Simple diode sensors can become linear at higher signal levels, and can indicate much higher field levels than really exist when measuring modulated signals and/or in multisignal environments. This can result in unnecessary restrictions on operations.

At multisignal sites, with emitters operating at frequencies where the standards allow different exposure levels, it is not enough to accurately sum the various signals with an RMS sensor. Somehow the contribution of each of the emitters

must be assessed relative to each standard. One approach is to turn all the emitters off and then measure the levels for each source one at a time. This is rarely practical.

Another method is to gather hundreds of measurements from narrow band detectors and then to perform complex calculations.

The more rational approach is to use a sensor that correctly relates the contributions from each emitter to a particular standard.

Narda's patented "shaped" probes vary their sensitivity at the point of detection in accordance with major standards. The new, lower-cost Model 8742, available in May 1994, is designed for the broadcast environment, and monitors the electric field from 300 kHz to 2.7 GHz. Other available models are the Model 8722B, which monitors the electric field from 300 kHz to 40 GHz, and the Model 8732, which monitors the magnetic field from 300 kHz to 200 MHz. All three models meet the IEEE/ANSI C95.1-1991 standard.

For information, contact Bill Reich in New York at 516-231-1700; fax: 516-231-1711; or circle Reader Service 130.

## TEKTRONIX

## Tektronix TDS 300 Scopes Combine Digital Function With Analog Response

**BEAVERTON, Ore.** TDS 300 scopes from Tektronix combine an analog-like display response with powerful digital measurement and storage capabilities to overcome the typical objections to using digital storage oscilloscopes in radio system servicing.

Incorporating Tektronix's Digital Real Time (DRT™) technology, these scopes have displays that look and respond like analog scopes. DRT enables the TDS 350, for example, to sample up to 1,000 megasamples per second simultaneously on both input channels. This high sample rate ensures the capture of crucial waveform details, up to the full 200 MHz bandwidth of the scope—including program switching events, modulation characteristics and even single-shot events like noise spikes.

Moreover, the TDS 350 updates its waveform display in real time, just like an analog scope. Because the TDS 350's update rate displays waveform changes immediately, it is useful for tracking waveform changes caused by circuit adjustments.

Along with real-time display capabilities, the TDS 350 includes numerous user-friendly features like an intuitive user interface, automatic set up of standard waveform displays and 21 automatic waveform measurements.

User-friendly features combined with an analog-like display make the Tektronix TDS 350 one of the most powerful—and affordable—digital scopes available for radio system servicing.

For information, contact Tektronix at 800-426-2200; fax: 800-835-7732; or circle Reader Service 120.

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Thermal Sentry

SINE SYSTEMS

The Thermal Sentry is a sensitive and powerful tool that provides important early-warning information about transmitter conditions that, if uncorrected, could lead to down-time and costly damage. Using two precision air-temperature sensors installed at the cooling-air intake and cooling-air exhaust of a transmitter, the Thermal Sentry computes and displays the temperature difference between the two sensors. An alarm output is provided that activates whenever the temperature differential exceeds a preset value. Call for more information on the many advantages of differential-temperature monitoring.

(615) 228-3500

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Circle (152) On Reader Service Card

**AUDIO PRECISION**

**Audio Precision Audio Test System Suits Multiple Needs**

**BEAVERTON, Ore.** The ATS-1 audio test system from Audio Precision is a two-channel audio analyzer for production test, service and product design applications. It measures amplitude and noise level (broadband and frequency selective), THD+N, SINAD, intermodulation distortion, frequency, phase, crosstalk, level ratio, signal-to-noise ratio, wow and flutter, generator load and AC mains parameters.



The generator provides transformer coupled outputs with a frequency range of 10 Hz to 120 kHz, up to 26 Vrms, and balanced/unbalanced configurations. The dual channel analyzer provides 250 Vrms input, 1.5  $\mu$ V residual noise, residual distortion below 0.0025 percent and frequency range of 10 Hz to 300 kHz. Combined generator and analyzer amplitude accuracy is  $\pm 0.2$  dB with frequency response flatness of  $\pm 0.05$  dB from 20 Hz to

20 kHz. A large graphic display provides three simultaneous measurements with choice of units, dual bar graph displays and dual sweeps with a cursor and numeric read out.

The ATS-1 is available with four different types of connector panels configured for rear or front mounting. The instrument is programmable with an IEEE-488.2 interface and command set and also emulates the HP8903B audio analyzer command set for a drop-in replacement. A parallel printer port prints graphics, alpha-numeric displays, sweep plots, measurement tables and self test results to an Epson-compatible printer.

The ATS-1 is priced at \$5,450 with options for IMD, rackmount, filters and connector panels.

For information, contact Stephen Peterson in Oregon at 800-231-7350; fax: 503-641-8906; or circle Reader Service 208.

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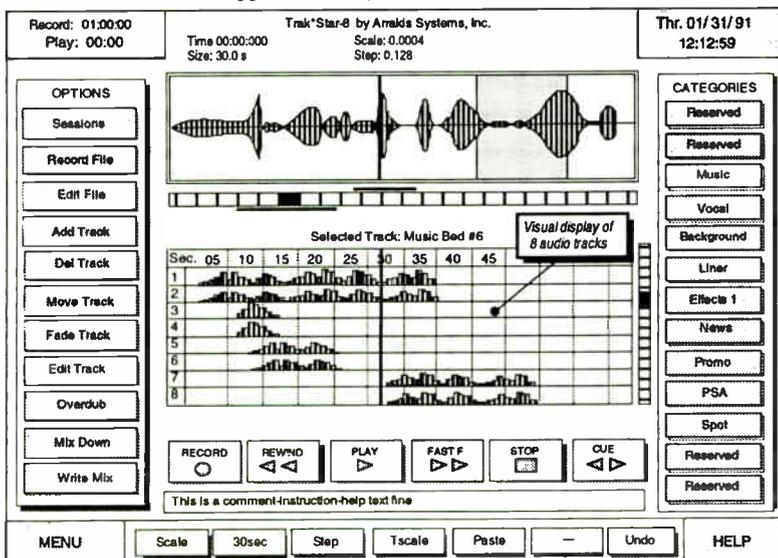
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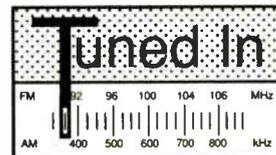
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**People, Promotions and Appointments**

**Wegener Communications** tapped former Communication Strategist Inc. CEO Neil Kohn to head its newly created corporate development organization.

Also, Wegener hired **David Molinaro** as its eastern regional sales manager.



**American Urban Radio Networks (AURN)** made two new appointments. **Glenn J. Bryant** is now director of affiliate relations. And **Ronald R. Davenport Jr.** is manager of affiliate relations.

**DYMA Engineering** hired **Darrel Clement** as sales manager. Previously, Clement was distribution account manager for Sony Electronics.

**Broadcast Programming (BP)** tapped former Bonneville Broadcast Systems (BBS) Vice President of Operations **Walter Powers** to supervise the transition of BBS products and services into BP's operation. BP purchased the assets of BBS in October 1993.

Engineer **Mike Pollock** joined **SJS Entertainment**. He works in the production division of SJS, which produces a variety of syndicated programming for radio, as well as other media services.

**Northeast Broadcast Lab Inc.** appointed **Jack Layton** as a sales representative. Layton is responsible for sales in western Pennsylvania, western Maryland, western New York state, Ohio and West Virginia.

**Company News**

**A-Ware Software** renamed its MusicScan computer music scheduling and inventory system. The product's new name is MusicMaster.

**Basic Measuring Instruments** acquired Advanced Logical Solutions, a manufacturer of SCADA systems for utility distribution system management.

**Spar Aerospace Ltd.** designated **ComStream** as the official "doing business as" name of its communications subsidiary. In December 1992, Spar purchased ComStream Corp. and merged it with Spar's former Communications Group.

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### AMPLIFIERS

#### Want To Sell

GE A1-320 (2) 20 W amp uses 6L6HIGB output tubes, \$25 ea; Eico ST-70 stereo amp, \$50. J Daniels, WRAV, 333 Delaware Ave, Delmar NY 12054. 518-439-0945.

Bøler FM RF amp, tuned to 107.1, \$400. R Wynne, KFLS. 503-882-4656.

Macintosh MC-2300 pwr amp, 300 W RMS stereo, 600 W RMS mono, excel cond, factory box, schematics, \$1000/frm, FOB Austin. J Block, The Prod Block, 906 E Fifth St, Austin TX 78702. 512-472-8975.

Ampex 620 2 rack mount, one in original case. V Coleman, WXTK, 278 S Sea Ave, W Yarmouth MA 02673. 508-775-7400.

Datatek D525 stereo dist amps w/frame (10), \$2950 plus shpg; frame w/ (6) Datatek D525 stereo dist amps, \$1750 plus shpg. H Frost, WSPR, 195 High St, Holyoke MA 01040. 413-584-6280.

Crown D-75 studio amp, less than yr old, hardly used, \$275. B Rice, W/VO. 207 N Main, Concord NH 03301. 603-228-8910.

Perma-Power S-102 amp with S1420 batt pack, mobile/portable PA unit, 12" W out, excellent condition, \$4100. R Sumner, CAVU Corp, 3322 Applegate Ct, Annandale VA 22003. 703-968-8894.

Stanton 310 preamp, \$100. L Schmitz, Soundtrax, 8116 Brucar Ct, Gaithersburg MD 20877. 301-948-4288.

RCA & LPB phono preamps, RCA for \$50 & LPB for \$75. V Coleman, WXTK, 278 S Sea Ave, W Yarmouth MA 02673. 508-775-7400.

New 10 kW amp under \$24,000. Call for details. Bill Hoffman, 518-743-1601.

Crown DC 150 amp, silver face, \$250. Wilsound, 4400 Old Lebanon Rd, Campbellsville KY 42718. 502-789-1505.

Andrew 78 ARM EIA flanged connector for 3" Helix, \$175; Andrew splice for 3" Helix, \$250; Cablewave EIA flanged connector for 3" Helix, \$175. A Chatman, WXCVC, POB 1408, Crystal River FL 32623. 904-795-7220.

ERI FM7AE 7-bay HP 1987 model w/de-icers, 100.3 MHz. J Zicherie, WISM, 1819 Mitchell Ave, Eau Claire WI 54701. 715-836-9476.

TOWERS...bought and sold. Call 1-800-393-2266.

#### Want To Buy

Low power CP FM antenna on or near 95.9 MHz. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

Part or complete Phelps Dodge CFM HP antenna on or near 93.3; also need ctr feed section from Phelps Dodge CFM-HP antenna system, freq does not matter. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

ERI Rototiller-type low power antenna, 3 or more bays, must be at 107.1 or higher. P Celaney, KKRF, 212 S Division, Stuart IA 50250. 507-895-2065.

Rohn 45 tower, 160' with any accessories; Phelps Dodge or similar 6 bay low or medium powered CP antenna in good condition on or close to 92.3 Mhz and 3 bay low powered antenna at or near 99.5 Mhz. K Diebel, 1207 Louisa St, Rayville LA 71269. 318-728-5852.

### AUDIO PRODUCTION

#### Want To Sell

dbx 165X (2), over easy limiter compressor, \$150 ea. R Phipps, Griffin Bdtg, 301 Jct Hwy #3333, Kerrville TX 78028. 210-896-1230.

UREI parametric EQ, \$300; BBE Sonic Maximizer 822, stereo/balanced, \$250. R Payne, Song Sketches Prod, 15112 Totten Pl, Shelby Twp MI 48315. 313-786-1767.

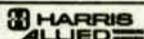
Barcus-Berry 202R (2), \$200 ea, FOB Austin. J Block, The Prod Block, 906 E Fifth St, Austin TX 78702. 512-472-8975.

Op Amp Labs mic to line-level pre-amplifier, 2 channels in custom chassis with power supply, will accept one more preamp module, \$50. C Scherer, WDOCK, One Radio Ln, Cleveland OH 44114. 216-696-0123.

Eventide BD-941 broadcast delay line with 3, 6, or 12 sec delay, \$975; UREI BL-40 Modulimiter, mono compressor limiter SN 632, \$250. R Chambers, KSUE, 3015 Johnstonville Rd, Susanville CA 96130. 916-257-2121.

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dbx 157 NR (4), simul type-1 encode/decode, indiv level controls each channel to match -10 thru +8, 2 units need repair, manual, \$350 for all/BO plus shpg. J Mehne, Clearwater Audio Recdrs, 611 E Miller Rd, Ithaca NY 14850. 607-277-0540.

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Pacific Recorder LS-4 switcher, LSM-10 mon switcher, Audiometrics 8-2 dist amps. P James, 414 Washington, Defiance OH 43512. 419-782-8591.

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Sony PCM-501ES digital recording adapter (3), \$1800 ea plus freight; other assorted audio broadcast equipment, call for list. Linda, 800-521-2537.

Fostex 4010 SMPTE reader/generator, \$325. B Seifried, Eclair Engineering, 221 Pine St, Florence MA 01060. 413-584-6767.

#### Want To Buy

Fairchild 600 conac or 602 Conex high freq limiters. J Gangwer, 942 32nd St, Richmond CA 94804. 415-644-2363.

### AUTOMATION EQUIPMENT

#### Want To Sell

IGM EC automation system, new, 12 stereo inputs, mono outputs, line amps, VUs silence sensor, etc, has live assist control package, also capable of satellite programming, all software manuals, source cables included, BO. C Gennaro, WJMS, 222 S Lawrence, Ironwood MI 49938. 906-932-2411.

IGM Instacarts/Go-Carts, (2) stereo 48 tray Instacarts touch pad on front panel, \$100 ea; (2) stereo 42 tray Go-Carts, good condition, \$500 ea, buy any two, get rack free. D Greer, WDZZ, 1830 Genesee Twrs, Flint MI 48502. 313-238-7300.

SMC MSP-1 automation system complete with (4) Otari ARS-1000 R-Rs, (3) 350RSB stereo Carousels, SMC 712 dual cart player, all in 3 matching SMC custom delux racks, manuals, currently in use, \$6000/BO. R Wynne, KFLS. 503-882-4656.

ITC 750 play only reels (4) for automation, \$150 ea/\$500 all, get rack free & 10 music reels free for AC format. D Greer, WDZZ, 1830 Genesee Twrs, Flint MI 48502. 313-238-7300.

Conex CG25A 25 Hz tone gen, adjustable tone levels, timing intervals. P Bailion, KMCM, 1218 Pioneer Bldg, St Paul MN 55101. 612-222-5555.

Harris 9001 automation w/(2) Otari ARS-1000, (2) IGM 24 Go-Cart, (2) single play ITC carts; also second system for spares or standby w/Brain, switcher, pwr supply, terminal keyboard & manuals, \$4000/BO. R Wynne, KFLS. 503-882-4656.

SMC MSP-1 automation controller w/all cables, works, BO. B Ladd, WNR, 108-1/2 E Main, Bellevue OH 44811. 419-483-2511.

IGM RAM automation controller, stereo 6 source switcher, line, que amps, VU meters, silence sensor & update clock w/source cables, live assist remote box all manuals, BO or will trade for FM exciter suitable for standby, preferably on 99.7. C Gennaro, WJMS, 222 S Lawrence, Ironwood MI 49938. 906-932-2411.

Harris 9000, (4) Otari ARS-1000 reels, (3) SMC 350 mono Carousels, input terminal, printer & manuals, 3 racks, recently removed from service, \$2500. A Chatman, WXCVC, POB 1408, Crystal River FL 34423. 904-795-9595.

SMC 350 stereo Carousels (6), will sell one or all, you pay shpg, \$300 ea. J Leutzinger, KFSB, 2620 Dogwood Rd, Joplin MO 64821. 417-624-1310.

Carousels 250 Series (3), \$250 ea; Carousels 350 Series (2), \$400 ea; Audiophile A2, \$400; Cetec 7000 automation, terminal, 5046 event memory, several source cards, \$1200; ITC 760 R-R decks (2), \$300 ea. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

Schafer 903 automation system w/Wyse terminal encoding system, (5) R-R decks 2.5 Audiophiles, printer, remote control. (5) racks, all service manuals, spare parts kit, \$3000/BO. B O'Connor, KDES, Palm Springs CA. 619-325-1211.

## HE HALL Electronics

1305-F Seminole Trail Charlottesville VA 22901

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Tascam 133 stereo cassette w/cue track	\$ 495
Valley 610 stereo compressor/limiter	\$ 395
Ramko RS-1616 routing switcher	\$ 595
BE FX-30 FM exciter (2)	\$ 2,596
ITC Delta 3D stereo cart player -	NEW \$ 1,995
ITC Delta stereo record amplifier -	NEW \$ 495
Urei equalizers - most models available	CALL
Sennheiser HD-440 II stereo headphones -	NEW \$ 52
Eventide H-3000B harmonizer - (1 only)	NEW \$ 1,995
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Harris 9002 (5) ITC 750/770 PBs, 48 tray mono Instacart, (3) cart deck PBs, (2) VDTs, manuals & schematics, in use. J David, KMPL, POB 907, Sikeston MO 63801. 314-471-1520.

ITC R-R's (4); Schafer 903 with many extra cards with logging; (5) Carousels; (2) Audiofile II; SP10MK2 TTs (4); Otari ASR1000 R-R, new; Centurion 12 channel mono audio console; Criterion cart machine; Gates stereo 80 console, all at BO. R Taylor, WHEN, 620 Old Liverpool Rd, Liverpool NY 13088. 315-457-6110.

SMC ESP-1 Carousel plus complete ESP-1 equipment; (2) steel equipment racks on rollers, completely wired, \$1000/SMC, \$500/rack. M Taylor, KNEO, POB 845, Neosho MO 64850. 417-451-5636.

## CART MACHINES

## Want To Sell

Audicord PB only (2) in gd cond, \$350 ea. R Phipps, Griffin Bldg, 301 Jct Hwy #3333, Kerrville TX 78028. 210-896-1230.

Great Prices on original equipment tape heads for ITC, Bl, Fidelipac, Otari, Tascam & others!

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ITC 99 R/P w/ELSA, no heads, capable of stereo use, needs interconnect cables, BO. C Scherer, WDOK, One Radio Ln, Cleveland OH 44114. 216-696-0123.

ITC 99B R/P in gd cond, BO. S Michaels, GMN Inc, Box 2205, Cincinnati OH 45201. 606-572-9446.

BE 5302 & 5310 triple cart R/P, good condition, Best Offer; IGM 10A single deck player, good condition, Best Offer; Delta stereo R/P, Best Offer. R Fries, WVSY, POB 7932, Charlottesville VA 22901. 804-973-2200.

## Want To Buy

ITC stereo R/P, mono R/P, M Harris, KDOK, POB 1330, Tyler TX 75710. 903-593-2519.

ITC, BE, Fidelipac cart machines: single, triple, mono, stereo, play & record/play. Call M O'Drobinak @ 619-758-0888.

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## Want To Sell

Sony 770-2 portable, 2 trk, 7.5-15, add'l 1/4 trk PB head, variable speed DC servo capstan, manual, needs some work, \$350/BO plus shpg; Revox 700, 2 trk, 15-7.5-3.75, rack-mount, DC servo capstan, constant tension transport, works but tough shape, 1 VU meter dead, manuals, \$200/BO plus shpg. J Mehne, Clearwater Audio Recdrs, 611 E Miller Rd, Ithaca NY 14850. 607-277-0540.

Berlant-Concertone 23 custom stereo Series 20, circa 1959, mostly working w/schematics, free, just pay shpg. C Dunnam, Linear Research, 5244 Perry City Rd, Trumansburg NY 14886. 607-387-3411.

Revox PR99, gd cond, BO. R Fries, WVSY, POB 7932, Charlottesville VA 22901. 804-973-2200.

Tascam 2640-25 cassette duplicator 16:1, high quality, BO. P James, 414 Washington, Defiance OH 43512. 419-782-8591.

Tascam 112B, excel cond, \$520; MCI JH1624, 16 trk, 2" analog recorder, mint cond, 100 hrs on new lapped heads w/auto-locate type 3, manual, call for details. R Payne, Song Sketches Prod, 15112 Totten Pl, Shelby Twp MI 48315. 313-786-1767.

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Palatine, IL 60067  
708-358-4622

Revox G-36 Mark III tube recorder, excellent condition, BO; Tandberg 6000X, 3 speed, excellent condition, BO. R Rhodes, Roger Rhodes Music, POB 1550, NY NY 10101. 212-245-5045.

Ampex AG-440-B, 2 track, 7.5-15, add'l 1/4 track PB head with both scrape flutter idlers, synchronous capstan, spare hold-downs & pinchroller in Ampex roll-around, manual, excellent condition, \$1400/BO plus shpg. J Mehne, Clearwater Audio Recdrs, 611 E Miller Rd, Ithaca NY 14850. 607-277-0540.

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Nashville, TN 37203 (615) 244-6892

Tascam 32 (2) in excellent condition, low hours, \$600 ea. K Thomas, Rebel Recdg, 5555 Radio Ln, Jacksonville FL 32205. 904-388-7711.

Tascam MS-16 1" 16 track with integral dbx, excellent condition, factory stand, fancy remote/locator, \$3750, FOB Austin, J Block, The Prod Block, 906 E Fifth St, Austin TX 78702. 512-472-8975.

Otari MK-III 8 trk, \$1995; Eventide H3500 Ultra-Harmonizer, \$2495; Audiotronics 110A 18 chnl Grandson, \$495; Kurzweil K1200 Pro-88 keyboard, \$1595. St John Productions, 504-464-8881.

Pioneer RT-1050, 2 track & 1/4 track headblocks, 15-7.5, balanced mic inputs, edit/cue lever mod, needs rewind switch, manuals, \$200/Best Offer plus shpg. J Mehne, Clearwater Audio Recdrs, 611 E Miller Rd, Ithaca NY 14850. 607-277-0540.

Scully 250 2 trk R-R in homemade cabinet, seems to work, BO. J Wells, Sound Arts, 8377 Westview, Houston TX 77055. 713-464-4653.

Otari ARS 1000 (4) interfaced to operate on SMC automation system, will sell one or all, \$450 ea. J Leutinger, KFSB, 2620 Dogwood Rd, Joplin MO 64821. 417-624-1310.

Ampex AG440 8 track, excellent condition, 10 hrs on relapped heads, \$1800; Ampex 300 Series, electronics modules only (8), \$200 ea. B Seifried, Eclair Engineering, 221 Pine St, Florence MA 01060. 413-584-6767.

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Recorder heads, used Scully mono & 2 track, \$25-50, ATR100's, 3M M79-16 & 8's, Otari 1/2" 8 tracks, \$495. W Gunn, 619-320-0728.

Otari Mark II-IV 1/2" 4-track, multi-track, mint, less than 50 hours, Best Offer. R Kaufman, Pams Productions, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

Tascam 112R cassette decks, 3 head, auto reverse, source/tape monitoring, pitch control, \$395. Pro Digital Inc., 215-328-8992.

Technics RS-270X with Dolby B & dbx II NR scheme, excellent condition, \$225; remote control for RS-270X, \$30. L Snyder, MB Inc, Box 182, Floral Park NY 11001. 718-347-2940.

Panasonic SV 3700 rack mount digital audio tape decks (6) in excellent condition, 9 months old, \$900 ea or all for \$5000. W Specht, KHAS, 906 W 2nd St, Hastings NE 68901. 402-462-5101.

AKAI GX6300-55 1/4", 4 track, Quadra-Sync 10.5" reels, \$250. L Schmitz, Soundtrax, 8116 Brucar Ct, Gaithersburg MD 20877. 301-948-4288.

RCA RT-21, vgc, spares for electronics, manual, needs capstan solenoid, \$400; FT in original case, very good c, \$175. V Coleman, WXTK, 278 S Sea Ave, W Yarmouth MA 02673. 508-775-7400.

Otari MX5050 B-2HD 2 track (6), good working condition, \$795 each plus freight or \$4500/all; other equipment available, call for list. Linda, 800-521-2537.

Uher 4200 Report Monitor, R-R stereo 1/2 track portable, 3 heads, 4 speeds, new in box, \$500. R Sumner, CAVU Corp, 3322 Applegate Ct, Annandale VA 22003. 703-968-8894.

Telefunken M-12A stereo 1/4", as is, \$750; Ampex 350 & 440, 2 transports, 3 headstacs, 3 sets 440 electronics, 440 remote & roll around case, \$500. R Friedman, 1137 Recording, 1137 Fillmore St, Baltimore MD 21218. 410-889-4228.

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## Want To Buy

Sony TC-105 motor in good condition. D Neish, Mobile Tadio Comm, Box 100, Chester SD 57106. 605-489-2497.

Fostex PD-2 portable 4-head time code DAT recdr. G Warren, 3715 N Lakewood, Chicago IL 60613. 312-327-4785.

Otari MX 5050 III, 1/4", 2 track, late model, must be in excellent working condition. Susan Kernes, True North Productions, POB 984, Homer AK 99603. 907-235-5194 or FAX: 907-235-3414.

Cooper ARPC resolver & time code interface for Nagra; Nagra QSEF balanced input preamp. G Warren, 3715 N Lakewood, Chicago IL 60613. 312-327-4785.

Scully '100' recorders, record/play amplifiers, 8, 16, 24 track heads. Sequoia Electronics, 4646 Houndshaven Way, San Jose CA 95111. 408-363-1646.

Spotmaster TP-60B tape timers from cart tape winders (TP-1A or TP-1B). Mel Crosby, 408-363-1646.

Ampex ATR100 taperecorders for parts. Circuit cards, heads, motors, machine parts, or electronic parts. Call 818-907-5161.

## CD PLAYERS

## Want To Sell

Denon DN-970FA CD cart player, new in box. Originally \$1850, sell \$1295. Pro Digital Inc., 215-328-6992.

## COMPUTERS

## Want To Sell

Franklin 8086 IBM compatible computers (2), floppy drive & 20 meg hard drive, mono monitor, \$300 ea. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

## Want To Buy

Radio Shack TRS-80 model 4 wanted for back up, no junk, must in gd cond. Jack or Shirley, WENT Radio, Harrison St Ext, Gloversville NY 12078. 518-725-7175.

## CONSOLES

## Want To Sell

Sparta 8 pot, works, but better as parts source, will trade. S Callahan, Talking Info Ctr, Enterprise Dr, Marshfield MA. 617-834-4400.

Auditronics 110-B special 48 trk plus dual foldback mixing board, as is, BO. U George, 840 8th Ave, NY NY 10019. 212-969-0240.

Tascam 5 w/R-R 12-4, Tascam 40-4 w/dbx R-R, Tascam 25-2 1/2 R-R, Otari 5050, BO. P James, 414 Washington, Defiance OH 43512. 419-782-8591.

Shure FP-31 3 channel mono mixer/case, used in good condition, \$500. Raider Productions. 215-889-9565.

CAD Maxcon mixing console, 16 input, C frame, 36 panel with additional ribbons, stereo buss, 8 monitor buss panels, PS-2 supply with separate for meter bridge, Type 1 master modules, mint condition, call for details, \$6200. R Payne, Song Sketches Prod, 15112 Totten Pl, Shelby Twp MI 48315. 313-786-1767.

Microtouch 5 channel stereo, \$500. G Erway, KKSBB, 1330 Cacique, Santa Barbara CA 93103. 805-563-1444.

Tascam M216 16 channel mixer, \$825; Audio Technica 4 track 6 channel mixer, \$825. G Fitzgerald, Fitzmusic, 37-75 63rd #B29, Woodside NY 11377. (no phone # given)

Tascam 5B mixer, 8x4, 2 band EQ, 2 sends, talkback module, spare Master Module, spare blank, wood shipping crate, documentation, PB-64 patchbay w/cables, gd cond, \$800/BO plus shpg. J Mehne, Clearwater Audio Recdrs, 611 E Miller Rd, Ithaca NY 14850. 607-277-0540.

Soundworkshop 1208-EX, 12 input, parametric EQ, separate monitor system, mint condition, \$1500. C Volpe, Volpe Recdg, 5210 Silver Spring Rd, Perry Hall MD 21128. 410-931-1163.

Roland CompuEditor, automated fader package, SMPTE based w/15 long throw ALPS faders, 15 chnl of voltage controlled gain elements (2), \$500. B Seifried, Eclair Engineering, 221 Pine St, Florence MA 01060. 413-584-6767.

Auditronics 110A 2 channel/4 channel, 2 stereo inputs, 4 mono inputs with EQ, foldback, 2 echo returns, 144 pt TRS patchbay, 4 VU meters, \$2500/BO. L Schmitz, Soundtrax, 8116 Brucar Ct, Gaithersburg MD 20877. 301-948-4288.

Ward Beck bdct console, 26 in, 9 out, fully parametric EQ, dynamics modules, 4 subs, 4 aux, P&G faders, \$4500. R Friedman, 1137 Recording, 1137 Fillmore St, Baltimore MD 21218. 410-889-4228.

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BE BEFSD 100 splice finder, nice cond, \$275. L Snyder, MB Inc, Box 182, Floral Park NY 11001. 718-347-2940.

BE 5300C tripledeck, stereo, PB, mint less than 50 hrs, BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

## EMPLOYMENT

To place ads in this section, use the ActionGram form. To respond to box numbers write Radio World, PO Box 1214, Falls Church, VA 22041. Attn: \_\_\_\_\_

## POSITIONS WANTED

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Hands on Engineer w/over 30 yrs of AM/FM/TV. MF/HF/UHF background, desires position with Intl SW bdctg facility, FCC Gen SBE Cert, IEEE, AE Degree. Lou, 904-383-1002.

Exper GM-OM w/unbeatable track record is fired up to make your statio the community's most well known, former major market sportscaster. Big Ed Edwards, 4009 17th St, Sarasota FL 34235. 813-366-0732.

CE w/big production voice & over 15 yrs hands-on eng exper seeks CE position w/production, strong troubleshooting, RF & computer skills. G Morgan, 704-563-8676.

AAS Grad, 3 yrs on-air, seeks FT announcing, CHR, AC, AOR, Light Talk, CHR PD potential. Brian, 1104 Park Circle, Conyers GA 30207. Atlanta area only.

The skills and talents of some broadcasters have been known to unravel; invest your trust in this poetic announcer who is ready to travel. Mike, 405-733-7859.

Recent broadcasting graduate seeking an on-air position, gd prod skills, fast learner, will relocate. Chris, 405-631-6758.

Experienced news reporter/anchor, worked w/NY/NJ medium market stations, great writing & announcing skills, news hound, seeks midwest opportunity. MC, 908-940-9179.

Pleasant voice, friendly personality, career oriented female seeks relocation to AZ, CA, or NV areas, gifted writer, full of excitement. Barbara Ann, 405-872-9384.

General Manager, 15 yrs exper, seeks similar position with US radio station. Send replies to J Riordan, c/o D. O'Hara, 1 Kimball Ave, Yonkers NY 10704.

Experienced pro seeks Midwest market, for FT shift, currently employed in Michigan doing Country, gd production. Jack, 906-643-8569 or 414-242-4357.

Country/AC, currently AM drive/MD, humorous, topical & great phone voice. Mike, 707-253-8548.

Experience isn't only years! Hire Janet, 502-895-5888. PT announcing, programming aspirations, computer literate, in radio since 1980 w/mktg exper, serious inquiries only.

## HELP WANTED

Massachusetts AM/FM, seeking news, sports, announcing & production talent. Send resume, tape to: Corydon L. Thurston, Berkshire Broadcasting, Box 707, No. Adams MA 01247. EOE.

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Mail to: BROADCAST EQUIPMENT EXCHANGE  
PO Box 1214, Falls Church, VA 22041 Attn: Simone Mullins

**CONSOLES...WTS**

Shure M-67 original condition, \$150. V Coleman, WXTK, 278 S Sea Ave, W Yarmouth MA 02673. 508-775-7400.

RCA BT15AD dual mono channels, 2 VU meters solid state, nice condition with manual, \$250. R Elm, WWJC, 1120 E McCuen, Duluth MN 55808. 218-626-2738.

Audioarts/Wheatstone 8X 8 track recording console with 16 inputs expandable to 24, LED meter bridge, console support legs. Privately owned, excellent condition. \$3900. D White, WROK, POB 6186, Rockford IL 61125. 815-399-2233.

**Want To Buy**

Neve BCM 10, or any small broadcast console made by Neve. J Wells, Sound Arts, 8377 Westview, Houston TX 77055. 713-464-4653.

RCA BC-19A or BC-19B, 4 mixer stereo board. M Harris, KDOK, POB 1330, Tyler TX 75710. 903-593-2519.

**DISCO-PRO SOUND EQUIP**

**Want To Sell**

Roland DEP 5 sound processor, \$400. Wilsound, 4400 Old Lebanon Rd, Campbellsville KY 42718. 502-789-1505.

Complete 4 track studio, Tascam, Symetrix, etc, mint condition, over \$14,000 invested, Best Offer. B Callahan, 489 Hastings St, Boca Raton FL 33487. 407-241-4942.

**Want To Buy**

Altec 604, Altec/WE 755s, WE speakers & system. L Blackmon, RQ Studio, Larson Rd #4, N Reading MA 01864. 508-664-0174.

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**LIMITERS**

**Want To Sell**

Aphex 250 Aural Exciter III, as new condition, original crate, manual, \$675. J Ying, 140A, Bellevue Ave, Newport RI 02840. 401-846-9743.

Allison Kepex 8 channel in 19" powered rack, can fix 8 more channels in rack, BO. J Wells, Sound Arts, 8377 Westview, Houston TX 77055. 713-464-4653.

Solid Statesman AGC and limiter; Audimax 4440A & 4450A, discriminate audio processor & 2 older Volumax's, will trade. S Callahan, Talking Info Ctr, Enterprise Dr, Marshfield MA. 617-834-4400.

Optimod 8000A, 8100, 8200, good condition, \$1500-\$8000/BO. S Michaels, GMN Inc, Box 2205, Cincinnati OH 45201. 606-572-9446.

dbx 160X comp/limiter, Fostex digital delay, Orban 672A EQ, Tapco 4400A stereo reverb, BO. P James, 414 Washington, Defiance OH 43512. 419-782-8591.

UREI 1176 good condition, \$475. V Coleman, WXTK, 278 S Sea Ave, W Yarmouth MA 02673. 508-775-7400.

Optimod 8000A, good condition, \$1200/BO; Aphex 300 Compellor, stereo, \$500/BO; Aphex Aural Exciter, stereo, \$500/BO. D Mussell, Broadcast Engineering Svcs, POB 2542, Aptos CA 95001. 408-688-5209.

Orban Optimod 8100 A/1 with Texar card 5 & original card 5 in excellent condition; Texar Audio Prisms (2), excellent condition; MSI CP-803 composite clipper in excellent condition, all equipment complete with manuals, to be sold as complete processing system, \$6000/all. T Jenkins, KNFM, 2911 La Force Blvd, Midland TX 79711. 915-563-5636.

Orban 424A w/chnl gated compressor/ limiter, de-esser, \$500. L Schmitz, Soundtrax, 8116 Brucar Ct, Gaithersburg MD 20877. 301-948-4288.

Gates/Harris M6629 Solid Statesman AGC, \$75. R Elm, WWJC, 1120 E McCuen, Duluth MN 55808. 218-626-2738.

**Want To Buy**

Dolby SR 280 CAT cards (2) for Dolby SR NR. G Warren, 3715 N Lakewood, Chicago IL 60613. 312-327-4785.

Fairchild 670 or 660 tube compressor/ limiter, Teletronics LA-2A tube compressor/limiter or UREI LA-3A solid state compressor/limiter, call after 3PM CST. 214-271-7625.

**MICROPHONES**

**Want To Sell**

AudioTechnica 811 bi-directional, new, \$150; Gitzo 14' fishpole/intermal-wired w/AT mic mount, used, gd cond, \$125. Raider Productions, 215-889-9565.

Sennheiser 441, new, never used w/all papers & response curves, \$420; Neumann U87Ai, new, never used w/all papers & Gotham box, \$2400; Beyer M-201 cardioid dynamic (pr), mint cond, \$180 ea/\$350 pr; Sennheiser 421, excel cond, \$320; CAD condenser mic, mint cond, box & all papers, \$580. R Payne, Song Sketches Prod, 15112 Totten Pl, Shelby Twp MI 48315. 313-786-1767.

Neumann NKMU pwr supply for KM56 mic, never used, \$225; Neumann U-67 w/pwr supply, like new, \$2895. F Virtue, Virtue Recdg, 8811 Rising Sun Ave, Philadelphia PA 19115. 215-763-2825.

EV 103 like 365A, gd cond, XLR mount, many avail, \$35 ea. U George, 840 8th Ave, NY NY 10019. 212-969-0240.

AKG The Tube mic, \$2600; AKG 421, \$275; (2) Beyer M160 ribbon mics, \$550. G Fitzgerald, Fitzmusic, 37-75 63rd #B29, Woodside NY 11377. (no phone # given)

Shure SM 82 unidirectional mic, \$275/BO. J Daniels, WRAV, 333 Delaware Ave, Delmar NY 12054. 518-439-0945.

Audio Technics C87 cardioid condenser mics (12), like new, \$150 ea. R Suraci, Fine Art Prod, 67 Maple St, Newburgh NY 12550. 914-561-5866.

Gefell Neumann UM57 tube mics, New capsules for SM2 & many others, New AC701 tubes for Neumann mics, \$275. W Gunn, 619-320-0728.

AKG 414's, \$695, original D12 like the Beatles used, \$295, Sony ECM54, \$150, Beyer M500 1k new, \$300, Demeter 4-ch tube DI rack mt lk new, \$875. W Gunn, 619-320-0728.

**Want To Buy**

Valley 400 mic processor in gd cond. S Michaels, GMN Inc, Box 2205, Cincinnati OH 45201. 606-572-9446.

RCA 91-A mic desk for RCA 44 mic. E Kovach, 1409 Oak St, Wyandotte MI 48192. 313-285-9710.

EV 666 w/connector, desk stand & stand clamp in excel electrical & physical cond. D Sites, VOA Sri Lanka, Colombo-DOS, Washington DC 20521. 202-619-1897.

77-DX's, 44-BX's, KU-3A's On-Air lights. Top price paid. Fast response. Bill Bryant Mgmt, 2601 Hillsboro Rd, G12, Nashville TN 37212. 615-269-6131.

RCA 77DXs/44BXs ribbon, chrome/TV grey, gd cond, BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625, after 3PM PDT.

**MISCELLANEOUS**

**Want To Sell**

10 Double row, 48 jack, tip-sleeve patch panels wired to Xmas trees, \$25 ea/BO; WE 19645 recorder connector, provides 15 sec beep tone & output for recording telephone calls, needs relay, \$35. M Muderick, Muderick Recdg, 101 Earlington, Havertown PA 19083.

ProComm 48-position audio patch bays, many avail, BO. U George, 840 8th Ave, NY NY 10019. 212-969-0240.

Altman 12" pan style lights w/o bulbs, \$25 ea. Wilsound, 4400 Old Lebanon Rd, Campbellsville KY 42718. 502-789-1505.

Old equip manuals, RCA, GR, Presto, others, send SASE for list & prices. V Coleman, WXTK, 278 S Sea Ave, W Yarmouth MA 02673.

Tube output transformers by UTC, Triad, Freed, WE, Acrosound, Peerless. L Blackmon, RQ Studio, Larson Rd #4, N Reading MA 01864. 508-664-0174.

**Want To Buy**

Ampex tube recorders and mixers. W Gunn, 619-320-0728.

Metal Bell System ringer boxes & round or oval base. J Newman, Box 1211, Newport RI 02840. 401-847-0455.

Radio Dramas, narrations, story's wanted for production; also looking for weird, space, alien sfx sounds. R Suraci, Fine Art Prod, 67 Maple St, Newburgh NY 12550. 914-561-5866.

Jazz record collections, 10" LP/12" LP be-bop, swing, dixie, highest prices paid. B Rose, Program Recdgs, 228 East 10th, NYNY 10003. 212-674-3060.

Radio transformers by Chicago, UTC, Triad, Peerless, Freed, Sola, send list. J Gangwer, 942 32nd St, Richmond CA 94804. 415-644-2363.

**MONITORS**

**Want To Sell**

Gorman Redlich EBS encoder/decoder, like new w/manual, \$250 plus shpg. B Dickerson, WEAG, 1421 S Water St, Starke FL. 904-964-5001.

Modulation Sciences 188 data SCA generator, \$3600. R Humphrey, WWVA, 1015 Main St, Wheeling WV 26003. 304-232-1170.

**Want To Buy**

EBS encoder/decoder, not to old, working. P Swartz, WXJC, 6831 Holiday St, Homosassa FL 34446. 904-621-0402.

McMartin (buy & sell) any model. C Goodrich, 11435 Manderson, Omaha NE 68164. 402-493-1886 or fax 402-493-6821.

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Panasonic portable FM-SW-MW-31 band receiver model RF-3100 dbi superheterodyne, digital frequency readout, rcdg jack, AC-battery operation, good shape, works perfect, \$250/Best Offer. L Snyder, MB Inc, Box 182, Floral Park NY 11001. 718-347-2940.

**Want To Buy**

Marti SCG-8 SCA generator in good shape, preferable set up for 67 kHz; Johnson portable SCA analyzer. S Callahan, Talking Information Center, Enterprise Dr, Marshfield MA. 617-834-4400.

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Old Marti remote broadcast transmitter for parts, will consider transmitter & receiver; also need copy of receiver service manual. G Phillips, WLNC, POB 925, Laurinburg NC 28353. 910-276-0000.

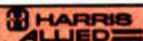
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AM & FM western Colorado, AM was country format, both dark now, \$75,000 both, \$50,000 Fm, \$35,000 AM; Transaction Realty Professionals, Inc. (303) 945-2361.

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Russco Cue Master, 33, 45, 78 rpm, gd cond, \$150. V Coleman, WXTK, 278 S Sea Ave, W Yarmouth MA 02673. 508-775-7400.

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Scully VP131 customed by Haeco, Westrex 3-IIAH stereo head, in operation, call for details, \$30,000. F Virtue, Virtue Recording, 8811 Rising Sun Ave, Philadelphia PA 19115. 215-763-2825.

Technics SL-1200 MK2 (2), \$275 ea; RCA BQ-70F 3 speed, 16" transcription TT w/Shure 16" tonearm, completely rebuilt, \$150. G Dunn, No Cal News, 5383 Willow Lance Ct, Byron CA 94514. 510-516-0299.

Technics SP-10 MK II (6), 4 with SL1000 base & tone arm, 2 TT only, fair condition, must pick-up, Best Offer, Technics SH-15B3 large heavy base & dust cover for SP-15/25 TT, new, unopened, will ship, \$75. M Byrnes, WAMU, 4400 Mass Ave NW, Washington DC 20016. 202-885-1200.

Gates TA-1 cartridge head; RCA 16" arm, head & network. B Rose, Program Recdgs, 228 E 10th St, Nyny 10003. 212-674-3060.

**Advertising  
Close Date for  
February 23, 1994  
Radio World:  
January 28, 1994**

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Record cutting lathes, 16" tables/arms, SME-3012, 45/78 records. 612-866-6183.

## ACTION-GRAM

**Equipment Listings**

Radio World's Broadcast Equipment Exchange provides a FREE listing service for radio stations and recording studios only. All other end users will be charged. Simply send your listings to us, following the example below. Please indicate in which category you would like your listing to appear. Mail your listings to the address below. Thank you.

Please print and include all information:

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Address \_\_\_\_\_

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I would like to receive or continue receiving  
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- I. Mfg. distributor or dealer
- J. Other \_\_\_\_\_

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WTS  WTB  Category: \_\_\_\_\_

Make: \_\_\_\_\_ Model: \_\_\_\_\_

Brief Description: \_\_\_\_\_

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WTS  WTB  Category: \_\_\_\_\_

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\*Closing for listings is every other Friday. Please be aware that it does take approximately 1 month for your listings to appear. They will then appear for only 2 issues. If more time is needed, please re-submit your listings.

### Broadcast Equipment Exchange

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Andy & Debbie Montgomery and Capt'n. Pat Adams, the morning team at KIX-106 in Memphis, Tennessee.

# We Make a Good Team!

KIX-106 is the number one country music radio station in the Memphis area. When they decided to remodel and expand their studios, the most carefully researched item on the equipment list was a new console for their on-air studio.

So they purchased the Auditronics 800 Series console.

Doug Cossett, their engineer, said some really great stuff about it, but we didn't want to get technical. Let's just say the specs are definitely superior.

However, Andy Montgomery, one-third of the KIX-106 morning team, said some really good stuff too... "Our entire studio is designed around the Auditronics 800. You might say that the 800 and, of course, Debbie are at the center of everything (Debbie's my wife, so I had to say that). It's reliable and it's sturdy. Have you ever spilled a cup of coffee or a soda on your console and everything shuts down? I don't recommend it, but so far this hasn't been a problem for the 800. It's so versatile. It does everything I need and it always works. That sure makes my job a lot easier. Debbie, Cap'n Pat, the 800 and I make a good team!"

"It's hectic on our morning show and we get lots of phone calls, especially Debbie. This new telephone mix minus system makes them so much easier to handle."

"There are always the three of us on the air in the morning, but it's not unusual to have 5 or 6 people in the studio and on the air at the same time ... plus the music, the commercials and the phone calls. And we still haven't begun to max out the console. It's so reliable that I don't think Doug has had to make even a minor adjustment or anything since we started using it."

If you want to find out what Doug and other users had to say about the Auditronics 800 console, call your favorite Auditronics dealer or Auditronics today.

*The Sound Of Perfection*

**AUDITRONICS**

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factory support from a technically competent and responsive staff.

We've also handled your special requirements as well with a super family of accessories, including a choice of three different telephone modules, an intercom module, an off-line mixer module for your remote feeds, talent control stations, accessory panels, failsafe power supplies, and auto cart and CD sequencing options.

**So take a close look:** we've got the quality, we've got the innovations, and you've got our commitment to top-notch support.



## *The Better We Look!*

*A-500*