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# Radio World

Buyers Guide  
Cart machines  
See pages 33 to 47

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## Angry Class A's Quit NAB

by John Gatski

**Washington DC** ... A few angry Class A FM radio station managers have resigned their NAB memberships and others are talking about forming an alternative broadcast group because of the NAB's position on the proposed Class A power increase, now before the FCC.

An undetermined number of Class A stations, of which some have withheld 50% of their dues to the NAB, have sent letters announcing withdrawal of their memberships and others may follow suit, according to station managers.

Susan Kraus, NAB VP for media relations, confirmed that "a couple" of resignation letters and a few announcing dues

withholdings have been received.

"I sent them (the NAB) a letter of resignation, November 8," said Bob Channick, GM at WCCQ-FM, Joliet, IL.

A station GM who declined to be identified said his station also has resigned from the NAB and there are more than a "couple" that have stopped paying their dues. He declined to name the other stations.

Channick said he will not rejoin the NAB unless it supports the New Jersey Class A Broadcasters Association's proposal to grant all Class A stations a power increase from 3000 W to 6000 W.

"It seems crazy for us to be paying dues so they can pay their lawyers to battle us on this," Channick said.

The NAB favors granting a limited number of Class A's the power increase and the rest only on a case-by-case basis with approval that depends on the station's ability to meet increased separation distance requirements.

The FCC is considering both proposals in its Proposed Rule Making deliberations, on which comments were due 22 November. (See separate story this issue.)

### Alternative association

New Jersey Class A Broadcasters Association President Bob McAllan confirmed that some station owners are so concerned about NAB's position, they are talking about forming an association for smaller broadcasters.

The broadcasters are sorry they let the old National Radio Broadcasters Association (NRBA) dissolve, McAllan said. The merger of the NAB and NRBA was finalized this year after a two-year evaluation period during which time former NRBA members studied NAB's responsiveness to radio issues.

(continued on page 3)

## License Filing Quiets Booster

by Charles Taylor

**Walnut Creek CA** ... A California FM licensed here has agreed to retire its booster and pay an undisclosed cash settlement to an adjacent station after a petition was filed with the FCC to deny the Walnut Creek station's sale, according to the parties involved.

KALW-FM, based in San Francisco, charged in a 16 September filing that Chabin Communication Corp., the licensee of KKIS-FM in Walnut Creek and KKIS-AM in Pittsburgh, CA, was not fit to be a Commission licensee, thus should not be allowed to transfer ownership of the stations to Diamond Broadcasting of California.

Eight months earlier, insistent complaints from KALW and KSJO-FM in San Jose led the FCC to order that KKIS turn off its booster.

That controversy began in the summer of 1985 when the two stations charged that KKIS's signal was extending beyond its legal coverage area and interfering with the adjacent stations. (See 15 August **RW**.)

After investigating, the FCC determined that KKIS's signal extended its 1 mV/m contour "far in excess of what could be reasonably be considered 'spillover.'"

But Chabin then filed a Petition for Reconsideration, insisting that the booster should be grandfathered from laws limiting its coverage area since it was installed in 1985 within what then were legal guidelines.

KALW's effort to block the sale of KKIS, according to KALW GM Daniel del Solar, was an attempt to insure that KKIS would not return its booster to the air.

Because of the Petition for Reconsideration, "the booster issue was not dead," he said. "The feeling was that if the booster issue remained unchallenged in

the transfer, then the new owners might give (KALW) new trouble.

"We had to take a position to insure that the booster issue would be laid to rest. (The petition to deny the sale) was the only point of pressure that we had, a last ditch attempt to be sure that we would not be further injured," del Solar said.

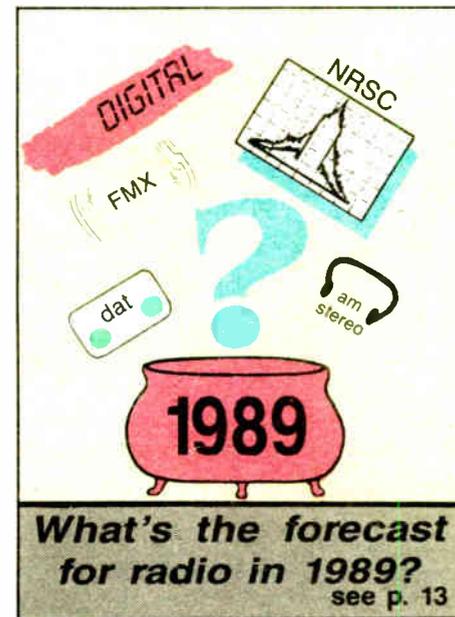
To fuel its charges, KALW presented the FCC with 20 pages of allegations regarding some of KKIS's past activities, including the booster issue.

Chabin, in a subsequent filing, called KALW's charges nonsense, and said that

the station's primary motive was delay. The company also asked the FCC to dismiss the petition.

The Commission, however, did not respond to the issue because of a backlog of such cases, said Alan Schneider, chief of the FCC's auxiliary services bureau.

But according to Roger Metzler, the attorney representing Chabin, "The FCC's standard dispute resolution mechanism is to ignore the problem and let the parties solve it. If the Commission ignores it, pressure generally builds up—as KALW well knows. That's why petitions (continued on page 15)



## AM Sync Projects Continue

by Alan Carter

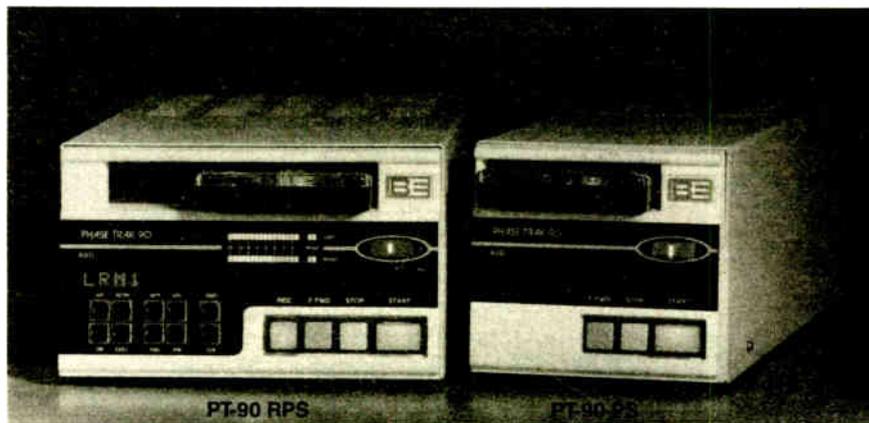
**Albuquerque NM** ... Engineers experimenting with AM synchronous transmitter setups are not discouraged by an FCC decision against amending rules in order to allow these multiple operations.

While not fully sanctioning AM synchronous transmitters, the Commission said it still will accept applications for experimental operations and said it would take up the issue again. The FCC noted it would open a new docket for additional technical filings on experimental operations.

"It's not a step backward," said Gary Diamond, CE for KKOB-AM in Albuquerque, which has been operating a synchronous transmitter. "They've left the door open for experimentation, which is good."

Gordy Alsum, a consulting engineer for KROL in Laughlin, NV, where another setup is operating, said he more data should be gathered to fully understand the AM synchronous situation.

The FCC concluded that current trans- (continued on page 7)



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Circle Reader Service 21 on Page 32

# Call for Renewal Reform Mounts

by Alan Carter

Washington DC ... Broadcasters continued a call for comparative renewal reform at the FCC under allegations of abuse in the process.

The NAB, in the latest round of filings on a Further Notice of Inquiry and proposed rule making, reiterated findings in its study on license renewal transfer.

Over half of the stations are approached for some form of redress by challengers, NAB found. From the perspective of broadcasters, almost all of these appeals for redress are abuses of the Commission's process.

The association claimed that the stations incurred costs in paying off challengers and defending against a challenge "at the expense of public interest."

As some broadcasters also argued, the NAB stated that it supports rules banning payments in settlement agreements

between licensees and parties who file petitions to deny and/or competing applications.

But NAB also noted, "While some parties legitimately might disagree as to whether payments should be banned altogether, almost all the parties believe some limits (e.g., reimbursement of legitimate and prudent expenses) should be adopted to prevent parties from using the Commission's process for private gain."

Capital Cities/ABC was not in favor of new regulations in the petition-to-deny process. "The current system fosters dialogue between citizen's groups and licensees that is frequently in the public interest," the broadcast group wrote. "A limitation on settlements is likely to inhibit some valuable dialogue and meritorious petitions."

The NAB noted that evidence in the proceeding proves private parties use the Commission's renewal process for

financial and other windfalls and the FCC must prohibit payment in settlement agreements.

One group of commenters, including Capitol Broadcasting, Infinity and Shamrock, however, pointed to its suggestion that payments be allowed only in "rare cases" for compelling public interest and limited to documented legitimate and prudent expenses.

## Qualifications count

In another area broadcasters addressed, NAB supported steps to assure that challenge applicants are qualified before applying for an FCC broadcast license.

"Most parties believe that additional information about applicants will help prevent unqualified applicants from applying and help disclose frivolous applicants," NAB argued.

Parties filing a mutually exclusive application against an incumbent licensee should be required to provide additional ownership, financial qualification information and more details regarding the applicant's integration of ownership and management proposals, the association said.

Capital Cities/ABC also called for more information from applicants.

On renewal expectancy, NAB repeated its call for a renewal system based on a licensee's "responsive service" to the audience and "substantial compliance" with the Communications Act and FCC rules and policies.

## Programming concerns

"The overwhelming majority of the parties recognizes programming as a legitimate—if not the most important—factor in determining whether an incumbent facing a renewal challenge should be renewed," NAB stated.

From initial comments, NAB opposed a suggestion from the United Church of Christ that AM-FM simulcasting should be considered "spectrum inefficient" and counted against a licensee because the FCC has rejected similar arguments.

"To conclude now that this issue should be litigated in every comparative proceeding, where a licensee following the Commission's rules chose to simulcast, would be inconsistent with reasoned communications policy and patently unfair to broadcast licensees," NAB argued.

The United Church of Christ and joint commenters including the NOW Legal Defense Fund and Black Citizens for A Fair Media, noted a concern to define abuse "strictly in terms of improper financial concessions" to avoid measures that would chill legitimate dialogue and negotiations between broadcasters and the communities they are licensed to serve.

The group supports proposals to limit payments in settlement agreements to reimbursements of "legitimate and prudent expenses." In the comparative challenge, where the group said the greatest opportunity for abuse exists, it called for full disclosure of ownership behind all applicants.

## Questioning the focus

But the joint commenters questioned the Commission's focus on comparative renewal as a source of instability in the industry. "If the Commission is truly interested in addressing instability in the broadcast system it will curtail the current unregulated trafficking of licenses by speculators who have no commitment to quality broadcasting and no regard for the public interest."

The National Black Media Coalition (NBMC) questioned attacks on the petition-to-deny process and said during the group's 15-year existence, the FCC has not found that NBMC petitions were not submitted in good faith or did not have some material evidence for support.

NBMC said that over half of all petitions to deny based on Equal Employment Opportunity violations result in sanctions.

Another filing from Southeast Florida Broadcasting Limited Partnership and Garden State Broadcasting Limited Partnership questioned the evidence presented for abuse.

The group wrote, "The pendency of ill-considered and unfounded allegations directed at renewal challengers as a class is presently having a prejudicial impact on the right of any renewal challenger to receive a full and fair hearing and such allegations should be expeditiously repudiated."

For information on comparative renewal, which is under Docket 81-742, contact Andrew Rhodes at the FCC, 202-632-7792.

## NEWS BRIEFS

**Harris Finalizes GE Deal**  
Melbourne FL ... Harris Corp. and General Electric have signed an agreement for the previously announced acquisition of GE Solid State by Harris. The \$206 million cash transaction to be completed in December. GE Solid State produces semiconductor products under the GE, RCA and Intersil brand names. Upon completion of the purchase, GE Solid State will become part of the Harris Semiconductor Sector.

**Westwood Buys KIQQ-FM**  
Los Angeles CA ... Westwood One has purchased KIQQ-FM here for \$56 million from Outlet Communications in an all-cash transaction. The station, which broadcasts on 100.3, plays Transtar's formatted soft rock music and markets itself as K.Lite 100 FM.

Westwood One recently bought its first radio station, WYNY-FM in New York, and currently is awaiting regulatory approval to begin operation of WNEW-AM in New York.

**Electro-Voice Expands R&D**  
Buchanan MI ... Electro-Voice Inc., expanded its research and development arm with construction of new engineering facilities. The new three-story R&D center contains more than 28,000 square feet of space and houses 50 engineers, technical assistants and support staff. The facility, according to the company, allows for the complete designing, testing and evaluation of prototypes, as well as offering superior conditions for fast Fourier and time-energy frequency testing via a specifically designed listening room and anechoic chamber.

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# Class A's Exit NAB

(continued from page 1)

"I'm not talking about two or three people calling me," McAllan said. "It's just about everyone who's called here."

McAllan said he is not encouraging the move. "I have not volunteered (to organize a group) and I don't intend to volunteer."

"I am not trying to fan the flames."

Asked if he would join other Class A station members if a decision was made to form another broadcasting group to better serve their interests, Channick said, "I would certainly consider that."

Mike Rice, president of Nutmeg Broadcasting, Willimantic, CT, said he has reduced his dues by half and although he has not made a decision to leave the NAB and join another group, "the seeds of interest" are there.

"We realize the value of having a trade association, but we want them to know how unhappy we are," Rice said.

Class A stations believe the NAB is catering to the higher powered Class B stations, which, they point out, also pay higher dues.

According to Class A stations, Class B stations are afraid that if Class A stations get more power, they will be competing with the larger stations.

"We don't want 25,000 W," Channick said. "We just want to serve our communities."

## NAB wants to protect band

The NAB does not favor Class B stations, Kraus said, but wants to make

# FCC Filings Continue Power Hike Dispute

by Alan Carter

Washington DC ... The New Jersey Class A FM Broadcasters Association and the NAB went head to head in comments to the FCC arguing over a proposal from the New Jersey group for an across-the-board power hike from 3000 W to 6000 W.

Comments filed 22 November continued the battle that began when the New Jersey Class A's filed a petition for a power increase in September 1987. The FCC issued a proposed rule making in July.

The FCC proposal provides for a power increase for all Class A's except those currently short-spaced. A second proposal requires an increase in spacings between Class A stations and other classes, in order to implement the increase, and then only on an application-by-application basis.

Short-spaced stations would be re-

quired to utilize a directional antenna, relocate their transmitters or reduce antenna height to not increase coverage in short-spaced directions.

Under these conditions, not enough Class A's would benefit, according to the New Jersey Class A group. Of approximately 845 Zone I Class A's, 257 or 30% are currently short-spaced.

The second proposal would create two groups of Class A's, those that can increase power and those that would have to use directional antennas, move transmitters or reduce the height of their antennas—all unacceptable to the New Jersey group.

If the Commission does not accept a 3000 W increase across the board, the New Jersey group suggested a lower across-the-board increase.

The second part of the proposal came about as a result of a petition by the NAB, which said it supports a power increase for Class A's—based on re-

vised mileage separations, a move that would affect 1300 of the 2043 Class A's.

Most of the 1300 however, are in Zone 2, not Zone 1; those in New Jersey who are seeking relief are in Zone 1.

In its comments NAB stated, "These technical standards and related mileage separation requirements are needed to ensure that only limited additional interference will occur to existing service—existing service which includes Class A broadcasters themselves."

Class A's countered that the extra conditions imposed by the second part of the rule making would "preclude coverage improvement in the very directions where it may be needed most."

The issue is under Docket MM 88-375. Reply comments are due 22 December

sure that higher powered Class A stations do not cause "significant interference," or what the NAB has coined as "AMization" of the FM band.

"In terms of our proposal, the great majority of Class A FM's would be given their upgrades," she said.

When asked what the NAB meant by "significant" interference, Kraus said she did not know the answer.

Perry Simon, secretary of the New Jersey Class A Radio Broadcasters Association, said "AMization" will not occur in the FM band if all Class A stations are granted 6 kW because the band inherently does not suffer from the same levels of interference that AM does.

Because the NAB proposal would evaluate each Class A application, stations in the more populous areas of the East Coast believe they would not be allowed the power increase unless they relocate their transmitters—a move which they said is nearly impossible because of the expense and space limitations in heavily populated areas, Simon said.

The 2,043 Class A FM stations, 100 to 3000 W, make up about 50% of all FM stations. The other classes are: Class B1, 3100 to 25,000 W; Class B, 25,500 W to 50,000 W; Class C1, 5100 W to 100,000 W; and Class C, 100,000 W.

For information from the NAB, contact the public affairs department at 202-429-5350. Contact Perry Simon at 201-774-7700.



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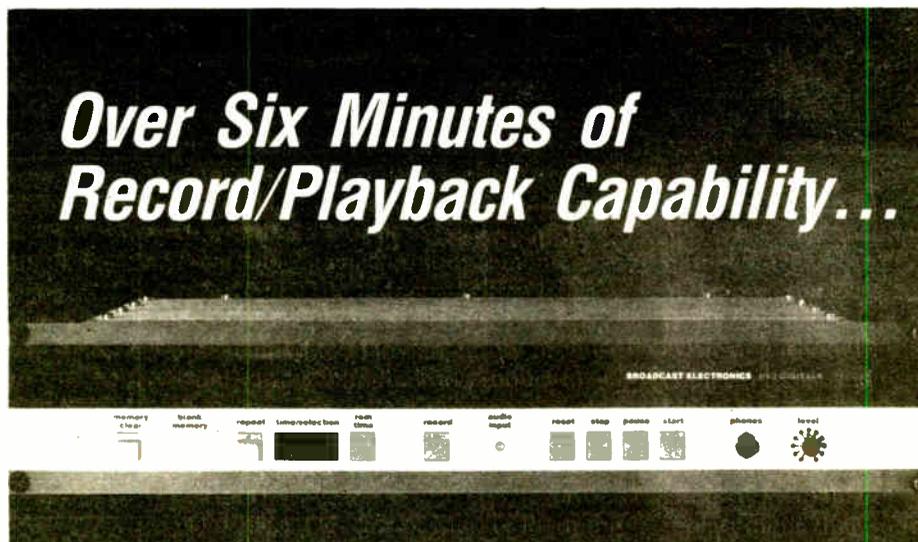
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# Radio Rebels and Memory Lane

by Judith Gross

Falls Church VA ... A rebel radio organization? The NAB reports that it's only a few stations who have turned in their memberships over the Class A brouhaha. Most of the 2000-plus Class A's who were members still are.

But those who are upset about the NAB's alternative to a blanket 3000 W power hike for all Class A's are more than a little upset. Now comes word that there are rumblings about forming an alternative organization—a throwback to the old NRBA, which merged with NAB two years ago.

The marriage was working so well that just this year, the NRBA was officially

dissolved. But the grass roots discontent goes on, and the angry Class A's—mostly in populous areas such as the northeast—have been testing the waters for support on a possible renegade organization.

The problem that those who are upset have with NAB is that the organization didn't just stay out of the whole mess from the start, but came up with a proposal that would require increased spacings and some antenna changes for some of the Class A's who desire the increase the most.

They say NAB has been gathering ammunition to achieve its goals and they don't like their own dues money being used in the fight against them.

The Class A proposals, like the NRSC and some others dealing with AM, seems to be one of the issues slated for fast action at the Commission, before possible changes with the new administration in January. So we'll soon see what the outcome of all this is.

It will be January, not sooner, before there are any new appointments slated for the FCC. President Reagan made a batch of "recess appointments" several



weeks ago and there were no FCC slots among them. So it's wait until January.

☆☆☆

The end of the year seems the time to look back; or maybe look ahead to looking back, when it comes to AM's problems. WLAM's Ron Frizzell, our "Titanic" analogist awhile back, once suggested the idea of an AM time capsule.

We could put in all sorts of current stuff about AM's plight. How about the NRSC standard and the B. Angell study on listener acceptance of interference?

A current AM receiver, with about, oh say a 3 kHz frequency response would be good, also some RW articles on the AM stereo wars. Maybe also some info on current formats, satellite stuff and news of AMs going dark. Also the bleak Arbitrons, showing listening down to 25%. Then maybe a few success stories, like WGN in Chicago.

Then in a hundred years or so we could arrange for the capsule to be unearthed and see if AM has gotten better or worse, or what new-fangled glitzy technology might have overtaken radio itself.

I can just see some archeologist digging up the capsule and scratching her head in puzzlement: "Why did they ever name a part of the spectrum after a time of day?"

☆☆☆

On the subject of looking back, Tom Wolfe said you couldn't go home again, but I did. Took a little trip down memory lane in my old stomping grounds in upstate New York, where radio came alive for me, in Binghamton.

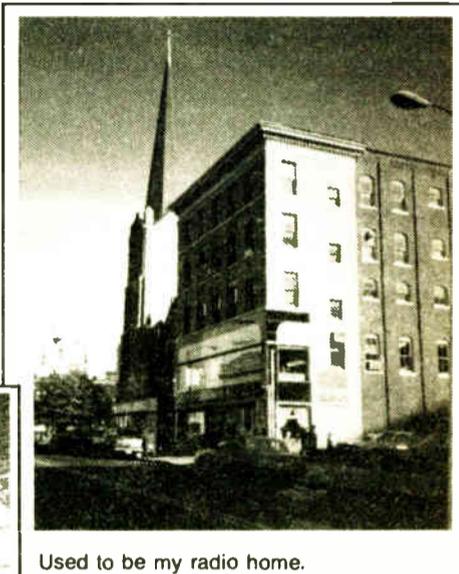
The central NY area is probably the only place where AM radio actually offers better programming than FM. There are four commercial AMs and only three FMs; also two public and one university FM.

Only one AM is stereo unfortunately, and many of the formats have changed. The beautiful music FM with the "quiet" letters—WQYT—now calls itself "The Hawk"—WHWK—and plays country.

And the station where I started out, WKOP-country-AM is now WRSG oldies. It moved out of the four-story building over the music store, where the rickety old elevator warned you far in ad-

vance of any visitors.

The building once suffered a fire and the walls, as I recall, were still charred, as was the intercom, which never worked. The old vertical sign with the call letters is gone from the front of the building. The music store moved across the street; there's a furniture store downstairs now and the empty studios recently became temporary headquarters for some political races.



Used to be my radio home.

The X-rated movie house across the street is gone; in its place is a store for "pregnant people." And the cozy, run-down Ritz Tearoom next to it, where I had many a fresh-squeezed lemonade and blue fish smothered in tomato sauce between newscasts has become a yuppie diner. Anyway, the coffee was still good.

I even had time to journey up the hill where the three tower array and transmitter are and where I used to make "food runs" for the my pal the CE (and got stuck in the snow more than once) when "babysitting" transmitters was still required by the rules. No snow this time, luckily.

I still recognized many familiar air talent, even in stations where I would no longer know the engineers (in stations that still have them). The places and faces and voices all seem to stay the same, only the music and call letters change. Now who says you can't go back and feel good about it?

Some new names and faces you'll find here at RW. Richard Farrell has taken over the Buyers Guide from Marlene Lane, who now edits TV Technology, our sister publication in that other medium.

John Gatski has joined our ace news staff; he studied broadcast journalism at West Virginia University and will be rooting for his team against the Fighting Irish in the college football championship next month.

And a special welcome to Arthur Constantine, formerly with Fidelipac, who has become Radio World's associate publisher. Art isn't venturing too far from the world of cart machines and he brings many years of experience and his unique perspective on the industry to our pages. Gee Art, you can even wear the leiderhosen if you'd like.

Well, time to sign off on double-eight. Look for dubious achievements in RW's annual, in January. Enjoy the holidays, but don't mix booze and the road. Have a (non-alcoholic) eggnog for me.

Heard something interesting? Spill your guts to Earwaves. Write PO Box 1214, Falls Church VA 22041, or call me at 703-998-7600. Best tidbit of the month wins a coveted 1989 edition Radio World mug.

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### More licensing furor

*Editor's Note: The following letter was written by Steve Konopka to the National Society of Professional Engineers. It is reprinted with Steve's permission.*

Dear Mr. Schwartz,

I wish to comment on recent publicity regarding proposed state licensing of "broadcast engineers."

I respectfully submit my view that SPE has no familiarity whatsoever with real-world technical jobs prevalent in typical radio/TV broadcast stations.

The average radio operator, or Chief Operator (using proper terminology) is often times dubbed an "engineer" purely as a result of society's modern-day tradition of putting fancy wrappers on very plain products.

In my job, Mr. Schwartz, I am responsible for the technical maintenance of two large broadcast facilities. My qualifications are fulfilled by my possession of rather elementary electrical and radio theory, and, to put the most important asset last, good physical shape to perform common labor.

If you think I sit at a desk in a suit and tie, you have much to learn. If you think Chief Operators at all of America's typical broadcast stations receive Professional Engineer's pay levels, I respectfully say that your head is up in the clouds.

Proposing state licensing for "broadcast

engineers" should be accompanied by the same for "building maintenance engineers," (janitors) and "sanitation engineers" (garbage collectors).

In conclusion Mr. Schwartz, perhaps you need to be informed that a very high percentage of America's radio stations are small Mom-and-Pop operations, wherein the owner does everything from cleaning a plugged toilet to fixing the transmitter, all under a tight budget.

Your proposal would mean much worse than thousands of technical workers losing their livelihoods... many broadcast stations would be forced out of business.

I have absolutely no doubt that the ramifications of this absurd deal will be quickly recognized by both our legislators and federal government and I frankly submit that SPE should pull its nose out of an area which is none of its business—especially one which is already regulated by the FCC.

I'd be happy to hear any response you may have.

Steve Konopka, CO  
WGEE, Green Bay, WI

### Criticism of licensing effort misplaced

Dear RW:

I am writing with regard to your article titled *Groups Fight State Licensing* (1 November RW).

With all due respect, I would suggest that you consult someone knowledgeable in the field of professional engineering before you publish additional articles of this type.

The state licensing bills which exist in most states really have no problem with broadcast operators referring to themselves as engineers. The concern of registration acts is not with those who maintain broadcast equipment or operate such equipment.

Rather, the concern is with those who would advertise their services as a professional engineer without having either the expertise or the experience to fulfill that profession.

I would like to refer to your quotation for general counsel for SBE. As he is paid to do, he is trying to raise enormous fears that the entire profession will be wiped out by these supposed new laws.

The truth of the matter is that these engineering registration laws exist in all the states at the present time. Hopefully, some additional enforcement is under way. If you wanted to hear someone really scream foul, let a law clerk start calling himself a lawyer. Then you will hear your Mr. Schwartz really step forward and complain.

The old argument that professional engineer exams do not contain questions relating to the broadcast industry is one which has been raised for many years by those who either were incapable of passing a PE exam or were afraid to try.

There are no questions on PE exams which specifically refer to any specialized area in the broad practice of professional engineering. PE examinations actually test for a broad general knowledge of the practice of engineering.

There are questions which pertain to the broad areas of electrical, civil, mechanical and industrial engineering but none for a given small speciality.

The end of 1988 and start of 1989 bring an upbeat note to the radio industry. If equipment sales are any indication this year was healthy and the trend should continue into the new year.

While forecasters are still leery about a recession and many believe the high prices for radio properties can't continue, there are still positive signs.

Stations that were the objects of financial wheeling and dealing are becoming long-term properties and technical improvement of the plants has resulted. On the regulatory side, even with a new administration, the trend toward deregulation is expected to go on with market forces continuing to play a major role.

Technical concerns have been successfully addressed as well. This was the year the FCC listened to the industry about AM's problems in its technical review. In addition, a complete NRSC standard—from audio to transmission—was finished.

FM saw the development of first an NAB subcommittee, then an NRSC technical subgroup to prevent the same erosion of quality which has plagued AM.

While all of this is a good sign there are still some technical and

non-technical issues posing a challenge for the coming year.

AM stereo and its accompanying patent disputes have yet to be resolved. And it remains to be seen if AM can clean up its act enough to attract listeners back to the band.

On the FM side there is still the question of permitting flexibility in translators without inadvertently encouraging abuse. And stations are still evaluating the potential of FMX.

On all sides there is the increasing trend towards a digital station with the question, "How much and how soon?" And for engineers, the thorn of state licensing remains to be resolved.

With more possibilities available than ever before, it's an exciting time for broadcasters. Staying informed, keeping an open mind and being prepared to act when action is called for will be the keys to meeting the challenges of the coming year.

—RW

## On To 1989

I know of no case where a state registration board has prevented a broadcast technician from practicing his trade. There have been occasions where state agencies have attempted to prevent people from advertising themselves as professional engineers being capable of performing station designs or other complex functions when that knowledge did not exist.

Let's be honest about this. The state registration laws are not trying to stop anyone from doing work which they are actually capable of doing. Instead, the laws are attempting to prevent people who are not qualified to practice as engineers from performing those services at a substandard or dangerous level.

I know of no competent professional engineer who has been bothered by the concept of a licensing requirement. On

the other hand, I certainly do not acquaint my professional abilities with those of people who collect refuse or polish floors.

In a similar fashion, I am sure that SBE's Mr. Schwartz would not acquaint his talents as an attorney with those of a file clerk in his office.

A professional registration examination is just as necessary to maintain the quality of professional engineering ranks as the SBE exams are necessary to maintain the quality of that fine organization or as bar examination are for stations.

Your article was totally out of line and displayed a complete misunderstanding of the principles involved in registration examinations.

Don Markley, PE  
D.L. Markley & Associates  
Peoria, IL

## Radio World

Vol 12, No 24 December 15, 1988

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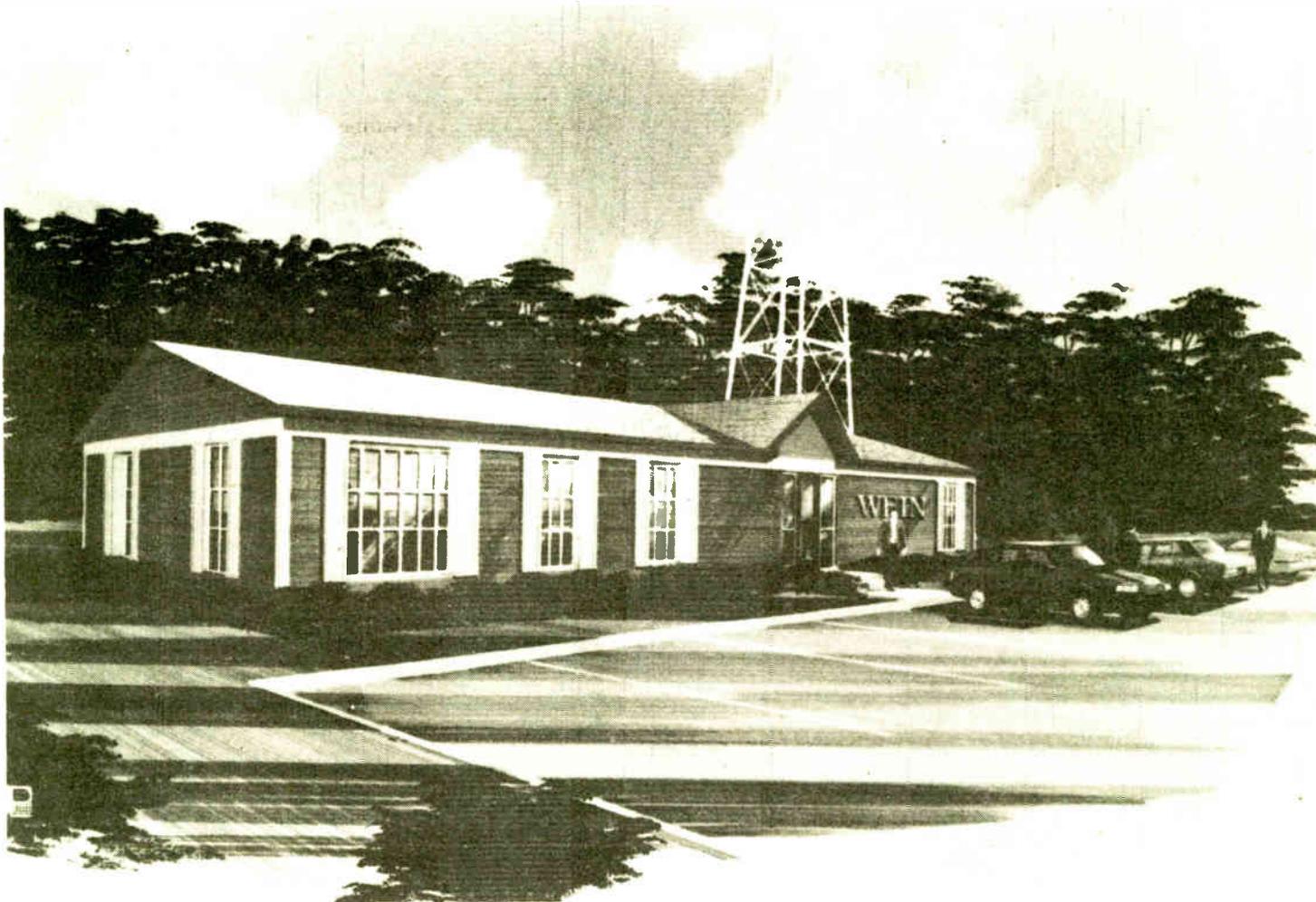
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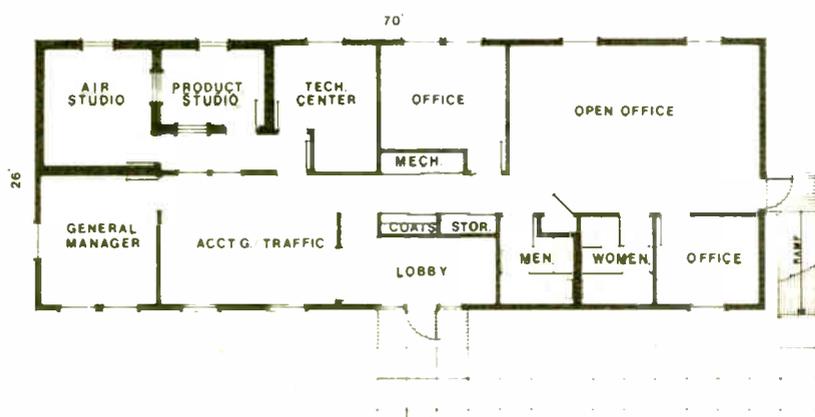
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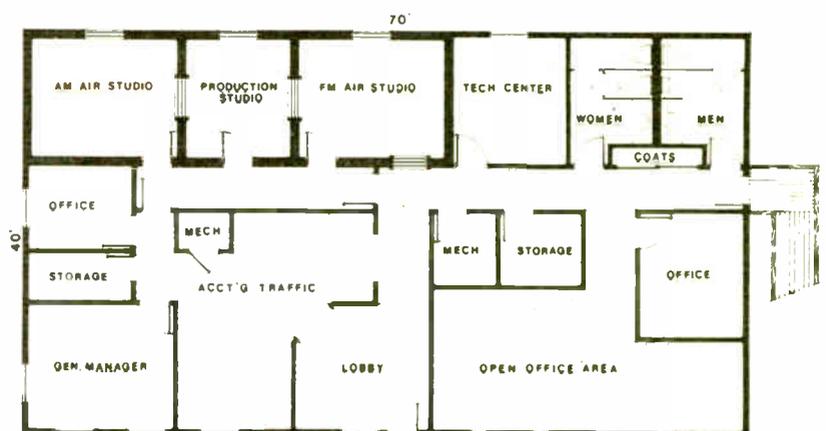
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# FCC Urged to Adopt NRSC-1 First

by Alan Carter

Washington DC . . . The FCC should implement the NRSC first as an audio standard before adding a complementary transmission standard, according to comments filed on a proposed rule making.

Among the comments filed 22 November on standards developed by the National Radio Systems Committee (NRSC) broadcasters recommended that the FCC adopt an audio standard first and then, at a later date, consider making a transmission standard or "RF mask" mandatory.

The audio standard, known as NRSC-1 and used voluntarily, establishes a 75  $\mu$ sec preemphasis and a 10 kHz stop-band. The RF emission standard, NRSC-2, addresses the signal from the transmitter out and has a station's signal parallel to the NRSC audio standard to 10 kHz.

The Commission's proposal favored adoption of NRSC-2, although initially a petition from the NAB asked only for a mandatory NRSC-1. NAB was among the stronger opponents to adopting NRSC-2 without NRSC-1.

The two National Radio Systems Committee standards are complementary systems designed to improve the quality

of the AM broadcast signal and reduce interference," NAB stated. "Moreover, the initial implementation of NRSC-1 would foster the improved manufacture of receivers, which in turn would improve the quality of AM broadcasting as heard by the public."

NAB pointed out that by building on a NRSC-1 conditioned signal, NRSC-2 can accommodate the numerous modulation artifacts, transmitter instabilities and antenna characteristics that may cause distortion in a transmitted signal.

NAB also expressed concern that a mandatory NRSC-2 would be more burdensome for stations to implement with respect to test methods and cost, despite the rule making's contention that the cost of monitoring both portions of the standard is about the same.

"Not only does the Commission overestimate the cost of NRSC-1 monitoring equipment, it seriously overestimates the ability of current technology to test for NRSC-2 compliance," NAB wrote.

Group W supported the adoption of both standards but stated its opposition to only a transmission standard. NRSC-2 was intended to measure the effectiveness of NRSC-1, which was designed to provide a universal specific audio preem-

phasis characteristic, it said.

"In failing to address the preemphasis issue, the FCC is sending the wrong message to receiver designers," Group W wrote. "It is less likely that AM radio receiver manufacturers will support the NRSC standards with receiver designs if the preemphasis portion of NRSC-1 is ignored."

Comments were mixed on a suggestion that the FCC could assume stations were in compliance with NRSC-2 if they adopt NRSC-1.

The NAB said a survey of five groups found the theory to work.

However, Delta Electronics, which makes the Splatter Monitor to measure a station's compliance with NRSC-2,

found one of three stations it measured in Washington DC to be out of line. One of the stations in compliance did not use the NRSC-1 standard.

Among equipment manufacturers, Orban Associates also questioned the presumptive compliance scenario because it said over-modulation or transmitter malfunction can cause excessive occupied bandwidth.

"It is dangerous to assume that NRSC-2 will automatically be satisfied if an NRSC-1 filter is installed because, over-modulation or transmitter malfunction can still cause excessive occupied bandwidth," Orban noted.

Circuit Research Labs (CRL) supported both standards but stated that if one were adopted, the audio standard should be selected first.

The issue is under Docket MM 88-376. Reply comments are due 22 December.

## AM Sync Work Goes On

(continued from page 1)

mitter synchronization technology does not warrant amending its rule to authorize their use by AM stations "at this time."

The Commission said that necessary technological advances could take three to five years to develop and test, and would likely make much of the information it had on file obsolete.

Another consulting engineer involved in AM synchronous experimentation, Mark Durenberger, who works with KKOB's operation, said he has not given up. He said he was concerned that the FCC wanted a technical record but did

not know exactly what it wanted on file.

One area of concern in the synchronous operations is the distortion zone where the service area of the main transmitter and synchronous transmitter overlap.

While noting that stations must comply with AM interference criteria, Durenberger said broadcasters can make their own decision about tradeoffs in accepting interference in the distortion zone.

He said what he has found to work is an "unlocked" system. By closely maintaining the offset frequency, the distortion zone can be controlled by the synchronous broadcasters, he said.



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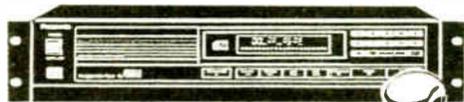
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# Engineer Licensing Focus of SBE Panel

by Charles Taylor

Seattle WA ... In the midst of controversy surrounding attempts to force state licensing of broadcast engineers, the pros and cons of such licensing were examined in a well-attended panel at the Society of Broadcast Engineers' (SBE) show here 9 November.

Moderator Charles Morris, director of engineering at KIRO Radio/TV in Seattle, called the panel a fact-finding group, adding, "This is a subject that's getting controversial in the sense that you can be on the register-everybody group or

the let-the-market-decide group and be right in both cases and wrong in both cases. There's no right answer."

The issue surrounds increasing efforts in a number of states to require telecommunications engineers to meet various requirements—including a minimum term of experience, passage of a written or oral exam and a four-year academic degree—to legally practice and advertise as a consulting engineer.

So far, cases against individual engineers have been pressed by registrars in Washington, New Mexico, New Jersey and Michigan, according to Ray

Thrower, president of the National Association of Radio and Television Engineers (NARTE). Other states are eyeing with interest the ramifications of requiring that the profession be monitored on the state level.

The most pointed testimony against state licensing at the panel discussion came from J.M. Scovill, a Seattle consulting engineer who was ordered by the state of Washington to stop his practice until he had passed an engineering exam given by the state.

Scovill said the charge included fines and a potential prison sentence "unless I signed a settlement that I would never call myself an engineer and would stop the practice of engineering" or take the required test.

## Case eventually dismissed

Scovill, whose case eventually was dismissed with legal assistance from NARTE, outlined decades of experience designing telecommunications systems in the industry, including some for the state.

NARTE said the state dropped the case when the association showed that it had no jurisdiction over radio, electronics and telecommunications personnel.

"This goes far beyond licensing," he said. "Each person has the right to make a living. As to whether they're qualified, I thought the market could decide."

The point was disputed by Alan Rathbun, registrar for Professional Engineers for the state of Washington.

"The only legitimate reason for licensing is to protect the health, safety and welfare of the public," he said. Currently, 16 different branches of engineering are monitored in the state, he added.

Don Wilkinson, director of engineering at KOMO-AM and TV in Seattle and a registered Professional Engineer (PE) since 1963 in Oregon and 1986 in Washington, encouraged engineers to view the license as a career goal.

"As the law applies to those of us in Oregon and Washington, I don't see a problem," he said. "Ninety percent of you can live with current laws as long as you don't advertise as a consulting engineer."

"But I would like to encourage any of you who have goals along that line to consider what it would take to go ahead and get your registration."

"It's a very attainable professional goal. The time and effort I devoted to studying and passing that test has been returned to me many times over," Wilkinson said.

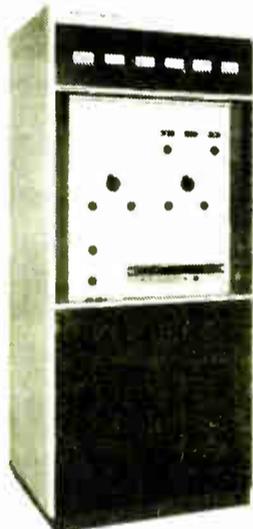
## Test on federal level

While the certification as a PE might well satisfy some individuals, some panelists argued that the testing belongs at the federal level.

"The public isn't benefitted by state regulation of telecommunications engineers the way it is with other types of engineering that have more direct relations," said Chris Imlay, an attorney from

(continued on page 10)

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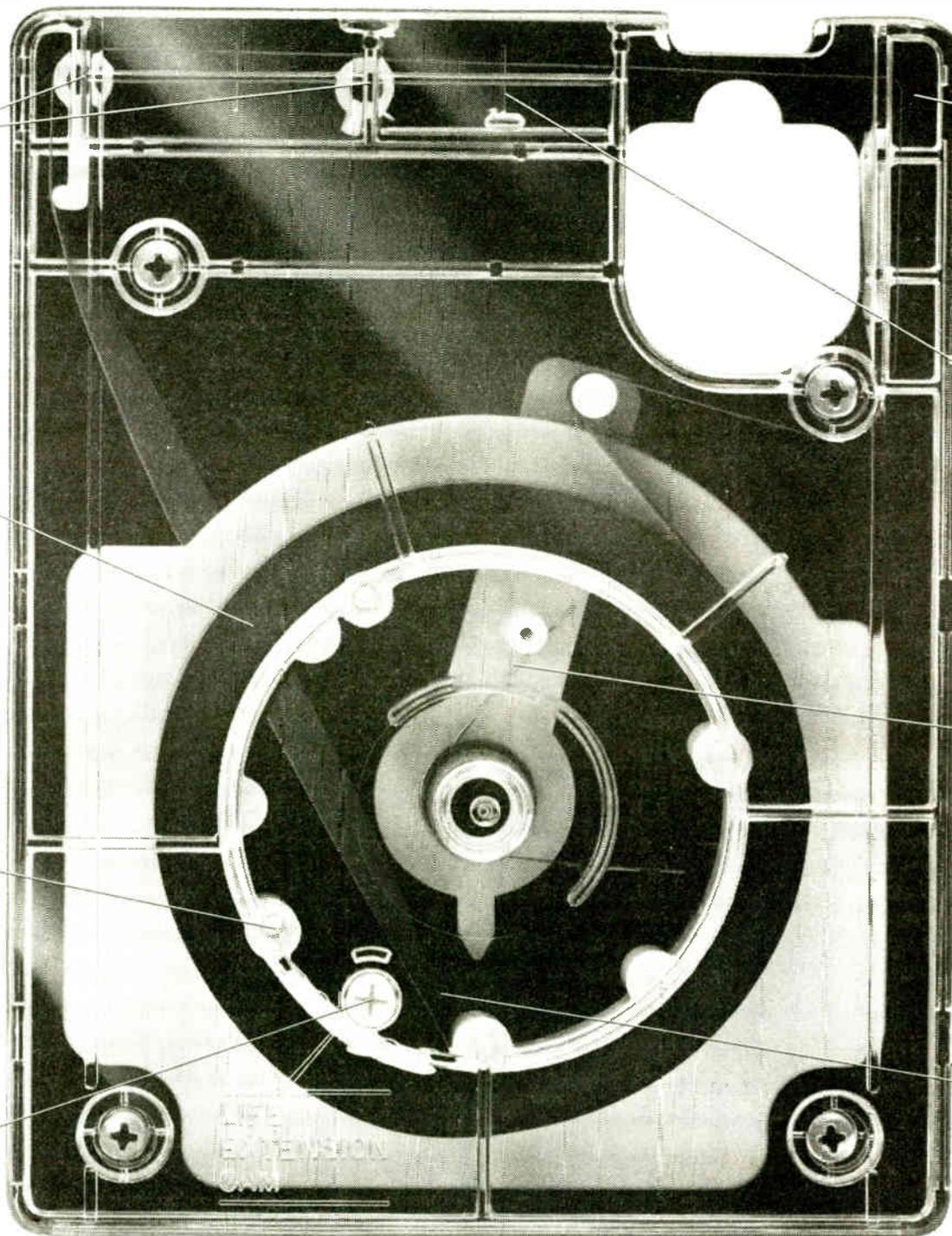
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# NRSC Convenes FM Subgroup

by Charles Taylor

Washington DC ... Subcarrier multipath and cross-talk artifacts, first adjacent and overload rejection in receivers, intermodulation problems and multipath degradation were identified as major areas for concentration by the National Radio Systems Committee's FM subgroup, which held its initial meeting here 16 November.

The committee was born out of the NRSC's belief that if broadcasters and receiver manufacturers work together, FM will not suffer the same degradation that AM has over the past couple decades.

"AM service, over a period of so many years, deteriorated because of receivers, and receivers deteriorated over the years because of the service that we as broadcasters gave them, and it was a never-ending battle. The idea of this committee was to start before then," said Wes Whiddon, engineering manager of FM stations at Group W Radio, who was elected NRSC FM subgroup chairman at the meeting.

Fifteen issues were earmarked in a September survey of NRSC members as areas of common interest between broadcasters and receiver manufacturers. At this first meeting, the 17

attendees prioritized many of the topics.

"A lot of the topics are going to get more severe in the future. They're not as severe as many of the technical issues are with AM right now, so we're catching them early," said Stan Salek, an engineer with the NAB.

## Optimum FM

Among the meeting's most tangible results, Ed Anthony of Broadcast Electronics agreed to draft a paper on optimum FM transmitted bandwidth, which he will present at the NAB spring convention.

The paper will hint at a counterpart to the already established AM NRSC standard, Salek said. The NRSC standard is currently before the FCC in a proposed rule making. (See separate story this issue.)

Regarding first adjacent rejection in receivers, it was suggested that a tutorial be commissioned for FM tuner manufacturers.

A tutorial also was suggested on the IF taboo, which is an FCC allocations restriction requiring that stations be sufficiently spaced from each other when operating 10.6 or 10.8 MHz apart on the FM dial. The industry currently is not in agreement as to how restrictive the standards should be.

## Establish a history

The group also decided to put together a bibliography of studies, documents and articles on multipath to suggest limits of synchronous amplitude modulation for manufacturers. Currently, industry opinions differ regarding what level of suppression allows for freedom of distortion from synchronous AM-induced multipath.

According to Tom McGinley, director of engineering for Cook Inlet Radio Partners Group, the industry's level of acceptance ranges from -38 dB to -60 dB.

"I wonder if we might not take some of the smoke out of the veil we see," McGinley said.

In discussion of second- and third-order intermodulation overload in FM receivers, the group decided to table action until the FCC takes anticipated action on the issue.

The newly formed NRSC FM subgroup will convene quarterly. For more information, contact Wes Whiddon at 713-622-1010.

## SBE Tackles Licensing

(continued from page 8)

the national office of SE. "I think FCC law supercedes state laws. It's a unique situation in the overall concept of engineering."

Dane Ericksen, an SBE regional director and a consulting engineer at Hammett & Edison in San Francisco, voiced concern about the deciphering of exactly who is affected by the various state guidelines.

"In general, if you're doing these things for an employer, you're not required to be licensed. If you're self employed, you must be. But if there is a move to go after engineers with the employer, I have a problem with that," he said. "I think, as a minimum, there needs to be a grandfather clause."

The panel also discussed concerns that current state tests are irrelevant to radio and TV engineers. Rathbun said that in Washington, the engineering test is divided between questions regarding the disciplines of power, electronics and computers, along with problem solving questions from which the participant can choose.

Rathbun added that the state board is willing to work with SBE to add pertinent telecommunications questions to the test.

For more information on state licensing, contact Ray Thrower at NARTE, 817-799-9661; or Arthur Schwartz, general counsel for the Society of Professional Engineers, 703-684-2800.

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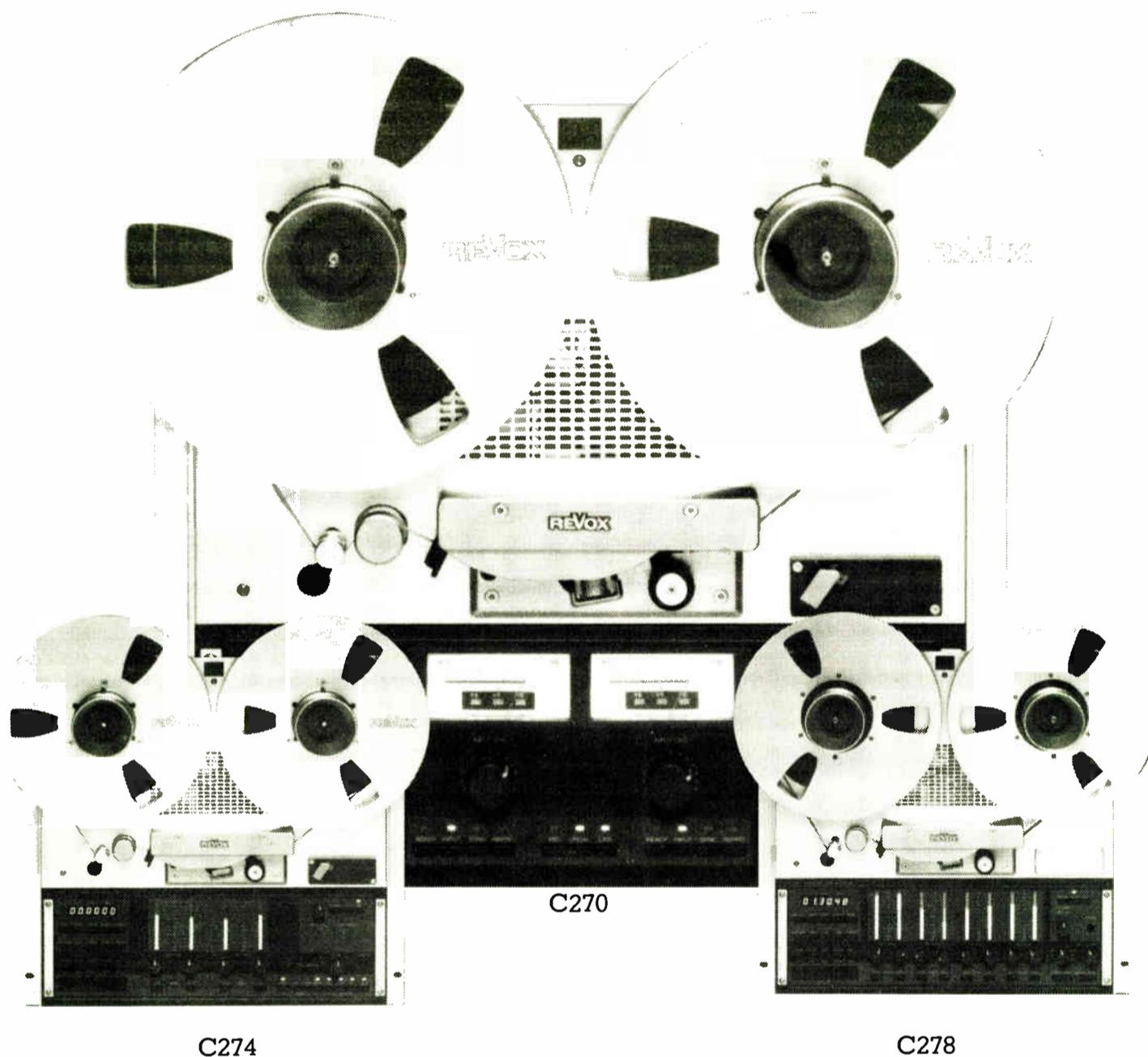
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# Experts Forecast Trends in Radio

by John Gatski

Washington DC ... 1988 may have been the year of the L-word in politics (that's "L" for liberal), but for radio, 1989 looks like the year of the D-words—digital and continued deregulation.

Equipment manufacturers see an ever-broadening foray into digital technology such as DAT and digital workstations, while market analysts and broadcasters predict a continuation of a deregulation policy at the FCC under a George Bush administration.

Besides regulation and technology, other areas that will be watched very carefully include the future of AM, the after-buyout effects of the Harris-Allied deal and whether the frenzied pace of station sales will continue.

## Regulation or deregulation?

One story to follow in 1989 is the ramifications of Bush's election to the presidency.

Having served as head of President Reagan's Task Force for Regulatory Relief, Bush presided over extensive deregulation of the broadcasting industry.

And with Bush at the helm, it does not look like there will be a turn away from deregulation, some in the industry predicted.

"The position of the FCC is likely to be even more laissez-faire," said Doug Sheer, an industry analyst with Sheer and Chaskelson in New York. "The broadcasting industry is not going to see any positive intrusion by the government. They will have very little help coming out of Washington."

He pointed to the lack of a standard for AM stereo as evidence that the FCC has not been overly involved during the Reagan years. The trend is likely to continue under Bush, he suggested.

Bush, in response to questions submitted by RW during the 1988 presidential campaign, said: "... As president, my administration will continue to cut

through unnecessary red tape that hurts American competitiveness."

John Marino, vice president of engineering for NewCity Communications, says he does not see much change from the FCC's present course of deregulation.

Some insiders speculated that FCC Chairman Dennis Patrick, appointed by President Reagan, will stay on as long as



he wants, but are unsure when two vacancies on the Commission will be filled. They have been vacant since 1987 because Congress refused to confirm two Reagan appointments.

Deregulation has contributed to the fast pace of radio station sales, but that trend slowed down somewhat in 1988 because of the stock market crash in October 1987, Sheer said.

Station buying is expected to slow even more in 1989, industry observers said.

"My gut feeling is that there is a slow-down, and it will continue into 1989," Sheer said.

"It looks to me like it has slowed down to some extent," Marino agreed. Many speculators and would-be speculators found out that it is not easy or cheap to operate a radio station, he said.

## The year of digital?

Although the government probably won't get any more involved in broadcasting in 1989, manufacturers are not about to sit on the sidelines as the conversion to digital broadcasting continues.

"I think 1989 is the year digital audio comes into its own," said Neil Glassman, sales manager for Bradley Broadcasting.

"There is a definite trend toward the all-digital studio," Sheer said.

With the introduction of better DAT machines, transmitters, audio controllers and digital workstations, Harris Corp. Sales Manager Ron Frillman predicted 1989 will be the year "the roof blows off" for digital.

Frillman said the radio broadcasting industry abides by the philosophy of getting the best audio to car radios and right now digital is the way to do it.

According to manufacturers and distributors, there are a lot of products to keep an eye on.

Sony, Panasonic, and Tascam DAT machines will continue to do well in 1989, according to Tim Schwieger, Broadcast Supply West marketing VP.

Glassman noted that the Telos 100 Digital Telephone System is a product that offers better flexibility and connection capability for many applications, including the ever-increasing number of radio call-in shows. "We've already seen a real explosion in demand," he said.

Jeff Detweiler, QEI domestic sales manager, said that his company's solid grid, higher power transmitters should do well in 1989.

However, he thought that DAT's reliability needs to be improved or "a less volatile medium" needs to be developed.

Detweiler said engineers at some stations have experienced extensive head wear in just three months and tape jamming on some DAT machines.

To improve reliability, Detweiler said he would like to see a "marriage" of the radio cartridge (cart) format and digital technology in the near future at a cost

most stations can afford.

To manage all the digital signals, Orban is promoting its latest line of digital audio control of analog processing products.

Howard Mullinack, Orban's broadcast products marketing and sales manager, said the company's programmable microphone processors and parametric equalizers offer more versatility and ease of control for various settings.

Meanwhile the Harris Corp. is unveiling its new high power digital transmitters, up to 50,000 kW, that, according to Frillman, are 86% efficient—nearly 15% more efficient than older models.

## Best value for the dollar

"You're going to see a lot of people paying attention more to products with the best value for their dollar," Frillman said. "I now think we're dealing with an aggressive customer base in radio."

He said most of the new high power Harris transmitters are more efficient than older models and their competitors.

For Class A FM broadcasters who want to upgrade economically, Harris is now offering a single phase 10 kW transmitter that can be operated at the lower power limits, Frillman added.

Other manufacturers agreed with Frillman's assessment of the cost-conscious broadcast equipment buyer.

QEI's Detweiler said the company is focusing on such economical products as integrated remotes with built-in microprocessors and audio switchers/microprocessor combinations.

Many industry observers told RW it is *(continued on page 15)*

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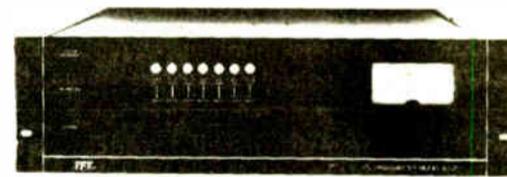
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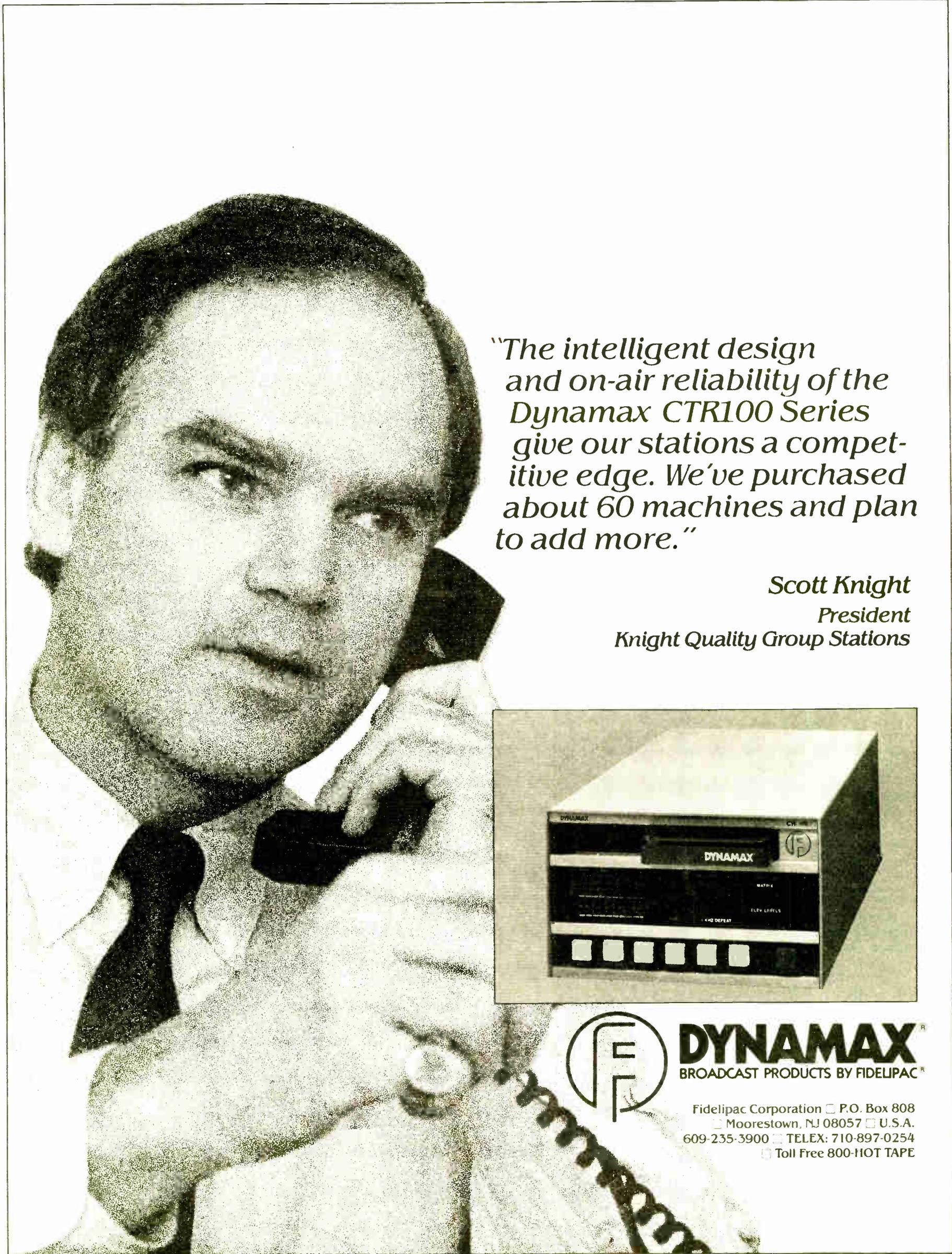
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# Banner Year for Digital in 1989

(continued from page 13)

too early to tell what effect the Harris acquisition of Allied will have on the distribution market.

"I think it is too soon to tell," Sheer said. "But I don't see it radically changing Allied."

Frillman said the acquisition of Allied will be good for his company and the industry. "I think that it shows that Harris

## Booster

(continued from page 1)

to deny, even ones without any legitimate basis, are effective."

"We do not ignore the situation," responded Schneider. "We take these cases in turn based on our work load. We look at the merits of the allegations and request the parties to supply us with additional information if we are unsatisfied. We cannot, by statute, approve an assignment of license to a person where there are questions of fact raised and unresolved."

Before the case reached the FCC, the two parties resolved the issue, which Metzler said was rushed because of tax laws taking effect at the new year that will change the structure of station transactions.

KKIS has promised that it will permanently retire the booster, said del Solar, and will also pay KALW a cash settlement to dismiss the petition. Neither group would disclose the amount of the settlement and pertinent documents had not yet been filed with the Commission.

"We came to an agreement that allows adequate compensation for the damages caused (in the booster ordeal) and for legal expenses," del Solar said. He estimated that the station lost revenues of \$150,000 over the three years that KKIS operated its booster and that legal fees ran in excess of \$30,000.

Metzler held a different sentiment about the agreement.

"We have signed and filed a settlement agreement with them in which we're paying blackmail. They're going to drop their complaint, and we'll give them money," he said.

Ronald Strother, president of Diamond Broadcasting, which paid close to \$4 million for KKIS AM and FM, said he feels no apprehension regarding the controversy between Chabin and KALW.

"We're not overly concerned about it. We've been assured by the parties that this will have no effect on us," he said.

Said del Solar, "We believe that Diamond Broadcasting will be a responsible broadcaster in its management of the KKIS facility and that is why we have withdrawn our pleading."

For more information, contact KALW at 415-648-7530; or Roger Metzler at 415-392-7077.

is a total broadcast company," he said.

Broadcast groups, manufacturers, distributors and market observers agreed that AM's future looks in doubt but may be able to start rebounding in 1989 with the advent of better audio quality and by settling down into comfortable formats.

"I would like to see continued efforts to try and save the child of broadcasting," Detweiler said. "I think there has to be a real concentrated effort by all parties involved."

"We have some rule makings pending. Hopefully, the positive aspects will win over the negative," said Stan Salek, an NAB staff engineer.

Salek said the NAB hopes the increased power of smaller AM stations

will not cause additional interference in the already-crowded AM spectrum.

"I think that AM is going to continue within a slow steady internal battle," Mullinack said.

Many insiders said AM's survival depends on technology to improve the reception and transmission of broadcasts as well as finding its own format niche.

A bill was introduced in Congress last October to require the FCC to choose an AM stereo standard and it likely will be reintroduced in 1989.

Many broadcasters also would like to see receiver manufacturers improve the quality of their products so listeners could hear the improving AM signals as the technology progresses.

Programming is another area that AM must settle into in order to survive, New-City's Marino said.

"It's my hope that AM will continue to experiment with new formats," he said.

He said all the technology improvements are helpful but if people don't like what they hear, the technology won't make a difference.

Marino said that FM's programmed music formats sound very much alike, and AM must try for something different—something that is interesting to listener.

Most insiders predict that the radio industry will come through the digital revolution, buyout frenzy and other market factors now affecting the industry in good shape.

"It's conceivable that in the 1990s, we will see a trend to how radio will be handled for the future," Sheer said.

# RADIO

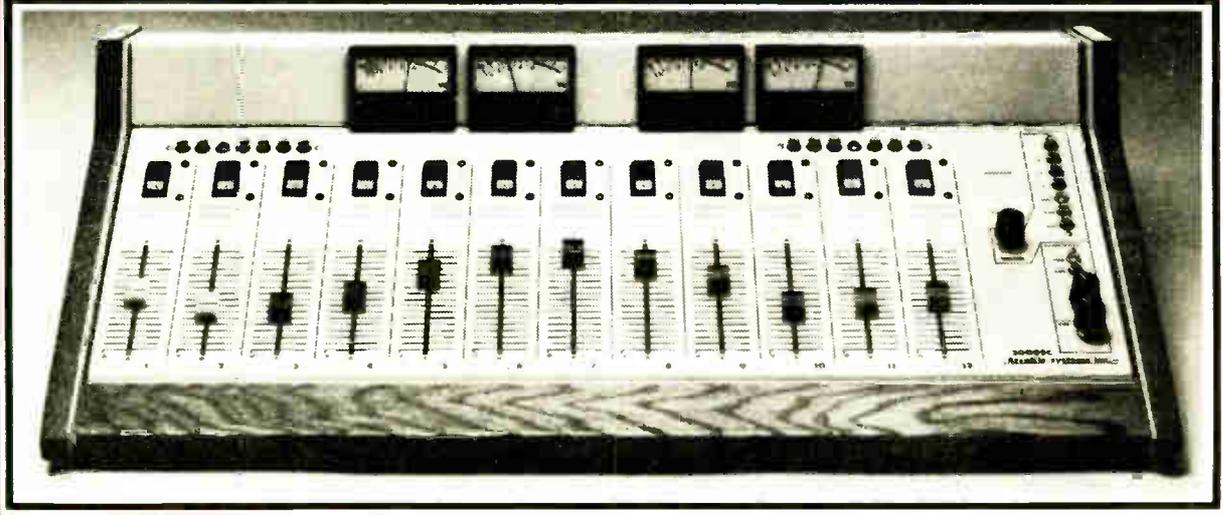
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# Transmitter Meltdown KO's WPFW

by John Gatski

Washington DC ... Sometime around 9 AM on 21 October, John Hofstetter got a call from WPFW-FM. The station, where he had spent half the night fine tuning the transmitter, was off the air.

Hofstetter, a contract engineer for the Pacifica Foundation and several other broadcast groups, rolled out of bed and headed back to the 50,000 W, non-commercial jazz station in Washington DC.

Back at the station, the engineer went through the usual trouble shooting procedures. The remote checked out, so he went to inspect the 12-year old RCA BTF-20E 20,000 W transmitter. He no-

ticed the breaker was tripped but had no luck resetting it.

Then Hofstetter discovered a blackened area around the RF cavity door. "I opened up the door and saw that the RF cavity was a cinder," he recalled.

A fire within the transmitter had destroyed a significant portion of the internal circuitry. The fire, however, was contained within the transmitter case and did not damage the station.

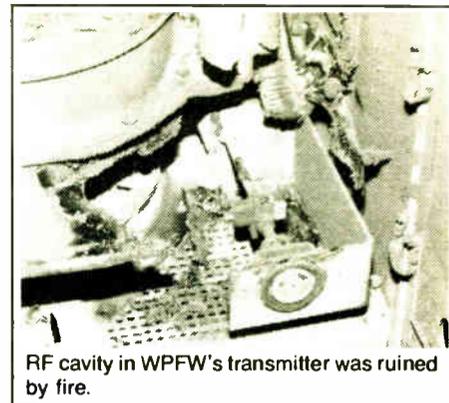
After consulting with several engineers Hofstetter was able to get the station broadcasting again by hooking the 30 W exciter directly into the transmission line, giving it an effective power of 90 W with the antenna gain. The station was off the air a total of five hours.

It was enough power to broadcast adequately in DC and the immediate suburbs, commonly called "inside the Beltway." In the fringe areas, however, the signal was very weak or not heard at all. WPFW ended up broadcasting with the low power configuration for 10 days.

"It was noticeably weak outside of the Beltway. Some people switched to mono to get rid of the hiss," Hofstetter said.

The power loss also came during the end of a membership campaign, GM Mary Drayton said.

"We really had some excellent programming," Drayton said. "It's a shame a lot of people didn't hear it. It was very frustrating in a way."



RF cavity in WPFW's transmitter was ruined by fire.

A new \$45,000 CCA FM transmitter was installed 1 November. After the station took delivery of the new transmitter, it took several days to get it operational because of extensive rewiring.

Hofstetter did not install the new transmitter because he was scheduled to go on vacation in Europe the following Monday. But before he left, he theorized what caused the transmitter to "melt down."

The fire started, he explained, when the parasitic absorbing stub overheated, igniting the plexiglass tube socket shelf.

Apparently, Hofstetter found out after the fire, RCA BTF-20E transmitters can be prone to parasitic ignition if they lose their neutralization.

A loss of neutralization can result from such adjustments as cross-talk reduction, which Hofstetter had made during those hours before the fire.

"They (RCA transmitters) are very touchy about their neutralization. Unfortunately, the tech rep didn't point that out to me," Hofstetter said.

RCA is no longer in the transmitter business, but with many radio stations still using the company's transmitters, Hofstetter believes engineers should be advised to take precautions when making adjustments to them.

If he had known about the problem, Hofstetter said he would have installed an ultraviolet sensor, which can detect burning and arcing in a transmitter.

Drayton said the transmitter looks worse than the actual damage it incurred and the station plans to have it rebuilt for use as a back-up.

For information from WPFW, call 202-783-3100.

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# Be a "Do-er": Plan for Success

by John Cummuta

**Downers Grove IL ...** In 1953, Yale University conducted a survey of its graduating students. Among the questions they asked were: "Have you set goals for your life?" and "Have you made any plans to accomplish your goals?"

Only 3% of the students could answer. Twenty years later the Yale researchers tracked down the surviving members of the 1953 class and found out how they had fared since leaving school.

The facts were both conclusive and impressive in bearing out the values of goal-setting and planning.

The 3% of students who had set goals and written out plans for achieving those goals were worth more in financial terms, 20 years later, than the other 97% combined.

Those figures coincide closely with the results of a famous study by the United States Department of Health Education and Welfare, which showed that if you take an average, cross-section group of 100 Americans and follow them to age 65, you'll find that certain facts never change.

One of those facts is that only 5% of them will have attained financial inde-

**The do-ers are those who plan to succeed, they don't just attain it by accident.**

pendence.

The bottom line is that only the "Do-ers" succeed. But it's more than that. The do-ers are those who plan to succeed, they don't just attain it by accident.

## Why do so few people plan?

Most people never plan their work. In fact, research has shown that the average American worker puts much more effort in planning the family vacation than into planning a career.

Why? Probably because the thought of planning seems both overwhelming and dull.

But that's because when the average person thinks of planning, he or she thinks of a long, drawn-out project that could take days, even weeks. That's not how it really works.

It might help to look at planning the same way you should look at losing weight.

You don't lose twenty pounds in one day or even one week. You lose a few pounds a week over an extended period of time.

That's how successful people face

planning and it multiplies their effectiveness many times over.

Yes, it's important to have long-term goals. These should be from one year to maybe five years.

## Engineering Manager

Don't try to go much beyond that, because there's no way to know what circumstances you'll be facing that far off.

These long-range targets are important to give you direction but they should not be your regular measuring sticks.

To determine what kind of progress

you're making you need much shorter plan periods, so you can measure how quickly you're getting to each milestone.

The other reason why you want closer, shorter goals and plans is that you build confidence and momentum by achieving regular and continued success.

Achieving a series of near-term goals gives you a lot more lift than getting another 10% closer to a long-term target.

## What is a plan?

A plan is nothing more than a list of activities prioritized and put in chronological order.

In other words, to achieve a given goal, what you should do first, and what you

should do second and so on. That's a plan.

It doesn't sound so intimidating that way, does it?

But even if you can discipline yourself to establish a plan for your career, your life or just for next month, you still have to get it done and getting things done usually turns out to be the hardest obstacle to most people's success.

They know what needs to be done but each day just gets away from them and nothing important seems to get accomplished.

Well, I'll tell you the secret to avoiding that trap. This simple little device is guaranteed to a least double your productivity. And what's more, it's something you already know about.

It's the "To-Do" list. But the secret **(continued on page 27)**

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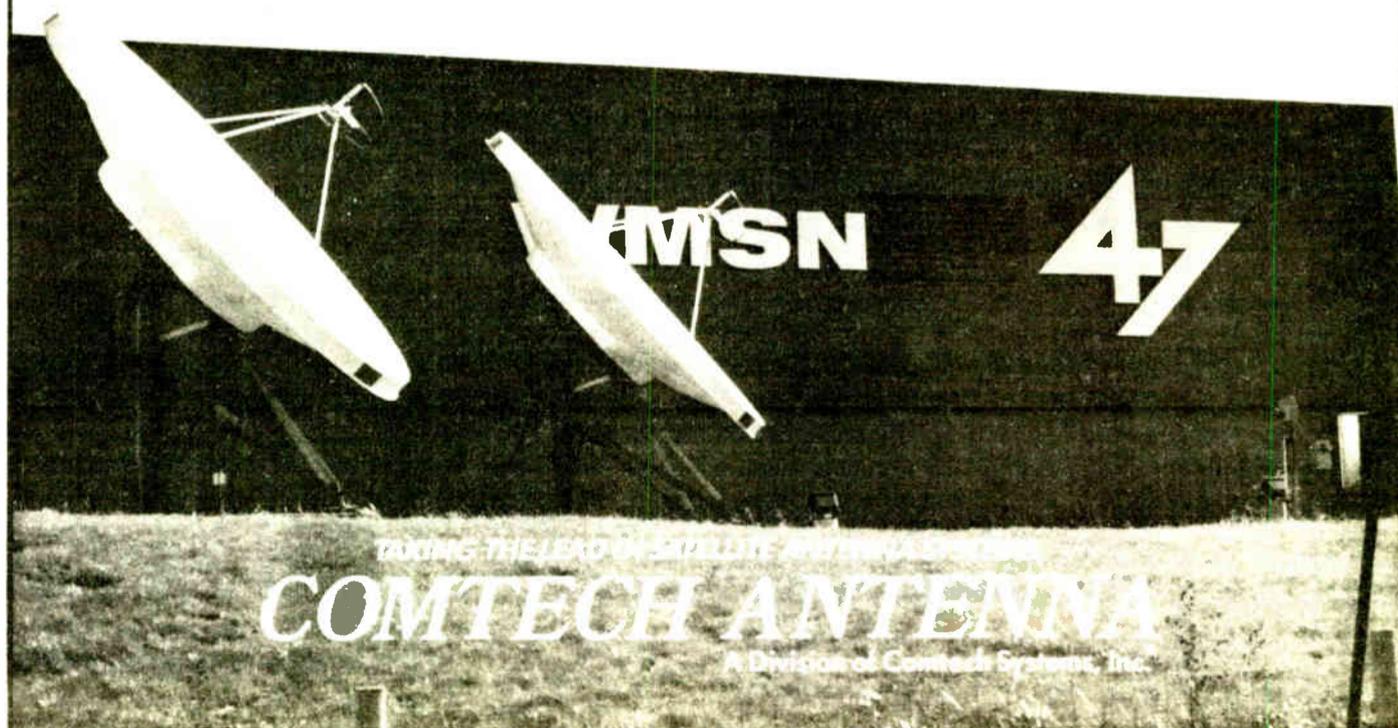
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# Basics of Digital Troubleshooting

by Bill Higgs

Louisville KY ... There is one word which at once brings visions of the miraculous to the PD and terror to many engineers: digital. Multilegged black slivers quietly doing their mysterious and magical task.

If anything is advertised as "analog," it is relegated in the non-engineering (read programming) mind as on the level of Marconi's and Edison's originals. Digital is "where it's at."

A panic is quickly averted. After all, "digital" can mean anything from a NAND gate to a Cray supercomputer.

Most digital equipment used in radio broadcasting can be divided into two categories: control and signal processing.

Although digital signal processing is finding its way into the larger stations' audio chains, most of us with more limited operations find digital circuitry primarily in control functions.

## When the digital box malfunctions

So the new box arrives, works as advertised for warranty—+10 days—and then dies. A check of the schematic shows terrifying shapes with points and small circles rather than familiar transistors plus a dreaded 5 V power supply.

The service data (if there is any) begins by describing the hookup of the logic

analyzer! More often than not, the device goes back to the factory for half a millenium for service for a simple problem.

The problem is not usually a lack of knowledge on the part of the engineer. Most of us grew up with light switches; we understand on and off.

The test equipment in the wish books make us think that exotic diagnostics are

## BottomLine—Broadcaster

necessary. To some extent this is correct; the old H-P 200 and DuMont scope are pretty useless.

Logic analyzers, multichannel scopes and the like are useful, particularly when working with microprocessors, but are simply not necessary for most digital troubleshooting likely to be encountered by the engineer in the smaller station.

Ninety percent of problems can be pinpointed with very simple equipment.

(I have an old-timer friend who says he has been doing digital troubleshooting for 40 years. He licks a finger and sticks it in the circuit).

## Using logic

I have a commercial logic probe, and I would recommend one as standard

equipment.

I have found, however, that the circuit in Figure 1 does almost as well. It could be called the "bare minimum" digital tester. The parts count is low and the cost can be as low as \$1!

The circuit is quite simple. U1A and U1B act as simple inverters and LED drivers. When the input is at a logic high, LED1 will be on; when the input is low, LED2 will light. R1 serves to pull the input to a logic low when the tester is unconnected.

4011 or 4001 can also be used, with slightly lower performance on pulses.

The LEDs are garden-variety, although you may want to choose different colors for each function.

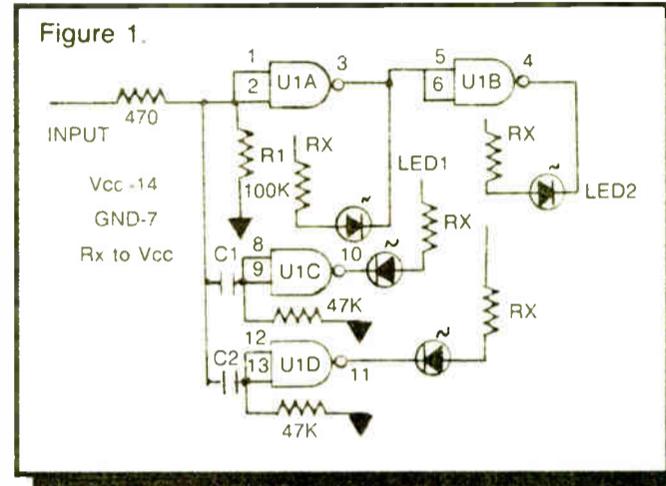
Rx is a value chosen so that the current through the LED is limited to about 5 ma at the voltage to be used. Using 2700 ohms is usually about right.

If the LEDs used are of unusually low output, or if the tester is only to be used on 5 V logic, the value may be lowered to 1200 ohms or less. These resistors should be 1/2 W values.

## Putting it together

Construction is, as they say, up to the builder. Nothing is critical. The unit can even be built into existing equipment, with a small test probe stowed away ready for use.

If a portable version is built, any small box will do. Should you choose this route, use small component clips for the power and input leads. Don't make my mistake and use alligator clips.



U1C and U1D work identically, except that C1 and C2 permit this part of the circuit to respond only to pulses. The value of C1 and C2 are selected based on the speed of the pulses; some experimentation may be necessary here.

I used .01 and .001uFd. The value is a bit of a tradeoff with the values of R3 and R4, the combination of R and C setting the output pulse length. I prefer to use a small value of C to avoid loading when checking CMOS circuitry.

## Selecting parts

I chose CMOS for the tester so that the circuit can be used with either CMOS or TTL logic.

Note that U1 is a 4093 quad NAND Schmitt trigger IC, used so that pulse trains would be automatically shaped. A

Use of the unit is straightforward, although some experience can tell you a lot.

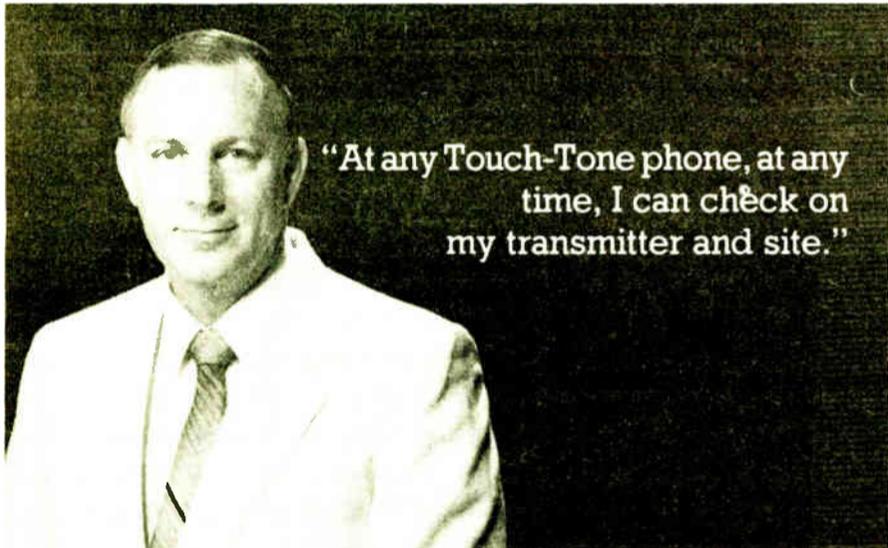
The LED1 and LED2 give simple high-low indications, while LED3 and LED4 show the presence of quick pulses and give some idea of the frequency.

Noting the relative brightness of LED1 and LED2 can give some indication of the duty cycle, as well as indicating whether you are dealing with a normal low pulsing high or a normal high pulsing low.

Try it on a working unit, and you will get an idea of what normal conditions look like.

In my experience, the usual problems with both CMOS and TTL circuitry is that pins get stuck either high or low.

(continued on page 27)



Pat Lane — WKNO Memphis, TN

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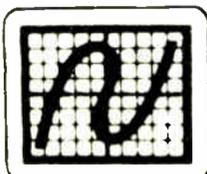
VRC-1000 time clock to identify the main channel each hour.

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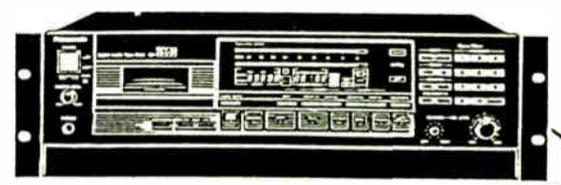
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# ProMusic CD Library Shows Diverse Flair

by Ty Ford

Baltimore MD ... This month the march of the CD production music libraries continues with the ProMusic collection. There are 27 CDs from three different libraries: *Cavendish* (11), *Parry* (14) and *Intermede* (2).

In some ways this collection reminds me of the DeWolfe library. Not only are both libraries very diverse in musical style, they may not be your first choice if you were looking for that standard bed that screams, "I am a local retail radio bed!"

The exception is *Parry Music's* CD 1011 "Jingles 1." (Even they don't scream, just strongly suggest.)

This is not to say that you can't use these beds on radio spots; you can. It's

## Producer's File

just that some of the compositions are a lot "bigger" than most radio spot beds.

The character of the music is often so strong that it lends itself to radio spot use only if the copy is equally strong.

Most price and product local retail copy lacks the inspiration. (Hint to copywriters: if you can meet the challenge you'll have one great sounding radio station!)

Production houses whose clientele are "big business" directs and ad agencies who do TV and corporate non-broadcast, will probably use this collection a lot.

### What's up, doc?

Documentation of music libraries is important. How much depends on how big and extensive the library and how it's arranged.

The CDs in the ProMusic collection have been given descriptive titles. The enclosed cue sheets offer a concise description of what is on each CD.

The *Cavendish* collection offers a clue in each CD title and a one sentence description of each track on the inside label of each CD.

The *Parry* collection offers only a CD title and a one line description about the entire CD up to CD 1006. From then on you get an additional one line description for each theme on the enclosed label.

The two *Intermede* discs offer hints in their CD titles and a one line description of the contents.

More information, instrumentation, energy levels, synth content and style would be helpful.

The problem is that after, unless you are constantly using the package, it's difficult to remember the location of that certain cut.

### Finding the cut

Network has gone to great expense to publish a huge descriptive index to help locate the piece with the right energy and feel.

The Aircraft library, although not as thoroughly documented, comes with a very similar catalog.

These companies should consider

looking into making their cross-referenced indexing available as software.

If designed properly, production people could not only do a word search in an existing library, they could include info about other libraries to the same data base.

This would cut down on printing costs and make things a lot easier for those people with more than one library.

### Time is tight

Production music companies particularly after the TV commercial market should remember that at many stations the audio window slams shut at 29.5 seconds.

Making beds that hang over that mark often cause the producer to edit or speed up the track.

Some of the indexed 30 second and standalone 30 second cuts of the *Caven-*

**Production houses whose clientele are "big business" directs and ad agencies who do TV and corporate non-broadcast will probably use this collection a lot.**

*dish* collection work better as bridge material than they do as 30 second beds. The short versions don't always have the right lift-off.

The *Parry* library folks obviously spent more time in the editing process starting with #1011 "Jingles 1."

Each of the 88 cuts (60 and 30 second versions of 44 themes) has been edited to be gone by 29.5 and 59.5 seconds respectively.

Additional care has been taken to start each piece at the right place compositionally. Disc #1011 "Jingles 1" contains A/C, CHR, C&W, folk, rock and beautiful music styles.

It does contain material which is on the other CDs but the editing is worth it. This is a real workhorse disc for spot work.

The one element of the *Parry* library documentation which I would like to see changed is the index timing.

The current method shows you how many seconds into a theme a particular index point is. While that may be useful to some, I would rather know the time from the index point to the end of the theme.

### Crossing formats

*Intermede's* 30s and 60s consistently ring out past 29.5 and 59.5 seconds. If you don't mind doing a quick fade this shouldn't be a problem.

(continued on page 25)

### SCA RECEIVERS



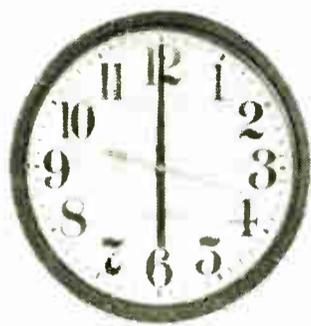
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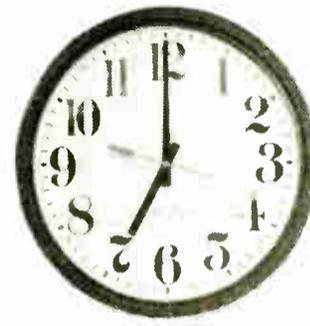
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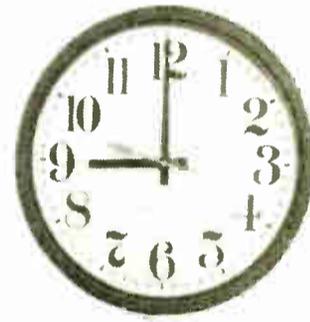
6:00-6:00 Pacific



7:00-7:00 Mountain



8:00-8:00 Central



9:00-9:00 Eastern

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Circle Reader Service 12 on Page 32

# Standard on ours is "N/A" on theirs.



Every recorder in the C270 Series comes *loaded* with professional features that aren't available—not even as options—on “comparable” machines from other manufacturers . . .

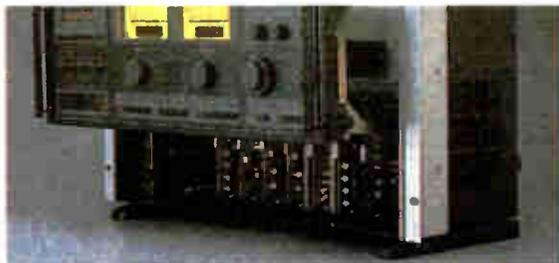
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## STUDER REVOX

# Is It Really "Good Enough?"

by Barry Mishkind

Tucson AZ . . . One of the attitudes that has often been cited as an explanation for the decline of some American industries can be summed up in the phrase, "It's good enough."

What occurred in the auto industry, for example, was the emphasis on production levels, rarely worrying about whether or not the vehicle worked correctly. The feeling was that problems could be fixed under warranty.

However, after spending several weeks visiting the repair shop, most consumers resolved that next time they would buy a car that runs properly from time of purchase.

The Japanese take their expectations one step further, they refused to buy a car whose appearance is blemished, such as a poor paint job or doors that do not fit perfectly. Attention to detail brought success to Japanese automakers.

Here, in the US broadcast industry, we face similar problems in evaluating equipment for our stations. On the one hand, most of the time, we do not have the option of sending equipment in for servicing, as our top priority is to get it back on the air.

## Eclectic Engineer

This places two required attributes upon any proposed purchase: high quality design and construction and a complete, well written manual for quick field service. Any conscientious engineer will agree with this policy.

### The problem

While many stations and engineers do acquire top quality equipment, sadly the bulk of national buying often turns on price alone. Sometimes that is unavoidable—there just isn't enough in the capital budget.

But if you talk with some of the manufacturers that exhibit at the NAB shows, all too often they hear an owner look at several products and then return to the cheapest one, remarking "It's good enough."

Good enough for what? To stand up to the abuse of 24 hours a day, 365.25 days per year operation? To produce a high quality signal for the station's listeners? Or, to keep the equipment budget at its minimum?

Of course, inexpensive equipment is sometimes appropriate. There are stations in small markets that use their studios lightly and only with a few trained professionals. They don't need and can't afford the top of the line models.

Inevitably the decisions that must be weighed and made have their impact. As working engineers, we often have to

simply grin and wade in to fix the gear when it breaks.

That is where a good manual is literally worth its weight in gold. Unfortunately, the price paid for broadcast equipment does not always guarantee that when you turn to your manuals they will truly be helpful.

### Case of the missing instructions

As I write these words, I am looking at the manual for a well built, popular low power FM transmitter. In a section devoted to troubleshooting input problems, it directs the reader to section 4.3 and specifically figure 4.3.1. Yes, you

have probably guessed that there is no section 4.3 at all!

Contacting the factory resulted in the explanation that while it *was* true the manual skipped from section 4.2 to 4.4, they *had* intended to insert section 4.3 *someday*. So far, the "Sri Lankan" technical writer hasn't had time to do so. And there was no indication of when he might. It was "good enough."

It has always been a source of irritation to be forced to hunt for servicing information that should have been available when the gear was delivered. What often makes it worse is the lack of a phone number anywhere in the manual

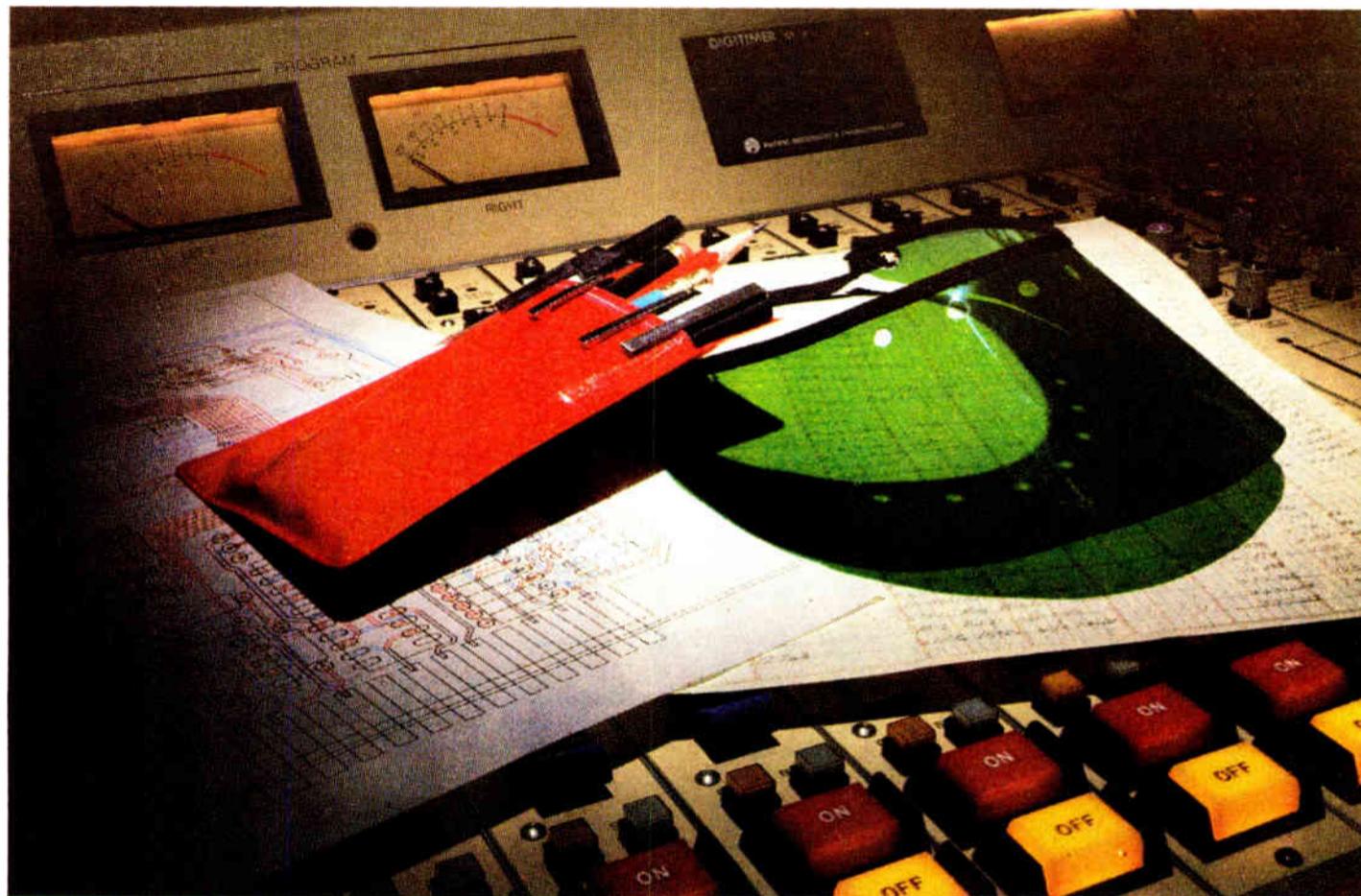
or in the shipping boxes.

It is true that manufacturers do relocate from time to time, and printing a phone number may leave information out of date at some future time. But, some number is better than none, isn't it?

Other manufacturers do provide an 800 number for assistance. This is nice, but expensive to maintain. Still others have a policy of having you call them, then they call you back on an outward WATS line.

And then there are some that simply use an answering service. They will get back to you . . . usually.

There was one company with which I used to try real hard to get angry. Their manuals are just fair. If I called seeking *(continued on page 28)*



# Designed. Then priced.

### Not vice-versa.

Other manufacturers set price goals, then commit their designers to create products to fit the price. Worse still, their prices must leave room for dealer profits.

Your station works as well as your consoles let it. How do you know whether your consoles have been built to a price, or designed to perform? If they're from Pacific Recorders, you have the assurance that a very real difference in priorities is at work.

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### When they're finished, we price it.

And since we don't build in a dealer mark-up, our customers always receive the best price on their equipment. Our published end-user price would be others' "confidential dealer cost". The "negotiation discount" you'd properly expect from their dealers, we invest in superior components.

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# Mastering Signal-to-Noise Ratios

by Thomas L. Vernon

Harrisburg PA ... Maintaining outstanding noise figures in a modern broadcast plant is an ongoing challenge.

While the noise specifications of audio equipment have improved over the years, so has the complexity of most operations.

The typical setup of an eight-channel console feeding an AGC, phone lines, limiter and transmitter got lost somewhere in the late '60s. Nowadays there

## Station Sketches

are mic processors, routing switchers, STL hops and aggressive limiters, to name a few.

The cumulative effect of all this new equipment can make overall system noise figures look kind of shabby.

In this month's column we'll look at signal-to-noise ratios: how to make measurements, and how to interpret them.

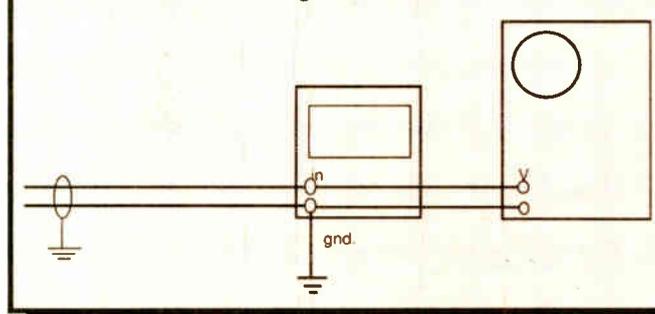
We'll also examine some ways to improve the SNR and track down offending noise sources in equipment.

### What is noise?

It seems somehow logical to begin with a definition of noise. Noise is any unwanted signal that obscures the desired signal. This may include RFI, ground loop hum, or any other form of periodic noise.

It may also take the form of random

Figure 1a. How NOT to measure system noise. Grounding one side of a balanced line will give erroneous results.



noise, having equal power per decade of frequency. This is also known as pink noise.

Pink noise is a large umbrella that includes shot noise, Johnson noise and base current noise.

Such random noise may be generated both in the amplifier and any transducer connected to it.

The absolute minimum noise threshold is determined by the random motion of free electrons in conductors. This averages out to about  $0.27 \mu\text{V}$ , or  $-130.9 \text{ dBm}$ .

Often, audio equipment is tagged with an "equivalent input noise" specification.

This is really a measure of noise generated by components in the input stage, when it is terminated in its characteristic impedance. This is important because it sets the absolute limit for overall system noise. Typical figures are around  $-120$ - $-127 \text{ dB}$ .

If an amplifier had an equivalent input noise of  $-127 \text{ dB}$ , and we feed in a signal at  $0 \text{ dB}$ , the SNR would be  $-127 \text{ dB}$ . If a mic with an output of  $-55 \text{ dB}$  were

and some metal film resistors of the appropriate value to terminate sources.

Care must be exercised so that the test equipment setup doesn't ground one side of the balanced line, or otherwise create problems.

Figures 1A and 1B show correct and incorrect ways of connecting test equipment to the system being evaluated.

With all controls set for normal operations, feed in a  $1 \text{ kHz}$  tone at standard operating level.

Record this level, remove the oscillator and terminate the unit with a low noise resistor of the correct value. Do not short out the input terminals. You'll get better noise figures, but that's cheating.

With the input terminated, again

connected, the SNR would be  $72 \text{ dB}$ .

### Measuring noise

Measuring SNR requires the use of a signal generator and audio VTVM.

It's also a good idea to have an oscilloscope and headphones for monitoring noise,

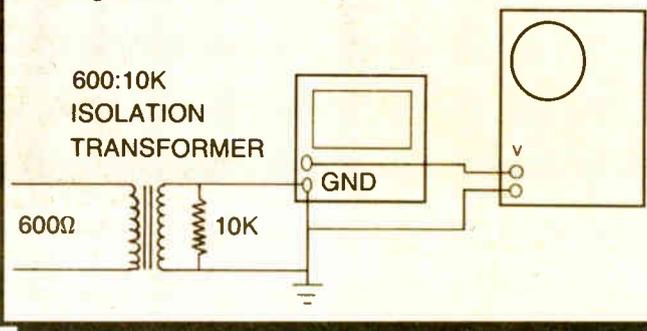
measure the device's output with the VTVM. Subtract this figure from the earlier one and you've got the noise figure.

Let's say that your device's output was  $+10 \text{ dB}$ . With no input you measured  $-62 \text{ dB}$ . This gives a SNR of  $72 \text{ dB}$ .

### Improvements still needed

Suppose you only get nominal noise figures from your system. There are probably some things you can do to make improvements.

Figure 1b. A transformer will isolate test equipment from the system under evaluation. To prevent HF rolloff, be sure to terminate the transformer secondary. Connect test equipment ground to the station ground.



The best place to start is with mic preamps, since this is the area most sensitive to noise ingress.

Earlier I said that shorting out the input during noise measurement isn't kosher. But there's a lesson to be learned here.

We know that thermal noise power is proportional to resistance (and band-  
*(continued on page 31)*

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World Radio History



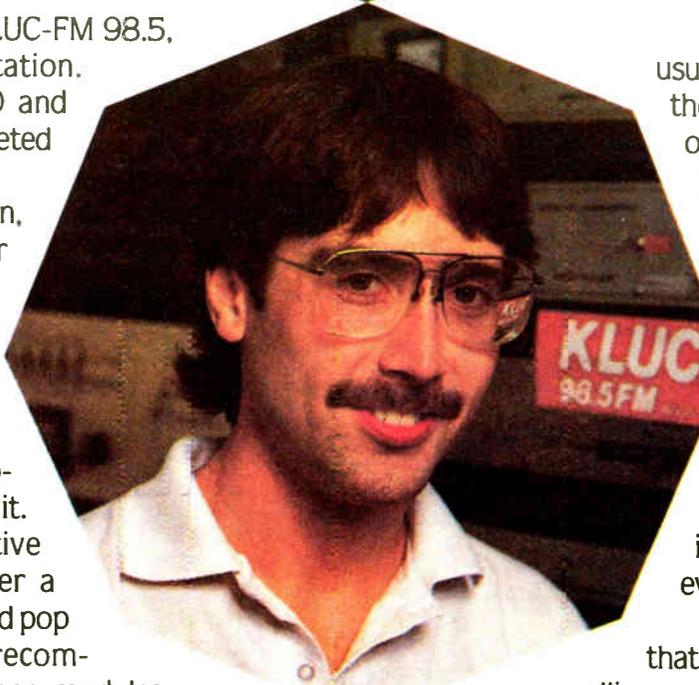
## “Auditronics’ transparency helps us

## stay number one in Las Vegas”

says Jay Pierce, Chief Engineer of KLUC-FM 98.5, Las Vegas’ number 1 hit music station. “Now that we’re almost 100% CD and Bernoulli disks, we’ve virtually obsoleted vinyl.”

“As the heart of the station, the Auditronics 200 lets our superior program come through to the listener. We only have one console left that isn’t Auditronics, and when it goes on the air you can definitely hear the degradation.”

“Our 200 is my first exposure to Auditronics and I really like it. It’s easy to access and all the active devices are socketed. If there’s ever a problem you just pop a module out and pop another one in. Though it’s not recommended practice, you can even change modules while you’re on the air without shutting down the board.”



“In three years I’ve had no problems, just the usual meter lamp replacements. I’ve changed the headphone pot once (our jocks are tough on gear!), but other than additions the signal path remains untouched to this day.”

“Incidentally, our jocks love the Auditronics 200 because everything’s laid out well for them. What you need is at your fingertips. The meters are easy to see and easy to read. The monitoring system’s easy to use. Multiple inputs are at the top and out of your way. The calibration system’s easy to get to. If Auditronics could just supply meter lamps with infinite lifetime, I could forget the consoles even exist.”

You can have a trouble-free console that’s transparent to digital programming by calling us free at 800-638-0977 for complete information about our 200 Series.

Photo: Jay Pierce, Chief Engineer, KLUC/FM, KRSR/AM, Nationwide Communications, Inc.



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*\*Available in three or single phase models.*



# ProMusic Displays Diversity

(continued from page 19)

Incidentally, just because you're at a rock or CHR formatted station doesn't preclude you from using the C&W or beautiful music cuts for the right client.

I realize this may run against your grain if you've been programmed to be "modal."

The point to consider is whether it's better to try as hard as you can to make every station-produced commercial on the air sound just like your playlist or to let your imagination or the client's marketing position dictate the right music.

Several of the discs in this collection are the result of ADD recording. In case you haven't run into this terminology yet,

The three letters represent the phases of recording and mastering. "A" refers to analog and "D" to digital. ADD means that the material was recorded analog, mixed to a digital master, and produced as a digital product (CD).

While more "Ds" does not necessarily mean better recording, CAD CV 9 & 11 do sound a little crisper than the others. The *Intermede* discs are DDD.

Unless noted otherwise on the chart, all of the music on these CDs is of full theme length.

## Paying the piper

ProMusic offers several Annense plans: Plan I provides for your choice of 15 CDs or 25 LPs with the rate of \$800 for educational institutions, \$1150 for non-broadcast and \$1350 for broadcast.

Plan II provides for your choice of 30 CDs or 50 LPs with the rate of \$1500 for educational institutions, \$2150 for non-broadcast and \$2350 for broadcast.

With either plan you will be informed of new releases and will be able to purchase them on CD or LP. The CD rate for new releases is \$55 for educational, \$75 for non-broadcast and \$85 for broadcast. LPs are less expensive.

This library is also available on a needle drop basis. There are 20 categories ranging from \$50 (non-broadcast only) to \$400 (theatrical plus free TV, pay TV and videocassettes) per drop.

ProMusic also offers blanket rates for unlimited use of the number of drops based on the length of the production. On any radio spot a drop costs \$65, \$75 or \$100 for local, regional or national play.

The radio blanket rate is \$200 and covers the use of any number of drops for a radio spot, regardless of the number of markets the spot plays in.

Single drops for broadcast TV are \$65, \$75 and \$100 respectively, for local, regional and national use. The broadcast TV blanket rate for use of multiple drops in one spot is \$385, regardless of the number of markets the spot plays in.

The rate schedule is laid out in an easy to read fashion. For more information about the ProMusic libraries contact Alain Leroux at 1-800-322-7879. Florida inquiries can be made at 305-776-2070. Fax them at 305-776-2074.

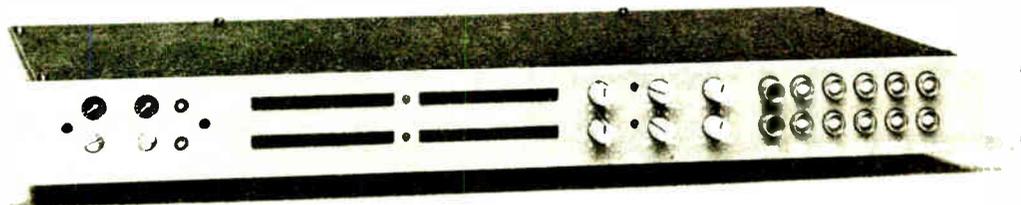
Ty Ford, audio production consultant and voice talent, can be reached at 301-889-6201 or by MCI mail #347-6635.

## The ProMusic CD Collection at a Glance

CATALOG #	TITLE	LENGTH	# OF CUTS	INSTRUMENTATION	SUGGESTED USE	COMMENTS
#CAV CD 1	So Far So Good	68	25	Theme lengths of up to date arrangements and sounds for rock combo with lots of well tempered synth sounds	TV/AV/Film	A Whs Sampler of from first six Cavendish vinyl releases. Alan Parsons/Jan Hammer, '60s R&R, a acoustic guitar. Very visual music.
#CAV-CD 2	The Power Connection	49	15	Theme lengths with 30 sec versions of each, AC/CHR arrangements with synth accents	TV/AV/Film	Compelling melodies and moods, mostly up tempo, one or two more reflective.
#CAD-CD 3	Murder, Mystery & Suspense	65	7	Fully orchestrated theme suites, each with from 3 to 9 parts, each part from :09 to 4:12	Specialty	Great stuff!! Selections are color-coded for chase, suspense, tragedy, murder, mystery or horror. This is the real thing!
#CAD-CD 4	Breaking Glass	63	22	Theme length up tempo AC/CHR with synth accents	TV/AV/Film	You'll probably hear these in Flashdance II. Good positive driving stuff.
#CAD-CD 5	Victorian Edwardian	70	23	The Royal Philharmonic performs a great collection of period pieces	Specialty	Admit it, you've always wanted to hear a tarantella. Excellent recordings, you can almost feel the velvet and hear the silk rustle.
#CAD-CD 6	The Comedy Store	61	43+	Primarily fully orchestrated themes and stingers plus 7 synthesized beds, of various lengths	Specialty	This collection reminds me of the Rocky and Bullwinkle theme. Great orchestrated farce.
#CAD CD 7	So Far, So Good vol. 2	67	24	Up to date Rock, CHR and Urban Contemporary themes with lots of sampled sounds	TV/AV/Film	Very visual music. Strong melodic TV theme type stuff. Too hip for use under a "corporate benefits package" video. Jan Hammer toys with "new age."
#CAD CD 8	A Case for Guitars	68	28	Standard rock, folk, blues, easy listening and classical instrumentals in theme length	TV/AV/Film	A great music anthology of guitar-based music since the 1950's. If you're a guitar player you'll listen to this one after work too.
#CAD CD 9	To Every Action ...	60	12	Contemporary rock ensemble with sampled strings and horns	TV/AV/Film	48 Hours or West 57th St. theme music. 11 of the themes have :30 or :15 outtakes, two have melody minus mixes. Powerful and well constructed. A great choice of sounds.
#CAV CD 10	We Have The Technology	59	23	Techno-Synth composition	TV/AV/Film	Sad and serious cybernoid themes with that "computer-generated" feel. Titles like "Scientific Illustration," "Infected," "Aftermath" and "Heart Attack" sum it up.
#CAD CD 11	Gold	68	6	Multiple versions of 5 themes	TV/AV/Film	The same melody performed via different arrangements is useful when you want to maintain a strong identity on longer projects. Styles range from ethereal to "Starsearch," electronic to orchestral.
PML CD 1001	The Zenith Orchestra	71	13	Contemporary orchestral and large combo arrangements	TV/AV/Film	"Sports, industry and achievement" themes. All but one has a full length alternate version.
PML CD 1002	Technovision 1	68	37+	Synth combo arrangements	TV/AV/Film	30 themes from :60 to 2:49 with 4 "builders," and 4 "drone" beds each about :30. "Music for technology, industry and space."
PML CD 1003	Light And Bright	71	29	Orchestra and/or combo	TV/AV/Film	Theme lengths with indexes. Perfect programming for a "light and bright" beautiful music station or music on hold.
PML CD 1004	The Winning Spirit	69	24	Orchestra or combo with synth accents	TV/AV/Film	"Orchestral themes for sports, industry and achievement."
PML CD 1005	Country Folk	70	37	Solos and small groups	Specialty	A wide variety of flannel-shirted arrangements. Mostly guitar, some pedal, harmonica, autoharp and dulcimer.
PML CD 1006	Rocking On	71	21	Rock combo	TV/AV/Film	A good attempt at copping a few licks from the commercial charts. Some tracks have melody minus mixes, some have shorter outtakes.
PML CD 1007	The Zenith Orchestra 2	71	11	Orchestra w/rock and synth accents	TV/AV/Film	"Contemporary themes, underscores and fanfares for industry, sports and achievement."
PML CD 1008	World Tour 1	71	33	Traditional arrangements	Sty	International theme favorites (and then some) from Italy, Mexico, Scotland, India, France, Hawaii and Israel. No travelog soundtrack would be complete.

(continued on page 28)

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# Planning to Succeed

(continued from page 17)

about the time-management device is—you have to use it.

There was a business management consultant named Ivy Lee, and one day he was sitting in the office of the president of one of America's leading steel companies. Lee was selling. He was pitching all the ways he could help the president and his management team define the important things they needed to accomplish, to achieve greater success in their business.

"But we already know what we need to do," the president said. "What we really need is some help in actually getting these things done. If you can tell me a way to help me and my managers get more accomplished, I'll pay you any reasonable fee you ask."

Ivy Lee smiled. "I'll give you a method in 20 minutes. You try it for a month, and when you're satisfied that it works, just send me whatever you feel is fair."

The consultant continued, "Get a piece of paper and a pencil. Write down the ten most important things you need to accomplish tomorrow, in the order of their importance. Then, when you come in tomorrow, get the list out and start with task number one. Work on it until it's done, if possible, then move it to number two."

"Don't worry if you don't get to everything in one day," Lee said. "Just take the things that weren't completed and put them at the top of the next day's list and start out with them when you come in the next morning."

As the story goes, about a month later Lee received a check for \$25,000 with a note stating that one concept of making a daily "To-Do" list increased the steel company's management effectiveness

and efficiency by a large percentage.

While I don't expect you to send me a check for \$25,000, I'll promise you that you'll be amazed at the productivity increase you'll receive for such a simple investment of your end-of-the-day time.

## Instant gratification

Another important benefit of the daily "To-Do" list is a psychological one.

Knowing that you have a handle on the things you'll need to accomplish tomorrow will take a lot of stress off of you today.

For example, I know that I have a tendency to lay awake at night thinking about all the tasks and projects that face

me. So it's absolutely necessary for me to make lists.

That way I know that I don't have to think about the important tasks. They're already written down and I won't miss any.

Another part of the same benefit is the great feeling of accomplishment you get from checking a project off of your list.

Nothing succeeds like success and nothing reminds you of your successes like seeing them listed each day. It's a great confidence builder.

## A successful future

There you have it. A plan for a successful future. Just determine where you want to go: in your profession, your personal life, your important tasks or projects; then write out the steps you must take to get there.

Break those steps down into monthly, weekly and finally daily steps.

Then, at the end of each day, write out the important things you'll need to accomplish tomorrow to keep you on track to your big goals and you won't be thrown off course by the distractions that inevitably pop up during the course of every day.

Put this planning plan to work in your life and watch your productivity take off.

Why, you'll probably end up becoming engineering director of one of the major networks, or owner of your own station, or ...

If any of that stuff happens, don't forget my \$25,000 check.

*John Cummuta is president of Marketline, a broadcast management and marketing consulting firm, and a regular RW columnist. He can be reached at 312-960-5999.*

# Keeping Up With Digital

(continued from page 18)

Contrary to some belief, I have seen very few "maybe" gates. This little gadget may not keep all bad boxes from being returned but it will at least help keep the tape transports, switchers, decoders and boards merrily dealing with their ones and zeros.

## PCB caveat

On an unrelated subject: if you, like me, are contracting for PCB removal, don't stop with the transmitter!

You may forget older monitor equipment or mechanical devices such as old tape transports, turntables and the backup generator.

The motor-start capacitors in older equipment may contain the stuff. Antenna rotator controls are also suspect.

A friend of mine even found a Pyranol cap in the station drill press motor! You are usually paying a fixed amount, so you should clear out all of your problems at once.

*Bill Higgs has been CE for WXLN/WFIA for six years and has also done station consulting work. He has a Ph.D. in Theology which helps explain his patience with small market radio. He can be reached at 502-583-4811.*



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## Is It Good Enough?

(continued from page 21)

information at noon, or on weekends, they didn't answer the phone, period. If I called at any other time, and if I left a message, the wait was long. Boy, did I get start to get steamed!

However, after I did get through, there was knowledgeable, patient assistance on the other side of the phone. They answered every question, and sent out needed parts instantly and cheerfully. I couldn't maintain any anger.

Talking to a company representative brought forth an explanation that is satisfying. The company has a policy of being as helpful as possible to customers. While it has not maintained a separate customer service department, the technical people will talk as long as necessary to solve any problem from the field.

He went on to say that the lack of answering at noon, and reluctance to take messages follows this logic: rather than playing telephone tag to get the station engineer and company technician together on the phone, they take calls as they come in.

PDs or sales managers are welcome to call and be helped where possible, but they are invited to have the engineer call back directly.

This approach seems to work, for this one company has many satisfied customers and it is not forced to hike equipment prices sharply to pay for service.

ProMusic CD Collection . . .						(continued from page 25)
CATALOG #	TITLE	LENGTH	# OF CUTS	INSTRUMENTATION	SUGGESTED USE	COMMENTS
PML CD 1009	Field & Stream		32	Mostly flute, guitar & piano with a little synth	TV/AV/FILM	Theme length "Pastoral & romantic settings."
PML CD 1010	Overdrive	73	12	Contemporary orchestra w/rock and synth accents	TV/AV/Film	Each theme has full, underscore, 60 and 30 versions. The 60s and 30s are cut to 59.5 and 29.5. "Sports, Action, Industry and Drama."
PML CD 1011	Jingles 1	70	44	Various (see article)	Radio/TV/AV/Film	44 themes worked out as 30s and 60s (see article). A/C, CHR, C&W, Folk, Rock, Beautiful Music. A good collection of spot beds for all occasions.
PML CD 1012	Action & Motion	70	28	synth and sampler combo	TV/AV/Film	"Rhythmic music for energy sports and industry." A few of these would work for spot beds, but most don't have that "commercial attitude," promos maybe.
PML CD 1013	Time Periods	72	31	Various	Specialty	A versatile and convincing collection of period themes covering: '30s Dance, '30s jazz piano, '40s dance, '50s rock and '60s rock. The CD also has two tracks of 78 rpm surface noise for that touch of authenticity
PML CD 1014	Christmas Carols	70	45	Various	Specialty	The complete Christmas production CD. Xmas favorites done by choir and organ (multiple verses), solo organ, orchestral (no vocals), small group (instrumental, solo celeste, a capella children). Six or seven standards done lots of different ways with a few lesser known tunes for good measure.
INT CD 1001	73	12	Sounds Successful	Orchestral w/very good samples	TV/AV/Film	Each theme comes with full score, shorter underscore, full 60, 30, 15 and stinger. You'll have to fade the 60 and 30 ring outs to make 59.5 and 29.5. Positive music for sports and industry. Beautiful Music should sound this good.
INT CD 2001	73	12	Natural Beauties	Orchestral w/very good samples	TV/AV/Film	Each theme comes with Full score, shorter underscore, full 60, 30, 15 and stinger. You'll have to fade the 60 and 30 ring outs to make 59.5 and 29.5. New age beautiful music. "(Music) portraying the natural world."

Some other ways in which manufacturers try to anticipate problems in the field are exemplified in manuals that cover what may seem to be "basics" to manufacturers, but welcome reminders to many users.

### Back to basics

Chuck Kelly of BE shared a short manual from RANE that has no less than nine detailed diagrams on wiring connectors. The text clearly and chattily explains the mysteries of balanced and unbalanced lines, and how to avoid ground

loops. Praying, garlic necklaces and voodoo are listed as not necessary.

That may seem trite to some of you, but the next time you spend an evening tracing down a phase reversal in a station, you will surely wish the previous engineer had read this kind of information. If it is in the manual, there is a better chance that he would have done so.

Similarly, a question addressed by some manuals is how to properly interface external equipment to TTL control circuitry. Someone puzzled by cart machines interacting when hooked to a

clock would be saved a lot of grief by a few simple diagrams.

If you have some suggestions to pass on, a strange instruction or weird typo, or a particular manual that was really helpful, let me know. We'll keep publishing examples as they come in. Send them to 2033 S. Augusta Pl., Tucson, AZ 85710.

*Barry Mishkind, aka RW's "Eclectic Engineer," is a consultant and contract engineer in Tucson. He can be reached at 602-296-3797.*

# Splatter matters.

Splatter is a form of radio interference that can drive listeners away from AM radio. It creates distortion in your signal, wastes transmitter power on undesired sidebands and interferes with other stations. Even with an NRSC audio filter, misadjustment of the transmitter or audio processing equipment can still produce an RF spectrum that can exceed NRSC or FCC limitations.

That's why routine monitoring of your station's RF spectrum is a must. But it doesn't mean you'll have to bust your budget on a spectrum analyzer. It just means you need the rugged SM-1 AM Splatter Monitor from Delta Electronics.

For just \$2,150 you can now accurately measure your transmitter's spectral output, monitor transmitter IPM levels and make adjustments to improve clarity. An external audio input helps identify splatter sources.

The Splatter Monitor's unique offset feature tunes spectral segments for closer examination 10 kHz to

100 kHz away from the carrier. Unlike a spectrum analyzer, you can listen to the front panel speaker or your own headphones as you measure splatter levels on the front panel meter. The Splatter Monitor also has an alarm output to drive your remote control.

In this day and age where splatter matters, monitoring it doesn't have to cost you a fortune.

To find out more about the new Delta Splatter Monitor, call (703) 354-3350, or write Delta Electronics, Inc., 5730 General Washington Drive, P.O. Box 11268, Alexandria, VA 22312.

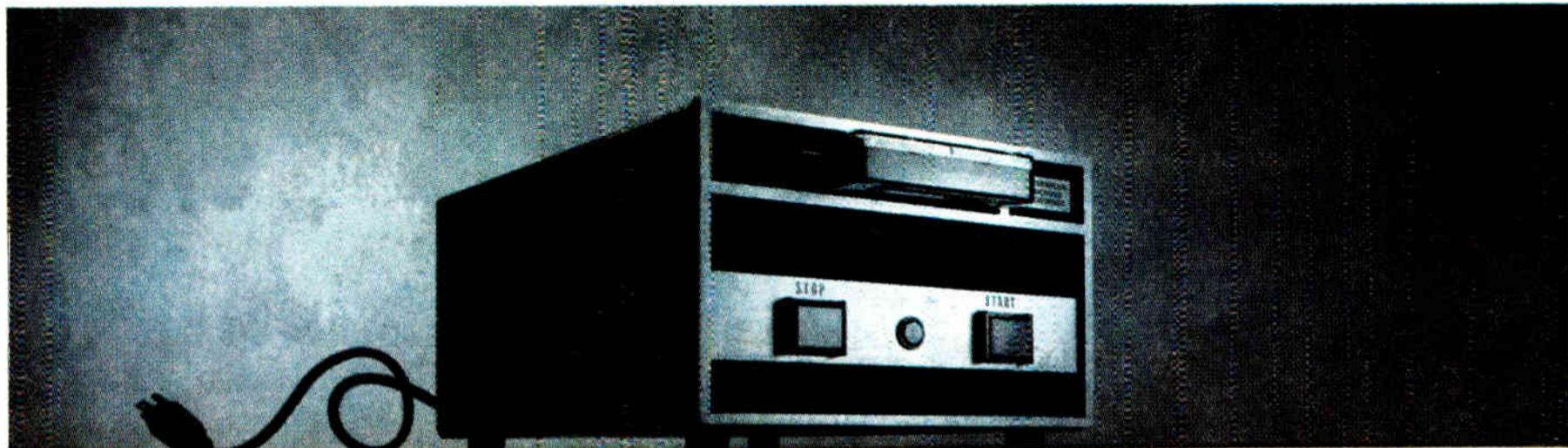
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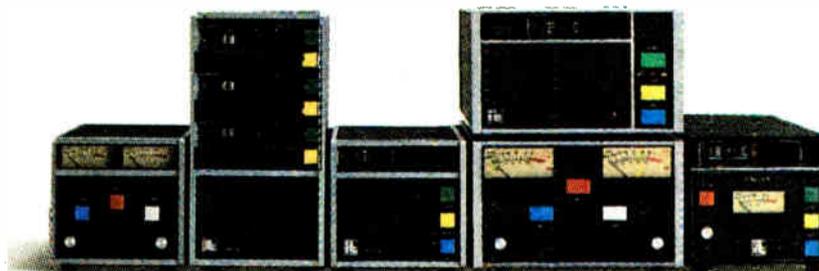
And our reputation doesn't just end there. Engineers tell us ITC also offers the undeniably best support in the business. With toll-free technical consultations. Fast turn around on repairs and replacement parts. And our 2-year warranty on factory labor and all parts, including motors, heads and solenoids.

No wonder, then, more stations buy ITC machines than any other brand. And keep coming back for more.

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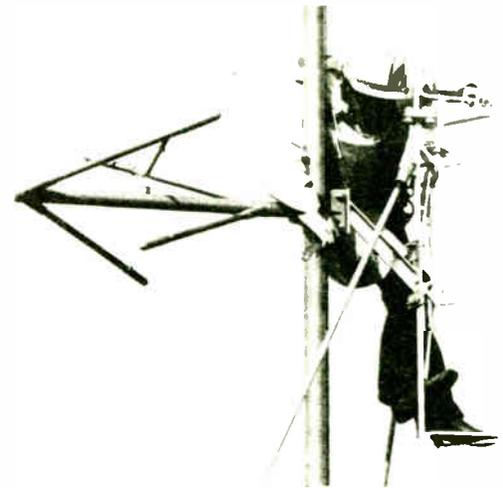
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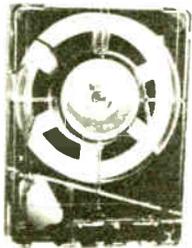
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A-2

All Factory Wound



AA-4

20 Second  
40 Second  
70 Second  
100 Second  
2.5 Minute  
3.5 Minute  
4.5 Minute  
5.5 Minute  
7.5 Minute  
10.5 Minute

**A-2**

**3.40**

**3.75**

**4.25**

**AA-4**

**4.85**

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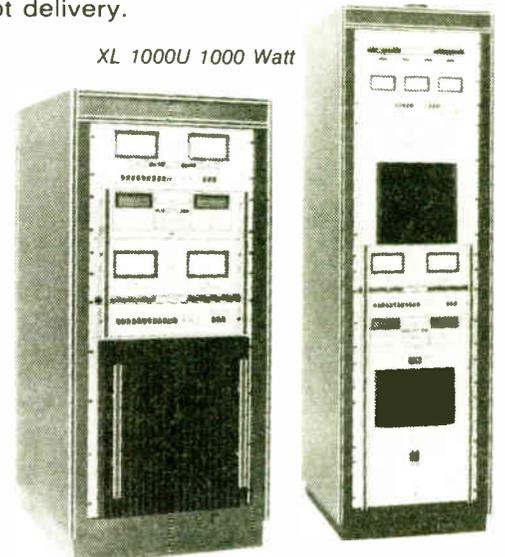
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# Getting Control of Your SNR

(continued from page 22)

width), so the lower we can hold the input resistance the better.

This requires a radical departure from the concept of proper impedance matching but remember that the object of impedance matching is to maximize power transfer.

At the mic input terminals our goals are a little different. We want to maximize noise input.

If a mic is matched to a preamp it loses half the desired signal inside the mic and

bandwidth are desirable.

Microphones often have better transient characteristics if they respond to supersonics and monitor amplifiers provide tighter damping of speakers if the speaker's response extends beyond the audio range.

Subsonics aren't usually as much of a problem as supersonics but they deserve a brief mention.

Very low frequency signals often originate in poorly erased cassettes and tapes or from turntable rumble and eccentric

sert 25 kHz bandpass filters to eliminate some of these problems.

Such filters must be carefully designed so as to not introduce ringing and transient problems of their own.

## The power chain

An often overlooked source for ingress of noise into the station's audio is via the power line and audio wiring.

This is a common entry point for hum, RFI and computer interference.

The power feeding audio equipment should be transformer isolated and this branch should be used for no other purpose.

Sharing power feeds with 3-phase lines connected to heavy equipment should be avoided.

Equipment should be wired so that the shield never carries ground currents. There must be a consistent grounding scheme followed throughout the installation.

The station equipment ground and power line ground should be isolated from each other, except for one point where they're bonded together. Typically this is the main breaker panel.

(The subject of wiring for low noise was discussed at length in Station Sketches appearing in the 15 May issue of RW.)

## Other sources for noise

Occasionally an amplifier becomes noisy and behaves like a pink noise generator.

Such problems are usually traced to a transistor in the early stages with collector-junction leakage.

This isn't to say that large output transistors can't become noisy, but the odds always seem to favor small transistors. Germanium transistors have more noise problems than their silicon cousins.

Other sources of noise include: resistors, diodes, leaky capacitors and bad solder connections. Note that high resistance components tend to be noisier than low resistance components.

Noisy parts are usually temperature sensitive and can be located with an os-

## Occasionally an amplifier can produce excessive noise and the guilty components are usually identified with conventional troubleshooting techniques.

delivers half of the unwanted noise signal to the amplifier.

On the other hand, the microphone's output is almost doubled when it is operated into an impedance several times its own internal impedance!

Thus the point for optimal signal to noise is somewhere between matched impedance and high impedance. This type of intentional mismatch attenuates noise faster than signal, which is what we really want to do.

The exact point is arrived at by experimentation and depends on the microphone and type of amplifier involved.

As a rule of thumb, start out with an input impedance about five times the internal impedance of the mic.

## Bandwidth limiting

Recall that thermal noise is proportional to bandwidth as well as resistance. Limiting bandwidth is another good way to prune the noise out of a system.

It's a myth that an audio system performs better if it has a response that extends from DC to light. Actually, there are only two places where extremes of

records.

Left untamed they can modulate AGC and limiter amp control voltages, blow out speaker coils and amp fuses and trip the "MOD OL" relay in plate modulated transmitters.

Suffice it to say that there's little to be gained by trying to extend system bandwidth below 20 Hz.

## Beyond the audible

Supersonic noise is a more serious problem in most operations.

Noise beyond audibility can be troublesome because it can be heterodyned down into the audible range. The vehicle for such action is usually intermodulation in some non-linear device.

The acid test for this type of problem is to feed a clean 30 kHz signal into the system and observe the output.

In an undamped amplifier, the noise will modulate the 30 kHz signal, producing products that fall in the audible range.

The ringing associated with this phenomenon results in an apparent loss of transparency.

As we move closer to a transformerless audio chain, it may be necessary to in-

cilloscope and a can of freeze mist.

The increased complexity of modern audio systems has made maintaining low noise figures an ongoing challenge.

Noise can be reduced by shunting down the input resistance of preamps to favor signal voltages over noise.

Bandwidth should be limited to 25 kHz. Studio powering and grounding must be designed for low noise performance.

Occasionally an amplifier can produce excessive noise and the guilty components are usually identified with conventional troubleshooting techniques.

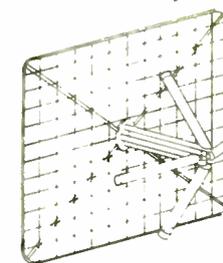
With patience and hard work, you can be the master of your station's noise levels, instead of its victim.

Tom Vernon, a regular RW columnist, divides his time among broadcast consulting, computers and instructional technology. He can be reached at 717-249-1230.

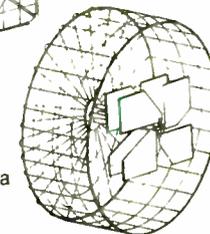


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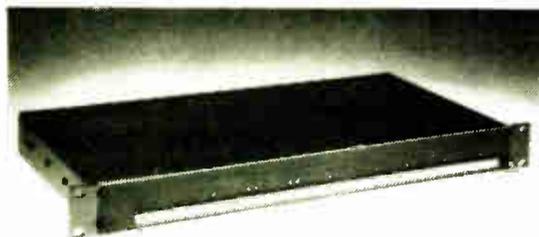
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# Radio World Marketplace

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### Stereo distribution amp

Wheatstone's eight-channel stereo distribution amplifier, Model SDA-82, may be used in single input/16 output or stereo input/eight stereo output configuration.

Each of the inputs and 16 outputs have their own 3-pin gold connector to allow load and source changes after installation.

The Model SDA-82 is provided with 16 individual output gain controls to compensate for load dependent gain shifts.

For information, contact **Patty Bagshaw at Wheatstone: 315-455-7740**, or circle **Reader Service 66**.

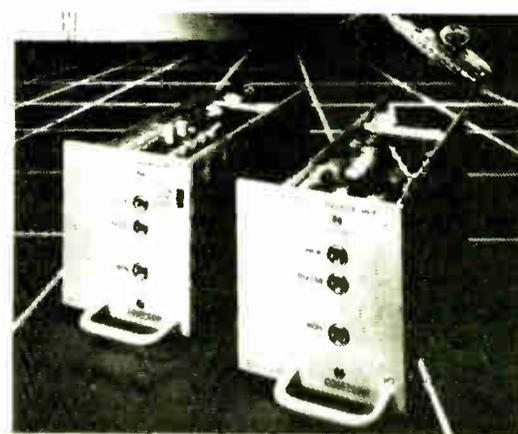


### Hiss reducer

The 563X from dbx is a hiss reducer which audibly eliminates background hiss from audio sources without sacrificing treble overtones. The unit is the latest in dbx's moderately-priced Performer Series half-rack line.

A single-ended noise reduction unit, the 563X combines an intelligent low pass filter with dbx's True RMS™ detection. The device allows single slider programming for any audio or video tape at speeds from 1 7/8 to 30 ips. The unit's "Quieting" control adjusts the initial amount of hiss reduction, with a compromise value set by the user.

For information, contact **John Stiernberg at dbx: 617-964-3210** or circle **Reader Service 61**.



### Digital program channel

New from Coastcom is the Digital Program Channel DPC 15, which converts program quality audio into digital form before transmission, avoiding problems associated with telephone transmission of analog audio.

For information, contact **James Connor at Coastcom: 415-825-7500** or circle **Reader Service 63**.



### RDS coder

The RE531 from RE Instruments is a programmable RDS coder to be used by broadcasters for audio insertion of page information, clock data and program information into a VHF/FM broadcast.

For information, contact **Steve Watts at RE Instruments: 216-871-7617** or circle **Reader Service 64**.



### Wireless microphones

Telex Communications' FMR-25 series of wireless microphones includes the single antenna FMR-25 and the Pos-i-Phase™ true diversity FMR-25TD (pictured above). The receivers are half the size of the Telex FMR-50; four can be placed side by side in a standard 19" rack mount.

For information, contact **Gary Fisher at Telex: 612-884-4051** or circle **Reader Service 69**.



### CD cleaner

New from JBF Laboratories is CD Saver, a compact disc scratch remover and cleaner.

For information, contact **John Wismer at JBF: 714-630-7733** or circle **Reader Service 67**.

## Subscription/Reader Service Forms

# Radio World

December 15, 1988 Issue Use until March 15, 1989

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| D. Combination AM/FM station | I. Mfg, distributor or dealer   |
| E. Network/group owner       | J. Other                        |

#### II. Job Function

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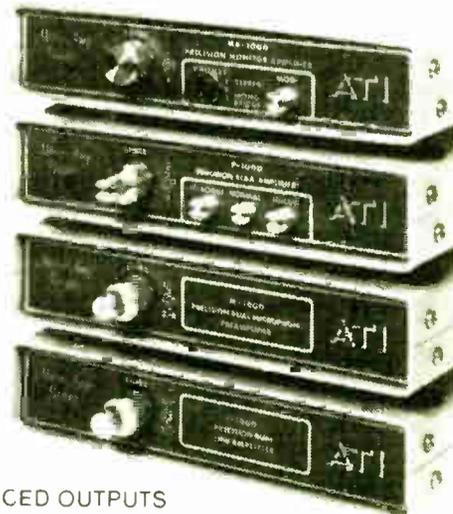
001	021	041	061	081
002	022	042	062	082
003	023	043	063	083
004	024	044	064	084
005	025	045	065	085
006	026	046	066	086
007	027	047	067	087
008	028	048	068	088
009	029	049	069	089
010	030	050	070	090
011	031	051	071	091
012	032	052	072	092
013	033	053	073	093
014	034	054	074	094
015	035	055	075	095
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# BUYERS GUIDE

## Cart Machines

# Dolby SR Rivals CD Quality

by Ross Martin, Studio Eng  
KUDL/WHB

**Kansas City MO** ... Since the introduction of high quality audio from CD players into the air chain, you may be asking yourself if the cart player is destined to become another "Brontosaurus-99" or a "Dyna-saurus-Max." Not so! Dolby Labs Spectral Recording from Pacific

Recorders is the way to upgrade your machines for high quality audio. At KUDL, what we wanted to achieve was a system that would enable us to provide CD quality audio without the common pitfalls associated with playing CDs directly to the air. We also needed a system that would be as operationally transparent as possible to the DJ on the air.

This transparency is necessary so that encoded as well as non-encoded material may be used in the same on-air playback decks.

### CD fidelity from a cart

Dolby Spectral Recording (SR for short) gave us the opportunity to achieve CD quality with NAB cartridge flexibility and reliability. In listening tests with program directors and talent, few if any were able to tell the difference between direct CDs and a cart recorded from CD with Dolby SR.

What we found with the SR system is that it pushes the noise floor dramatically downward and at the same time

improves the dynamic range of the source material so that the resulting quality rivals that of a CD.

We decided that it was impractical for us to install SR capability in all of our cart decks in every studio and felt it would be most beneficial with our carted music. We chose not to process our spots with SR for a couple of reasons.

First, our in-house production is fine, especially since it is first generation and recorded on decent tape equipment. Second, with any agency or client dubs we receive, the SR system will not improve any problems such as noise or dropout, etc.

The SR does a great job of conserving the original sound quality. Therefore, recording clean-sounding music onto the cart will result in clean-sounding playback. It's still true that "garbage in, garbage out."

### Studio layout and gear

Our installation at KUDL consists of two parts. The first is an SR-equipped record/play ITC 99 in our music dubbing studio. This room is as simple as possible. It has both a turntable and a CD player that go through an APT-Holman preamp directly to the SR modules.

In our air studio we have all six 99 carts

running through the Pacific Recorders mainframe, which holds two SR modules and an interface card for each deck. The mainframe has room for six machines (18 cards total).

As far as transparency goes, Pacific Recorders has come up with a good SR detection scheme that works well for us. It uses the "cartscan" principle by affixing a reflective tape to the right side of the tape cartridge. Each cart deck has a

the station. This makes it easy for our jocks to intermix music, spots, news and promos without having to think about it.

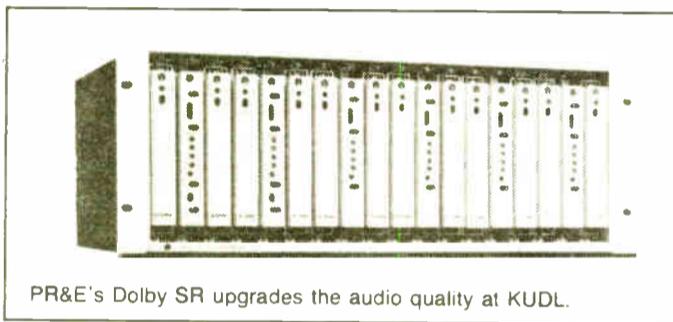
Another great advantage of the SR sensing system is that we have been able to slowly re-record our music library by integrating SR-recorded carts a few at a time. Had certain decks been SR-playback only, we would have had a marathon dubbing session to make the whole system work all at once.

A reference level of 250 nW/m=OdB is used for our Dolby SR system and unity gain is maintained to and from the production room's record/playback unit. The outputs of all cart decks need to be maintained at the same operating level in order to operate the Dolby SR system properly.

### Auto compare

Another useful feature of Dolby SR is called "Auto Compare." It provides a quick method of telling whether any level or equalization adjustments are needed. When the unit is switched to setup, Dolby noise will be recorded on the cart 15 dB below the reference level.

When the cart is played back, it will switch between the internal Dolby noise and tape. Front panel LEDs will illuminate, showing either internal noise  
*(continued on page 38)*



PR&E's Dolby SR upgrades the audio quality at KUDL.

modified right hand cart guide that has an infrared emitter/detector installed.

### SR detection

When a cart is inserted into the deck it looks for the reflective tape. If it is there, the interface card turns on the SR circuit. If not, it simply plays like a conventional cart with unity gain so as not to upset our level scheme throughout

## Digital Draws Near

by Richard Farrell

**Falls Church VA** ... Analog cart machines have heard for several years the sound of digital technology's footsteps closing the distance between them. But they have survived a number of what now look like premature industry predictions of their own death.

What keeps the cart alive seems to be its ease of use, durability and the fact that manufacturers, by their own admission, have not yet given radio stations a compelling reason to replace their tried and true machines.

"Until there is a good reason for stations to stop using carts, they will remain in use," notes Bill Parfitt, Broadcasting Product Supervisor at ITC/3M. "A replacement is not going to happen overnight. So stations are going to stick with what works."

Otari's Marketing Manager John Carey goes a bit further to point out that "the manufacturers who have produced digital systems for replacing the cart machine have so far not done what was promised. The technology we have produced has not adequately replaced the cart systems."

What has resulted is an overall wait and see attitude adopted by stations reluctant to go for the "Next Big Thing" at the expense of staying current and competitive in their markets.

"Everyone is wondering which way to

go," says Bill Parfitt, who advises stations to "buy the best of what is available today and don't lose your position in the industry waiting for something that may never happen."

But even though many stations choose for the moment to stand pat, few will deny that digital is the wave of the future, if a wave slow to crest. Some concepts along this line have already been tried.

One example of a digital cart machine replacement that did not get off the  
*(continued on page 46)*

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Also, Technology Updates from Fidelipac, Audiopak and ITC.	

If you are one of the many FM broadcasters who would like to know if installation of one of the proven, new boosters or Synchronous Repeaters Systems could really give you a bigger audience and higher revenues, there are some things you need to know.

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# A Tale of the Tape: Fidelipac

## Dynamax Tape Offers Greater Headroom Than Its Predecessors

by Bill Franklin, Dir Eng  
Fidelipac

Moorestown NJ ... Beginning in 1982, Fidelipac® designed, constructed and staffed a new magnetic tape manufacturing facility; the first ever dedicated exclusively to serving the needs of the broadcast industry.

The relatively small volume requirements for 1/4" back-lubricated tape used in NAB broadcast cartridges, as opposed to much larger quantities of various formats for consumer use, allows Fidelipac to manufacture tape in smaller batches, permitting a higher degree of precision.

Tape products manufactured by Fidelipac are marketed under the trade name Dynamax®, as are the CTR10, CTR30 and CTR100 Series tape cartridge machines and the ESD10 Eraser/Splice detector.

Fidelipac presently manufactures three types of 1/4" back-lubricated magnetic



Fidelipac markets its tape under the Dynamax trade name.

recording tape; DYN-400X, DYN-475 and DYN-1000X. To better understand the applications of these tape products, it is helpful to know a little history.

### NAB's 160 nWb/m standard

In 1964, the NAB published the first *NAB Standard for Cartridge Tape Recording and Reproducing*. It specified 160 nanoWebers per meter (nWb/m) as the zero reference level, based on the performance of tapes available at that time.

The choice of the 160 nWb/m represented the best compromise between S/N ratio, distortion and headroom.

(We define headroom as the difference, measured in dB, between the reference recording level and the occurrence of three percent third harmonic distortion resulting from tape overload.)

Tape of that era, when operated at 160 nWb/m, offered about four dB of headroom. That is, it was possible to record signals about four dB above 100% on the VU meter without fear of distortion. But if you allowed the level to go much above that, look out!

Dynamax DYN-400X tape has an 88 gauge basefilm and an overall normal thickness of 1.17 mil. It is bias and equalization compatible with older tapes, but offers the advantage of greater headroom.

### DYN-400X headroom

On properly adjusted cartridge machines, DYN-400X allows 8 dB of headroom above 160 nWb/m. Fidelipac installs DYN-400X in its model 300, 350,

600, 1200 and Master Cart tape cartridges. It is also available on 7", 1200' reels or in 3600' pancakes.

DYN-475 is a new tape product intended for use in background music applications where extended mechanical

## Technology Update

life is a greater consideration than headroom. It is most often sold in 4200' pancakes to be pre-recorded and loaded into Fidelipac Model 600 and 1200 tape cartridges destined for the local bank, shopping mall or pizza parlor.

DYN-475 uses 75 gauge basefilm and is 1.12 mil in overall nominal thickness. It contains special bonding agents and lubricants that considerably extend its mechanical operating life. Headroom is about 6 dB above 160 nWb/m.

### DYN-1000X Cobalt tape

Introduced at the 1987 NAB, Dynamax DYN-1000X Cobalt has already achieved the status of a world class mastering tape. Assembled on a basefilm of 88 gauge polyester, Dynamax Cobalt measures 1.31 mil on overall thickness. Its ferric/cobalt oxide coating is bias compatible with recently discounted HOT TAPE® and other elevated-level tapes.

But only Cobalt offers extended headroom in the critical 6-14 kHz range, providing totally transparent copies of CD and DAT masters.

On properly adjusted equipment capable of handling the dynamic range, Dynamax Cobalt provides 12 dB of headroom above 160 nWb/m and 8 dB above 250 nWb/m. But beware: your older cartridge machines may be severely taxed reaching the top end of this tape.

DYN-1000X is standard equipment in the new Dynamax Cobalt tape cartridge. Although the cartridge is available only factory loaded, DYN-1000X is available on 7", 1200' reels or in 3600' pancakes.

*Editor's note: For more information on Fidelipac tape products, contact the author at 609-235-3900.*



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# Tape Made the Audiopak Way

by Nick Krassowski, President  
Audiopak, Inc.

Winchester VA ... In any format, making high quality magnetic tape is a complicated, difficult process. Making it for continuous loop broadcast cartridges is even harder.

Materials, manufacturing, assembly and testing must all be carefully controlled in order to produce a consistent product that delivers quality sound reliably.

This is especially true of the approach Audiopak takes in producing 614, the high-performance ferric oxide tape used in our AA-4 carts.

The first step in producing quality tape is to determine the best ingredients and combine them properly. Cart tape—and the carts themselves—are part of a system. Their ability to work with other elements in the system is just as important as their performance on their own.

This fact will influence decisions about all ingredients, including magnetic oxides, binders, back lubricants and base film.

## Ferric oxides

To maintain compatibility with a wide range of cart machines and other tapes, we chose premium ferric oxides for 614 over the more exotic chrome or metal particles. These oxides are produced to very close tolerances in particle shape, size and magneto-chemical properties (which control the tape's electro-acoustic performance), stability and consistency.

The added coercive force of the premium oxide improves performance significantly without requiring bias adjustments or resetting of record levels.

Next to the oxide itself, the binder is the most important material in the tape. Binders are complex blends of polymers which bond the oxides to each other and to the base film, just as mortar holds bricks together.

The physical properties of the finished tape—its durability, its coefficient of fric-

tion against the head and its freedom from dropouts and buildup on the heads—are all determined by the binder.

For optimum physical and electrical performance, the individual oxide particles should be isolated from each other by a molecule-thin layer of binder. This reduces energy cancellations caused by magnetic "short circuits."

Conductive agents in the binder will eliminate static charges, while chemical cross-linkers will help it resist wear and remain stable under extremes of high temperatures and humidities.

The graphite lubricant on the back of the base film is the key to the whole concept of broadcast tape carts. It's also the source of some of the most difficult problems, because it needs to cling tightly to the back of the tape while sliding easily along the front.

A 10 minute cart, for example, holds 375' of tape in an endless coil less than 3.5" in diameter. Every time that cart is

played, the layers slide against each other. To allow the tape pack to adjust its internal tension and to reduce wow and flutter, the back lubricant must be as slippery as possible.

And yet it must cling tightly to the back of the tape without transferring to the oxide side or to the tape heads. Audiopak uses a proprietary graphite formulation that meets all these requirements—it's one of the main factors behind the longevity of our carts.

## Flexibility needed

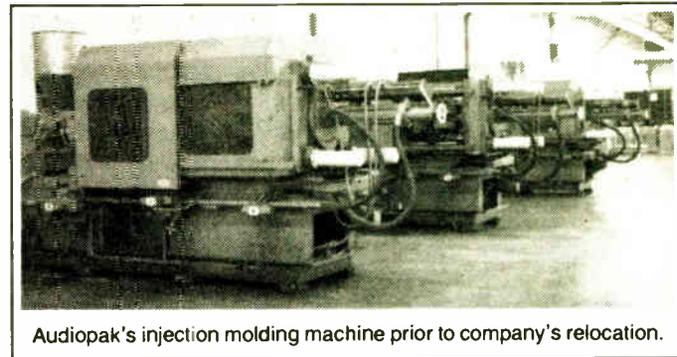
For good head contact, the polyester base film must be very flexible from front to back. At the same time, it must be rigid from side to side. This allows positive edge guiding without bending or collapsing.

A third requirement is longitudinal stability under temperature and humidity

changes. This will help maintain a stable slack loop in the tape pack.

The problem in the initial manufacturing stage is to disperse the oxide uniformly throughout the binder without damaging the fragile oxide particles.

It's a massive, yet incredibly delicate operation. We have adapted the processes used for the finest videotapes to the manufacture of Audiopak cartridge tapes.



Audiopak's injection molding machine prior to company's relocation.

The first step is to dissolve the binder in solvents and introduce the oxide to this blend. Next, they pass through a high energy mill where the material is thoroughly mixed by tiny steel balls or glass beads.

The resulting "slurry" then goes *(continued on next page)*

## ITC Assembles ScotchCart II

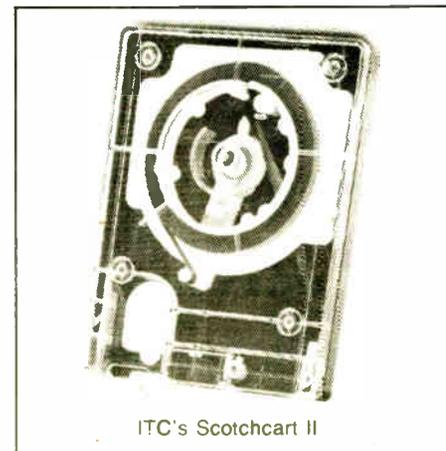
by Bill Parfitt  
Bcst Prod. Supervisor, ITC/3M

Hutchinson MN ... Trying to match cart capabilities with FM fidelity became a great concern during the 1970s.

In a complete analysis of cartridge mechanical and electromagnetic functions equated to professional broadcast needs, 3M formed a completely new cartridge concept when it introduced its initial ScotchCart™ cartridge nationally in 1982.

## Technology Update

While compatible with all NAB standard cart players, its mechanical design was far beyond conventional. It featured a large-diametered stationary hub that was slotted to allow the tape to be pulled



ITC's Scotchcart II

on a straight line out of the center.

A spring-loaded tape tension arm replaced the need for pressure pads and provided automatic tension control for all tape lengths.

Then, in 1985, 3M introduced a new product, the ScotchCart II™ broadcast cartridge, which offered even greater improvements in both tape performance

and physical operation.

The most dramatic improvement noticeable with the ScotchCart II cartridge is its new Scotch™ 219 lubricated tape construction, visible as "black" rather than "brown" in color.

As with the cart's mechanics, the tape is designed to NAB specifications for complete broadcast compatibility, while also providing greater sensitivity and output, with a wide 62 dB S/N ratio that is of real value in achieving the performance levels of FM transmission.

## Precision process

Watching the process of making high performance cart tape is an experience in high tech, precision manufacturing. The tape is produced in 3M's Hutchinson, MN magnetic tape plant, a hospital-clean, 370,000-square-foot facility for compounding, coating, slitting and assembly operations devoted exclusively to magnetic tape.

*(continued on next page)*

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# ITC Improves ScotchCart Tape

(continued from previous page)

The company designs, tools and molds its own plastic components in order to maintain the same quality and supply assurance that it does for tape.

The tape manufacturing starts with dispersion compounding, where electromagnetically tailored, low noise oxide particles (individual magnetic needles so tiny that some 30,000 could fit inside the period that ends this sentence) are combined with the binder formulation.

The binders, matched to backing characteristics, are compounded with permanent lubricants to create a uniform liquid dispersion in which the billions of oxide particles are evenly suspended.

The 3M backing film, customized to the specific thickness for cart tape, is tough and tempered polyester that is produced in wide, splice-free jumbo rolls some three miles in length. The binder/oxide dispersion is applied in a precise layer calibrated to millionths of an inch.

The match of perfectly flat film and exact coating thickness is important. It pre-

vents coating depth variations that would produce distortions in recorded signal response.

These are so carefully controlled that if a single tape strand was magnified to a mile width its surface level would vary hardly more than half an inch.

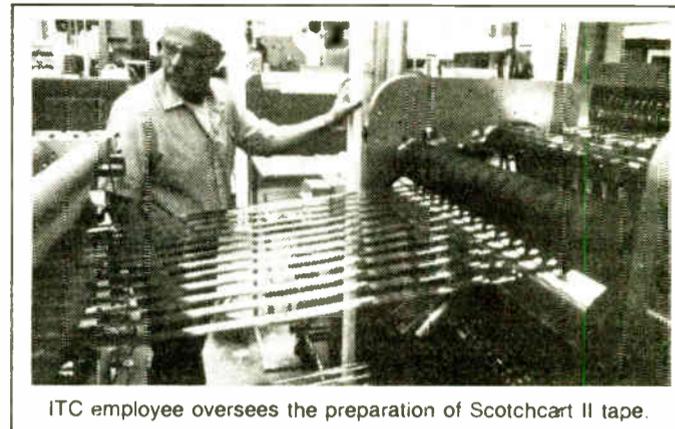
### Coating and drying

The coated tape continues directly through huge drying ovens where the solvents are evaporated and captured for re-processing and the coating is cured. This coating and drying process, computer controlled to microscopic tolerances, is accomplished as the full-width film web travels at hundreds of feet per minute.

The finished tape jumbos are moved to slitting stations, where each roll is cut into quarter-inch strands. Here, 3M incorporates a sophisticated, laser-scanning, 100% surface inspection of every square inch of the tape that will pinpoint for rejection even minute specks or flaws too tiny for the human eye to detect.

This inspection assures the end user of a smoother, more uniform and defect-free tape. Precision mated rotary knives slice the tape to width, shearing the tape cleanly without edge distortion. This is another critical operation, because it is essential to have a truly straight-line tape for cartridge use.

A strand of Scotch 219 tape for the ScotchCart II cartridge, for example, is slit to a centerline tolerance of less than the thickness of a human hair in a mile length.



ITC employee oversees the preparation of Scotchcart II tape.

### Tape installed

In modern, closely monitored assembly, tape in a specific metered length (10 seconds to 7.5 minutes) is put into the cartridge. Its operation is checked and the cartridge is completed for pack-

aging. During all the process steps from raw materials to completed ScotchCart II cartridge, in-plant quality assurance labs are checking the product constantly.

From wet-lab analysis of oxides and dispersion, to in-process coated tape testing with elaborate infrared spectrometry and X-ray fluorescence analysis, and actual recording performance of finished product, quality verification is maintained.

3M innovation has required a huge investment and dedication of its full resources to effect an advancement of cart technology. Other developing technologies may offer varying degrees of promise, but our cartridge technology is already delivering new generation performance.

*Editor's note: For more information on Audiopak tape products, contact the author at 703-667-8125.*

*Editor's note: For more information on ITC/3M tape products, contact the author at 612-736-5019.*

## Audiopak Follows Systems Path in Tape

(continued from previous page) through a number of filtering, blending and "polishing" steps. Finally, chemical cross-linkers are added to prepare the slurry for the coating operation.

The binder/oxide slurry has about the consistency of printer's ink: In fact, the high speed coating machine uses a method similar to rotogravure printing when it applies the slurry to wide sheets of the base film.

The coating step must maintain final tape thickness with great accuracy, since it determines the tape's low frequency output, distortion and uniformity. Audiopak 614 tape is only 300 micro-inches thick—about 15 times thinner than a dollar bill.

### Orienting magnet

While the coating is still fluid the tape passes through a powerful "orienting" magnet assembly. This lines up the needle shaped oxide particles so they face in the direction of tape motion (like those bricks in the wall). This step greatly increases the tape's sensitivity and reduces certain types of noise.

Next the tape moves through drying ovens where the solvents are evaporated. The vapors are then collected, condensed and reused.

Calendering is another key step in tape manufacturing. The calender uses a number of highly polished steel and composition rolls to smooth the surface of the tape. The tape is squeezed between these rolls under high temperature and pressure, imparting a mirrorlike finish to the oxide surface.

This in turn improves head-to-tape contact, maximizing high frequency performance and uniformity. And as you can imagine, a smooth tape surface helps greatly to reduce dynamic friction in the tape pack.

A second coating stage applies the graphite lubricant to the back of the tape. Again the thickness of this layer, less than 60 micro-inches, must be maintained accurately and consistently. A second drying oven then cements the back coating.

Up to this point the tape is processed in wide webs 10,000' or more in length. To cure the tape and stabilize the various layers, the web spends a period of time in a high temperature chamber. Then it receives another inspection and, if approved, is sent to the slitting machines.

### Cutting the tape

These machines use rotary blades to cut the tapes to width. For the highest levels of performance, the nominal tape width must be maintained within 0.001". It is also vital that the tape be slit straight, without the weaving or "snakiness" that could affect tape azimuth adversely.

The cuts themselves must be absolutely clean—slivers or clinging debris could produce dropouts in the left channel or on the cue track.

The final step before the tape is packaged is de-gaussing the tape to the virgin noise level.

Throughout the manufacturing process, samples are taken and tested for purposes of quality control. The data points gathered from this process are then analyzed for conformity to the theoretical standards.

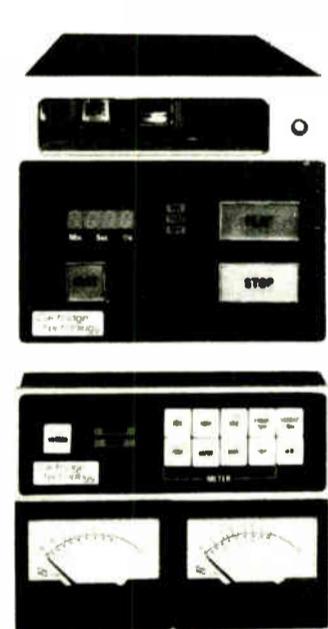
By using computers we can perform a comprehensive analysis of this data. The results can then be used as part of a statistical control process which further improves manufacturing methods.

### Must pass muster

The final tape inspection covers all key physical and electrical parameters. Only when the product meets or exceeds specifications is it ready to be loaded into carts. The assembly—and much further testing—has to be completed before another batch of AA-4s will be ready for use on the air.

Five years ago digital audio was little more than a glimmer on the radio horizon. But even in its early stages it promised to set new standards for audio performance. At that time, Audiopak introduced its SGS-4 tape, now known as 614.

As you can see after reading this article, high quality tape isn't easily produced. But it's worth it whenever we hear positive comments from radio professionals around the country.





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# Denon Ushers in "CD Cart" Era

by Stephen J. Brown, CE  
WHBY-AM/WAPL-FM

Appleton WI ... I spent much of 1985 and 1986 in a state of frustration with the compact disc. Here was a medium that held so much promise for broadcast, but I could not find a way to play it reliably enough

for a broadcast control room environment. That is, until Denon introduced its DN-950F CD cart player.

WAPL was the first in its market to use CDs directly on-air a few years ago. We tried a large number of "home-type" CD players with varying results. Some cued up the tracks poorly,

while some sounded better than others.

But none had hard-wired remote control capabilities and all were highly susceptible to dirt, pizza and other contaminants getting on the CD itself as it was handled.

This added up to a lot of machine errors and operator incon-

venience. Some of the machine errors happened on-air, which was even worse. But even with all of these problems, the percentage of CD-to-air programming was steadily increasing, until 1987 when it approached 35% of our total air-time!

We had put money in the 1987 budget to buy a "professional" quality CD player for the control room. At that time, very few were available. Most were either extreme high end units with

## User Report

one controller and multiple transports or converted home-type players with some features added. Either option made me nervous.

I was struggling about which direction to go when a friend who attended the 1987 NAB convention told me about the newly introduced Denon CD cart player. It sounded like the machine's designers had addressed many of the concerns I had.

One problem that all the machines seemed to have was in the handling of the CD itself. Dirt easily got onto the CD and messed up the tracking of the machine. Early publicity on the CD had seemed to indicate that you could run over the CD with your chair and then pop it in whatever machine was available.

It was difficult to convince an-  
(continued on page 41)

## Dolby SR

(continued from page 33)  
or tape and a quick aural comparison can be made.

When Dolby Labs introduced the SR system it really did not address the interfacing of their cards to broadcasters' cart decks. It was set up to replace the company's existing noise reduction system in multitrack recording studios.

Pacific Recorders has taken Dolby's product and made it extremely adaptable to the broadcast market. The company modifies the SR cards and builds its own tape and cart interface cards as well as a multideck mainframe.

In addition to Kansas City, other Shamrock stations—KXKL in Denver and our group's latest addition, KMLE, in Phoenix—are equipped with SR. KMLE got a complete turnkey SR/Micromax setup from Pacific Recorders. Both of these stations are thrilled with it, as are we.

Between the noise reduction capabilities of the Doby SR and the interfacing work done by Pacific Recorders, the resulting package could truly displace CDs in the air studio.

*Editor's note: Ross Martin has been an engineer at KUDL for almost two years. He holds a Masters degree from North Texas State and held an undergrad major in music, with a minor in electronic music. He may be reached at 972-722-2866.*

For more information on Dolby SR, contact Anders Madsen at Pacific Recorders & Engineers: 619-438-3911.

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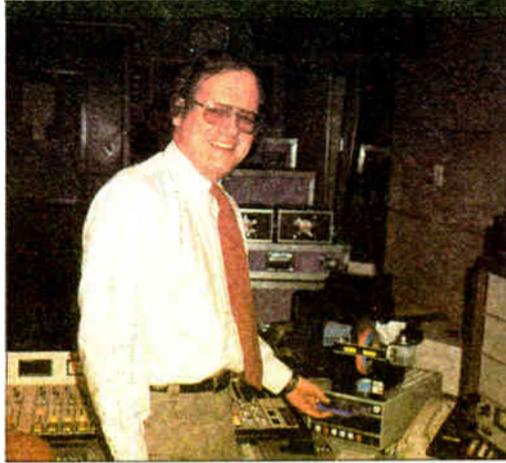
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# THE CART YOU CAN COUNT ON...



**Mike Malo, C.E.**  
**KNIX, Phoenix, AZ**

"Getting to #1 is tough, but staying #1 is tougher. It requires consistently outstanding performance. We depend exclusively on the AA-4."



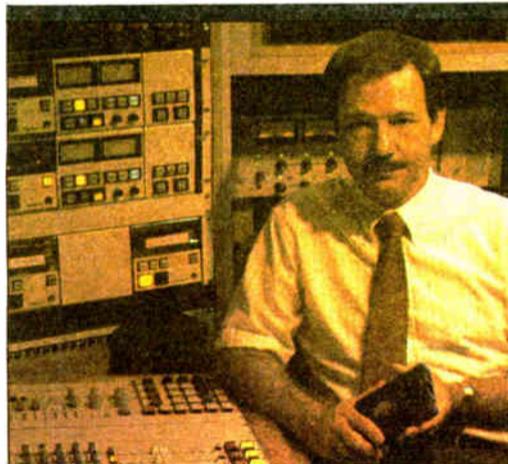
**Mike Callaghan, C.E.**  
**KIIS, Los Angeles, CA**

"From time to time we evaluate other carts, but we've never found anything as consistent or dependable as AA-4s. We're very happy with them."



**Gerry Dalton, C.E.**  
**KKDA, Dallas TX**

"We've used AA-4s for years. The highs are cleaner than other carts we've tried, and the response is more consistent."



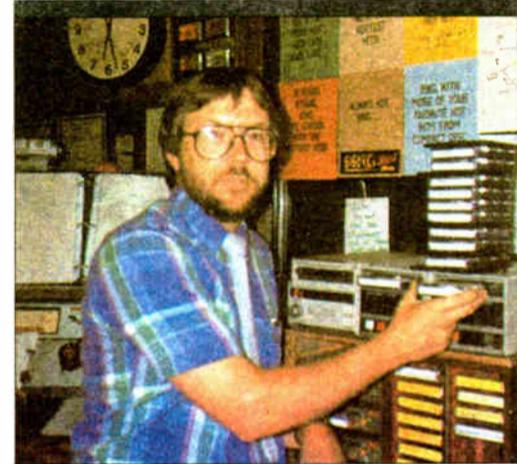
**Ray Klotz, C.E.**  
**KZLA/KLAC, Burbank, CA**

"We've been using AA-4s ever since we built our current studio in 1984. We tested several different carts and machines, and AA-4s were our choice. We're very satisfied."



**Don Cook, C.E.**  
**WOVV/WIRA, Ft. Pierce, FL**

"In the tests I've run, Audiopak carts give the best performance consistently. They're also simpler to maintain and re-load. We dub a lot of music off of CDs. Quite honestly, when the machine's in good shape, I can't tell the difference. They definitely do the job."



**Ray Pollard, G.M.**  
**KSKG, Salinas, KS**

"We've used AA-4s since 1986, and they perform flawlessly. We've had no phasing problems at all—they just work great. They're the only cart we use."

## ... CART AFTER CART AFTER CART AFTER CART ...



... the "new Audiopak" continues to lead the way. "Workhorse" A-2s, "stereo" AA-3s or "digital-ready" AA-4s—all deliver the reliable performance you need. If you'd like to feel as good about your carts as these radio pros do, now's the time to do something about it. Pick up your phone and dial (800) 522-CART for the name of the Audiopak dealer nearest you.

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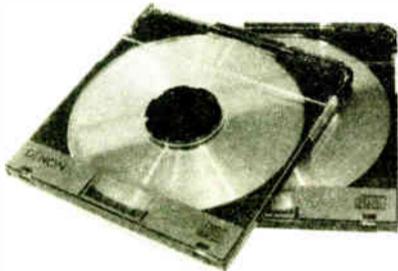
audiopak inc.  
P.O. Box 3100  
Winchester, VA 22601

If you're not taking CDs direct to air, you're losing an audio edge your competition is probably using.

CDs have delivered the promise of faultless audio. They've also delivered a maintenance nightmare.

With any other CD player, consumer or pro, everyone who plays CDs at your station also has to touch the CDs. If everybody wears white gloves, there's less chance for a disc to be contaminated with body oils, chewing gum, peanut butter and cigarette smoke.

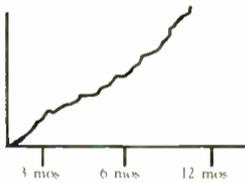
Let's eliminate the contaminants completely. Let's keep the disc in its original condition.



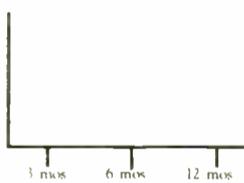
Unlike every other CD player, the Denon DN950 uses cartridges which permanently secure discs to their pristine, original condition.

Your CD library is no small investment. Since music is such an important part of your operation, consider the cost of entire-library replacement. Although in reality, this would take place over a period of time, the expense would be a capital expenditure if all had to be replaced at once.

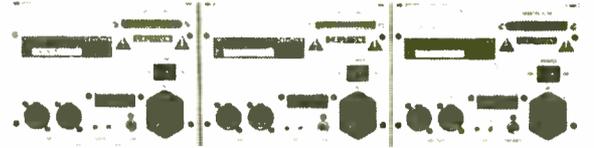
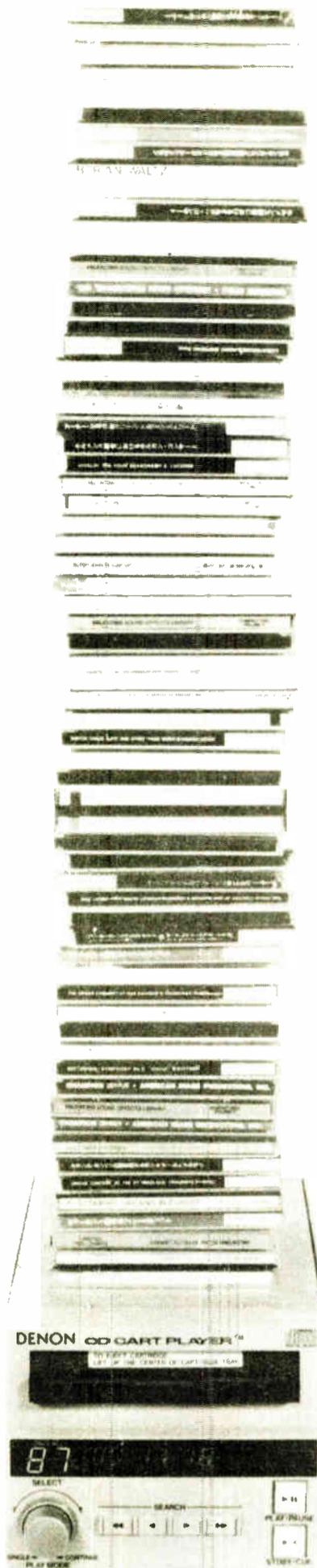
The Denon DN950F system totally eliminates the risk of handling. NO wear, NO tear, NO skipping, NO on-air glitches, NO embarrassment.



Simulated number of on-air embarrassments without CD cartridge protection against contaminants



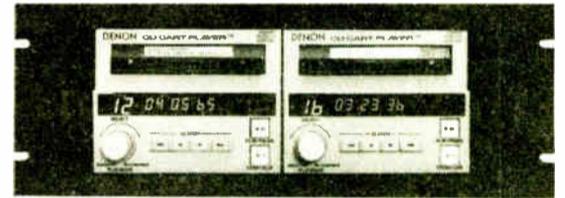
Simulated number of on-air embarrassments WITH DENON CD Cart Player CD protection against contaminants



Mono-stereo selector, easy access, simple interface of remote functions and professional levels and impedances are indicative of the attention to professional detail.

Denon's CD Cart Player is easy to interface, that's because it's built to the needs of your radio station. Remote control, end-of-message warning (which may be removed to the alarm of your choice), quick cue and review, 3-pin XLRs... does this sound like a broadcast device?

What about quality? A 3-beam pickup and meticulously designed D to A filters provide sonic accuracy which has resulted in Denon's replacing other pro machines throughout the industry. Thousands of DN950s are in studios around the world. Working and playing day and night.



Two units can be easily mounted in the optional rack mount assembly. The total Denon approach is "professional."

You can win with the Denon DN950F system. CDs are surpassing black vinyl in consumer sales. CDs will be a part of your musical programming, if not already. This system will please the P.D., the G.M., the C.E., and the C.P.A.

And last, but definitely not least, the Denon DN950F makes playing CDs as easy as playing a cart. AND, no other CD player can do that. Talk to us today.

CD CART PLAYER® Denon, America

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Broadcast Equipment  
1-800-622-0022

# ALLIED and DENON introduce several thousand audible improvements to the CD player.

# WAPL Plays Denon CD Carts

(continued from page 38)

announcers who had heard this publicity that it was important to treat the CDs as well as they treated vinyl discs.

## Cartridge keeps discs clean

The Denon engineers addressed this problem by designing a plastic cartridge in which to house each CD. The CDs are labelled and stored in the cartridge. When ready for play, the entire cartridge is inserted into the player and the player opens a small access door in the cartridge through which the laser can read the disk.

The operator's hands never touch the actual CD, which dramatically reduces on-air problems with the disks, and is much more convenient for the operator.

After the disk is inserted, you select which track is to be played by rotating the selector knob on the front panel. The disc will cue up automatically to the selected track. When started, the selected track will play and the machine will stop. What could be simpler?

If you use it in production and wish to cue to a particular spot inside a track, there are cue buttons on the front of the machine that enable you to cue to the exact point you desire. I have never seen a more accurate or repeatable cueing system on any CD machine.

## More front panel features

After you have selected the track, a front panel readout indicates the length

of time. When started, the readout counts down while the track is playing. There is also a switch to select a "continuous play" mode in case you want to play the entire CD or several songs in a row.

The front panel of the machine is deliberately simple and easy to operate. It looks very much like a cart machine, so most announcers can learn to operate it very quickly, unlike the players we used before. However, many of the player's important features are visible only when you look at the back panel.

The machine is set up for the standard 600 ohm audio line level output that is standard in most control rooms. The audio connections are made with standard XLR connectors and the audio level controls are accessible on the rear panel of the unit. A rear panel headphone jack and a multiple purpose remote control jack are on the rear.

In our application, we are only using the remote start function, but all front panel controls are available at the remote jack. There are also DIP switches on the rear panel to control cue detect level and EOM relay timing.

## The best choice

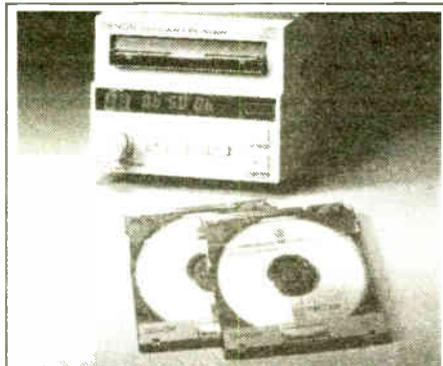
After investigating the machines, I felt strongly that these were what we should try. This was the first manufacturer to really address many of the problems we saw with CDs in the control room environment.

But I was nervous for two reasons.

One was that I was unsure of how the "cartridge" concept would be received by our programming department. The other was that I dislike buying the first machines of any radically new design.

But it was clear that the Denon was the best that was available, so we ordered three machines and took delivery in late 1987.

As with any new design, a few prob-



CDs are easier to handle with Denon's CD cart player.

lems will come up in the early stages. After running them very successfully for several months on the air, a few minor problems began to show up.

## Service a plus

However, a quick call to the factory representative got us action in every case, whether we needed advice and instruction, a part or, in one case, a completely different machine in exchange for

our misbehaving model. It is nice to see that Denon has made a commitment to good service support.

One suggestion I would make to the Denon people would be to consider using a metal cabinet instead of plastic. I believe most broadcasters would pay the small added cost.

My machines do not seem affected at all by RFI (my studios are co-located with 1 kW AM and 100 kW FM transmitters), but I have them mounted side by side in an equipment rack.

We are experiencing a little unwanted interaction between the machines, which may or may not be related to the lack of shielding provided by the machine's cabinet. The factory is working with me now to solve this minor problem.

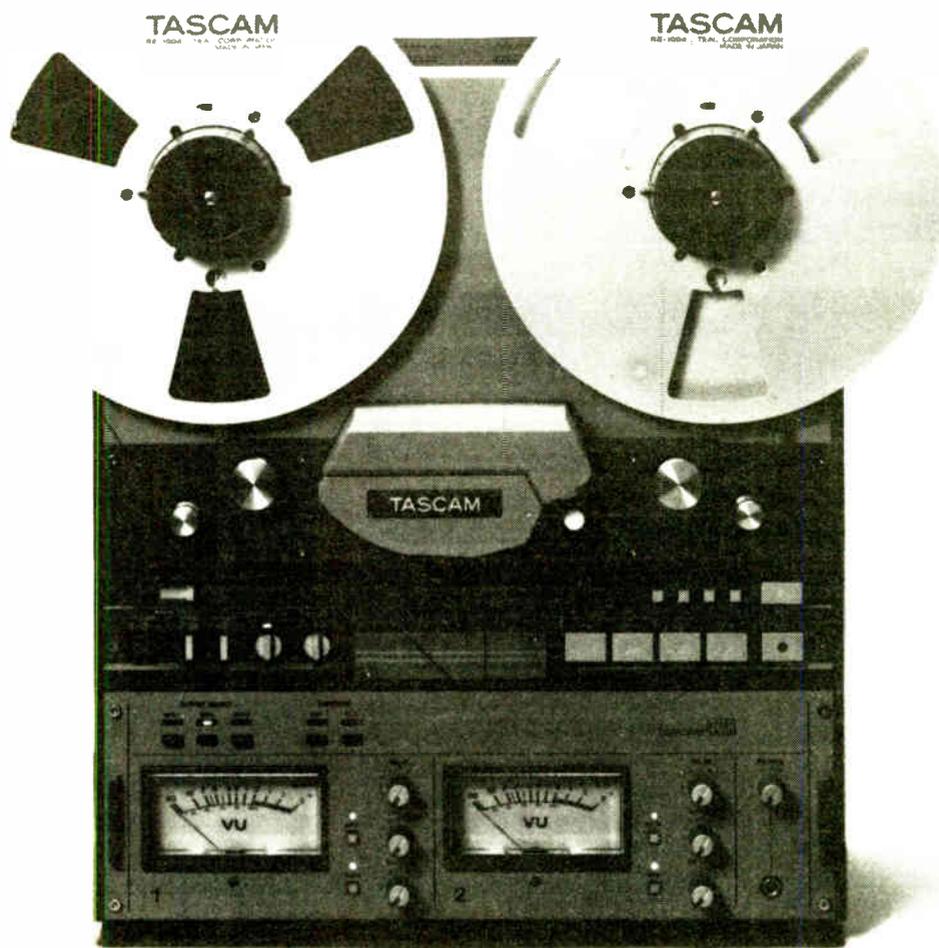
I have to say that overall I am extremely pleased with the Denon machine. The program director and his staff also really appreciate the player.

WAPL is now 80-90% CD-to-air, so you can imagine the workout we are giving these machines. They have cut our CD problems so dramatically that we hope to install the machines in our AM control room and all production studios in 1989.

*Editor's note: Stephen J. Brown is president of the Fox Valley, WI chapter of the SBE, and is a member of IEEE and NARTE. He does some part time contract engineering work and collects and restores antique radio receivers in his spare time. He may be reached at: 414-734-9226.*

*For more information on Denon's DN-950F CD cart player, contact Laura Tyson at Denon: 201-882-7467.*

# On time. On budget. On air.



The Tascam 42B makes other 2-track recorders seem downright slow.

That's due in part to an ingeniously accurate tape handling system, and in part to Tascam's unique head technology. (Its heads provide sync response fully equal to repro, so you don't waste time rewinding to make audio decisions.)

And because the 42B probably offers more features per dollar than any equivalent machine, it makes everything else seem downright expensive, too. (+4 dBm balanced inputs and outputs, plus easy-access calibration are just a few of its standard features.)

For more information, call or write about the Tascam 42B today. It's a new and vastly improved way to keep meeting your deadlines.

And your budgets.

# TASCAM

# Delta Reigns in KNIX Country

by Mike Malo, CE  
KNIX AM-FM

Phoenix AZ ... Since it was first introduced in 1982, it is easy to see why the Delta series cartridge equipment from ITC has become the most popular on the market.

Its versatility, performance and modular construction make Delta a good investment that will work indefinitely, with a minimum of maintenance and with a minimum of downtime.

Of the 14 single play machines we have, five of them are stereo—used for music playback in the AM control room—and the other nine are mono, used throughout our busy news studios. The machines range in age from three to five years old and have not been out of service.

The Delta series machines are trim. Slightly wider than a standard cart, you can put three units side by side in a rack mount.

## Economical use of space

There is a very efficient use of space throughout the machine and every detail has been carefully thought out. The mechanical components have close tolerances, and the electronics are all top-grade.

When you take a close look at the Delta series you realize that the engineers at ITC did an excellent job. Design concepts and standard features are important whether you operate it, maintain it or pay for it.

A number of useful features are available to the operator. There is a high

speed re-cue and a repeat play lockout, and a ready/stop lamp can be programmed to flash fast if the cart is manually stopped, or to flash slowly if the cart has played and recued.

## User Report

The leading edge of either EOM you choose can trigger other machines and the trailing edge mutes the audio and initiates high speed re-cue. For searching through a selection, you push and hold the cue button to hear high speed audio.

On record amplifiers, the VU meters automatically switch between record and reproduce. The 1 kHz tone add or defeat buttons are up front and the record set lamp flashes to indicate that mode.

## Efficient design

The Delta is well-built. All critical elements concerning tape to head contact are referenced to a 1/2" thick anodized aluminum deck plate. The micro-adjust headblock assembly is patented.

The circuit boards are of the highest quality and all ICs are socketed. The resistors and the capacitors are 5% with some 2% tolerance.

All features are enabled or disabled by changing jumpers. EQ formats, speed selection, transformerless I/O, EOM function, open collector relay contacts for EOM tones and I/O impedance are all easily changed. There is also a 100 msec logic pulse upon start for timer switching.

Tone detection is digital, so there are

no sensitivity adjustments. Both the 150 Hz and the 8 kHz tones may be detected and switched simultaneously.

## Maintenance access

When maintenance is necessary, the top cover pops right off to gain access to all the routine adjustments. Multiturn trim pots are used throughout, which allow stable, precise settings.

The heads are also patented. The "flat face" design eliminates the inherent 3 dB rise in frequency response on the low end. It also distributes the tape contact across the entire surface, which greatly reduces wear and extends head life.

All machine functions and indicator lamps are brought out through a multi-pin "D" plug on the rear of the machine.

## TUNED IN

People ... Arnie Christensen, former western regional sales manager at Simmons Electronics USA, Inc., has been named Sales Manager at Aphex Systems Ltd. The signal processing equipment manufacturer has also announced that Michael Stewart will manage the company's newly formed Systems Design Group.

Previously a successful musician and producer, Stewart brings to Aphex the combination of a life-long musical background and computer programming expertise, which Aphex hopes will help enhance their position in the music technology market.

Gentner Electronics Corp., a company in the midst of a rash of personnel moves lately, has hired Kelly Hannig as a Product Line Specialist for RF and audio processing products.

Hannig will make presentations to professional groups on RF and audio processing, and will also be in charge of new product development for these lines. Hannig possesses presentation skills honed as an instructor at Salt Lake City Technical College.

Meanwhile, Richardson Electronics, Ltd. of LaFox Illinois has named two new district sales managers: Mike Messmer will handle sales for Eastern Pennsylvania (215 and 717 area codes), while Mike Thompson will concentrate on district sales for Maryland, Virginia, Delaware and Washington, DC.

Acquisitions ... Chicopee, MA-based H&E Corp. has formed a new company, H&E Micro-Trak Corp., following the purchase of undisclosed assets of Micro-Trak Corporation. H&E VP of Operations Denise Ewing will

The power cord is the removable IEC type and has an integral RFI filter. The I/O connectors are XLR.

The technical manual is as important as a piece of test gear. It contains complete instructions on the operation and maintenance of the entire Delta line of equipment.

The schematics are directly across the page from the component layouts, which makes troubleshooting easier and corresponding parts lists are a page away.

If you ever need parts, service or a question answered, you will find the people at ITC very helpful.

## Those who pay for it

Station owners and/or GM can be assured that the Delta is an excellent value. The machine will effectively deliver the product to the audience, last for many

(continued on page 46)

Readers of the Buyers Guide may have noticed some changes recently. Marlene Lane, who edited this section capably for two and a half years, has become editor of RW's sister publication TV Technology.

"I have to say that it is with some regret that I leave my position as Buyers Guide editor. I have made many friends along the way and want to thank you for helping me to nurture the Buyers Guide to its present level of success.

"You can be assured the Buyers Guide will continue to improve under the capable stewardship of RW's new BG editor, Richard Farrell. (With initials like RF, how could it not?)

—Marlene Lane

serve as CEO for the new company, with Roger Hamel becoming president.

Former Micro-Trak President William E. Stacy will become VP Sales and Marketing for H&E Micro-Trak. Any warranty service of existing Micro-Trak products will be handled through H&E Micro-Trak's service department. Any questions regarding products or service, call Ms. Ewing or Mr. Stacy at 800-358-8729 (413-594-8501 in Massachusetts).

England's Studio Equipment Distribution, Ltd. has recently taken over the manufacture and worldwide distribution of the Court Signature Series line of studio monitors. The line is comprised of the SN20, SN30 and SN60.

Earnings ... For its first fiscal quarter ended September 30, Harris Corp. reports a 10% increase in net earnings over that period one year ago. The company also reports a 13% increase in total orders.



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- Automatic audio polarity correction
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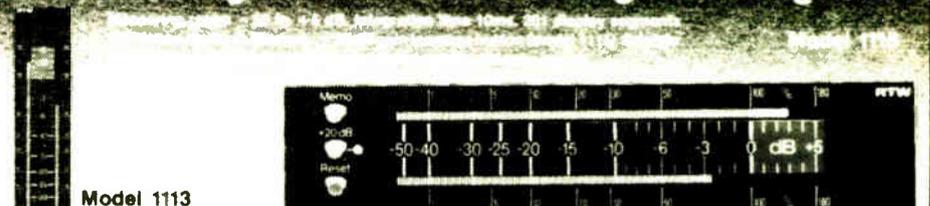
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# Fidelipac Enters Machine Age

by Barry Mishkind

Tucson AZ ... The first time I saw the Dynamax<sup>®</sup> cart machines from Fidelipac, my initial response was: Why would a well known cartridge manufacturer like Fidelipac want to go into building machines?

What did they think they could bring to the marketplace that was not already offered? And how would this affect their cartridge business as competitors discouraged their customers from buying Fidelipac carts?

Fidelipac's answer was that they had more of the features desired by stations and that they had done a lot of design work to perfectly mate the cart machine with the NAB cartridge to maximize performance.

Over the past years, broadcast equipment in general has become more complex. Microprocessors have been introduced into many types of gear. This is because while the basic function of most equipment remains simple, end users have an endless list of desired functions.

## Doubts about microprocessors

However, Fidelipac found out that a fair number of engineers were questioning the need for microprocessors in cart machines. Their reasons ranged from difficulty of bench repair to greater susceptibility to static electricity and RFI. A cart machine that suddenly goes into reverse is not exactly desirable.

Fidelipac's design has spoken to these doubts. While the Dynamax 124 incorporates many features welcome in a busy studio, it does it all with CMOS logic circuits laid out for reliability, even with suspect grounds.

Its host of features include a built-in timer that is accurate even when the machine is put into fast forward (hooray!);

## User Report

a splice finder; a built-in tone oscillator; the Cartscan<sup>™</sup> system that allows a single machine to run several types of tape emulsion or audio formatted carts; a cleaning switch; SMPTE compatibility and a front panel status display.

## Responsive service

Fidelipac's head of customer service Fred Buhler seems really glad to hear from users. His people seem to be ready to help in any way and are in no hurry to chase a caller away.

Opening the cover reveals a clean machine with a rather substantial cart positioning mechanism. Much of what you'd expect is there: solenoids, tape guides, etc.

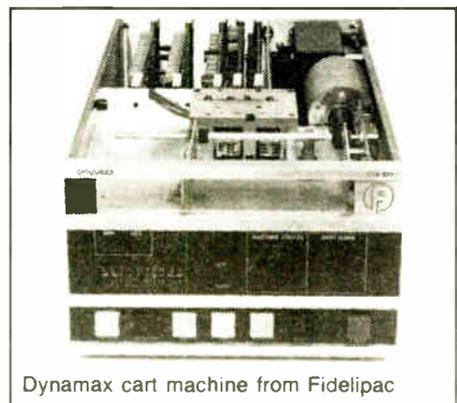
But there are also unexpected items: Cartscan sensors, a self-aligning pressure roller and a solid cart hold down system.

Interestingly, by using slightly different pressure rollers in the record and

play units, quieter replay operation is effected.

While one might be concerned about the plastic tape guide, which is made of delrin, it does seem to hold up well, and with very little wear noted. On the other hand, a warning is made that improper alignment can destroy the guide in short order.

The outputs are on D connectors, 9 pin for audio and 50 pin for remote control. The audio is pulled right off the PC board, which itself has been designed



Dynamax cart machine from Fidelipac

thoughtfully, using gold plated connectors.

## Specs up to date

Specifications for the Dynamax 124 are certainly state of the art: output capable of +20 dBm, amplifier distortion under 0.05% and very low noise (machine noise was virtually unmeasurable).

As the machine is turned on, a built-

in timer lights up. Not only does this make timing and locating audio a snap, it can be strapped to freeze on a secondary tone.

Regardless of using fast forward, normal speed or both, the clock was accurate. A built-in oscillator makes setup of the machine easier. The splice finder accurately locates the head of the cart.

The Cartscan system is based on a series of reflective labels that tell the machine how to treat the cart. It is possible, for example, to intermix mono or stereo or stereo matrix carts in the same machine.

## Tape mixing possible

Cartscan also allows stations to intermix carts with different tape. Cartscan allows two sets of levels and bias to be set up, the cart telling the machine which to use.

As the cart is used, front panel legends show the status of cart and machine clearly. Starting and stopping times are about 100 ms.

After playing, the stop button flashes slowly or rapidly to indicate normal recue, or forced stop. Various muting and replay inhibit functions are also available.

The manual provided was fairly well written, with only a few odd tendencies, such as explaining how to change lamps but forcing you to leaf through all the schematics to find out the bulb number. Also frustrating is the manual listing of the frequencies on the internal oscillator, which is on a rather fuzzy schematic.

These may be changed in upcoming manuals. Fidelipac reacts positively to

*(continued on page 47)*

Put the Tascam CD-501 next to any other broadcast compact disc player, and you'll find there's no comparison.

Nothing can compare to the purity, clarity, and accuracy of its sound, thanks to breakthroughs like Tascam's proprietary ZD Digital Circuit and double oversampling.

And in the split-second, high-speed, high-pressure world of the broadcast professional, it's the only machine you can depend on, 100% of the time.

Which figures, since the CD-501 is not an adapted consumer deck, but a highly-engineered system that's built for broadcast. Nothing else offers its combination of professional features, including 19" rack-mountability, balanced outputs, and a hard-wired remote that lets you completely control and program either of two decks in any mode.

Call or write for more information on the CD-501. Find out about a new, higher level of digital quality. And digital toughness.

# TASCAM

# Digital defined.

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# Phase Trak 90s Find a Home

by Lowell Kiesow, Staff Eng  
KPLU-FM

Tacoma WA ... When I started shopping to replace all of KPLU's cart decks, I had an open mind about brands, features and prices. One machine, the Broadcast Electronics Phase Trak 90, stood out from the rest because it had more unique features that improve sound and reduce maintenance time.

## User Report

The most outstanding feature of the PT90 is its automatic phase correction system. Phase differences between stereo channels are caused by head azimuth misalignment and by variations and wear of the tape cartridge.

In stereo, phase errors have little effect on sound quality. In mono, however, a small phase error can have a big effect on the sound. This is important, since 50% of all FM listeners regularly listen in mono.

### Corrects phase error

A head azimuth error of 0.5° would cause a high frequency roll-off at 10 kHz to the stereo audio. To the summed mono listener, this would create nasty cancellations at 4.3 kHz and 13 kHz. Figure 1 shows this very audible response curve. This is not just a theory, but a real world problem.

Before I bought the PT90s, I borrowed a loaner from a local dealer. I also borrowed some recorded carts from another

station since I had none in stereo. At first I listened to the carts in stereo and they sounded fine. Then, with the phase correction defeated, I listened in mono.

They sounded horrible and had anything but flat response. Then, as I switched in the correction, the sound quality returned. I could switch between mono and stereo and hear no response changes.

Broadcast Electronics does the correction at the proper time, which is during playback. This way any errors caused while recording, changes in the cartridge or playback azimuth are eliminated. The correction is made without any of the problems that are introduced by other phase correction schemes.

The most common phase correction technique on the market is matrix encoding. This way, the stereo audio is recorded as sum and difference signals. This method works, but creates other problems, since there are still phase errors between the L-R and L+R channels.

Its other drawbacks would include decreased separation and reduced S/N ratio. It certainly doesn't work as well as Broadcast Electronics' method.

### Recording parameter adjustment

Another feature that I find valuable is the PT90's ability to adjust the bias,

equalization and record level automatically. Recording tape is not very consistent in its characteristics. Even the same brand, type and length will be different from batch to batch.

If the recording parameters are not changed as the tape changes the frequency response will be unpredictable. Figure 2 shows how different tape types would sound without changing the recording parameters for each one. If the bias, equalization and level are customized for each tape, then the frequency responses would be almost ruler flat.

The Phase Trak 90 can optimize the settings for any tape in less than a minute. Just insert a blank tape, push the button

and a microprocessor takes over. It can learn and store the settings of up to ten different tapes.

Changing between tape types is easy, which should save a lot of engineering time tweaking all of those decks. And for you

engineers who don't want the air staff making these adjustments, a switch on the back can defeat this learn mode.

### Test oscillator

A nice by-product of this system is that each record deck has its own built-in test oscillator. The frequency and level can be selected from the front panel. To simplify things for the air staff, this is also defeated with a hidden switch.

That hidden switch will also let you adjust the bias, equalization and level manually, using the internal test oscillators.

Broadcast Electronics has really worked on the small details also. Our air staff loves its real-time tape timer, and by changing jumpers inside you can choose to have the timer stop on a cue tone. It will reset on removal of the cart or by changing jumpers and pressing play.

Also a hit is the splice finder in the record deck. Now there are no more excuses for recording over the splice. Even the push buttons are quiet. It uses switches with hall-effect magnetic sensors instead of mechanical contacts.

The PT90 also has a noise reduction system. It is non-encoding Dynafex which works during playback. Like all non-encoding noise reduction systems, it can be heard working sometimes. It is defeatable and can be very handy during voice cuts.

For the engineer, the headbox is very well designed. It is especially rigid and the adjustments are locked down tight. The head's azimuth, zenith and height all work independently for easier adjustment. It's too early to tell, but I bet I won't have to realign the heads very often.

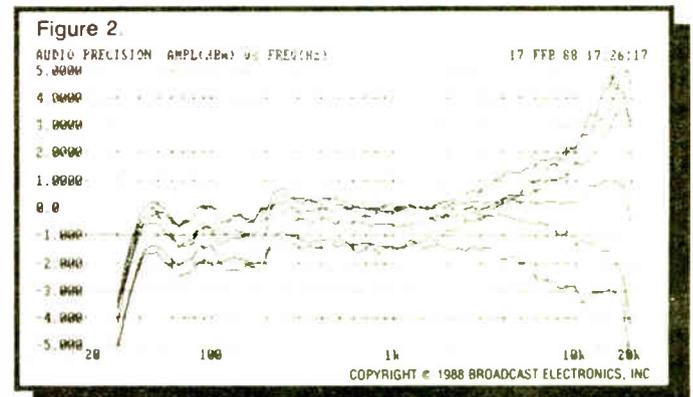
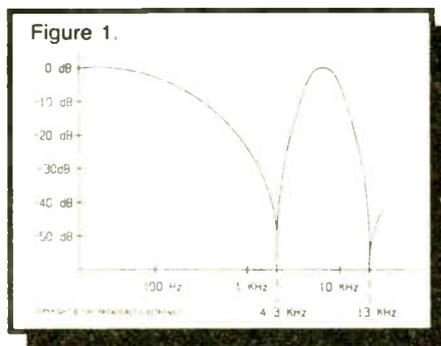
A feature that I use a lot is the pinch roller cleaning mode. When you press stop and play together, the pinch roller pops up for cleaning. If you forget, it shuts itself off in 90 seconds.

Other nice touches include a lubrication-free transport, no lamps to burn out and multiturn pots on input and output levels.

### A few suggestions

There are some small quirks, however. I found that these machines are a lot longer than my old ones and I had to do a bit of rearranging for them.

I found another small problem when using Scotchcarts. The cartridge's tension adjustment screw goes partly into the mouth of the deck. However, BE says that



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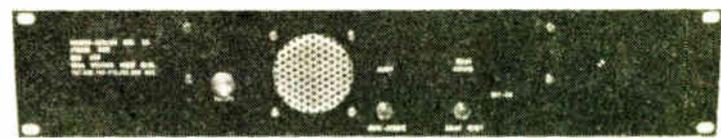


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# Diagnosing an Ailing Cart Deck

by Mike Rabey, CE  
WFBQ-FM/WNDE-AM

Indianapolis IN ... ITC's venerable workhorse "Premium Line" series of tape cartridge machines are no longer in production, but these bulletproof decks see daily use in countless stations across the country.

Almost 50,000 Premium Line decks were sold during the '70s and '80s; proof positive that they are

one of the most prevalent pieces of broadcast equipment in the industry. Broadcast engineers still revere these machines but passage of the years can cause any machine to malfunction.

Luckily, a moderate application of time and money can most often restore an ailing Premium Line machine to its original level of performance.

Let's start with the mechanical components, then turn our attention to the power supply and electronics.

## Mechanical components

Check the pinch roller for gouges, chunks missing along either edge or a glazed appearance. Does it feel spongy? Is it more than a year old? Replace it.

Be sure to use 70 durometer ITC pinch rollers on these decks. Sixty durometer pucks will fit, but they're too soft; they're for Delta machines with their smaller solenoids.

ITC gives their metal capstans a rough, textured surface to grab the tape and move it smoothly past the heads. Years of service, especially with modern hard-oxide tapes, can wear away the rough capstan surface and leave the shaft smooth, resulting in wow and speed fluctuations.

In these instances, there's not much you can do except replace the motor/capstan unit. Sandblasting the capstan will return the roughness, but will also decrease the diameter of the capstan, resulting in slow tape speed.

## Replace the bearings

If your triple decker sounds like a '73 Saab that threw a rocker arm, it's probably just the motor bearings. ITC will be happy to sell you a new motor/capstan unit, but you can replace the bearings yourself for a fraction of the cost.

There are two bearings: one in the base of the motor, the other in the bearing support block at the top of the capstan. (The bearing support block, by the way, has a built-in bearing puller! Check the 3D manual.) If you do this yourself, be sure to use the exact replacement bearings from the factory.

The heads are the most important component of the deck. Unfortunately, head wear is often not detected until performance begins to deteriorate. Poor frequency response, poor audio from one

channel and cue tone problems are often caused by worn heads.

Symptoms are often worsened when switching from one type of cartridge to another—a thicker tape will not bend enough to fit the shallow groove which didn't bother a thinner tape, for example. Sometimes a barely discernible head groove can cause severe problems.

Of course, any head with a discernible groove should be replaced or relapped.

If a head is not too badly worn,

When you replace heads, use ITC's head gauges to assure correct alignment. The factory manual is an excellent reference for this procedure, with diagrams and text that make every step clear.

And do not forget to replace those dummy heads in the playback decks. They are inexpensive and worn ones can seriously distort the tape path.

## Retrofit guides and springs

If you own older Premium Line decks with separate cart guides and hold down springs, retrofit them with the integral units as found on 99s and Delta decks. You will be rewarded with easier cart insertion and better phase stability.

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**Luckily, a moderate application of time and money can most often restore an ailing Premium Line machine to its original level of performance.**

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though, relapping can be a cost-effective alternative to replacement. Relapping of playback heads often yields good results if done by a competent firm. Relapping of record heads, however, is a much riskier proposition and is not generally recommended.

Also, be alert for broken connections within the head itself. One side of the coil may be floating or the internal hum shield may have become disconnected from the ground. These faults can cause all manner of strange symptoms. Before you spend three days agonizing over a playback card, try a different head.

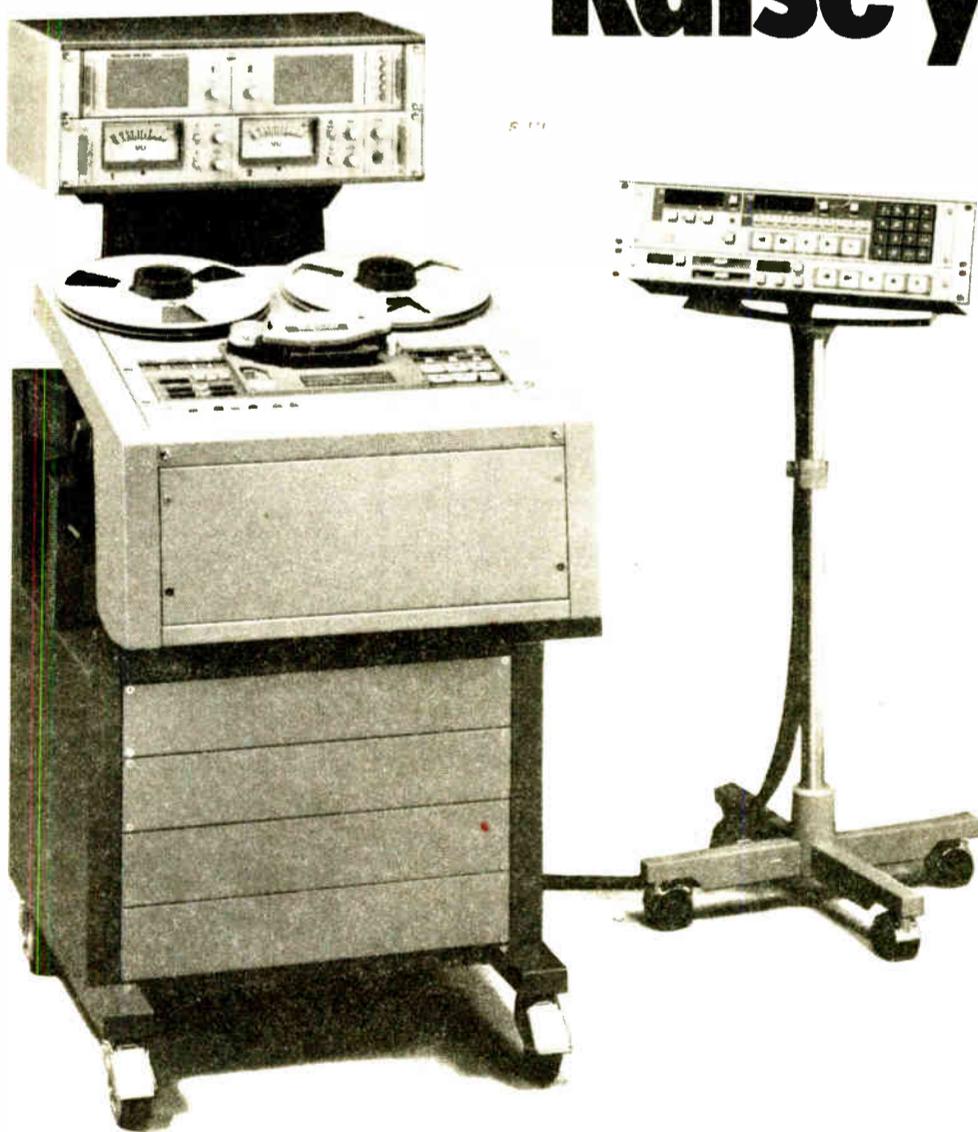
If you perform this modification, be sure to pry off the small metal plate glued to the deck in front of the playback head and add the hum shield plate over the playback head.

As with any electronic device, a properly operating power supply is essential to the welfare of the rest of the machine. And, as with any power supply, the ITC's filter caps start deteriorating the moment you plug in the machine.

Dried-up filter caps manifest themselves as hum on the audio, intermittent

*(continued on page 47)*

# Raise your standards.



To understand the superiority of the Tascam ATR-60/2N, begin with the heads: no other 2-track production recorder has heads that can provide sync response fully equal to repro response—an advantage that allows you to save time by making critical audio decisions without rewinding.

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Then call or write today about the Tascam ATR-60/2N. And take your broadcasting to a higher level.

# TASCAM

# New Digital Horizons

(continued from page 33)

ground was ITC/3M's HCDA 3000, a digital machine first shown in prototype form at 1987's NAB show.

The unit never shipped, following market studies showing that although the technology seemed to be there the machine would cost more than stations were willing to pay for it.

CompuSonic has for the last few years been marketing a product in the digital domain, and its model DSP-1500—in essence a tapeless digital computer that uses a hard drive or replaceable Bernoulli cartridge storage format—closely resembles in overall function the traditional analog cart machine.

Even the manufacturer, however, balks at calling the DSP-1500 a "digital replacement" for the analog cart machine.

"The DSP-1500 is not a replacement for anything," says Bob Kearns, CompuSonic's marketing manager. "It does not replace directly the way things are done in a radio station. In some situations we

can replace totally a cart system, but in some cases we cannot. It depends on a station's particular format and desired application."

And while there seems to be great potential for the DSP-1500 system in the cart arena, the computerized format still contains limitations in storage and access capabilities that are at present keeping sales of the equipment "slow," according to Kearns, who promises continued upgrades to the product aimed at correcting its lingering shortcomings for radio.

Another possible cart machine alternative sparking differences of opinion is DAT, a digital audio tape format employing a rotary drum and recording heads. Some in the industry see R-DAT as a far reaching technology with equally broad applications in radio broadcast, while others think these applications will be limited.

Radio Systems President Dan Braverman, whose company manufactures modified Sony DAT players for broadcast

use, says "DAT is certainly not going to be everything for a radio station. It won't be hard storage or a cart machine, but it is and will be a great way for real-time, inexpensive storage. I think it will find a place in every radio station in the next 10 or 15 years."

"DAT is not going to be the wonder answer for radio," offers Bill Parfitt, who cites its consumer-aimed design and rotary head media as reasons for its limited professional applications, and adds that

**... the radio station of the future will probably use a combination of carts, DAT and hard storage.**

"to make DAT operate like a traditional cart machine would be so expensive that the market would not bear the cost of its development."

With regard to DAT's potential as a cart machine, Braverman agrees. "To date," he asserts, "DAT is having little to no impact on the cart machine market." Braverman instead sees DAT as the ideal and inevitable replacement for reel-to-reel.

"With reel-to-reel," Braverman explains, "you are married to the order in which you place the cuts. But DAT gives you random access to these cuts."

Braverman warns that DAT would require more care in handling than a cart. DAT systems, he says, "just will not take the kind of abuse that cart machines traditionally do."

One intriguing, if still unproven technological possibility is the optically erasable and re-recordable CD.

In April of this year Tandy Corp. announced the THOR-CD™, a digital media claimed to be erasable and re-recordable. The announcement was received by the industry with a healthy dose of skepticism.

It seemed to many an empty promise from Tandy, who had no product to accompany the announcement, saying only that the media and a player/recorder would be available within two years.

Ed Juge, Director of Market Planning for Tandy, acknowledges the industry criticism and says that perhaps in response to it his company may introduce its product "sometime in the first half of next year when we have a hardware prototype which we can let people see record and erase and do all of the things we said it will do."

"What we really announced was a technology and not a product, and our intent is to keep quiet until the product is ready to go," Juge explains. "We wanted to let people know what we were doing so that we could sign up a lot of licensing agreements and make the THOR-CD a low-end industry standard."

Other erasable CD technologies do exist but Juge differentiates his company's product from the rest by pointing out that the THOR-CD will be the first recordable CD to be fully compatible with all existing CD audio and CD-ROM players.

"We wanted to try, before investing any more money, to flush out any competing technologies that were also CD compatible," Juge explains further of his company's initial announcement. "And we have found none," he adds.

Current reaction to the Tandy story is

still general skepticism, but not many would dismiss entirely the possibilities for such a product, were it to materialize.

"I think the implications could be great," says Bill Parfitt of the THOR-CD. "but it must be cost effective, easy to use and reliable. If it does not meet these criteria, then its effect will be minimal."

Stan Salek, an engineer at the NAB's Science and Technology Department, thinks "if (the THOR-CD) materializes, it would probably be the thing we would see between today's technology and the totally solid state medium. It would probably be the bridge."

Braverman is underwhelmed with the THOR-CD's chances of being the next cart machine. "I think it is an in-between technology," he offers. "I think it is stuck somewhere in the middle between CDs and DATs and is not going to make it."

"Remember," he says, "on DAT you can get from one side of a two-hour tape to the other in 40 seconds. And while it is still true that you can't air two cuts from the same DAT tape back to back, you can't on a CD either."

Braverman feels that the machine Tandy is proposing is obviously more directed toward the consumer market and will therefore not be adequate for professionals. "There will be no balanced outputs or remote control, etc. and it will be a mess."

Otari's Carey, however, thinks "if the optical disk system will work, then we are getting close to a cart replacement, because it has all of the benefits that a cartridge does in that each unit provides one unit of playback, whether it be a music or commercial spot."

When all is said and done, however, what seems increasingly likely and plausible is a sort of hybrid environment where a variety of formats work together.

Braverman concurs. "My guess is that the radio station of the future will probably use a combination of carts, DAT and hard storage. All you need to do is look at the mix that exists today. There are already seven or eight media."

For now though, the analog cart machine endures, and we may have to heed John Carey's words when he says that "The industry may have to accept that technology, at least for the near future, is not yet capable of coming up with a replacement that sounds better and is more reliable than the analog cart machine."

## Delta Deck

(continued from page 42)

years and have a high resale value.

In the three and a half years I have been responsible for the 14 Delta machines we use, I have replaced one start switch, one or two 15 V regulators, and had one intermittent record lamp socket. They just don't break!

I consider International Tapetronics to be among an elite group of broadcast equipment manufacturers who stand behind everything they sell. You can believe it too.

*Editor's note: KNIX has been named station of the year for two years running by both the Academy of Country Music and the Country Music Association. Mike Malo has enjoyed working as a radio CE for over ten years in Arizona and northern California. He welcomes your questions or comments, and can be reached at KNIX: 602-966-6236.*

For more information on ITC's Delta Series cart machines, contact Bill Parfitt at ITC/3M: 612-736-5019.

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# Premium Line Maintenance Tips

(continued from page 45)

relay operation and weird behavior from the cue detector cards.

## Check power supply

To check the filtering of your power supply, connect your scope to the input pin of the voltage regulator (be careful with that probe!). You should measure 40 VDC with very little ripple. If you see ripple, check the filter caps beneath the deck with a capacitor checker. Or better yet replace them all.

And be alert when you wire up the new ones—sometimes the replacements do not observe the same pinout as the factory originals.

Once you have checked the electrolytics, check the output of the 24 V regulator. It should measure (surprise!) 24 V,  $\pm 0.5$  V, with no ripple or oscillations. Caution: older machines may have to be modified before installing a Motorola or ECG replacement regulator. Call the factory for guidance.

A variety of control malfunctions may be attributed to burned contacts on the control relay. A visual check should indicate whether this is the problem.

## Diagnose burned contacts

If your machine has multiple cue tones, you can borrow one of the auxiliary cue tone relays, plug it into the control relay socket and see if the symptoms disappear.

A burnishing tool will remove carbon

deposits from any burnt relay contacts: a new relay will give longer-lasting relief.

The control relay, K1, is more trouble-prone than the auxiliary tone relays. This is partly because it switches more current and partly because the stop-tone circuitry of the cue detector card is not very efficient—it only applies about 16 V to the 24 V coil of K1.

To increase reliability of the control relay logic, gather up all your 24 V relays and determine the minimum pull-in voltage of each with an adjustable DC supply. Use the most sensitive relays in the K1 sockets of your decks.

## Cue detector problems

The cue detector card works in tandem with the relays in your deck and is responsible for many of the logic snafus encountered in these machines. If you have cue detector problems and the power supply checks out OK, you may have dried up electrolytics on these cards too.

Most cue detector card problems can be rectified by replacing the electrolytics, but be sure to use the exact value called for in the schematic—some of these caps determine critical R/C timing functions.

If everything else seems OK, but the audio just does not sound as good as it used to, look closely at the coupling caps in the playback card.

The playback card is home to a large number of electrolytics, but they unfortunately give no indication when they are failing beyond a very gradual deteriora-

tion in audio quality. A regular check with a capacitor meter can locate the culprits. Some engineers replace them all every couple of years.

## New playback card

You can, of course, replace the playback card with a retrofit card designed for Premium Line machines and enjoy performance on a par with current opamp-based designs.

The Audiometrics Premium retrofit card, sold by Allied Broadcast Equipment, offers significant improvement in slew rate, distortion, noise and trans-

parency, as well as an active-balanced output option.

It utilizes an on-card bi-polar 15 V regulated supply powering NE5534 opamps and it brings the audio performance of your Premium Line machines up to modern-day specs at a fraction of the cost of a new machine.

Every engineer has his/her own war story about nursing a sick Premium Line deck back to health. I hope this article has been an aid in keeping these venerable machines operating properly in your facility.

*Editor's note: Mike Rabey has been in radio for 12 years and is the founder and President of Indy Audio. He may be reached at 317-257-7565.*

# Dynamic Dynamax Deck

(continued from page 43)

errors that are pointed out.

Heat kills equipment. Bearing and component life suffer. Perhaps my biggest reservation about the Dynamax 124 is the heat level.

In an open area, the machine stabilized in operation at about 124° on the cart deck. The solenoid was about ten degrees warmer. That concerned me.

However, according to Fidelipac's tests, the tape does not deteriorate until temperatures reach 200°, and the plastic holds up until 250°. So, while there seems little danger there, you will have to make your own decision. Or perhaps install a fan.

Disk jockeys seem to like the machine

for its features. The clock was very popular. Cartscan seems to be more or less valuable depending on your station and the test tone is handy, especially for quick checks in the production room.

None of the replacement parts seemed to be excessively expensive. Matched with a well informed and caring support staff, this machine is a good value.

Overall, the operation of the Dynamax 124 is very good and it would make a fine addition to your station.

*Editor's note: Barry Mishkind is Radio World's "Eclectic Engineer." He may be reached at 602-296-3797.*

*For more information on the Dynamax 124 contact Fidelipac at 609-235-3900.*

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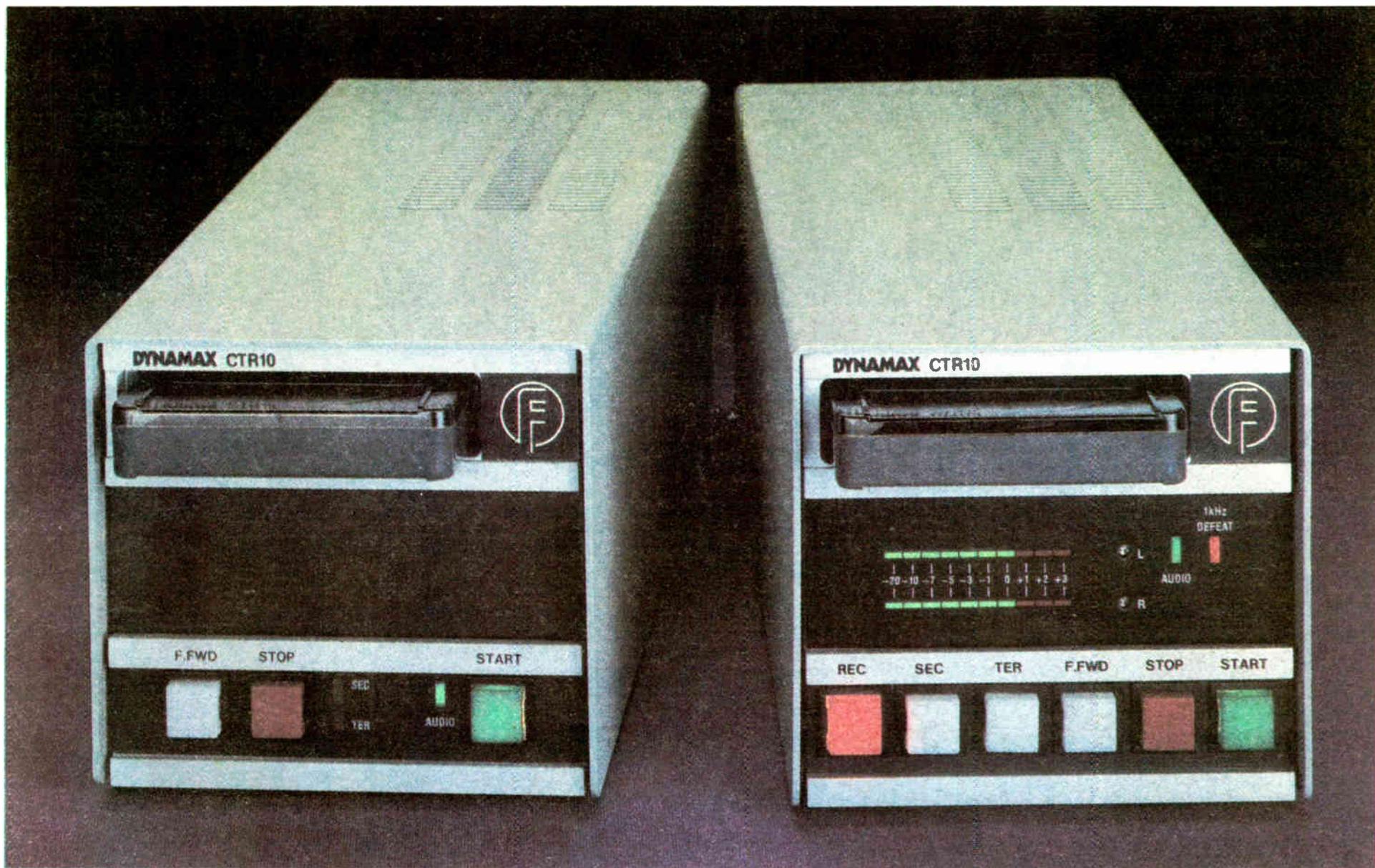
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# TASCAM



Circle Reader Service 20 on Page 32



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