

## VOA: 50-Years Old and Still Talking

by Marjory Roberts

**WASHINGTON** When the Voice of America (VOA) speaks, more and more of the world tunes in. The internationally acclaimed broadcaster turned 50 this year, looking back proudly on its finest moments

in news reporting and setting its sights on a more global role in international radio.

VOA staged a coup of its own over the past few years, covering—and many say encouraging—peace movements in China, Eastern Europe and the former Soviet Union. “The wave of uprisings for democracy

in 1989 began with Tiananmen Square in China, and international broadcasting played a big role in informing the Chinese and the world what was happening,” said Sidney Davis, director of programs for VOA.

Tens, if not hundreds, of millions of Chinese listeners relied on VOA for accurate news reports, fortified by what they heard to continue their fight for freedom. The VOA fed this mass hunger for information by upping the number of daily Mandarin and Cantonese broadcasts. When the Chinese government began jamming some broadcasts, VOA countered by using alternate transmitters and giving anti-jamming instructions.

During last summer's attempted Soviet coup, VOA's Russian branch and the other eight languages broadcast to the Soviet Union switched to an all-news format. The local media occasionally issued carefully worded statements, but filled the rest of its air time with classical music and movies. Again, the Voice and other international broadcasters provided the only credible information many listeners, including Mikhail Gorbachev, received as the incredible events proceeded.



Moscow in August of 1989. In Volgograd, Radio VEDO went on the air in May 1991 using VOA programming.

Just two months ago, radio stations in the Baltic republics of Lithuania and Estonia began broadcasting VOA programming, and the Voice is discussing an affiliation with Latvian radio.

Several other countries formerly “behind” the curtain now run VOA news and features or house VOA facilities. For example, a VOA office opened in Warsaw, Poland in December, 1989. Last July, the Voice's German Service resumed direct broadcasts to Germany, and this winter, Radio Hungary began using satellite-fed live VOA programming for one hour a day.

New audiences called for new kinds of  
continued on page 7 ►



VOA celebrates half a century on the air

## WCBS Resigns CPCS-1 Status

by Frank Beacham

**NEW YORK** WCBS-FM, the network flagship station criticized for failing to participate in a hurricane emergency last summer, has relinquished its designation as a Common Program Control Station (CPCS-1) in the Emergency Broadcast System.

“Participation at that level was voluntary and the station chose to exercise its option not to be a CPCS-1 station,” CBS spokeswoman Helene Blieberg said. “WCBS-FM is still part of the federal system and will continue to run the tests. This reduces its obligation as a relay, but naturally it will continue to inform its listeners of any emergency.”

Last August, as Hurricane Bob approached Long Island, WCBS-FM chose not to participate at all with the EBS program even though it was a designated CPCS-1 station at the time and EBS monitors were tuned to its frequency.

“State activation and participation is voluntary. There are no guidelines that indicate that you have to make a position known at the time,” Blieberg had said.

### Legal, but . . .

In response, FCC EBS engineer Frank Lucia conceded that EBS participation is voluntary, but emphasized that “there is an unwritten obligation” that the station should serve the community during an emergency.

“The broadcasters on Long Island, where many of the stations were supposed

to monitor WCBS, have got to take the initiative and say, ‘Alright, either CBS is

continued on page 7 ►

### Changes in Eastern Europe

The winds of change have helped dismantle the electronic Iron Curtain that once blocked western broadcasts. After 40 years of off-and-on jamming by the Soviet Union, VOA opened a news bureau in

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## NEWSWATCH

### AM Rule Clarification Sought

**WASHINGTON** The NAB has filed a petition for reconsideration of the mandated interference reduction provision of the FCC's recently adopted AM improvement rules, Docket 87-267.

Although the association is in agreement with much of the AM improvements package, the NAB said that the FCC's explanation of the conditions under which a station would be exempt from the mandated ten percent interference reduction rule—the so-called “ratchet clause”—is vague.

The rule states that any AM station making modifications must reduce its interference (signal) by ten percent.

“The NAB believes the Commission must establish a clear waiver policy for stations that must make involuntary changes,” the NAB said. “Stations that are forced from their transmitter sites due to rezoning, the inability to stabilize their directional array caused by nearby construction, etc., must have the ability to rebuild their sites without being subject to the ten percent reduction in signal level.”

continued on page 2 ►

# NEWSWATCH

► continued from page 1

The NAB requested that the FCC "address this issue clearly and spell out exactly what involuntary situations will be exempt" from the ten percent reduction.

## EIA Sets DAB Timetable

**WASHINGTON** The Electronic Industries Association (EIA) digital audio radio subcommittee plans to set a timetable for selecting a single techni-

cal digital audio radio (DAR) system for the U.S. during its March 17 meeting here.

Subcommittee Chairman Randall Brunts of Delco said system proponents have been asked to declare their intent to propose DAR (or DAB) systems for testing by summer, and to submit detailed descriptions of their systems by the end of 1992. Testing is likely to take place in 1993.

The subcommittee, formed last year, also will discuss testing

procedures and facilities for performance evaluation of proposed systems, and the voting procedures for the adoption process.

The EIA DAR performance parameters include CD sound quality, multipath immunity, and minimization of transmission costs and reception complexity.

## FM Freeze Proposed

**WASHINGTON** The NAB has made official its request to the FCC for sweeping measures to reduce crowding in the FM band, including a freeze on new FM allotments.

The NAB also is asking the FCC to expand its FM ownership opportunities for minorities

to purchase existing stations.

The NAB said FCC rules are in "dire need of reassessment and amendment" in view of technological changes such as DAB and an uncertain economic climate, which left more than half of U.S. stations in the red during 1990.

## New FCC Mailing Addresses

**GETTYSBURG, Pa.** The new mailing address for non-fee items being sent to the FCC's Gettysburg office is FCC, 1270 Fairfield Road, Gettysburg, PA 17325-7245.

Feeable filings should continue to be sent to the address that

is noted in the Private Radio Services Fee Filing Guide.

## FCC Asks for Justice

**CHICAGO** The FCC asked the Department of Justice to initiate civil enforcement proceedings against Evergreen Media Corp.

The action comes after the Commission fined Evergreen, licensee of WLUP(AM) Chicago, for broadcasting material the FCC found violated Section 1464 of the Communications Act. Section 1464 prohibits "any obscene, indecent or profane language by means of radio communication."

The FCC has requested payment of the fine twice, but Evergreen Media has refused to pay. The FCC said, "It is clear the licensee wishes to contest the matter in court."

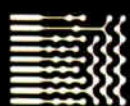
## Telos at the Olympics

**CLEVELAND** CBS employed Telos One digital hybrids at its master control and competition sites during broadcasts of the winter Olympic Games in Albertville, France. The units were used to link facilities and to allow telephone communication with the production team and network facilities in New York.

Telos LINKS were also used by CBS to interconnect two-wire RTS intercom systems at event sites with standard phone lines.

NBC used Telos digital hybrids at the Seoul Summer Olympics in 1988, and plans to use Telos again for this year's summer games in Barcelona.

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# FCC Allows WCFL Back on the Air

by Bruce Ingram

**CHICAGO** WCFL-FM was back on the air just two weeks after the FCC yanked it off the air in late January, following a field inspection that confirmed that the station was operating at more than twice its authorized power using a non-directional antenna in violation of its special temporary authority (STA) permit.

Because it is licensed to serve the public interest, WCFL was given permission to go back on the air Feb. 7, but the FCC has indicated that the station still is subject to subsequent fines, which can total \$12,500 per day for each day it operated above licensed power.

FCC Chief of Investigations Dan Emrick called the bureau's strong action "quite unusual," but said it "demonstrates how serious we are about stations operating according to granted authority."

## More fines possible

Emrick noted that the Morris, Ill. oldies station already is behind on \$3,800 in fines stemming from a June 1990 field investigation that revealed similar violations. Those fines have been turned over to the U.S. attorney for collection.

Emrick said non-payment of fines may have influence but not direct bearing on whether or not a station is granted authority to operate by the FCC's Mass Media Bureau. In fact, WCFL was operating on its fourth STA when it was taken off the air and is now operating on a program test authority after the station filed for a modification of construction permit.

The station's problems began in early June, 1990, several months after Columbus-based MM Group bought WUEZ-FM/WCSJ-AM in Morris, Ill. from Midwest Broadcasting Corp. for \$3.2 million.

Midwest previously had filed for permission to up WUEZ's power from 40,000 to 50,000 watts. The proposal to the FCC specified switching from a non-directional

to a directional antenna to hold power down to 11,000 watts in the direction of Elkhart, Ind.—where WFRN-FM occupies the same frequency—and Chicago, to avoid interference with FAA air traffic control.

According to complaints filed by attorneys for WFRN and WXRX-FM in Rockford, Ill., when FCC approval of the Midwest Broadcasting application came through, MM Group built a 500-foot tower

but ordered it to cut its power to 11,000 watts in all directions.

WCFL cut its power as ordered and shortly after received the first of its STAs from the bureau. WFRN, WXRX and other local broadcasters said they were satisfied at first, but again gradually noticed increasing interference from WCFL.

In mid-September 1991, local station engineers said they took another series of

over its authorized power level during the FCC inspection and said the FCC acted properly in taking the station off the air temporarily. He stressed, however, that the station did not knowingly ignore FCC guidelines and that the power coverage was entirely unintentional.

Spires said station staff had been working more than a year on plans to facilitate the upgrade to 50,000 watts. They were installing the proper equipment on the tower in early January when the consulting engineer was called away on an emergency. He was replaced by a contract engineer, who misunderstood the guidelines and "basically made a miscalculation that caused the power to rise."

"This was a situation that could happen to any station in the process of a power boost," Spires said. "It's impossible to babysit your technical staff and run a station. You have to hope they know what they are doing."

Regarding the stations that have been complaining about WCFL to the FCC, Spires suggested that they could have been motivated by competition.

He acknowledged that WFRN and, to a lesser degree, WXRX, may have had legitimate complaints to make at one time or another about co-channel interference. As for the others, Spires pointed out that WCFL has become an economic force to reckon with in this area, and it will grow stronger when its power increase goes into effect.

**The FCC said its action demonstrated "how serious we are about stations operating according to granted authority."**

for the station, now re-named WCFL. The station began broadcasting from the tower on June 6, 1990 without program test authority, using a non-directional antenna and creating considerable interference in surrounding service areas, according to the complaints.

## Exceeding the limit

Independent field strength measurements at the WCFL tower, commissioned by a group of local broadcasters and later confirmed by the FCC's Chicago Field Operations Bureau, revealed that the station was operating with an effective radiated power (ERP) of 40,000 watts non-directional.

"It trimmed our western coverage area anywhere from 10 to 20 miles," WFRN Station Manager Ed Moore said. "Our signal was either rendered inconsistent or ruined completely."

The FCC fined the station \$3,800 in late June 1990 and issued a cease operations order. Attorneys for WCFL countered the order to cease operations from the new tower by arguing that it was necessary to operate from the station's temporary facilities in order to maintain service.

FCC FM Branch Chief Dennis Williams granted WCFL a temporary "dispensation"

field strength measurements at the WCFL tower and found that its signal was in excess of 11,000 watts—in one instance reaching 25,000.

## Here we go again

Vigorous complaints to the Chicago bureau of the FCC and key departments in Washington resulted in another official FCC field inspection on Jan. 16. The inspection confirmed that WCFL was operating with an ERP of 28.3 kilowatts, more than twice its legal limit. That inspection resulted in the January 24 order to stop broadcasting.

WCFL General Manager Tim Spires admitted that the station had been operating

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# Putting the Punch Back in AM Radio

by Alex Zavistovich

**WASHINGTON** He calls it "the first new format for AM radio in the past 10 years," and it blends equal parts of news, weather and traffic with music hand-picked to sound good on the band.

The format is Amplitune II™, and the programmer is J.R. Russ, who's trying out his idea on WBUX(AM), in Doylestown, Pa.

When the Amplitune tape first crossed my desk about a year ago, two things occurred to me: The song selection seemed unusually contemporary for AM, and the high-end content was sharp and punchy—definitely a change from the mid-heavy, syrupy sound we've come to associate with a lot of AM programming.

Then, just last month I learned that J.R. had taken his show on the road and was programming WBUX. The 5 kW station, located on 1570 kHz, is licensed to the city of Doylestown in Bucks County, Pa., on the fringes of the Philadelphia suburbs. Previously best known only as the station owned in part by author James Michener, the new owners of WBUX (AmQuip) decided to try Amplitune as a way to break out of AM's rut.



What is it about Amplitune that J.R. Russ believes is so different? Foremost, it's music. At a time when news/talk has become a staple on the AM band, J.R. has decided to add music back to the mix. The sample clock he provided me shows an alternating pattern of CNN news, local news, traffic, weather and songs—which he calls the "mortar" of the format.

Not just any songs, either. With core ar-

tists like the Rolling Stones, Fleetwood Mac and Billy Joel supported by recurring groups like The Thompson Twins, Fine Young Cannibals and even The Fixx and Van Halen, the format seems to embrace a variety of genres equally.

There are technical criteria for the song

**Anything that shakes up the old thinking in AM programming is worth a listen.**

selections, too. J.R. says he looks for songs with similar production values: uptempo numbers with tight mid-range production and a nice low-end "thump."

In the audio chain, WBUX uses CRL processing. Although he plays it pretty close to his chest, J.R. did say his audio strategy includes backing off on compression, which had accentuated distortion in the audio chain, peaking the 8K-10K range, and keeping the bass flat (the song production apparently takes care of itself where the low end is concerned).

Having just signed on with the new format Jan. 24, it's a little too soon to tell how "The All-New 'BUX 1570" will do in the ratings. For my money, though, anything that shakes up the old thinking in AM programming is worth a listen. For more information, contact J.R. Russ at P.O. Box 16956, Philadelphia, Pa. 19142, or call 215-494-0910.

★★★

In these recessionary days, you've got to cut to the bottom line. We have.

Long-time readers of *RW* may recall that a few years back the paper had a regular column by the name of *Bottom Line Broadcaster*. The column was a fountain of ideas to stretch your engineering budget, featuring do-it-yourself projects for engineers of every skill level.

As sometimes happens, the author got out of broadcast engineering and eventually gave up the column. Since then, it's been waiting for someone to revive it. That someone is Jim Somich.

You may recognize Jim as the brains behind Somich Engineering, a company that specializes in nifty little "black boxes" like the Pilot-Lok. In the first issue of each month, Jim will present a new project in *Bottom Line Broadcaster*, for those of you who need to stretch your engineering dollar or just like creating electronic marvels in your free time.

This month, Jim focuses on a balanced line driver for stations combining consumer and pro gear in their audio chain. Other hands-on projects will be outlined in the column in the months to come. So if you're planning on tinkering in your shop, make sure you have your *Bottom Line Broadcaster* handy. And welcome aboard, Jim.

By the way, Jim's column isn't the only place you'll find hands-on engineering projects in *RW*. In the months to come, we're also going to launch *Do It Yourself*, another column that will feature circuits and boxes to make your life easier and your dollar go a bit farther.

★★★

Don't let it be said that *RW* isn't above a little fun now and then, though.

Another new feature that starts with this issue is a crossword puzzle. The puzzle will appear in the first issue of the month; the solution will appear in the second. Look for it in the classified section.

I won't give away any answers, but here's a clue: The closer you read the paper, the better shot you have at finishing the puzzles. Good luck.

★★★

I tried, but I just couldn't resist it. With apologies to The Doors and the memory of The Lizard King, I'd have to call this next tidbit of radio trivia, "Mr. Mojo Falling."

By the time you read this, WPLJ in New York will have dropped the "Mojo Radio" moniker from its IDs. No word at press time on what might take its place; right now, it's just "95.5 WPLJ." As for Scott Shannon (who moved back to the Big Apple after his "Pirate Radio" fireworks fizzled in L.A.), I guess he just couldn't get his Mojo working.

Sometimes I love this job . . .

That's it for now. Tune in next time,

Alex



►The Electromagnetic Energy Policy Alliance (EEPA) will hold its eighth annual symposium at the Radisson Mark Plaza Hotel in Alexandria, Va., May 4-6.

The symposium's theme is "Electrophobia: More Than an Electric Power Problem." Sessions will include research updates, new standards development and high frequency RF information.

For more information, call 202-452-1070, or write EEPA, 1255 23rd St., NW, Washington, D.C., 20037-1174.

►Unistar Radio Network's long-form programming and specials will be distributed in Canada by the Canadian Radio Networks (CRN). CRN was formed in 1989 and is Canada's largest network of private radio stations.

In addition to distributing Unistar programming, CRN will sell air time in the programs to Canadian national advertisers. The company has over 100 affiliates that reach about 500,000 listeners each week.

►The Corporation for Public Broadcasting (CPB) is looking for entries for its 1992 Public Radio Program Awards. The deadline for entries is 5:00 p.m., March 17, 1992.

For more information, contact the CPB's Office of Station Relations: 202-879-9772. Entries can be mailed to CPB, Public Radio Program Awards, Office of Station Relations, 901 E St., N.W., Washington, D.C., 20004-2006.



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

## Early binaural revisited

Dear RW,  
John Sunier's article on binaural audio (RW, Feb. 5) went way back into the earliest days of binaural. There were a few other attempts at binaural that are worth adding to his review. I was involved in one of these as the "everything" person at the WHVA transmitter/studio/living quarters on Mt. Beacon, N.Y.

About 1950, the New York Times' classical music radio stations WQXR (AM and FM), in New York City, had set up a network of FM stations operating throughout the northeast and parts of Pennsylvania. This was known as the "WQXR Network," and in upstate New York as the "Rural Radio Network."

The network operated by rebroadcasting the programs from station to station via off the air pickup, much like a chain of radio repeaters—with very good quality, in part due to the REL receivers used for network station reception. Those receivers that were tunable were so stable that they did not need AFC. On a power line "brownout" they would stay on frequency even after the fluorescent lights went out.

That radio relay network went from Mt. Beacon, N.Y., to Troy; Cherry Valley; Syracuse; DeRuyter; Watertown; Ithaca; Scranton, Pa.; Hornell and on via about 14 stations to Niagra Falls, with five of the stations remotely controlled on adjacent station carriers from Ithaca (monitoring was direct off the air from each). This was in the era before FM stereo. But WQXR was busy transmitting binaural using its AM and FM stations as left and right (or was it right and left?) channels.

Specific instructions were broadcast before each program advising listeners how to position their AM and FM receivers for correct "binaural" reception. In the New York City area it was quite good for its day. The AM station located along the East River blanketed the area and QRN was minimal.

But these instructions also went out over the FM "Network." Most of the binaural broadcasts were during nighttime propaga-

tion conditions and it was possible to hear the AM station at many locations around the FM network. But now, in addition to atmospheric, on one channel there was a new variable—skywave—which brought many strange effects and questions from those listeners who tried to pick up the broadcasts.

The effect would have been bad enough with delay added at each of the multitude of FM transmitters (many using the GE Phasotron for modulation, remember?) compared with groundwave AM propagation, but the AM channel was receiving skywave with its inherent variable delay. The binaural turned into a whole new and spaced out dimension which I must leave to your imagination . . .

I'm sure that there were other stations using the AM-FM system to deliver binaural or stereo programming at the time of the WQXR experiment but I doubt that any were as interesting as this one.

Those Cook "binaural" records mentioned in the article have two separate recorded bands, one for each channel. Equalization was different for the inside and outside bands, which made for fun and games. I still have some of the records, but the special arm with two heads about two inches apart, floating separately and mechanically adjustable for phase correction has long since gone.

Cook furnished a test record with the arm. It had a centered ticking clock used for manually adjusting the position of the heads. Crude by the standards of today, but it was a start.

I wonder what will be said about our CDs and DAT a generation from now when we will be able to carry the entire Encyclopedia Britannica on our wrist in a single chip. It is said that today, a single edition of the Sunday New York Times contains more information than there was available to Man three hundred years ago.

Gordon M. Pugh, PE  
Walpole, N.H.

## Bravo Running Radio

Dear RW,  
It was a pleasure to open the Jan. 22 edition of RW and find your new feature, *Running Radio*. This new section, which you have called a "resource for business, programming & sales," will make RW a more valuable read.

In a time when radio engineering departments are shrinking, it's important for those of us who are technical people to learn as much as possible about the business we work in. Only by fully understanding the missions of programming and sales, and how we fit into those missions, can we make ourselves more valuable to the industry.

I hope that, in the future, we will see more articles on accounting, asset management, programming theory and promotion, written by experts on those subjects.

John Rosso, CE  
WNEW-FM  
New York, N.Y.

## Enjoying the ride

Dear RW,  
I'm grateful for Nancy Reist's cover story

## 50 Years Of VOA

This year marks the fiftieth anniversary of the founding of the Voice of America (VOA). The longevity of this government-operated broadcasting service underscores the value of radio as a tool for public diplomacy and information dissemination.

When Chinese college students took Tiananmen Square in a valiant effort to have democracy in their nation, VOA was on hand to provide news to that dedicated group. When the political upheavals across Eastern Europe were being minimized by the Soviet Bloc media, VOA was the conduit of truth for a nation literally divided against itself.

In these and countless other instances over the half-century of its existence, the VOA has grown from being simply a vehicle for American foreign policy to an increasingly respected news source for people around the world.

VOA's success has done more than contribute to the country's international presence. It has validated radio as a vital link in spreading news on every level—international, national, regional and local.

More than any other medium, radio has the power to be on the scene as news is taking place. Radio reporters, with their less cumbersome and less obtrusive equipment, can be deployed to the site of a breaking story much more rapidly than their television counterparts. And unlike newspapers, radio can tell people what's happening *now*.

On a local level, radio's impact can be felt even more greatly. A rural area may be underserved by television, or may have to settle for news from a newspaper printed in a big city miles away, but still can count on local radio for the information that makes a difference in the day-to-day lives of residents.

The immediacy and constant availability of radio can be an undervalued commodity—even by those in the industry itself. More and more, radio stations are giving up on live broadcasts in favor of computer-driven operations.

That's not to say that computerization and automation don't have their own roles in radio broadcasting. But could the VOA have lived so long and done so well without remaining responsive to the changing needs of the community it serves?

Happy birthday, VOA. Your success is a reminder to the entire industry of all the things that are right about radio.

—RW

(RW, Feb. 5, 1992) on the live "Dead" broadcast. That issue is certainly a keeper! Though there may not have been any dead-air on the radio New Year's Eve, Dead-air definitely prevailed inside the Oakland Coliseum that night. All I can say is that "you had to be there" to fully appreciate and understand why so many of us make this event an annual ritual.

In the last paragraph of the article, it was amusing yet reassuring to see that despite all the digital gizmos and wizardry used by the engineering crew, final edited productions were transferred to good-old analog carts! (The brand wasn't mentioned, so I'll just have to assume they were blue!)

Nice job, Nancy! You can wear my tie-dye anytime.

Gordon Stafford, VP Sales  
audiopak  
Glendale, Calif.

Dear RW,  
I found your front page story about the live "Dead" concert to be of special interest.

IDB Communications Group, the largest provider of transmission service to the radio industry, delivered the program via our digital T-1 fiber from our facilities located at KNBR in San Francisco to our teleport in Culver City. At Culver City, the concert was uplinked to Satcom C5, Transponder

19 for final delivery to each station. IDB operates the only digital DATS uplink on the West Coast.

As noted in the article, the entire delivery path to the stations was digital, except for a brief D/A-A/D conversion as the program left the PCM and entered the fiber, and again as the program left the fiber and entered the C-5 uplink chain.

We at IDB are proud to have been a part of this event.

Robert N. Boxer, Mgr. Audio Sales  
IDB Communications  
Culver City, Calif.

## Clarifications

In the Jan. 8 *NewsWatch* section, the "Fee Waiver Adopted" story incorrectly identified FCC Form 703 as the form needed to apply for a feeless radiotelephone operator license for non-commercial stations. The correct form number is FCC Form 753.

□ □ □

In the Feb. 19 *Buyers Guide* section, the story "TM Century Automates WALX," identifies a product as the "TM Century DigiCart." DigiCart is a trademark of 360 Systems, and while the device has been incorporated into TM Century's automation system, it is not a TM Century product.

# Radio World

Vol 16, No 5 March 11, 1992

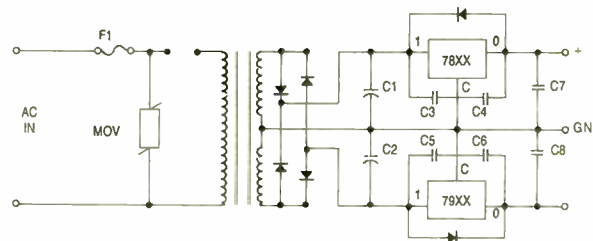
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**Next Issue of  
Radio World  
March 25, 1992**

## Clarification

The schematic in Tom Vernon's *Station Sketches* (RW, Jan. 22, p. 19) inadvertently depicted a bridge rectifier driving current directly to ground. The correct diagram is at right.



TUNED TO  
TOMORROW

# RAVE REVIEWS

## on the AudioMetrics CD 10 Cart Machine



*"It was a pleasure to get new equipment that, when first removed from the box, works as it should the first time. All in all we are very happy with our new CD 10s and will be adding more in the near future."*

**Bruce Harlan, Engineer, WDJQ/WPDN Alliance, OH**

*"Our AudioMetrics CD 10 is in our production room. Everyone has had good comments about it. Operation of the unit has been easy for people to learn. I like the speed of cuing up different tracks. It's very handy in production work. The search dial is fun to use, too. Overall, I have found the CD 10 to be a very well-built product."*

**John Graham, Chief Engineer, WFCJ-FM Dayton-Miamisburg, OH**

*"The jocks love 'em, they are easy to operate, and have worked flawlessly. From a technical standpoint, I like the features included in this unit. The selectable audio cue level is a nice change, being able to select your digital information down to the frame is very nice, sonically, they sound great! I wish this much thought would go into all broadcast equipment. Keep up the good work!"*

**Kevin Jenkins, Chief Engineer, KHEY El Paso, TX**

*"We have just installed our AudioMetrics CD 10 cart players in the studios, and I would like to commend you on creating a very well designed device. The ergonomics of the machine are well thought out and the jocks find the players intuitive and easy to use. It's nice to see an intelligently-designed product that meets the needs of the broadcast industry."*

**Tohru Ohnuki, Engineer, KROQ Burbank, CA**

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Oct. 9, 1991

Dear Harris Allied:

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ENGR: How's the new CD player working?

DJ: Fine, No problem!

ENGR: Has it muted, or "Glitched" on anything?

DJ: No, nothing.

ENGR: (Long Pause) ... Are you SURE?

DJ: Yes!

(Same conversation follows with two more jocks)

ENGR to MGR: The new CD player has obviously done the trick, we haven't had a glitch yet.

MGR: Well, that's great!

ENGR: I think we need to buy this one, and a second one, so we can finally keep all our CDs in their cartridges.

MGR: Are you sure?

The new CD 10 by AudioMetrics has performed flawlessly in our operation, since the first day. I was not very confident in this type player due to past experience with another unit. The CD 10 has managed to play CDs that even very forgiving consumer units refused to cue up! I also look for better life from this unit, since the transport does not move, only the laser head.

I would imagine that the phrase "Are you sure?" will be used quite often in the near future in conversations about the CD 10!

When I tested the CD 10 in the shop, I asked for three CDs that would not play in our other unit. They all played without a single glitch in the sound! I then tapped, hit, and finally DROPPED THE PLAYER from about 2 1/2 inches and it did not lose tracking!

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Chief Engineer  
Salina FM, Inc.  
KSKG-FM

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# WCBS Resigns EBS CPCS-1 Status

► continued from page 1

going to have to prove this is not going to happen again or they should change it," Lucia said.

Some New York-area broadcasters, who depended on WCBS-FM for emergency information, harshly criticized the station's inaction during the hurricane.

"It's an ethical obligation," said John W. Caracciola, chief engineer at WDRE-FM, Westbury, N.Y., whose station monitored WCBS-FM. "What if somebody depends on our station for emergency information and we just say, 'You know what, we're in the middle of a music set and we're not going to do it.' Then somebody gets killed by a tornado. Are we liable? I think so."

"A lot of people blame the disc jockeys for EBS failure. This is not a case of a jock

being stupid. This is a case of dropping the ball at the management level," Caracciola said.

WCBS(AM), also criticized for its performance during Hurricane Bob, will continue as a CPCS-1 station, Blieberg said. That station previously admitted using a pre-recorded EBS signal tone during the hurricane which failed to trigger receivers at stations monitoring its signal.

## AM gets a break

WCBS(AM), however, requested and was granted the right to avoid a provision of New York's new EBS operational plan which requires that emergency announcements be aired twice.

The "double tone-out" provision of the New York plan requires that stations repeat EBS messages to ensure that station oper-

ating personnel monitoring down the line have time to properly record the emergency information. WCBS-AM is allowed to use a single EBS attention signal tone followed by a one-time-only transmission of the emergency message. Though legal under FCC rules, such a procedure allows the station to use less than half the amount of air time than with the "double tone-out" method.

EBS officials said that using the single tone with a one-time announcement is less effective for conveying information in actual emergencies.

In a Jan. 24 letter to New York EBS officials, WCBS(AM) VP/GM Chris J. Witting Jr. outlined the plan the station will follow in future emergencies. The station has installed, Witting said, an auto-start cassette machine on its EBS monitor which

starts recording upon receiving the two-tone attention signal. At the same time, a very loud speaker in the newsroom alerts station personnel that an EBS signal is being received.

If the announcement is for an actual emergency, Witting said, the cassette message is to be dubbed onto a cart. Then the announcement is made: "We interrupt this program because of an emergency. This is not a test." An operator then activates the EBS attention signal tones and a second announcement is made introducing the emergency message. Then the cart with the actual emergency message is played. After playback of the announcement, the station returns to normal programming.

WCBS-FM will now monitor WFAN for EBS messages. WCBS-AM also will monitor WFAN until equipment is installed that will allow the station to monitor the new New York State EBS SATNET line.

# VOA: Still Talking at 50

► continued from page 1

programming. In 1990, VOA began a series called "Democracy in Action." The one-year series of stories "reported how to live and work in a free society with a market economy," Davis explained. "It covered how to get a loan, how to start a newspaper . . . all things people in Eastern Europe knew nothing about."

Such intelligent, relevant programming—along with objective, accurate news reporting—has increasingly won kudos for VOA. But some still say VOA's efforts are tainted because it is government financed. During its first decade, said a recent VOA historical booklet, Congress saw VOA "as an instrument of U.S. foreign policy." As the Cold War escalated, the government wanted an official channel to air its views.

But once the McCarthy era ended, VOA's leaders began to redefine its role as a more independent news organization. The VOA Charter, endorsed in 1960 and signed into law in 1976, made balanced, truthful news reporting a man-

date for VOA. From that point on, the proof was in the coverage.

## Technological catch-up

VOA's growth and change also includes an on-going effort to update its technological facilities. Only a decade ago, many of its transmitters were more than 30 years old, some were past 40 and almost none could produce the 500,000 W signals being generated by VOA's competitors (numbering more than 160).

To date, the modernization program has yielded a dozen new state-of-the-art studios, a new 200-channel Master Control Complex and a Network Control Center to coordinate and direct VOA's domestic and overseas relay stations. A recently installed Satellite Interconnect System provides for clearer and more reliable feeds from VOA's Washington headquarters to transmitter stations worldwide.

Construction of two major shortwave stations—one in Morocco and one in Thailand—has begun, VOA Chief of Staff

Joe Bruns said, and the Voice has contracted with Marconi-Cincinnati Electronics to provide 500 kW transmitters to both stations. VOA is also refurbishing stations in Greenville, S.C., Bethany, Ohio, Belize and Sri Lanka.

Unfortunately, the government's budget woes have slowed the pace of technological improvement, Bruns said.

## A global future

VOA plans to increase its live audience in the 1990s by seeking worldwide affiliates in local AM and FM stations.

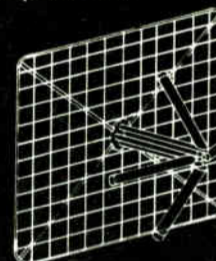
The Voice also recently introduced its second around-the-clock regional satellite-fed broadcast channel, called WORLD-SOURCE (the first, VOA Europe, began operations in 1985 and offers a mix of contemporary hit music and special English-language programming).

WORLDSOURCE provides news, cultural programming and features in 19 languages and "special English".

"We're constantly aware that radio has to compete with television and the VCR," Davis said. VOA's strategy includes airing more participatory formats, such as call-in shows and how-to programs.

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# Site Problems Cause SEDAT Muting

by Frank Beacham

**NEW YORK** Last summer, ABC and CBS Radio began the ambitious task of converting their networks to Scientific-Atlanta's SEDAT digital audio system. For many local station engineers the process has been a rough-and-tumble education in satellite technology. For the networks, the task has revealed significant maintenance neglect at hundreds of radio station satellite sites.

"You make certain assumptions that there is a perfect world of satellite receiving stations out there," said Robert Donnelly, general manager of satellite systems for ABC Radio Networks. "This has been a rather monumental task."

The joint venture between the two radio networks to upgrade to SEDAT represented the second major breakthrough in the satellite transmission of digital sound by significantly increasing the sonic quality and available channel "real estate" on satellites.

## New technology

SEDAT replaces DATS, also a Scientific-Atlanta technology, as the first widespread satellite application for digital audio. The SEDAT system, which went into effect July 29, 1991, allowed ABC to move from 19- to 46-channel capability while CBS increased from six to 11 channels. SEDAT provides up to four times the satellite transponder capacity of DATS, plus 20 kHz-quality sound.

On paper, the switchover to SEDAT sounded simple. Assuming their satellite

receive system was "in spec," station engineers were simply to remove the old DATS card from their existing receiver and replace it with a SEDAT card.

Though more than 3,000 stations performed the installation successfully, several hundred stations have experienced problems—mostly RF-related—in the changeover, Donnelly said. A special SEDAT "Help Desk" (phone number 212-456-5556) at ABC is working through those problems on a case by case basis.

"There have been some C-band RF problems," said Kent Malinowski, director of Broadcast Radio & Data Systems for Scientific-Atlanta. "Some sites have been neglected over time. You know what's happened to radio engineering in the past with reliance on subcontractors and contract engineers. Very little preventive maintenance was done in a lot of cases."

Scientific-Atlanta engineers have visited many station sites, Malinowski said. They found bird nests inside field horns, damaged antennas, water in coax cables and interference from nearby microwave units. Some sites originally installed very cheap, below spec antennas which had never worked properly, he said.

## Silence instead of pops

"With DATS, you heard clicks and pops when you lost the signal," Malinowski said. "ABC had asked us to put in a mute circuit in the new decoders so it would mute the sound when a problem occurred. Now when the signal is lost you are replacing a click and a pop with a mute."

"In some cases stations have lived with

and tolerated eight years of clicks and pops on the air and when you go to muting they say 'wait a minute, this thing doesn't work.' Because the symptoms are associated with the new card, some blame it unfairly on SEDAT," he said.

Such intermittent muting with SEDAT has plagued KGNC-AM in Amarillo, Texas for several months. CE Tim Guentz, who said he didn't call the SEDAT "Help Desk" until recently, initially blamed the problem on the new SEDAT card.

To help engineers like Guentz who are having problems solving their site problems, Scientific-Atlanta is offering a free PROM which shortens the mute time of the SEDAT system.

"It's called faster re-acquisition," Malinowski said. "It still will mute but it's a much shorter mute. It in no way changes or affects the algorithm. And it does not fix anything. You would hope that the radio station will fix the problem and not fix the symptom."

## CEs were baffled

Since Guentz installed the new PROM, his muting problem has seemed to disappear. Now, with Scientific-Atlanta's help, Guentz is searching for an underlying RF

problem. But he said he never heard clicks and pops with the old DATS card.

Donnelly said ABC has sent the PROM to several hundred stations, but he warned that "it is not a magic pill. It is not a software upgrade. It's only to be administered when everything else fails. This is not a cure for a badly managed site."

"The SEDAT (PROM) card is recovering faster but hasn't made the errors go away," Donnelly explained. "The errors will be present on a digital bus if there is noise in the digital channel. This noise can be coming from a lowering of gain, an absence of a good signal, a mis-pointed antenna, corrosion in the cable, terrestrial interference . . . many things."

Some station engineers have returned SEDAT cards to ABC with complaints that they are defective, Donnelly said. Each returned card, however, was tested by ABC technicians and 98 percent of the cards were found to be functioning properly. "The SEDAT cards are clearly not a problem."

Malinowski also emphasized that the problems are not related to the SEDAT technology. "I don't want the perception to get out that there is a SEDAT problem. These are C-band RF problems. This is something the networks have to deal with. It's been an increasing challenge to a network operation over the years as the level of engineering has decreased at some of those stations."

# NRSC Examines RDS

by John Gatski

**WASHINGTON** The National Radio Systems Committee (NRSC) and its subcommittees have been busy so far in 1992, including work on the Radio Data System (RDS) standard and promotion of the AMAX receiver standard.

The full NRSC and its RDS subcommittee met at the Winter Consumer Electronics Show (WCES). The RDS subcommittee also met in Washington last month and was scheduled to meet here this month.

According to the NAB's John Marino, the subcommittee is nearly finished with its work on a U.S. RDS standard. RDS is the European-developed technology that places a digital subcarrier on an FM (or AM's) main carrier that contains a variety of information. Via the subcarrier information, an RDS-equipped receiver can automatically lock onto a format, receive weather and traffic reports, display call letters and frequency, and switch between transmitters.

The FCC also is considering the technology as a replacement for the current Emergency Broadcast System.

## Still in the works

Although the U.S. RDS standard for FM is in draft form, subcommittee members are still working on the format (PTY) code designations, and some questions surrounding the technology's compatibility with Cue Paging service still remain.

Cue Paging is a popular paging service carried by approximately 270 U.S. radio stations. Also a 57 kHz subcarrier, the Cue system was found to inhibit some of the RDS receiver functions under the original European spec, such as the time it takes to display

text. Cue, however, made some software and design changes in late 1991 that were said to eliminate the adverse effects.

A modified RDS standard incorporating the Cue changes was put forth, but the specifications were placed in the appendix of the draft. According to Marino, Cue was not pleased that the Cue specifications were placed only in the appendix of the draft standard, and not in the main body. Other subgroup members argued that because the Cue specifications are technical, the appendix is the appropriate place to locate the information.

Marino said the issue was not completely resolved at the February meeting, but members were hoping to resolve it by the March meeting.

Following the March meeting, the RDS subcommittee was to forward the draft standard on to the full NRSC, which is scheduled to vote on it at the NAB convention.

## AMAX radios

With regard to AMAX, Marino said there was a lot of interest at the AMAX booth at CES. The Electronic Industries Association (EIA) and NAB agreed to promote the voluntary AM radio standard last year. AMAX-certified radios will have extended frequency response, switchable noise blanking, expanded band, variable bandwidth and an external antenna connection.

Marino noted that few AMAX receivers are on the market, but receiver companies have indicated they are not likely to start producing them in quantity by the end of the year.

Company officials, however, previously said that the AMAX production cycle will depend on how much demand there is for the improved radios.

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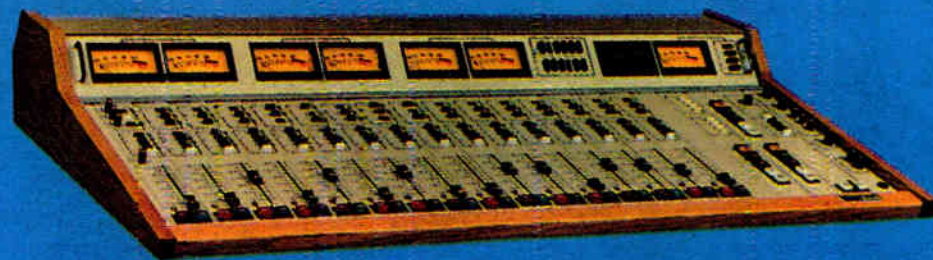
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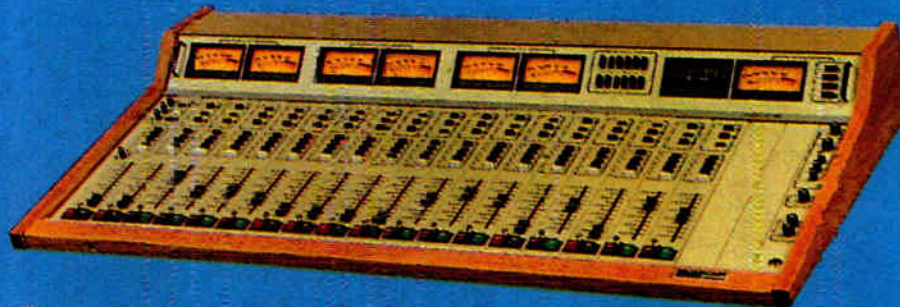




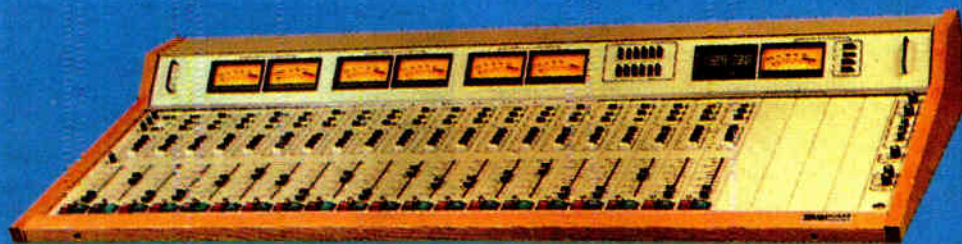
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## Texar Founder Glen Clark Joins RF Company CCA

by John Gatski

**ATLANTA** Last year, RF design engineer Glen Clark, who turned Texar into a million-dollar company in seven years and then sold it, decided it was time to get back into manufacturing.

While at the helm of Texar from 1981-'88, Clark helped propel audio processing into the digital age. He then formed an Atlanta consulting firm that pushed the benefits of computer-designed antenna arrays.

Satisfied with the consulting business, but restless, Clark took a look at the transmitter side of the business in 1991, and came away with the impression that it was a little behind the times.

After some negotiating with CCA President Ron Baker throughout late 1991, Clark decided to channel his energies into the long-time transmitter manufacturer.

"I was sitting at my desk one day looking at the transmitter market and realized things were not being done any differently than when I was in high school," recalled Clark, a former chief engineer with WLS-FM who went on to get his engineering degree from Penn State.

Designer of the Audio Prism and the original Lazer (both designs went to Gentner Electronics when he sold Texar in 1988), Clark's approach to RF design has always been considered cutting edge, according to engineers who have used his products and services.

During his three years of consulting, he familiarized broadcasters with the use of "neural networks"—the use of computers to plot signal patterns of broadcast stations and design arrays to fill in signal nulls. Several clients said they were able to provide more coverage using fewer antennas.

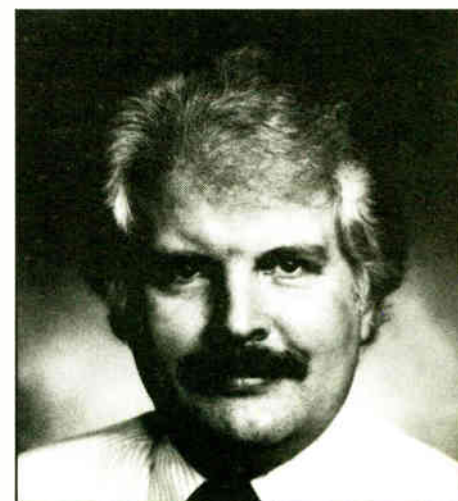
Now that he is in the transmitter design business, Clark said there are plenty of new areas to keep him busy. High powered solid state FM transmission, AM modulation and transmitter efficiency are among the RF issues in which broadcasters are interested, he added.

Clark said that high power solid state AM transmitters are evolving as reliable power-efficient products, but high power FM solid state units have not quite arrived. "The tube type transmitters are still going

to be more efficient right now, but we will get there," Clark said.

Although solid state products have acquired a "more reliable" label, wholesale application of that reputation is undeserved, according to Clark, because some solid state components can be very expensive to purchase and install if maintenance is required.

With the likelihood of in-band digital audio broadcasting (DAB), Clark sees a bright future for RF products, a prospect that is less likely with an out-of-



CCA's Glen Clark

band DAB solution.

In fact, when the NAB announced in early 1991 that it was pursuing the European Eureka technology for implementation in the U.S., a lot of equipment companies feared a major shift away from buying new products for awhile, Clark said. That apparently is not the case now that substantial research is being conducted on in-band, which will allow existing broadcasters and manufacturers to become major players, he added.

What is Clark's first project for CCA? Since he literally had been on the job for only a few days when *RW* interviewed him, Clark said it was too early to disclose any specific product designs in the pipeline.

But Clark said he was excited about working at CCA and predicted that several innovative products will be developed within the next few years. "A lot of people are going to be surprised by CCA."

## NRB Bound for LA in '93

by John Gatski

**WASHINGTON** Over the years, equipment manufacturers who wanted to get a jump on their competition would unveil a new product at the annual National Religious Broadcasters (NRB) convention in Washington, which is usually two months before the national NAB show.

Because the show is moving to Los Angeles in 1993, however, some equipment companies will have to spend a few more dollars in order to go west to unveil any new products.

NRB Spokesman Ron Kopczik said the show will return to Washington in 1993, but the NRB has decided to move it to the Mid-

west or to a west coast location every other year. The gathering has been held in Washington for 25 years, the last 12 at the Washington Sheraton.

Several equipment company officials, especially those located in the east, said they wished the show would stay in Washington because it has been a good show for generating sales and the expenses are lower than shows further west.

"I wish they would keep it here," one salesman said. "It's cheap to come here."

New or recently introduced products seen at the 1992 NRB show included Broadcast Electronics AM-5 transmitter, the Dynamax DCRI000 from Fidelipac, Ra-

continued on page 15 ►

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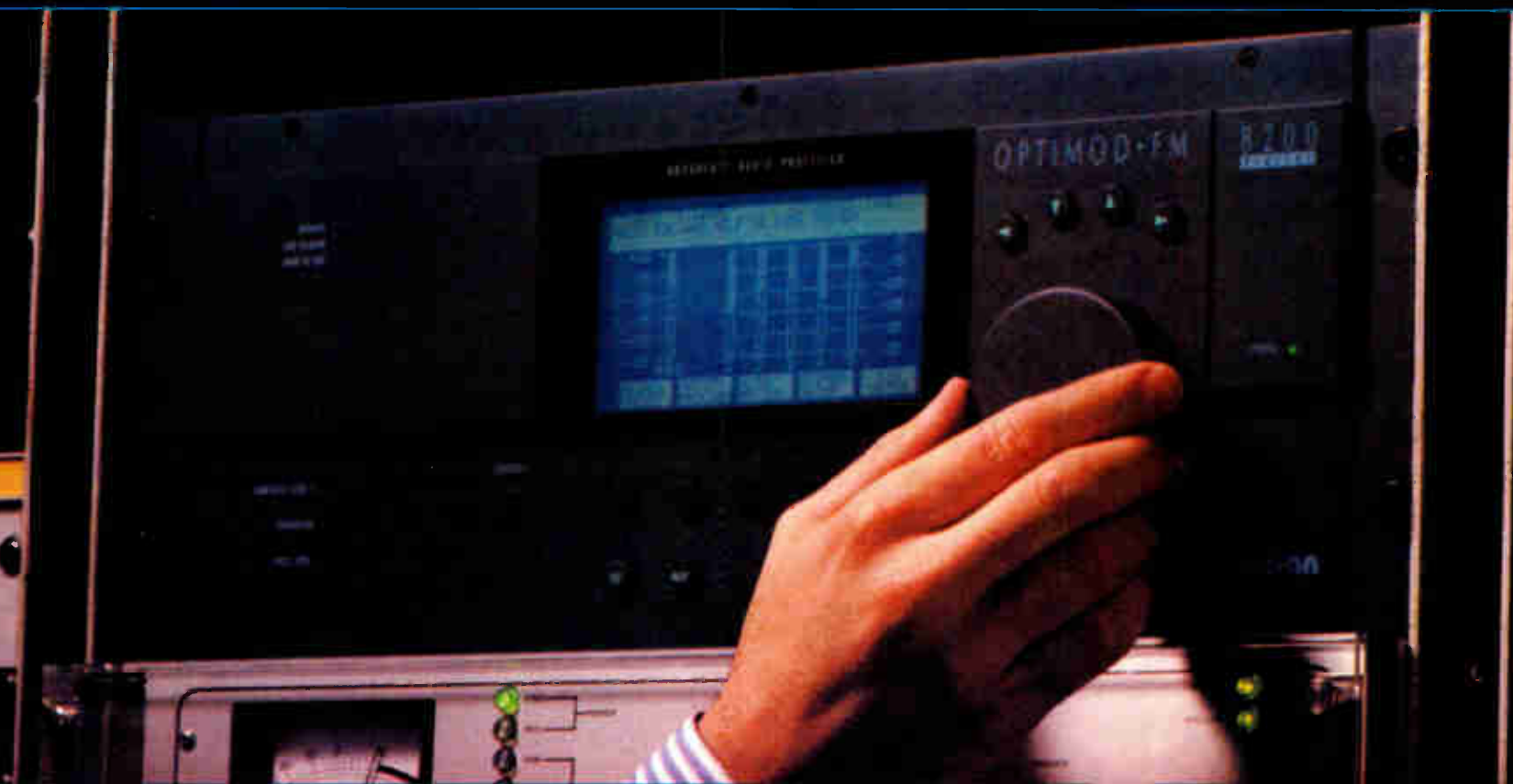
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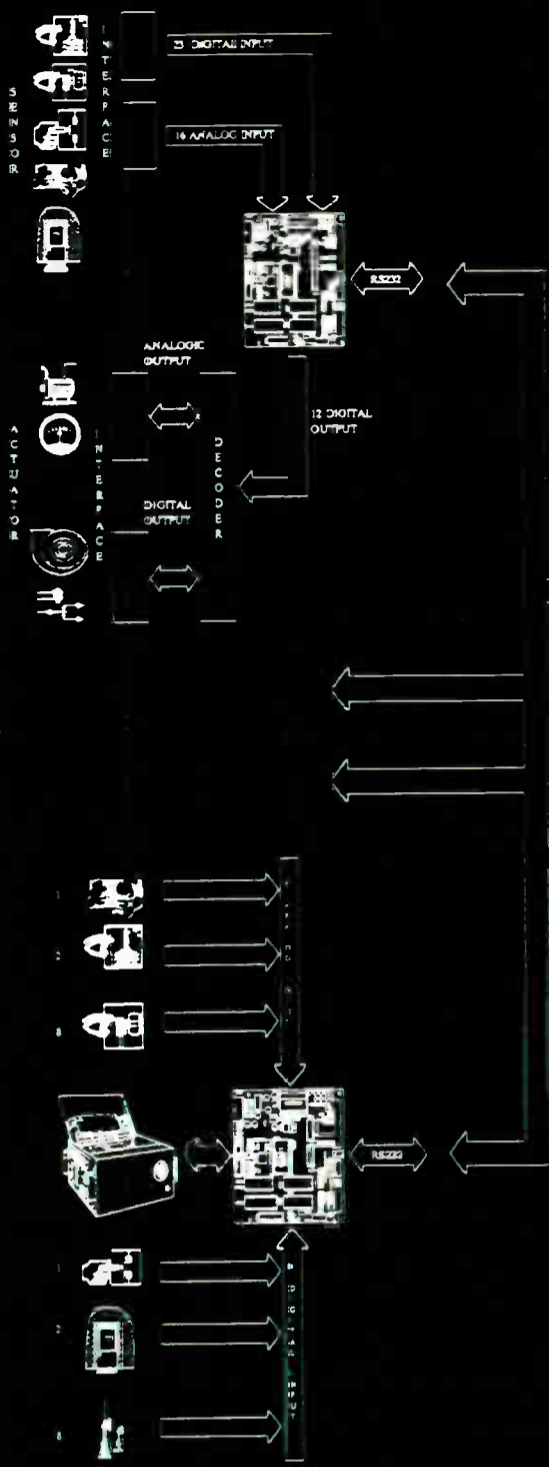
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World Radio History

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- ◆ the HELP function: an online troubleshooting manual that guides the user to assess the causes of malfunctions, and in some cases comes up with solutions.
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Please call or write for more information on the ELENOS RF DIAGNOSTIC system today.

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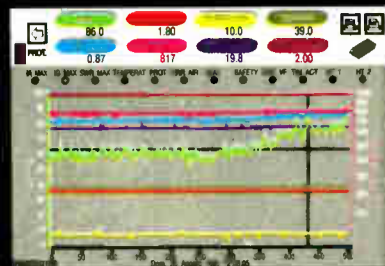
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**MULTI:** features a plotted graph displaying the daily parameter readings. You also have the options of selecting weekly, monthly, for a single parameter or for every parameter simultaneously. It is also possible to have this in bar graph form and to print the data.

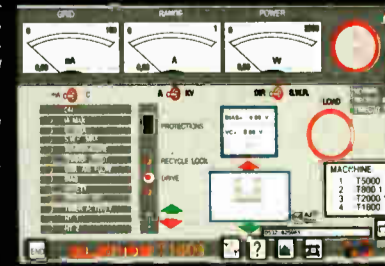
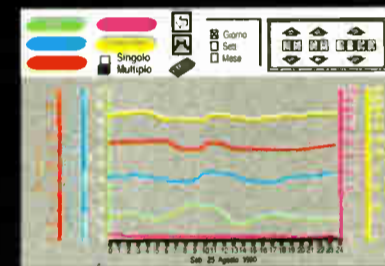
**OTHERDAT, OTHER INP:** with this feature you can display preset values. The green led shows that the values are within the set threshold limits. It is possible to redefine the scale and the alarm thresholds for maximum and minimum presettings on every analog instrument. It is also possible to define the description and the enabling and to disable the measurements.

**RFSETUP:** this feature allows a transmitting site with more than one transmitter to work on the same communication line.

**T1800:** if the transmitter controlled is made by Elenos, the monitor displays the front panel with the meters exactly as they are. In addition to the information displayed on the front panel, it is possible to have other functions displayed at the test points inside the transmitter. Some functions are remote controllable.



**COMPROT:** features a screen that displays a protection event triggered by the grid power. The cursor on one point of the graph displays the pertinent values of the plotted parameters.



**ALL THE LOGOS:** this feature provides the possibility of adding your station's logo on installation of the software.

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# Going to the WELL More Than Once

by Nancy Reist

**SAN FRANCISCO** People are gradually getting used to the idea that computers are replacing everything in radio from razor blades to consoles . . . but the corner taproom, too?

## FM Starts Own BBS

by Nancy Reist

**SAN FRANCISCO** San Francisco's KALW (FM) has implemented a bulletin board service (BBS) of its own. Users have access to updated program information and also have the opportunity to provide feedback and ideas.

Station CE, Dave Evans, started the BBS three years ago to "turn a one-way radio station into a sort of two-way communication."

The listeners, supporters, and subscribers to the station can communicate with the staff and each other.

Evans runs the BBS out of his home on an IBM 386. He is pleased with the software he uses, Mustang Software's Wildcat!™. He said Wildcat! can support up to 250 calls, though KALW currently has only two phone lines.

It also can run a statistical analysis of questions asked of the users. So, for example, Evans can ask listeners whether they would like to hear more of a certain kind of programming and when they'd like to hear it.

KALW is a public station and broadcasts programs from a number of independent producers. Some of these producers log onto the BBS regularly and interact with listeners.

One producer also posts information about topics and guests for upcoming programs. The publicity person can download these postings, reformat them and send them out as press releases. Evans said it's much better than faxing, because no one nothing is retyped, and the wording and spelling are exactly the way the producer wants it.

In conjunction with a monthly program, Amnesty International Reports, the BBS has a conference area dedicated to Amnesty International issues. It includes letters that can be downloaded, reworded and sent to leaders of countries Amnesty International has targeted as human rights violators.

Evans said KALW's BBS nearly runs itself. To maintain it, he answers mail, updates bulletins, and weeds out the occasional practical jokers. He volunteers the computer, phone lines, and his time for the endeavor and says he regards it as a fun and interesting hobby.

"I consider this a service of the radio station," Evans explained. "In a lot of ways it's very much like the original meaning of bulletin board, where you went to a town hall and you posted a message for others to see."

That's the analogy that keeps popping up when radio producers describe the Whole Earth Electronic Link, a computer bulletin board service (BBS) popularly known as the "WELL." They don't claim the WELL delivers their favorite brew, but they do describe it as a place to "hang out," find collaborators, discuss production ideas, solicit feedback, share funding and job tips, learn about new technology, and keep track of friends around the world.

The WELL is based in Sausalito, north of San Francisco, but subscribers come from all over the country. Recently connected to Internet, the WELL is also beginning to attract overseas subscribers.

Currently, the WELL is run on a Sequent mini-computer and can handle 64 users simultaneously, but the BBS's head of customer support, Matisse Enzer, expects service to be upgraded and its capacity increased this spring.

### Exchanging information

Users can exchange private messages through electronic mail, or they can post messages in any of the WELL's hundred-plus public conferences. Conferences focus on a wide range of subjects including politics, health, the environment, music and radio. Each conference is divided into topics. Users select and read topics that interest them and either pass or add their own input.

The radio conference is frequented by both radio professionals and dedicated

listeners. The emphasis is clearly public radio, though topics such as the quality of talk radio, the art and ethics of interviewing, tips for field recording, and the future of DAB also are popular.

Jay Allison co-hosts the radio conference. He is an independent producer living on Cape Cod, Mass. and considers the WELL a comfortable way to communicate with people around the country.

"I'll browse through the different conferences, find interesting people and contact them. I've done a bunch of collaborating with different people. Right now I'm working with Jon Carroll, a newspaper columnist for the San Francisco Chronicle. He does interviews and sends them back to me and then we work up a script and a piece for 'All Things Considered' through E-mail."

The radio conference has several topics dedicated to specific programs. Stephen Hill, producer of the nationally-syndicated 'Hearts of Space,' has two topics for his program. He posts his playlists on one and interacts with his listeners on the other. He also exchanges E-mail with a dozen other radio producers.

### Valuable exchanges

Hill said the WELL was a revelation for him when he started using it a year and a half ago. "It's an opportunity to meet and have exchanges with a bunch of really intelligent people who care about what they're doing. As far as the radio confer-

ence is concerned, I've found it has expanded my knowledge of my profession and deepened my relationships with my peers. In that sense I find it enormously valuable."



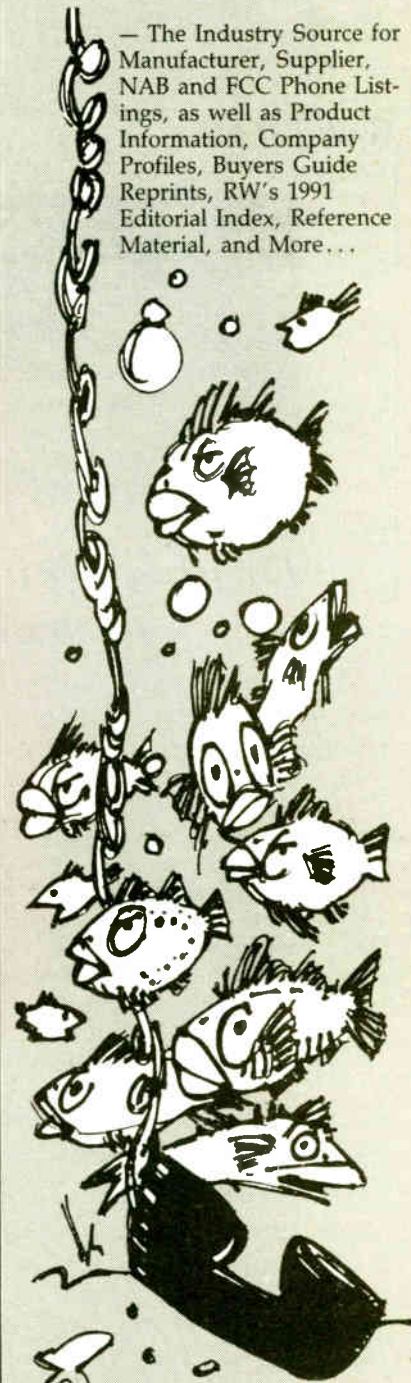
David Gans produces the nationally-syndicated Grateful Dead Hour. He started an extremely popular conference about the Grateful Dead in 1986, which eventually led to an entire conference based on his show. He gets listener comments, requests, and information about station problems.

"As a source of feedback, it's tops because it's interactive. I get messages from all across the country via the WELL and I can respond to them immediately. I can get feedback pretty quickly too. During the

continued on page 15 ►

## Fishing For A Phone Number? Catch it in the 1992 Radio World Directory Issue

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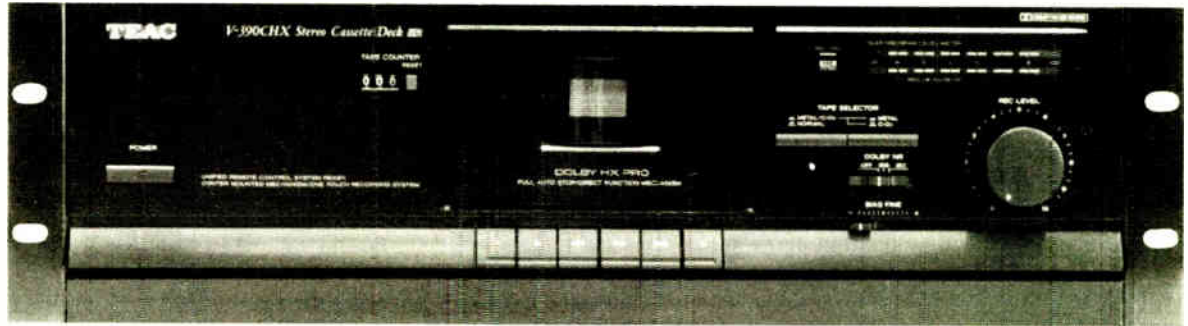
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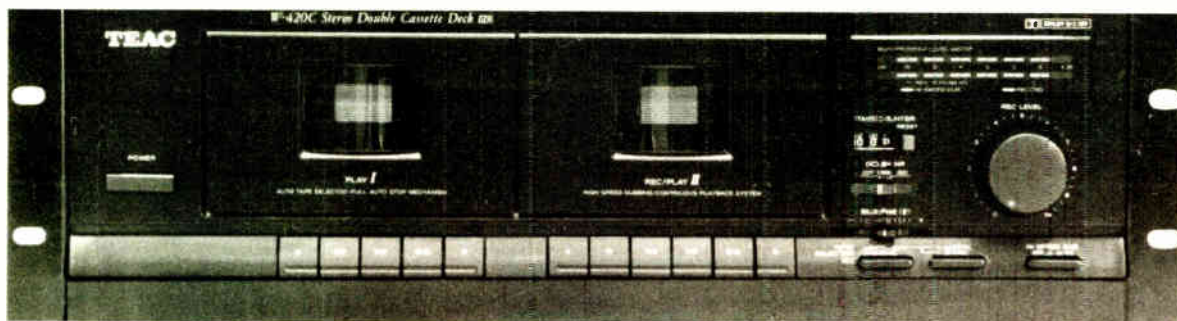
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World Radio History

# Los Angeles Planned as Site for 1993 NRB Show

► continued from page 10

Radio Systems' Analog Clock System and RS-700 low-cost DAT recorder, and Comrex's talk remote system.

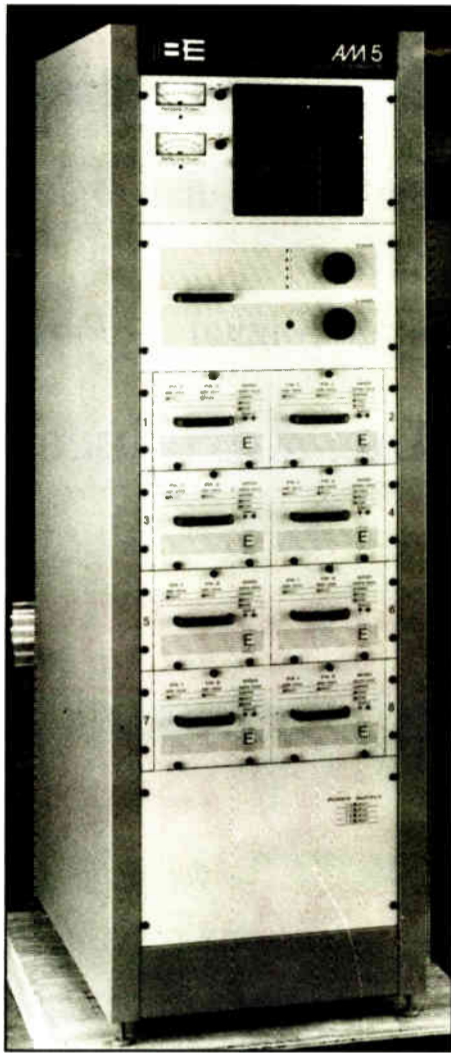
The AM-5 is hot off the assembly line, according to BE. The unit is a 5 kW version of the AM-1, 1 kW solid state transmitter introduced last year. It includes a built-in C-QUAM AM stereo exciter, Class E power modules, high efficiency redundant switching power supplies and "Star" combiner network.

Radio Systems' new analog master clock system, a low cost clock system, features a digital divider and pulse synchro board on each clock, allowing each clock to be "frozen," set individually and then sync started from the master impulse driver. The rack-mountable driver has battery back-up and enables the system to reference any 1 kHz or 10 kHz TTL, C-MOS or balanced external sync source.

Fidelipac displayed the Dynamax DCRI000 digital cart machine, slated for delivery in mid-February.

The unit enables disc recording with 40 Hz to 20 kHz audio at a 44.1 kHz sampling rate. Storage capacities range up to 13.3 megabytes.

Another product of note at NRB was the Comrex Talk Console, which is now out of the prototype stage, according to the company. The console combines a two-channel mixer with two phone lines. It conferences the two phone lines with two studio channels. The dial/cue feature enables the host to talk to a caller off the air and dial or answer a phone line.



Broadcast Electronics introduced the AM-5 transmitter at the 1992 NRB Convention.

# Users Go to the WELL

► continued from page 13

New Year's Eve broadcast, we had a topic open for people to respond to it while it was happening," Gans said.

Daniel del Solar, general manager of KALW (FM) in San Francisco, is another WELL enthusiast. He uses the WELL to keep up with news, politics and specific interests. "When I log onto the WELL I am listening to, among others, national level radio producers in Massachusetts; New York; Los Angeles; and Washington, D.C.; potential funders of radio programs, and to other dedicated individuals who are the democratic foundation of this society."

### AIR conference

Allison hosts a private conference on the WELL for members of the Association of Independents in Radio (AIR). Producers who are AIR members use the conference to discuss program ideas and technical information and to solicit feedback from other professionals. They exchange tips about interview and recording techniques, grant writing and marketing.

The AIR board of directors has a private conference of its own. The WELL is an efficient place for them to interact, since the board members live in several different states.

Allison explained that they even write grant proposals together on the WELL. "Someone posts a rough draft and we call everybody and say 'get on the WELL and work on this thing.' Everybody calls up,

downloads the application, rewrites it, uploads it, and the thing keeps evolving. It's like ants swarming over a piece of bread. Pretty soon we've hammered out an application that everyone had a chance to see and have input into."


Some critics of the WELL complain that it creates an information elite composed of people who are comfortable with computers. Since the WELL is command driven, it may intimidate new users who are used to relying on menus. Allison acknowledges that the WELL may have a "steep learning curve," but he contends "it's enormously easy once you get the hang of it."

Del Solar agreed. He said he doesn't consider himself to be computer literate but he's very comfortable using the WELL. "You learn fewer than 10 commands and you've got it," he said.

Local users pay a \$10 monthly subscription fee and an additional \$2 for each hour they're on line. Long-distance users can reduce their telephone fees by connecting through Internet, CompuServe's Packet Network, or PC Pursuit. They also can cut costs by downloading mail and new postings in the conferences that interest them into a buffer and then signing off to read and write responses. A program called Sweeper facilitates this process for PC users.

The WELL can be reached by modem at 415-332-6106 or by voice at 415-332-4335.

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Thanks for Steve, Dave, and Ken who really care about me and my old 835G.

Yours Truly,  
*Bill*  
William H. "Bill" Payne  
President & Chief Engineer  
Senior Broadcast Engineer

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January 9, 1992

Mr. Steve Claterbaugh,  
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Best regards,  
*Sheila R. East*  
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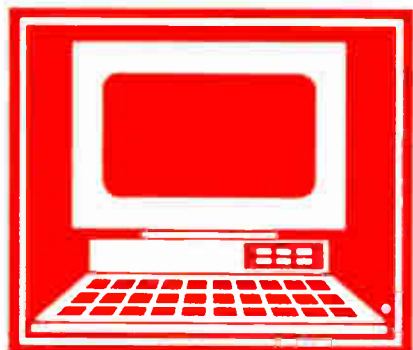
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# Combining Parallel and Series Circuits in Wiring

This is the last in a 10-part series called DC Fundamentals. Northern Virginia Community College will offer 1.2 CEUs (Continuing Education Units) to registered students who successfully complete the course and an examination mailed at its conclusion.

To register, contact the Director of Continuing Education, Annandale Campus, 8333 Little River Turnpike, Annandale, Va. 22003, or call 703-323-3159. The fee for the course is \$30.

by Ed Montgomery

## Part X

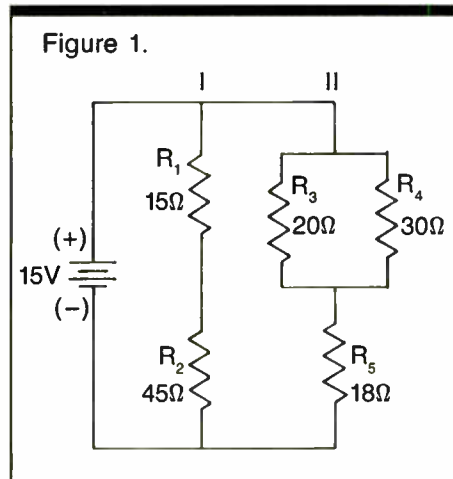
**ANNANDALE, Va.** In most instances, electrical and electronic wiring contain neither series nor parallel circuits but a combination of both. This is necessary to achieve proper operation of components and equipment. The series-parallel circuit includes the characteristics of both the series and parallel circuit in one wiring configuration.

Table 1 is a recapitulation of the characteristics of series and parallel circuits. This information must be known

R3 and R4 are in parallel. Using the parallel resistance formula, the total resistance of these two components is 12 Ohms.

In Branch II, 12 Ohms is in series with R5; a total of 30 Ohms is present throughout the branch. Figure 2 is a simplification of this branch.

Branch I, containing 60 Ohms, is in



parallel with Branch II, which contains 30 Ohms. This is illustrated in Figure 3. The total resistance of the series-parallel circuit can be calculated using the parallel resistance formula: 20 Ohms.

Branch I has a total resistance of 60 Ohms. R1 and R2 are in series connected across 15 Volts. Using Ohm's Law, the total current can be calculated—0.25 Ampere or 250 milliamps.

Branch II is also connected across 15 Volts. Using Ohm's Law, the total current through the branch can be calculated: 500 milliamps. Total current in the entire circuit is the sum of Branch I and Branch II—0.75 Ampere or 750 milliamps.

Individual voltage drops can now be calculated using Ohm's Law. Branch I contains R1 and R2 in series, the voltage drop across each is:  $V_1=3.75$  Volts,

continued on page 18 ►

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\*Radio Technology Component Grand Prix '88, CD Division, Stereo Sound Component of the Year (1988) & Best Buy (1988)

| Table 1. Lesson 10   |   |
|--|---|
| Circuit Characteristics  |   |
| Series   | Parallel  |
| Voltage— $V_T$ = The sum of the individual voltage drops           | Voltage is the same across all components   |
| Current—Constant or uniform throughout the circuit                 | $I_T$ = The sum of the individual branch currents                                       |
| Resistance— $R_T$ = The sum of the individual resistances          | $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots + \frac{1}{R_N}$ |
| Power— $P_T$ = The sum of the individual powers of each component. | $P_T$ = The sum of the individual powers of each component.                             |

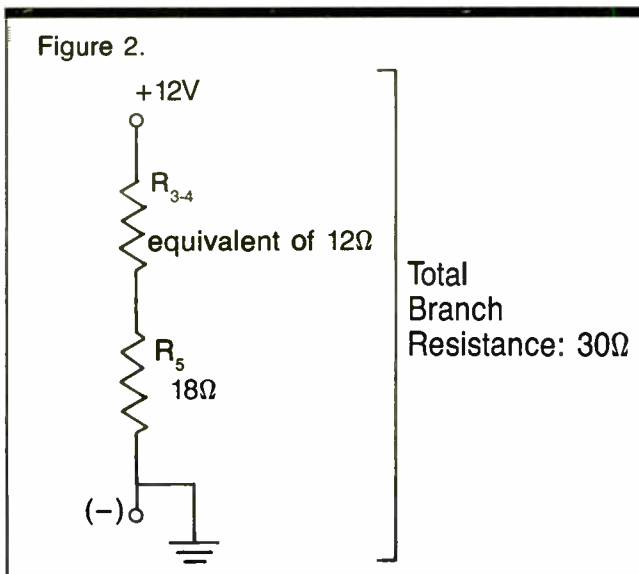
to analyze the series-parallel circuit illustrated in Figure 1. The circuit has a number of series and parallel circuit characteristics.

Branch I contains R1 and R2 in series with each other. In Branch II, R3 and R4 are in parallel with each other, but these two resistors are in series with R5.

Solving for voltage, current, and resistance in a series-parallel circuit requires one to simplify the circuit. Determining total resistance is a good place to start, and we'll do so by dissecting the circuit.

### Resistance

To simplify the circuit in Figure 1, first combine the series resistances in Branch I, resulting in a total of 60 Ohms. Branch II can next be simplified.





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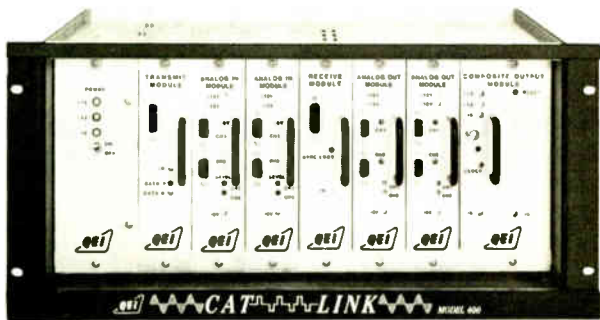
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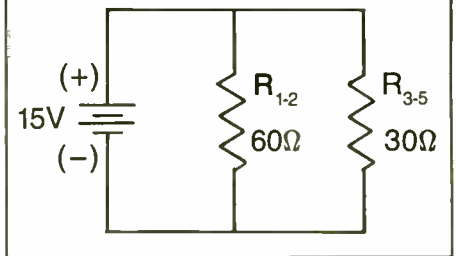
# Combining Parallel Circuits And Series Circuits in Wiring

► continued from page 17

V<sub>2</sub>=11.25 Volts. The sum of these two voltage drops equals 15 Volts.

Branch I contains R<sub>3</sub> and R<sub>4</sub> in parallel with each other but in series with R<sub>5</sub>. The voltage drop across R<sub>3</sub> and R<sub>4</sub> will be the same: V<sub>3-4</sub>=6 Volts, V<sub>5</sub>=9 Volts. Although R<sub>3</sub> and R<sub>4</sub> have the same voltage drop, their individual currents will be different because they have different resistance

Figure 3.



### Answer to Lesson 9.

$$R_T = \frac{1}{\frac{1}{600} + \frac{1}{150} + \frac{1}{400} + \frac{1}{100}} = 48 \text{ Ohms}$$

$$I_T = \frac{V}{R_T} = \frac{96}{48} = 2 \text{ Amperes}$$

$$I_1 = \frac{V}{R_1} = \frac{96}{600} = 0.16 \text{ Amperes}$$

$$I_2 = \frac{V}{R_2} = \frac{96}{150} = 0.64 \text{ Amperes}$$

$$I_3 = \frac{V}{R_3} = \frac{96}{400} = 0.24 \text{ Amperes}$$

values.

Using the voltage drop across these resistors (6 Volts), Ohm's Law can be used to calculate the individual currents: I<sub>3</sub>=300 milliamps and I<sub>4</sub>=200 milliamps.

### Power

Power can be calculated using Watt's Law to determine the amount of power each component uses, and taking the sum of all individual powers to determine total power in the circuit. Total power in this example is 11.25 Watts.

All calculations for voltage, current, resistance, and power are il-

lustrated in Table 2.

This concludes the DC Fundamentals course. A multiple-choice test will be mailed to registered students by March 15, 1992. The test answer sheet should be returned as soon as possible for grading. Results and certificates from Northern Virginia Community College should be mailed back to you no later than April 15, 1992.

□□□

Ed Montgomery is a communications teacher at Thomas Jefferson High School for Science and Technology. He has taught broadcast engineering at Northern Virginia Community College and worked as a broadcast engineer for several radio stations.

Table 2. Lesson 10

| Circuit Analysis  |   |
|---|---|
| Branch I  | Branch II                                 |
| $I_T = \frac{15}{60} = .25 \text{ Ampere}$                  | $I_T = \frac{15}{30} = .5 \text{ Ampere}$ |
| $V_1 = (15)(.25) = 3.75 \text{ Volts}$                      | $V_{3-4} = (.5)(12) = 6 \text{ Volts}$    |
| $V_2 = (15)(.25) = 11.25 \text{ Volts}$                     | $V_5 = (.5)(18) = 9 \text{ Volts}$        |
|   | $I_3 = \frac{6}{20} = .3 \text{ Ampere}$  |
|   | $I_4 = \frac{6}{30} = .2 \text{ Ampere}$  |
| Total Current = Branch I+Branch II<br>= .25+.5 = .75 Ampere |   |
| Total Resistance = $\frac{15}{.75} = 20 \text{ Ohms}$       |   |
| Total Power = (15)(.75) = 11.25 Watts                       |   |

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  - D. Programming/production
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- 019 041 063 085 107 129 151
- 020 042 064 086 108 130 152
- 021 043 065 087 109 131 153
- 022 044 066 088 110 132 154

INSIGHT ON RULES

# Doing Self-Inspections by the Book

by Harold Hallikainen

**SAN LUIS OBISPO, Calif.** Jim McDonald of Wind River Broadcast Center (phone 303-669-3442) sent me a copy of a two-page form, "Broadcast Station—Self Inspection" issued by the Denver office of the FCC. This form is a list of various items to check against the associated rule section. Send me a SASE if you want a copy of this checklist.

Wind River is also preparing a custom "Big Book" for stations. This book will be a station instruction manual. It will include details on the operation, maintenance and troubleshooting of studio equipment (how to get back on the air *now*).

The book will also contain station logs, equipment performance measurements, transmitter (and remote control) operating instructions, etc. The idea is that everything required to operate a station and simultaneously satisfy the FCC will be included in the book.

**By the book**

During an FCC inspection, the *book* is turned over, answering many related questions. It is, of course, necessary to have operators actually read the book and know what the instructions mean. Additional volumes of the book include the FCC regulations and the Public Inspection File.

This looks like an interesting project. I'd expect other consultants and contract engineers to offer similar services. It's more than just fixing what's broken or answering specific questions the station manager may have.

The book is akin to what I imagine the FCC had in mind for the designated chief operator. The chief operator should ensure that the numerous FCC requirements are being met.

If the chief operator does not wish to get involved in the public inspection file, program and issues lists, ownership reports, EEO reports, etc., he/she should ensure that *someone* is indeed fulfilling these responsibilities (and knows what the responsibilities are). Often, the chief operator is the one handy reference on FCC rules that station employees have.

In December, we left off on our discussion of the FCC's proposed self-inspection form with the review of the public inspection file. If you'd like a copy of the 20-page FCC self-inspection report, you can write or contact me.

**Station logs**

The FCC report concentrates on tower light logging. This and EBS are the only *required* routine entries for most stations. In order to demonstrate compliance with other rules, however, I'd suggest stations continue to operate under the "old rules," which required operator signatures when going on duty and again when going off duty—demonstrating the required licensed operator was on duty—and regular recording of various transmitter parameters.

The parameters are typically those required to determine power, both by the direct and indirect methods (although FM stations determining power by the indirect method were not required to log a direct power reading) and antenna monitor indications for directional AM stations. It would appear that any documentation you can generate that shows the station operates in compliance the vast majority of the

time, *and* is frequently checking its operation to ensure compliance, would be helpful during an inspection.

The self-inspection report asks "What method is used to check your antenna tower lights for outages and how are outages recorded?" Regulation 17.47 requires an inspection of tower lights at least every 24 hours.

Tower inspections may be made visually or by an indicator that registers "any failure of such lights." Can your operators determine that a steady-burning side light has failed?

As an alternative to daily inspection,

17.47 allows the use of an automatic alarm that provides an indication to the station licensee of the failure of any lamp. Finally, 17.49 requires any tower light failures and repairs to be logged in the station log.

**Notification required**

The FAA must be notified of the failure of any top lamp or any flashing side lamp. The FAA need not be notified of the failure of steady-burning side lamps, though such failures need to be logged and repaired as soon as possible. If a tower light outage has occurred in the last year, the FAA should be sent a photocopy of the log, la-

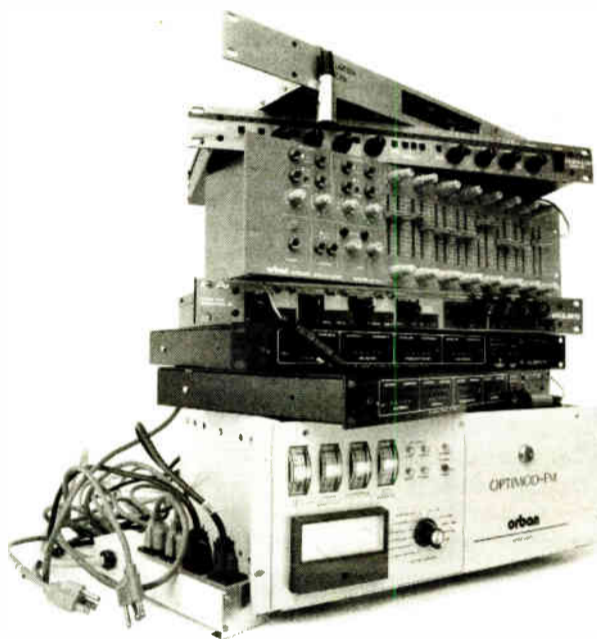
beled as Attachment B.

The form then asks for the date of the last tower lighting inspection, as required by 17.47(b). This section requires an inspection at intervals not exceeding three months of all automatic or mechanical control devices, indicators and alarm systems associated with the tower lighting.

Does the photodetector turn the lamps on and off at the proper illumination levels (lights on when the north sky illuminance on a vertical surface falls to 376.74 lux, or before; off when the north sky illuminance on a vertical surface increases to 624.31 lux or later)? Is the beacon flash rate correct (12 to 40 flashes per minute)? Can the operator detect the failure of any one lamp?

Has the FAA been contacted within the past year regarding tower light outages? Which FAA facility is normally notified?

continued on page 20 ▶



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## DIGITAL DOMAIN

# Synchronizing Multiple Digital Sources

by Mel Lambert

**STUDIO CITY, Calif.** Accurately synchronizing multiple digital sources within a workstation or other essential piece of radio production hardware requires a dedicated, highly accurate synchronization signal. As I began to discuss in my last column, the respective sampling-rate clocks of each component digital signal will drift relative to one another, and the sources will not be bit-accurate.

For smaller systems, such as several DAT machines connecting to a central two-channel editor, radio facilities need to con-

sider the use of a specific word-clock—implementing a formal such as the AES-specified Digital Audio Reference Signal (DARS)—to provide bit-accurate synchronization between the various digital sources.

For larger production facilities, or for networked systems, we need to consider other ways of ensuring reliable synchronization between digital recorders, processors, workstations, consoles and other sub-systems.

For connecting digital multitracks to a multichannel workstation, for example, or for linking an all-digital master control area

to several production centers, we may plan to simultaneously pass multiple channels of digital data from one location to another. To simplify the exchange of up to 56 channels of 16-, 20-, 24-bit data via relatively simple coaxial (or fiber-optic) connections, a recently published multichannel digital I/O protocol holds a great deal of promise.

## MADI digital protocol

Multichannel Audio Digital Interface (MADI) was developed by a group of well-known equipment manufacturers—notably Neve Electronics (now part of the Siemens group), Sony, Mitsubishi and Solid State Logic. The MADI format is capable of carrying multiple channels of digitized audio at sampling frequencies between 32 kHz and 48 kHz, over distances up to 150 feet.

Now formally published by the Audio Engineering Society as AES10-1991, "AES Recommended Practice for Digital Audio Engineering—Serial Multichannel Audio Digital Interface," MADI allows multiple stereo pairs of AES3-format signals to be combined into a serial bitstream, and carried into a single 75 Ohm, coaxial cable.

The MADI 32-bit/channel data format is identical to AES3-1985/199X, apart from the first four bits (which, for the familiar two-channel interface, comprise the sub-frame, frame and Channel Status sync preambles). Within the MADI format, these four bits carry a single-bit Channel Zero Sync (start of channel); On/Off Bit (channel active/inactive); A/B flag of a two-channel pair; and Block Sync (designating the beginning of a 192-bit Channel Status block).

Unlike the familiar two-channel AES3-format interface, MADI is designed to be run *asynchronously*. Since MADI data is not designed to be self-clocking, it *has* to be accompanied with a dedicated sync signal. Irrespective of the number of channels being carried or the sampling frequency, MADI transmissions run at a fixed data rate of 125 Mbit/sec. A 4:5 encoding scheme reduces the actual throughput of digital audio to 100 Mbit/second.

MADI's dedicated Master Synchronization Signal (MSS) is identical in format to AES3-1985/199X interfaces, and provides a well-defined source for synchronizing sources and receivers connected via MADI cables. A unique Synchronization Symbol is also added to the MADI bitstream at least once per frame period (a complete 32-bit channel block) to ensure precise synchronism of data blocks between transmitter and receiver. Sufficient Sync Symbols are added to the 4:5 encoded data words to pack out and occupy the total capacity of a MADI connection.

Historically, MADI's functional data capacity represents a real-world compromise between ease of implementation using off-the-shelf components, and operational flexibility. Realizing that serial links could be run reliably at bandwidths of 100 Mbit/sec, the AES committee calculated that, for a maximum sampling rate of 48 kHz compatible with existing AES3-compatible 32-bit format connections—plus a 12.5 percent varispeed option—this throughput provided a total useable capacity of 57.8 channels. Reserving some of the data bandwidth for synchronization codes, the maximum number of channels within the MADI spec was defined as 56.

To provide some idea of the amount of data involved, a 48-channel MADI inter-

face running at a sampling rate of 44.1 kHz will generate just under 65 Mbits of data per second. To completely fill up the connection to the specified 100 Mbits/sec before channel encoding, Sync Symbols are added into the bitstream. The transmitter decides where these extra Sync Symbols need to be placed.

## What's Involved

Because of MADI's non-synchronous operation, data buffers need to be inserted at both ends of a multichannel connection, to allow data to be re-clocked from the buffer at the appropriate rate, according to the master sync signal and the internal sampling-frequency clocks. At the receiver, data is clocked out of the buffer under the direction of the dedicated synchronization signal accompanying the MADI bitstream.

On a related topic, consider the case of a digital connection that lacks a dedicated timing reference—maybe a CD player using an S/P DIF connection to an editing workstation or DAT recorder. Rather than risk the two units failing to communicate with each other because of minor sampling-rate differences, techniques exist for matching sampling frequencies. Affordable sample-rate converters are now available that allow non-synchronous digital sources to be buffered into a random-access memory, and then re-clocked at the required sampling rate.

continued on page 22 ►

## Self-Inspection By the Book

► continued from page 19

This information (facility, phone number, etc.) should be part of the printed operator instructions available at the control point. I'd suggest that FAA notification be entered in the station log, along with the name (or other identification) of the person at the FAA notified.

## Next month

The next section of the FCC self-inspection form covers EBS. I get calls from many stations trying to "get around" the various EBS requirements when using "non-traditional control points." This section of the FCC form anticipates many of the problems people are having complying with EBS requirements when there is no one at the station program control point (the studio) who can instantly respond to EBS alerts (receive the alerts and put required announcements, tones and programming on the air).

As a rule, if you are proposing anything unusual, I'd suggest getting a letter from the FCC in Washington approving your proposal or granting a waiver of appropriate sections of the rules. In addition, some transmitter operating services (such as National Supervisory Network) have gone to considerable effort to ensure their services comply precisely with FCC requirements—so you can comply with the EBS rules instead of getting around them.

I'll look forward to your comments.

□□□

Harold Hallikainen is president of Hallikainen and Friends, a manufacturer of transmitter control and telemetry systems. He teaches electronics at Cuesta College, San Luis Obispo, and can be reached at 805-541-0200. He can also be reached on internet at ap621@cleveland.freenet.edu or hallika@pan.calpoly.edu or through CompuServe at INTERNET: ap621@cleveland.freenet.edu.

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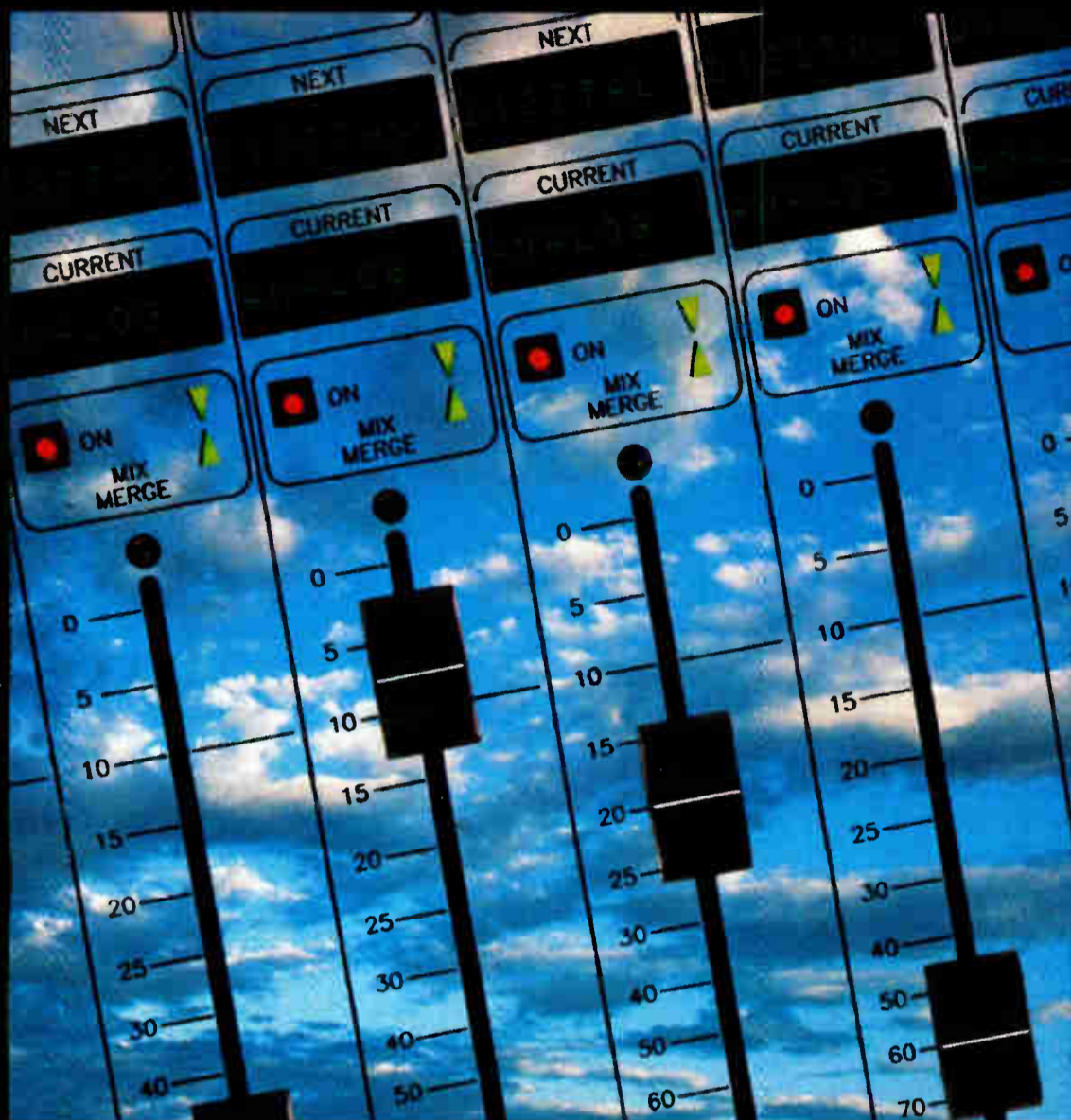
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## BOTTOM LINE BROADCASTER

# Spend Some Time, Save Some Money

by Jim Somich

**BROADVIEW, Ohio** "It was the best of times. It was the worst of times." The opening lines of Dickens' *A Tale of Two Cities* aptly describes the radio broadcasting business today. Gone are the large engineering staffs who could whip up a console or two in their spare time.

And nowhere to be found are the board operators or production people. You are probably "it." The financial sins of the 1980s have created the ultra-thin '90s. It is for today's often overworked and underappreciated broadcast engineer that *Bottom Line Broadcaster* is written.

## Finding a better way

The purpose of *Bottom Line Broadcaster* is to educate, instruct and encourage today's broadcast engineer. Your comments will always be welcome. And if you have found a better way, please let me know so I can pass it on. Do you have what it takes to be a bottom line engineer?

Bottom line engineering means having a *can do* attitude. It is being able to go to the "junk box" and build something that might cost hundreds of dollars to buy. It is the process of filing away hundreds of ideas and fixes that can be called up to meet a specific demand.

A good bottom line engineer doesn't need a shop full of expensive test equipment—he works more by his wits. The boon to having this mind set is that even when you buy something, like a console, transmitter or similarly

large purchase, you will be better prepared to analyze the product beyond the glossy exterior and manufacturer's claims.

Become the "MacGyver" in your station and you will build a solid foundation for recognition and raises. When you can document your value to management and ownership, you have paved the way to becoming *indispensable* to the company. This preparation goes with you wherever you move. It is a quality that separates the engineers from the "tweakers."

## The junk box

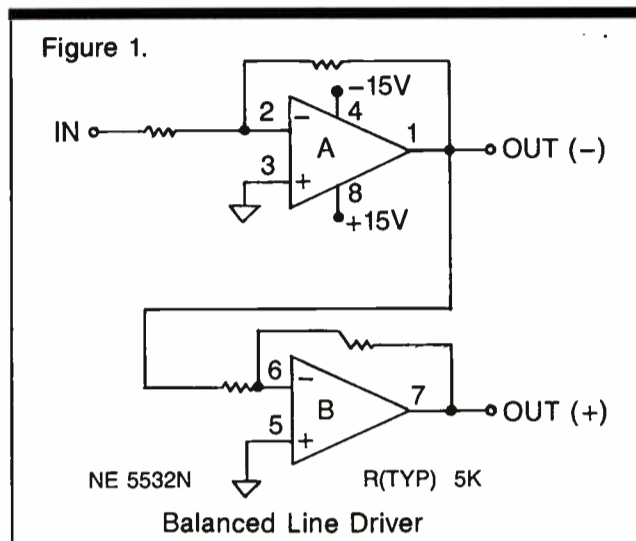
Every good bottom line engineer has a junk box. It can form the basis for most of your projects. Try to salvage parts from everything you discard. You will be surprised at how quickly you can reach for a part that you would ordinarily have to buy.

Scout the surplus stores in your city. They are an excellent source for top quality new or lightly used parts often at very low prices. Hams learned years ago that these stores were the best source for their projects.

Try to avoid expensive sources such as the corner chain parts store or the industrial distributor. Their prices are often five times the cost of an outlet store. A bottom line engineer

is always cost conscious.

While you will probably not build every project discussed in this column, each one will help to educate you to what can be done with little money and only basic test equipment. Do not automatically assume that anything you put together yourself has to be rough looking or amateurish in execution.



The "finish" of any project and its documentation are second only to its function. The day you finally realize that you can build most anything needed in your station is the day that you will have graduated from this college of engineering knowledge. Ready? Let's get started.

## Prosumer equipment

There used to be a clear-cut line between broadcast and consumer equipment. Today, we have coined the term *prosumer* to designate equipment originally destined for the home that can have professional applications. In many cases, your station can barter for prosumer equipment that can fulfill most of your requirements.

Although a piece of prosumer equipment may not be as rugged as a true professional unit, the distinction is blurring more every day. And besides, it is often easier to barter for another CD player or cassette machine than to find cash in your budget.

The problem with most consumer and prosumer equipment is the differing interface requirements for the home versus the broadcast studio.

The most significant difference between prosumer and pro equipment is the use of balanced inputs and outputs. In balanced circuits three wires are used. The audio is carried on two wires 180 degrees out of phase with each other and the third wire is ground.

## Balanced circuits

In most prosumer equipment, there is a hot wire and a ground. The most common pro-consumer audio connector is the RCA plug and jack. Balanced circuits normally use 3-pin XLR connectors.

Balanced circuits allow the transmission of audio over great distances without picking up hum and noise. This is not normally a problem in a home hi-fi system where interconnects seldom exceed six feet. In the broadcast environment it can be a big consideration, especially in the presence of RF.

Because the signal is 180 degrees out of phase in each wire in a balanced circuit, any noise picked up by the cable is usually equally induced in both hot lines and is cancelled out. This is referred to as common-mode rejection.

There is a further complication because the voltage levels are different between balanced and unbalanced circuits. Balanced signals are normally referenced to +4 dBv; unbalanced are referenced to -10 dBv, about 14 dB lower. Both of these considerations, balanced versus unbalanced and the change in levels, affect the integration of prosumer equipment into the broadcast chain.

Both inputs and outputs must be considered. If you are integrating a prosumer cassette deck into your broadcasting system, its input is normally unbalanced and referenced to -10 dBv. If you connect it directly to a balanced line, it will ground one side, unbalancing the line and reducing the line level by 6 dB. You will also have about 8 dB too much audio.

## Matching levels

Both input and output interfacing can be solved by the use of a level matching device. This handy device interfaces the unbalanced inputs and outputs of proconsumer gear to the professional balanced system. As a bottom line broadcaster, you can construct the interface yourself for a fraction of the cost of the least expensive commercially available devices.

In the days of input and output transformers it was easy to determine whether a circuit was truly balanced to ground. If the transformer had a center tap and it was grounded you had a truly symmetrical circuit. Common-mode rejection was very high and long cables could be used with little chance of interference.

Because of the high cost of audio transformers, "electronic" balancing became the norm in the early '80s. Single opamps were often used as a balanced input stage. These stages were not truly symmetrical because the plus and minus inputs to an opamp stage have a different impedance.

The net result was a balanced input with mediocre common-mode rejection. More

continued on page 26 ►

## Synchronizing Digital I/Os

► continued from page 20

The amount of RAM storage required to provide bit-accurate sync between non-locked sampling clocks is surprisingly small. By way of an example, a RAM buffer of just 5 msec would accommodate eight minutes of material that varies by up to 10 ppm from our master reference. If the material being sample-rate converted overran the RAM buffer capacity, the bitstream might be muted during a silent passage, and the buffer refilled.

Alternatively, the system could insert an inaudible crossfade or transition between the current output and material from, for example, the center of the buffer. In this way, the converter could automatically accommodate a wide range of disparate inputs, and take care of bit-accurate synchronization.

□□□

Mel Lambert has been intimately involved with the production and broadcast industries on both sides of the Atlantic for more than a dozen years. Now principal of Media&Marketing, a consulting service for the professional audio industry, he can be reached at 818-753-9510.

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# The Early Days of Microwave Transmission

by George Riggins

**LONG BEACH, Calif.** Ray Durso, W6THC of Cocoa, Fla. pointed out an error in one of my recent columns. I listed the source of program material for some of the early FM broadcasts as WQRX. The call should have been WQXR New York. The call was chosen with the "Q" to sound as close to the original experimental call of W2XR as possible.

James Pinkham, of Energy-Onix, called and mentioned a presentation done in 1931 by Guglielmo Marconi to the Royal Society in England about experimental work that he (Marconi) was doing in Italy. The data was not

readily accepted by those in attendance.

It is reported that the only defender Marconi had at the meeting was Major Edwin



Armstrong, who pointed out that this was experimental data, not a theoretical presentation. The data had been obtained from actual equipment tests. That were done on an island

about 60 miles off the Italian coast.

The subject of that early presentation? Microwave transmissions. The world had to wait another 10 years for the service to be developed and be named—radar.

## The wave of the future

Many have overlooked the fact that in 1931 there were 26 *visual stations* licensed to operate in the U.S. The names of the owners and/or operators included some of the earliest experimenters, such as Westinghouse, General Electric, National Broadcasting and the De Forest Radio Co.

De Forest was the only licensee listed who had a "mobile" license. In addition to W2XCD at Passaic, N.J., De Forest had W10XG which was listed as "United States, Throughout." The most interesting allocation was the one to Purdue University, which still has a strong presence in both visual and aural broadcasting.

Recently, Dale Gamble of Candler, N.C. shared some comments with me concerning the tower situation at WBT(AM) (1110 kHz) in Charlotte, N.C. According to Dale, the two towers destroyed by Hurricane Hugo have been replaced with towers of the same style and construction as the originals.

## Mae West towers

The structures were referred to as "cantilever" or "Mae West" towers in broadcast circles. The destroyed towers were reportedly 130.8 meters above the insulator, about six degrees less than a half wave at the present frequency. WBT(AM) frequency was 1080 kHz before the effective date for the Havana Treaty of 1941.

To back up a little, we should note that in 1926, WBT had a listed transmitting frequency of 275 meters (the towers would still be short) with power of 250 W. In 1938, the frequency was listed as 258 meters and the power given as 750 W, with higher power authorized for daytime.

In the 1928 FRC station listings, WBT was listed as being on 1080 kHz and with a CP for 10,000 W. The ownership at that time was listed as C.C. Coddington. In the 1929 All

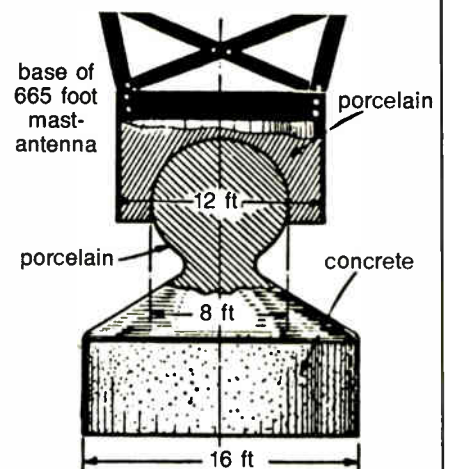
American Official Radio Log, the frequency assignment was given as 277.6 meters, slightly less than the theoretical 277.78 meters (for 1080 kHz), but very close. The power was listed as 5,000 W.

The 1932 International Radio Atlas, published by the Pittsburgh Post Dispatch, listed the station at 1080 kc, 5,000 W. Evidently the CP had not been completed. It was not until a 1934 listing furnished with Atwater Kent receivers—World-Wide Radio Station Directory—that WBT was listed as having installed the full 50,000 W of power.

## Not so high

Using the formula given in chapter 2, page 24 of the ARRL Antenna Handbook (copyright 1974), published by the American Radio Relay League, Newington, Conn., and given

Figure 1.



A reason for small leakage is the long path from base-to-base ground length.

the height of the WBT towers as 130.8 meters, the station would be a theoretical half wavelength for 1148 kHz. None of the listings I have been able to accumulate lists WBT as having been this high in frequency.

The theoretical half wave for 1080 appears to be 138.88 meters, and the theoretical half wave for 1110 kHz (its current frequency assignment) would be 135.135 meters.

George Stephenson, of WSM-AM-FM of Nashville, Tenn., points out that the "Mae West" tower at his station originally had a mast on top of the tower to make the extra physical length necessary for properly tuning the antenna.

A conversation with Dane Erickson and Bob Smith of Hammett and Edison, Inc. in San Francisco, indicated that steel towers are given a velocity factor of 0.95 when figuring electrical length for tuning.

Jim Hilliker of Monterey, Calif., sent me a copy of the article, "Half-Wave Mast-Antenna" that appeared in the November 1931 issue of Radio Craft, a Gernsback publication. If a picture is worth a thousand words, the detailed drawing of the base insulator is worth many thousand words.

The antenna described had recently been installed for WABC(AM) New York and had a total height above ground level of 665 feet. There were four guys which allowed the tower to have some give rather than being rigid. Obstruction lights were provided by flood lighting the grounds at night. (When were the regs for mandatory tower lights enacted?)

In 1932 WABC was affiliated with the Columbia Network (860 kc, 50,000 W) and sharing time with WBOQ (also with 50,000 W of power).

□□□

George Riggins has experience in radio and electronics dating back to the 1930s. He is also a licensed ham operator and has had his own broadcast sales and service company, Riggins Electronic Sales, for more than 20 years. He can be reached at 213-598-7007.

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# Thanks

# Julian!

WXER 104.5 FM  
A TR A EASY RADIO

June 6, 1991  
Pete Charlton  
The Management  
P.O. Box 1-36457  
Fort Worth, TX 76136

Dear Pete:

THANKS for making radio FUN AGAIN! Your Digital DJ system is fantastic. WXER went on the air at 12:00 noon on June 1, 1991 with the complete Digital DJ System you recommended including the on air system, production system, Super Log and Lantastic Network to tie them all together. We are on the air 24 hours a day with Unistar Special Blend and SOUND GREAT, thanks to you. People are calling to buy time. I've been in radio here for 33 years. It's never happened before!

I looked at all the systems out there including Smartcaster, Shaeffer, Systemation and a few others before choosing the Digital DJ. My past experience with you and your support staff on your logging system and the features of the Digital DJ made the decision. Incidentally, I found your system was priced lower than any of the others for more features and hardware.

The System was easy to install, just as easy to understand and works flawlessly. WXER is a brand new FM in the area and after an experience with an AM Daytime stand-alone I decided this was going to be different! No more 14 plus employee staffs to keep things going. Well, the Digital DJ came along just at the right time. We are on the air 24 hours a day and there is nobody in the office from 5:30 PM to 5:00 AM the next day. Saturday and Sunday we have someone come in to update the weather. That's it! Staff now is me and three others. And ALL of us sell including my secretary who does telemarketing. (I may have to add another salesperson, the rest of us are getting very busy and can't handle all the sales calls.)

Alan Freeman, Dane Roach, Lawrence Miller and the rest of your staff been a real joy to work with. Have there been some problems? Of, course, but your people usually fixed them over the phone or with overnight software updates and fixes. Now it just runs all day. And some of your future plans for additional features and hardware sound really exciting. I can hardly wait!

Thanks for the fantastic system.

Sincerely,  
*Julian*  
Julian E. Jetzer  
President

## Do It Right the First Time

We thought you might be interested in reading just one of the many letters we have received from our Digital DJ stations. Our installation at WXER is very typical: Digital DJ™ is running the Unistar *Special Blend* format with dual mono/stereo spot playback capability. A full production (DJ Pro) system is interconnected through a low cost LAN network to the On-Air (Sky Pilot) DJ system. Also interconnected through the LAN network is the *Super Log* traffic system (Julian has been a Traffic system customer since 1982!). Spots are produced on the DJ production system and transferred at high speed via the LAN to the Sky Pilot system. The *Super Log* traffic system produces the Logs, Billing and a complete ready-to-run DJ Log that is automatically loaded into the system. In addition, the Traffic system computer is also used to update the Cut Indexes of the DJ system to keep everything up to date and to display and print a number of DJ Reports that are invaluable in keeping up with the activity in a busy station.

WXER has several periods of *Live* operation daily. *Live Assist* capability is *standard* on Digital DJ. The complete broadcast Log is accessible by the operator and no *printed* Log is necessary. The entire WXER system above leases for about \$475.00 per month, complete. Single, standalone Satellite systems could cost as little as \$198.00 per month.

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## FEED LINE

# Does Your AM Qualify for More Power?

by Cris Alexander

**DALLAS** Until just recently, it seemed that very little allocation work was left to be done in the existing AM band. The band was "mature" (full), and just about every station on the air was operating at the maximum power possible that the station class and allocation considerations would permit. This remained true until the new AM rules came out last October.

These new rules specified a new classification scheme that, among other things, grouped all the old fulltime Class II and Class

III stations into a new Class B category. The new Class B has a power ceiling of 50 kW. Thus, old Class III stations that had a 5 kW power ceiling now have a 50 kW power limit.

So, can every old Class III station get on the horn and order up a new 50 kW transmitter? Not by a long shot. But for many, there may be room for some power increase.

## Do you qualify?

Let's look at a few preliminary steps that station engineers can take to find out whether they can increase power. I want to make it clear, however, that we are talking about *daytime* operations here. Nighttime operation falls under a far more complicated set of rules and is beyond the scope of this article.

Before you begin, you need to know the ground rules. The normally protected groundwave contour for Class B and D AM stations is 0.5 mV/m. Other stations must provide varying degrees of protection to this contour, depending upon frequency relationship.

For co-channel stations, the interfering-to-protected contour ratio is -26 dB (a voltage ratio of 1:20). Nominally, this means that the 0.025 mV/m contour of a proposed operation cannot overlap the 0.5 mV/m contour of a protected co-channel station (interference caused).

Conversely, the 0.025 mV/m contour of the protected station cannot overlap the 0.5 mV/m contour of the proposed operation (interference received). There is an exception to this interference received rule, but it would not apply in the case of an existing station wishing to upgrade.

For first adjacent channel stations, the ra-

tio is -6 dB (a voltage ratio of 1:2). The 0.25 mV/m contour of a proposed operation cannot overlap the 0.5 mV/m contour of a protected station on the next channel. The protected station's 0.25 mV/m contour cannot overlap the proposed operation's 0.5 mV/m contour.

There is no protection ratio for second or third adjacent channel stations—a "pro-

maps and groundwave curves should be available from the FCC's copy contractor or possibly your consulting engineer.

Using the database, retrieve all the records for all stations from three channels below to three channels above your frequency within a fixed distance of your site (use your transmitter site coordinates for the center of the search). If your area has relatively low conductivities (4 mS/m or below), use 500 km as the search radius. If your area has higher conductivities, use a larger radius—say, 800 km.

Now plot the transmitter site location of your station. Use the latitude/longitude

**Many engineers that take a look at their station's daytime allocation will find that adjacencies and other factors won't permit any power increase.**

hibited overlap" applies in each of these instances. The 5 mV/m contours of second adjacent and the 25 mV/m contours of third adjacent channel stations cannot overlap one another.

## Have tools handy

With these rules in mind, the next step is to find the protected and interference contours of all nearby co- and first adjacent channel stations, along with the 5 mV/m and 25 mV/m contours of all the nearby second and third adjacent channel stations, respectively.

To begin, you will need three things: a current FCC AM database, the appropriate soil conductivity (M-3) maps, and the new (9/26/91) FCC groundwave curves for all the frequencies being considered. The database is available on-line through Broadcast Data Services, Dataworld, and others. The M-3

markings provided on the M-3 maps. Continue by plotting the sites of the other stations closest to your site.

Pick the co-channel station closest to your site and, using a straight edge, draw a line directly between the two sites. With a protractor, mark off radials from the other station in five degree increments to either side of the direct bearing for 30 or so degrees.

## Plot the distance

Using a divider, straight edge and the map scale, find the distance from the other station to each conductivity break along each of these radials to a point that equals the distance between that station and yours. For example, if your station is 300 km from the other station, find the distances to all the conductivity breaks on all the marked radials out

continued on next page ▶

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## Spend Some Time and Save Some Money

▶ continued from page 22  
about this next month.

Figure 1 is a schematic of a simple circuit you can build to convert the unbalanced output of a CD player or cassette deck to a balanced output. You can customize the circuit for the output level needed in other ways.

### Build your own

I would recommend a high performance chip such as the Signetics 5532, which is internally compensated for unity gain. Look for a high slew rate, low noise, and good output capability. The matcher can be constructed on a small piece of perf board and mounted inside the unit you are balancing.

Bipolar power can be taken from the unit, also. Plus and minus 15 Volts is available in most prosumer equipment that uses opamps. Be sure to look up the recommended voltages for the opamp you are using—most will work fine on a bipolar 15 Volts.

This is a single chip per channel design if you use a dual opamp such as the 5532N, but you have a wide range of possibilities depending on what you have on hand. A quad

package could give you a full stereo balanced output interface with one chip.

I would recommend that you mount the chip or chips in a socket for easy maintenance. Bypass the power leads to ground at the socket with tantalum capacitors. The actual value is not critical as anything from 10-25  $\mu$ F at 25 V will be fine.

Follow good construction practices and keep leads short and direct. If you get sloppy, the circuit can oscillate.

### Pure and simple

This is the simplest form of a balanced line driver. Both opamps are configured as inverters. The bottom opamp inverts the output of the top one. Therefore, each opamp feeds the same signal to the output with one side inverted 180 degrees. If all of the resistors are the same value, the voltage gain is 2X (6 dB).

You can change the gain by adjusting the feedback resistor of the input opamp. The input resistor should be kept at a relatively low value for best noise performance. Its value is the input impedance of the circuit. Try to keep its value around 5K, but no higher than 10K.

When hooked up to a typical -10 dBV unbalanced output, using 5K resistors all around, the balanced output will be about -4 dBV, which is a decent console input level. If you need more level, try increasing the feedback resistor for the input opamp to 10K. This will give you 6 dB more output.

This simple circuit can be modified in many ways. For example, you can AC couple the input, if necessary, by using a capacitor. To keep this cap from rolling off the low end of your audio, make sure you use a large enough value. For best performance, use a

film cap rather than an electrolytic.

To determine the need for a coupling cap, either check the schematic for your unbalanced equipment and determine if the output already has a coupling capacitor, or measure the output with a digital DC voltmeter. If you measure less than 25 mV, the coupling cap can be eliminated.

### Making stable connections

Similarly, you could AC couple the output, but since most high performance opamps have a very low DC offset this usually is not necessary. Also, if you plan to feed especially long lines, try a 50 Ohm one percent resistor in series with each output lead. This will stabilize the circuit in the presence of the added capacitive load.

You can use any three-pin connector you have handy as an output connector. A chassis mount XLR would be best. You might even consider building the circuit on a small perf board mounted directly on the back of the XLR connector for each channel. The number one pin of the connector should be connected to signal ground and each balanced output should be connected to pins 2 and 3. Be careful to keep both channels in phase with each other.

There you have it. For a few dollars and an hour or so of your time, you have converted a piece of prosumer audio gear to interface with your professional system. Performance is limited only by the specs of the opamp you use.

□□□

Jim Somich is president of Somich Engineering and chief engineer of WOIO-TV, Cleveland. He can be reached at 216-526-4561.

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# Calculating Your Allowable AM Power

► continued from previous page  
to 300 km. Since the M-3 maps are marked in miles, be sure to convert to kilometers.

With the appropriate groundwave graph and the inverse distance field (IDF) value for the other station's antenna on each radial, the equivalent distance method (described in FCC regulation 73.183(e) and 73.183(f)) can be used to find the distance to the other station's 0.5 mV/m and 0.025 mV/m contours. Connect the points by a smooth curve. The idea is that the voltage level of radiation coming straight from the antenna system on any given radial or azimuth heading is unattenuated or unaffected by ground conductivity (that is, free space radiation).

To find the maximum permissible radiation (MPR) from your station to the other station, first draw a line from your site to the closest point on the other station's 0.5 mV/m contour. Measure the distance from your site to this point. Note the bearing and find the distance to all the conductivity breaks along this radial.

With the appropriate groundwave graph, determine all the conductivity breaks from your station to the other station's 0.5 mV/m contour.

## Finding your IDF

Reversely applying the accumulated correction for the last conductivity on the radial, find the field strength that corresponds to the distance from your site to the contour. Divide 0.025 by this value and multiply by 100 mV/m—this will yield the maximum IDF that your station can radiate without overlapping the other station's

protected contour with your 0.025 mV/m contour.

Repeat this procedure on the radial from your site to the closest point on the other station's 0.025 mV/m contour. This time, divide 0.5 by the field strength value found on the graph and multiply by 100. This will yield the maximum IDF that your station can radiate without interference received.

Whichever of the above two maximum IDF values is lower is the maximum permissible radiation (MPR) toward the other co-channel station.

Now, continue this procedure for all the other nearby co-channel stations. Plot their 0.5 and 0.025 mV/m contours, find the bearing to the nearest point on each from your site, and find the MPR toward each.

## Adjacent channels

When all the co-channel MPRs have been computed, move on to the first adjacent channel stations. Plot all of their 0.5 and 0.25 mV/m contours and find the nearest point bearing to each from your site.

Find the maximum IDF in the same manner as with the co-channel stations, dividing the value of your contour (0.25 or 0.5 mV/m) by the field strength given on the graph and multiplying by 100. Again, the MPR toward a particular station is the lower of these two numbers.

Finally, find the MPR toward all the nearby second and third adjacent channel stations using the 5 and 25 mV/m contours, respectively.

To determine this, you will need to know your own IDF on the radial toward each of the other stations (for non-directional stations, the IDF is the same in all directions).

Divide the MPR toward each station by your station's IDF on that bearing. After doing this for all the bearings you have calculated, find the lowest number. Square it and multiply by your present power. This will give you an idea of what power is permissible using your existing antenna system.

If this preliminary calculation shows that a substantial increase is possible, get on the horn to your consulting engineer and discuss it with him or her. Have a full daytime allocation study run and, if necessary, a new directional pattern designed.

Keep in mind that the consulting engineer will have access to a lot of resources that will

in some cases give different results than you got. An example of this is the use of measured conductivity data; this must be obtained from the FCC's files, and will often have considerable effect on an allocation picture.

Many engineers that take a look at their station's daytime allocation will find that adjacencies and other factors won't permit any power increase at all. On the other hand, together with the new groundwave curves, the new Class B power cap will make it possible for many stations to make big improvements in their daytime facilities, particularly in the sparsely populated areas west of the Mississippi. These days, AMs need all the help they can get.

□□□

*Cris Alexander is director of engineering for Crawford Broadcasting. He can be reached at Box 561307, Dallas, Texas 75356.*

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# WORKBENCH

## A Few Battery Pack and Drill Bit Tips

by John Bisset

**FALLS CHURCH, Va.** The weather is getting better, and that means your sales force will be pressing your RPU into service to help meet their sales goals. Rick Fess, CE at WLRB(AM)-WKAI (FM) Macomb, Ill., wrote in with a great tip for those who use the Marti RPT-2 or Marti RPT-15 transmitters.

If the battery pack on these units doesn't seem to be recharging properly, take a close look at the battery pack—not at the charging circuit. Remove the battery pack from the transmitter, and take the wrap off. The batteries are in series, so each cell can be measured easily. If a cell has a voltage of less than 1.25 VDC, it is probably bad.

Rather than replacing the entire bat-

tery pack, individual cells can be replaced using a Radio Shack "Sub C" Replace-a-cell battery (catalog number 23-190). It is electrically the same battery, and will physically fit right in with the rest of

of a series of fire-retardant coax, developed for indoor applications. The guide clearly explains the requirements that affect cables installed indoors, and list the categories of cable as established by the National Electrical Code™.

If you have an STL or RPU project that will involve running coax indoors, this six-page guide is worth the time to read. You can get your copy free from Andrew Corporation by circling Reader Service Number 143.

★★★

Next to a soldering iron, an electric or battery-powered drill may be the engineer's most popular tool. It seems we always have need to drill into something—whether we're modifying equipment, or installing computer or phone jacks.

Most of us "get by" using a set of drill bits that we either bought from some discount house, or were at the station when we started work there. In either case, they are probably dull, well-used, and not the greatest for drilling nice neat holes.

If I just described your set of drill bits, you must treat yourself to Black and Decker's BULLET Pilot Point™ drill bits. Until you see these bits in action, you don't know what you've missed.

The tips of these bits are chiseled in a manner that permits penetration on contact—you don't need a pilot hole or center punch when drilling metal panels. There's no "walking" of the bit to mar your front panels.

Furthermore, the bit design minimizes burrs, creating a clean breakthrough. Have you ever had the need to drill the front panel of equipment (like a transmitter) and worry about all the metal



Andrew's guide to fire-retardant cables discusses topics to be considered when running coaxial cable inside a building.

the other batteries. You will have to cut the old battery out, and solder the new one in. Watch polarity!

Using the Replace-a-cell is a very economical method to keep RPUs running, given the high cost of replacement battery packs; and especially if only one cell is bad.

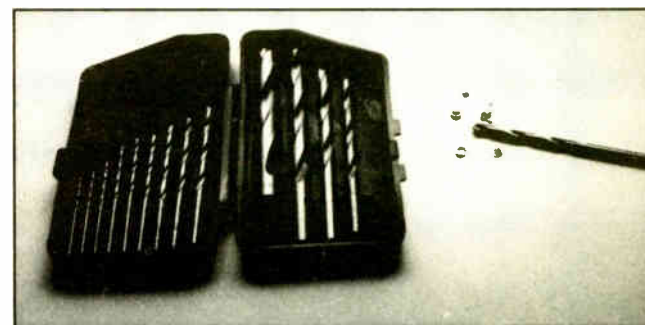
Rick Fess can be reached in Illinois, at WLRB(AM)-WKAI(FM): 309-833-5561.

★★★

It seems everyone longs for "the good old days" of nickel candy bars, cheap gasoline ... and less stringent building codes. If you have planned a new facility recently, or even improved your existing site, you've probably choked at the new building regulations and how they've changed.

This column won't take the space to debate these changes, because in any large city the rules are in place and must be followed (end of debate). But with the changes in mind, Andrew Corporation has released an illustrated guide to the electrical, building, and fire code requirements for coaxial cables.

This booklet accompanies the release



The chiseled "pilot point R" on Black and Decker's new drill bits makes metal panel drilling clean and easy.

filings and burrs scattering around inside?

With these bits, very few, if any, particles are seen. As the bit punches through the metal, the bit creates a little metal disk (see Figure 2), which stays on the bit. All of the metal filings are on the outside, away from the hole, making for cleaner drilling.

At \$40 a set, I would have been skeptical at first, too. But after you factor in the time you save not having to de-burr panels, or tape up "drop cloths" inside transmitters to keep the filings from shorting something out, \$40 turns out to be a real bargain. Thanks to Group W's John Diamantis, CE at WCPT(AM)-WCXR(FM) Washington, for sharing his find. John can be reached at 703-683-3000.

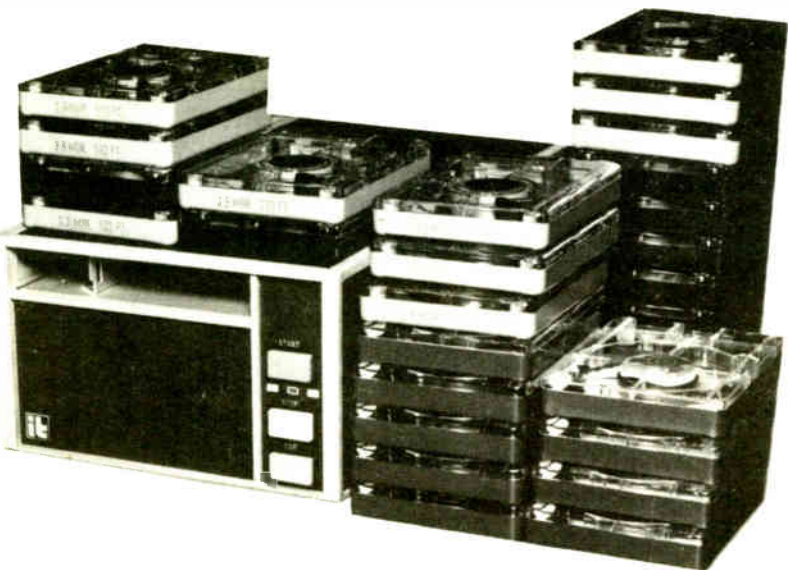
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John Bisset is a principal with Multi-phase Consulting, a contract engineering and projects company. He can be reached at 703-379-1665.

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## ECLECTIC ENGINEER

# The Importance of Attending NAB

by Barry Mishkind

**TUCSON, Ariz.** Times are tight. You don't need me to tell you that technical budgets are thin, and getting thinner by the day. Each expense you consider must be fully justified.

One area really taking a severe hit is the travel budget. Engineers all over the country are being asked to attend fewer conventions or forgo conventions altogether.

Often, it's the old refrain of "we aren't buying anything this fiscal year, so there's no need to send anyone to the NAB convention." I've heard it, you've heard it. It seems like it's the new business manager's mantra.

### Educational benefits

Of course, there's a lot more to the convention than buying equipment, although from the habits of some attendees you might not know it. One of the reasons the NAB keeps returning to Las Vegas is the available entertainment. And, yes, some delegates do spend more time in the hotels than at the convention.

Sure, the NAB show is the biggest equipment exhibition of the year. Yet there's also a lot of education to be had in the seminars. The attentive delegate can learn a lot about the future of the industry, as well as innovative products that are changing the way we operate today.

But perhaps the biggest benefit of going

to the NAB is the ability to speak directly with the manufacturers of the equipment we work with every day.

Over the years that any piece of equipment is in service, the engineer will bench it many times. Sometimes it's just preventive maintenance. Other times, it's to repair the unit, and get it back on line as quickly as possible.

### Face to face

Sometimes, in order to reduce the repair time, we pick up the phone and call tech support. Yet, even with the ability to fax drawings back and forth, it's hard to be sure your finger is in the same place as the service tech's finger as you discuss a picture over the phone.

Having the opportunity to discuss questions face to face is invaluable. A faster learning curve results in quicker turnaround and reduced phone bills. Also, being able to interact directly with the manufacturers' representatives allows us to develop a good working relationship with them.

For example, a former client of mine received tangible benefits shortly after sending me to one NAB show. An out-of-warranty upgrade, worth well over \$1,250, was done as a gesture of good will for \$250. That alone more than paid for all my expenses.

Each year I meet a number of engineers who've paid their own way to the conven-

tion site, stayed in the less expensive motels on the periphery of the city, and spent endless hours on the floor talking to every manufacturer, doing on-the-spot comparisons of different pieces of equipment.

Every one of them will vouch for the value of being there. Am I suggesting you pay your own way to the NAB show if your station won't? Perhaps. If you're a contract engineer, the value you'll receive will far outweigh the costs of getting there. Just one trick learned that saves you several hours in the middle of the night makes it all worthwhile.

However, there are approaches you can take that will moderate the expense.

### Keeping Informed

Certainly, the easiest way is to convince the station manager of the value of your being up-to-date on the state of the art and developing contacts that will work to the station's benefit. He may agree to pay for everything.

Can you do this in today's economic climate? True, the benefit of saving you several hours in the middle of the morning may not be at the top of his list. On the other hand, you can show how the station can avoid costly mistakes by having the information necessary to buy equipment and replacement parts in a wise and efficient manner.

Any sane manager ought to be quick to recognize that. He'd never call his local car dealer in July and order a car for November without knowing what new models will be coming out, with what features, and at what cost. The same goes for station equipment.

If the manager still claims there's no budget for you, try some alternatives. Many stations have a barter arrangement with Las Vegas hotels that they use for contests and clients. Perhaps you too could get some of that.

Or, try to hitch a ride or share a room with someone from another station. And floor passes are available from many of your favorite suppliers. You can get in without spending a bundle.

### Make the most

Now, once there, don't waste the opportunity. Make a list of the products and manufacturers you want to see, of spec sheets you want to get. Don't give up until you've accomplished your mission. Your feet will eventually heal!

While a suit is not mandatory, a clean shirt and tie won't hurt. You'll be competing with several thousand others for the attention of the manufacturers. Present yourself as an impoverished college student, and you'll be ignored. Present yourself as a professional, and they'll respond in kind.

Finally, after you get back, prepare for next year. Show the GM how your trip has benefitted the station. Let him see you weren't on a junket, but acquiring a continuing education of enormous value to your station.

The NAB show is a great opportunity to keep yourself current. If it's up to you, don't miss it.

□□□

Barry Mishkind, aka RW's "Eclectic Engineer," is a consultant in Tucson. He can be reached at 602-296-3797, or 325-9883 on MCI Mail, or [barry@coyote.data-log.com](mailto:barry@coyote.data-log.com) on Internet.

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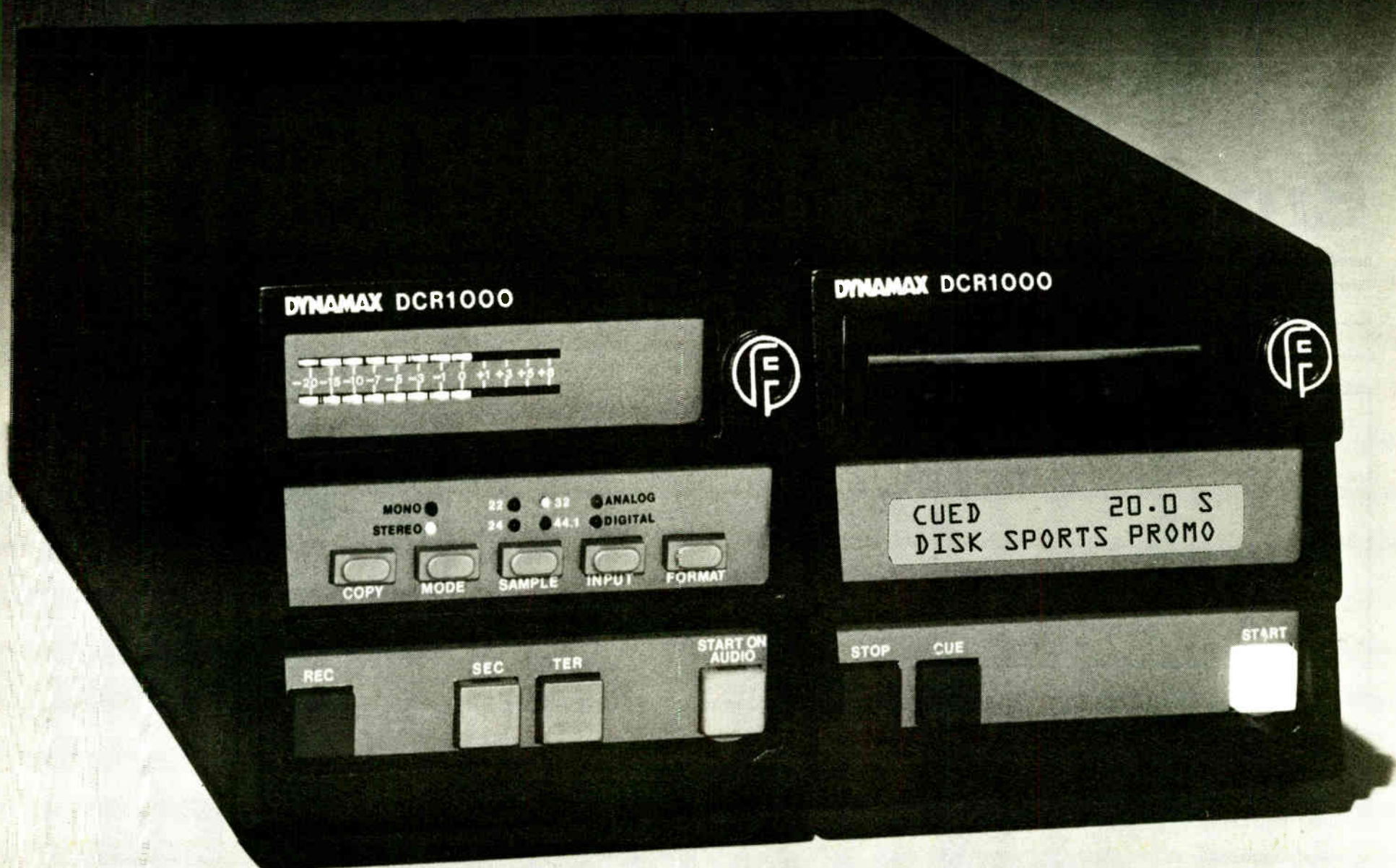
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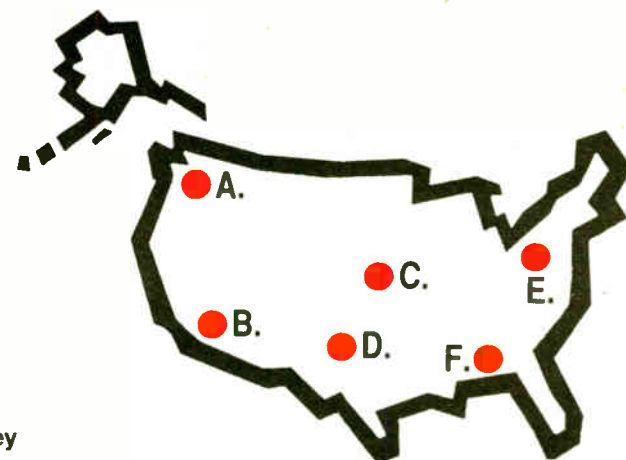
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Auditronics AUD-1100DAGLC (20) in 2 AUD-1100-MF 10-input mainframes w/AUD-PS60 RM external pwr supply, \$1200. B Lord, Lord Bdcg, 13313 SE 208th St, Kent WA 98042. 206-631-2374.

RCA BTE-15A w/2 SCA generators, extender board & book. 503-774-0459.

Crown D-75 gd cond, limited use, \$275. Davis, MCP, 1504 Sunset, Newberry SC 29108. 803-276-0639.

Crown Micro-Tech 1200 320 Wchnl 8 ohms, 495 Wchnl 4 ohms, 700 Wchnl 2 ohms, 1315 W 4 ohm bridge mono, new w/balance xferable warranty. B Fisher, KPCK, 122 S Main St, Bowman ND 58623. 701-523-3883.

Eddor PA-50 single chnl 5 1/4" rack mount audio, excel cond, \$135. Gary, 602-258-6161.

Audionics 100+100 W pwr, silver, rack mount w/handles, \$100; Soundcraftsman CX4100 2-band 1/2-octave preamp, black, 19" rack mount, will trade for tube gear, \$200, all in gd cond. R Glenn, 813-634-1940.

HPX high-perf headphone amp for monitoring, processing, setup, Q-C & maint checks, stereo, balanced instrumentation inputs, rack mountable. J Somich, 216-561-1919.

McMartin MS-252 audio, 25 W, 2 mic inputs, 1 line input, 4.8 ohm & 70 V outputs, \$200/BO. M Glaser, MRG Prod Assoc, 95 Colony Dr, Holbrook NY 11741. 516-447-1041.

Perma Power S-102 w/S1420 batt holder, mobile/portable PA unit, 12 W out, SS excel cond, \$100. R Sumner, CAVU, 3322 Applegate Ct, Annandale VA 22003. 703-560-0233.

RCA, Altec tube mic pre's & tube amps & mixers; Langevin AM-16's, sale or trade. Tracy Eaves, 615-821-6099 (evenings before 10PM EST).

Gates M-5287 tube pre-amps (2), \$150/BO. Robert, CESR, POB 4644, Berkeley CA 94704. 510-845-2625.

### Want to Buy

ATI DA-416 (1) Quad 1x4 distribution amp in gd cond. C Knerr, KCNA, 139 SE J St, Grands Pass OR 97526. 503-474-7564.

CSP phasor built for 5 kW day/1 kW night; DA-2 5 twr array on 1410 kHz; Potomac Instruments AM-19D phase monitor for 5 twr array. BO. L Fuss, WDTL, POB 159, Fayetteville GA 30214. 404-460-6159.

## ANTENNAS & TOWERS

### Want to Sell

Cablewave 510' of 4" Helix w/3 1/8" flanges, BO; ERI 6-bay circ polarized FM tuned to 102.1 MHz, BO. J Church, WLUM, 2500 N Mayfair, Milwaukee WI 53226. 414-771-1021.

Shively 6813 w/radomes, new, on air 3 wks, tuned to 96.1, \$6500. D Magnum, WBOG, 1021 N Superior Ave Ste 5, Tomah WI 54660. 608-372-9600.

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ERI 1100 series radomes, 2 bays, 2 yrs old, identical to Harris FMC series, \$650/BO. K Fitzgerald, WKGB, 495 Court St, Binghamton NY 13904. 607-723-2925.

Cablewave 1- 5/8", 80', \$100. H Beam, WAEY, POB 5588, Princeton WV 24740. 304-425-2151.

DB OCX 7/8 CP, like MCI, 7/8 fittings, broad band, 2.5 kW per bay, made of AISI 316 stainless steel. A Branch, KYAY, 2402 Woodridge Dr, Decatur GA 30033. 404-325-7847.

RCA BFC 12-bay (12) de-icers, only used by KOSU, BO. D Lacy, Mountain States, 1885 Ponder Heights Dr, CO Springs, CO 80906. 719-636-2470.

RCA BFC-6 Circ polarized 106.7 MHz, 6 bays only w/radomes, BO. M Everhart, 9500 SW Barbour Blvd, Portland OR 97219. 503-245-1433.

ERI 3-bay FM tuned to 92.1, 1 5/8" end input, you ship, \$3500/BO. E Coffman, KEZU, 7007 Riviera Dr, Ft Smith AR 72903. 501-782-0361.

Cetec FM 2 bay, true polarization w/pwr gain of 0.955, tuned to 95.9 w/radomes, \$1000. H Beam, WAEY, POB 5588, Princeton WV 24740. 304-425-2151.

Dielectric 50000 3 1/8", 4 port motorized coaxial xfer switch, excel cond w/local control panel, \$2800. R Sharkey, WAMO, 411 7th Ave, Pittsburgh PA 15219. 412-456-4070.

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Andrews (50) insulated line hangers; Phelps-Dodge CFM LP2 2-bay circ polar w/radomes, tuned to 105.5. B Walters, WASE, POB 2067, Elizabethtown KY 42702. 502-769-1055.

Shively 6813 bay w/radomes, new, tuned to 96.1, \$6500. D Magnum, WBOG, 1021 N Superior Ave #5, Tomah WI 54660. 608-372-9600.

Shively 6810 6-bay w/2 1/2 yr old deicer, BO; Cablewave 250 pt 3 1/2" xmission line w/ connectors, (2) 500' runs of 7/8 xmission line. B Newman, KEFX, 913-661-0101.

Jampro 2-element custom-built directional panel, tuned at 93.9 MHz, never used, BO. B Kingman, KRLT, Box 15460, S Lake Tahoe, S Lake Tahoe CA 96151. 916-541-6681.

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Rohn (5) 20' 65q sections, \$400 ea; approx 180' of HJ-50A coax w/type-N conn, \$6/ft, add \$150 for conn. Robert, 817-566-5036.

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Kintronics Isocoupler 103.7 MHz, \$1000. S Southern, WCIR, Box 1037, Beaver WV 25813. 304-252-6452.

Andrew 3" Helix 300'; various connectors, BO; Phelps Dodge HPCFM 6 6-bay FM on 93.1, \$4500. S King, KIXZ, 1703 Avondale, Amarillo TX 79116. 806-355-9777.

Anixter parabolic TRF 6020; P942, both \$80 ea. S Southern, WCIR, Box 1037, Beaver WV 25813. 304-252-6452.

Monopole, 102', free to good home, avail 3/1, you take down. B Engblade, WKLA, Ludington MI. 616-843-3438.

Tower, 350' w/24" face w/lights & beacon, 7 yrs old. C Shank, KSKU, 106 N Main St, Hutchinson KS 67501. 316-665-5758.

Rohn 180' self-supporting tower. Five years old with 8 1/2" base. Pick up for \$5000 or have it delivered for \$6500. John Lackness, 409-838-2938.

### Want to Buy

Single bay FM tuned to 104.9/close. E Coffman, KEZU, 7007 Riviera Dr, Ft Smith AR 72903. 501-782-0361.

Shively 6812 radomes. K Fitzgerald, WKGB, 495 Court St, Binghamton NY 13904. 607-723-2925.

Any antenna tuned to 100.1 MHz, 1/2 bays. D Reynolds, WGFM, 1356 Mackinaw Ave, Cheboygan MI 49721. 618-627-2341.

100-145' guyed/unguyed tower, minimum size like Rohn 25G. M Bohn, WLIO, Box 1669, Lima OH 45802. 419-229-7091.

Antenna in gd cond 100.5 freq, need by 3/92. D Rogers, KXAX, POB 465, St James MN 56081. 507-375-3386.

300-350' tower, used. L Trammell, WWNT, POB 1828, Dothan AL 36302. 205-792-2161.

Xmission line 400' of 3 1/8"; 300' of 1/2" of 7/8", various lengths. R Dees, KARX, 3507-A Van Tassel, Amarillo TX 79121. 806-355-4554.

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Eventide 949 Harmonizer, showroom cond w/manual, \$1595. B Boogalu, KNKK, 385 24th St #800, Odgen UT 84401. 801-621-3131.

Valley People audio pkg, 6 Kepex II, 2 Gain Brain II & tray, \$415; UREI LA4 compressor, \$165; ISI audio DA's & frame, \$145; Ramko MLA1E mic to line amp, \$115, FOB Atlanta GA. D Nobles, 4330 Royal Mustang Way, Lithonia GA 30058. 404-978-1299.

dbx 155 (2) 4-chnl type 1 noise reduction, \$200 ea/\$375 both; AKG BX-5 dual spring reverb, \$150. P Cibley, Cibley Music, 138 E 38th St, NY NY 10016. 212-986-2219.

ATI Emphasizer vgc, \$525. C Crouse, 48 Cedar St, Dedham MA 02026. 617-461-2699.

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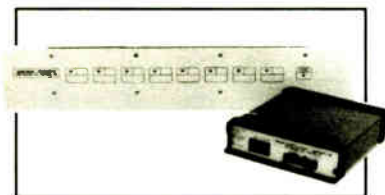
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Format Sentry FS 12C w/UPS syst, Tandy 1000 TL/3 computer, CM 5 color monitor w/2 yr warranty, \$3500; (4) IGM 504D dual 25 Hz detectors, excel cond, \$125 ea/\$400 all; Co-nex 25C tone gener, mint, \$250, both IB, 6 mos old, 2 mos use. Pegi, Global American, 1768 Coral Way N, Vero Bch FL 32963. 407-231-4800.

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**IGM Instacart**, 48-tray, mono, \$3500; Revox A-77 tape deck, stereo, \$500; Revox PR-99 stereo player, \$850; ITC 750 stereo player, \$500; IGM rack mount 25 Hz sensor, \$50; ITC SP mono cart player, \$450; Otari ARS-1000 stereo player, \$600, all clean & functional. M Grieger, PTR Studios, POB 3588, S Pasadena CA 91031. 818-799-6244.

**IGM-EC** w/Alpha 250 UPS, (4) stereo Go-Cart 24's, (2) racks w/ a/c, Panduit & (2) side panels, PC422 I/O card, interconnect cabling & spare parts kit, \$9500/BO. L Martino, 714-274-4959.

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**Instacart machines** (2) 48-hole w/Sentry firing and IBM-PC software. 503-774-0459.

**IGM (5) Go Cart**, (24) stereo, 4 Otari ARS 1000DC P/B, (3) Fidelipac stereo cart P/B, auto rwd, cue & load, excel cond, \$19500. B Walters, WASE, POB 2087, Elizabethtown KY 42702. 502-759-1055.

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**IGM Go-Cart 24** stereo Carousels (2) & an IGM EC automation controller, never used, wired for 220V/50 Hz, BO including freight. F Hirschmann, BCI-Rundfunkberatung, Reichswaldstr, 52-8501. 0-911-50 00 35, FAX 9-911-500 96 52.

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**Pacific Recorders Micromax** (2) stereo (NAB) w/all options, w/rack mount kit, \$1900; ITC RP cart recorder, stereo w/3 tones, new hds, perf cond w/rack mount, \$1100. H Landsberg, Henry Engineering, 503 Key Vista Dr, Sierra Madre CA 91024. 818-355-3856.

**ITC 3D0003**, mono, \$1000; WP mono R/P RP0003, \$650, both w/all cue tones, new heads/bearings/pinch rollers/IB, quiet, clean. Pegi, Global American, 1768 Coral Way N, Vero Bch FL 32963. 407-231-4800.

**Pacific Recorder Micromax** mnt cond, stereo in rack mountable pairs, \$3000 pr/(6) \$5500. K Rosato, Sound Bdctg, 303 Webster Ave, New Rochelle NY 10801. 914-235-5939.

**BE Spotmaster 505C** mono, works, \$100+UPS. L Spivey, WLLS, Hwy 231 S, Hartford KY 42347. 502-298-3268.

**BE 5310** stereo rec amp w/aux tones, gd cond, \$800. R Cowell, KNTR, POB 308, Ferrdale WA 98248. 206-384-5117.

**Tepecaster X700RPS** \$695; (2) X700PS, \$495 ea, both in very gd cond. DA Ishkani-an, 132 Arbor Oak Dr, Ashland VA 23005. 804-752-6942.

**RCA rack mount bdct cart P/B** & separate record unit, \$75+ish. Ronnie, Super Sonics, 1401 NE 159th St, N Miami FL 33162. 305-949-2040.

**Tepecaster 700 R/P**, gd cond, \$300; (2) 700P, needs work, \$100 ea. T Hopkins, Alexandra Comms, 580 Roger Rd, Walla Walla WA 99362. 509-529-7094.

**Gates Criterion R/P**, \$150; Tepecaster 700P, \$75. S Southern, WCIR, Box 1037, Beaver WV 25813. 304-252-6452.

**BE 2100RPS** stereo R/P, \$775. Gary, 602-258-6161.

**Scully 8300** 3-deck tape reproducer, audio switcher, reload indicator, 150 Hz sec cue tone, \$250. Jaye, Nimbus Prods, POB 5903, Takoma Park MD 20933. 301-507-3358.

**Want to Buy**

**Manuals:** Gates Cartrtape, tube-type: ATC P-150; IGM stereo R/P, late 60s vintage, made by Moulic Specialties; defunct Cartrtape II for front panel; seCter cards for same. S Todd, 3399 Kent St #307, Shoreview MN 55126. 612-483-9163.

**Collins dual R/P**, svc manual, any cond; Ampro R/P w/rapid cue. J Panza, LZSS, Box 9847, Kansas City MO 64134. 816-767-1118.

**CASSETTE & REEL-TO-REEL RECORDERS**

**Want to Sell**

**Tascam 48** 8-trk w/dbx noise red, all trks like new cond, \$5500. J Maples, WMYU, 8419 Kingston Pike, Knoxville TN 37919. 615-693-1020.

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Nashville, TN. 37203 (615) 244-6892.

**Revox A-77** walnut cabinet, \$350; Akai 4-chnl 10" NAB, many features, \$300; Crown SS700, 3 1/2, 7 1/2, 15 ips, 1/2-trk heads, all in gd cond. J Deering, Deering Imengineering, 329 Raindrop Lane, Hendersonville TN 37075. 615-264-2886.

**Nakamichi MR-1** master cassette R/P, \$500; JVC R431 cass decks R/P, bi-directional, wired for remote start/stop w/Henry Match Box Interface, \$200 ea/\$1200 for 7 sets, both mint cond, 6 mos old, 2 mos use. Pegi, Global American, 1768 Coral Way N, Vero Bch FL 32963. 407-231-4800.

**Scully 280** 2-trks in console takes 14" reels, \$1195; 280B mono in console, \$895, motors, parts, 8 & 16 trk heads. J Price, Price's Recording Studio, 2651 Globe Ave, Dallas TX 75228. 214-321-6576.

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**Stereo recorders** Otari MTR10-2c, \$3995; TE-AC X10R dual capstan drive bidirectional, \$395. J Price, Price's Recording Studio, 2651 Globe Ave, Dallas TX 75228. 214-321-6576.

**Technics RS1500** 2-trk, \$985; Sony/MCI JH110C on roll around metal cabinet, \$2500+s/h, both excel cond. J Gelo, 813-642-6899.

**Revox B77** MKII, FOB Atlanta GA, \$370. D Nobles, 4330 Royal Mustang Way, Lithonia GA 30058. 404-978-1299.

**TEAC A1200**, AKAI 280D; Pioneer RT-102OL, BO/all. D Morris, WKUN, 204 W Spring St, Monroe LA 70655. 404-267-6558/2035.

**3M M79-16** 16-trk 2" master recorder, gd cond, great sound, \$7000; M-79-8 8-trk 1". M Cogan, Bay Records, 1741 Alcatraz, Berkeley CA 94703. 310-428-2002.

**Ampex MM1200**, 8-trk remote AL control box, \$4500; 354 stereo in metal cabinet, \$495; PR10-2 stereo w/354 elec, \$295; 440 transports reconditioned bearings, brakes, \$935; motors parts 8 & 16-trk heads. J Price, Price's Recording Studio, 2651 Globe Ave, Dallas TX 75228. 214-321-6576.

**MCI Sony JH110C** stereo big reels console, \$2500; JH110A stereo in console, \$1250; JH110 stereo play only, \$995. J Price, Price's Recording Studio, 2651 Globe Ave, Dallas TX 75228. 214-321-6576.

**Ampex AG-350** mono w/solid state electronics rack mount, \$500. Art/Bill Baker, Bdct Prods of America, 804 E 38th St, Indianapolis IN 46205. 317-925-7371.

**Tandberg 641X** 1/4-trk rarely used, BO. S Winthrop, Winthrop Prods, 156 W 94th St, NY NY 10025. 212-662-8685.

**Nagra #3** use for cinema, TV & radio, single-trk recorder, XLR input, signal to noise ratio, use for bdctg, \$950; #IV-D, use for music, TV & film, full trk, Neopilot sync system, XLR inputs, use for bdctg, \$1500. Jaye, Nimbus Prods, POB 5903, Takoma Park MD 20913. 301-507-3358.

**Revox A77** less R/P heads, 3 1/4/7 1/2 ips, poor cosmetics but good parts, \$125+s/h. D Dintenfuss, 206-784-4803.

**Tascam 42B** 1/4" stereo mastering recorder, balanced I/O, 2 hrs use, rackmount, \$2000/BO. M Ravain, Trinity Christian Music, POB 2479, Flagler Beach FL 32136. 904-439-3671.

**MCI 110B** used parts in gd working cond, motors, set transport cards w/micro, complete audio drawers, M Shea, Precision, POB 723, NY NY 10276. 212-989-2684.

**Tascam 34B** 4-trk w/dbx, rack mount, \$1825. J Ripley, KORD, POB 2485, Tri-Cities WA 99302. 509-547-9791.

**Marantz/Superscope PMD220** 3-head cassette, works well, \$80+s/h. R Zimmer, Snd Enhc, 2430 N Dodge #134, Tucson AZ 85716. 603-326-2080.

**MCI JH-110B** in metal rolling cabinet, uses 14" reels, \$1200. P Wells, KJOY, 625 Broadway, San Diego CA 92101. 619-238-1037.

**Magnecoder** all transistor mono w/custom cab; (2) Ampex 350 tube type, both in gd cond. R Raines, Dixie Sound, 1002 Fulton Dr, Corinth MS 38824. 601-287-3116.

**Ampex AG-440C-2** 2-chnl, 7.5", P/B only, \$1000. A Garza, Foster Comms, 2824 Sherwood Way, San Angelo TX 76902. 915-949-2112.

**Telex 6120 XLP** high-spd cass duplicator, master w/3 slaves & rwd mod, used less than 100 hrs, \$5000; ITC 850 stereo R-R RP, \$1750. S Southern, WCIR, Box 1037, Beaver WV 25813. 304-252-6452.

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**Ampex 350** 2-trk PB only w/OpAmp elect, 1 chnl not working, \$300; full-trk mono R/PB w/Unitelect, heads need relapping, \$400. C Irwin, CI Prods, 85 Union C004, Memphis TN 38103. 901-521-1468.

**Scully 270** P/B, you ship, BO; 280 R/PB w/record electronics, nds rpr, as is, BO. M Meyer, KLOP, Box 70, Madison MN 56256. 612-598-7301.

**Ampex 350** full-trk, gd cond, \$150+s/h. S Chism, WMBI, 820 N LaSalle, Chicago IL 60610. 312-329-4068.

**Dictaphone 1"** 40-trk loggers mounted in rack w/time/date generator/reader, gd cond, \$1875. Gary, 602-258-6161.

**Otari MX5050 MKIII-8** 8-trk, less than 2 yrs old, in roll stand, \$3500. E Kain, WWL, 1450 Poydras St, New Orleans LA 70112. 504-593-2105.

**Otari MX-5050 MKIII-4** in gd physical/elect cond in roll around cabinet. J Glass, WROK, 3901 Brendenwood Rd, Rockford IL 61107. 07A G03A Otari ARS 1000 DC R-R's (4), 2 chnl reproducer, 1/4" 1/2 trk w/25Hz tone sensor & cuetone relays w/adjustable delay, excel cond, \$1100 each. R Chambers, 916-257-2121.

**Scully MS-280-2** console, P/B & R w/remote, \$400 ea+s/h. D Vernier, KUNI, Univ of No IA, Cedar Falls IA 50614. 319-273-6400.

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**Scully 286B** (2) 1/4" mono w/manuals, 1 for use, 1 parts, BO+s/h. D Moore, WDUZ, Box 310, Green Bay WI 54305. 414-468-4100.

**3M M7916** 16-trk 2" master recorder, gd cond, great sound, \$7000; M-79-8 8-trk 1". M Cogan, Bay Records, 1741 Alcatraz, Berkeley CA 94703. 510-428-2002.

**Otari ARS-1000** (4) 2-chnl, 1/4-trk/1/2-trk w/25 Hz tone sensor & cue tone relay w/adjustable delay & manuals, excel cond, \$1100 ea. R Chambers, KSUE, 916-257-2121.

**BE Spotmaster 2000** (3) mono P/Bs, \$300/3. B Walters, WASE, POB 2087, Elizabethtown KY 42702. 502-769-1055.

**Crown 6CSX** 1/2-trk 10.5", tube elect, works well, clean w/case & manual, \$250/BO. R Glenn, 813-634-1940.

**Revox A77** 1/4-trk in walnut case, very gd cond, \$570; Uher CR240 portable prof w/ALC, monitor line adapt, leather case, access, excel cond, \$650/BO. J Paul, 2800 3rd St, San Francisco CA 94107. 415-821-6464.

**Revox A-77** gd cond, 1/4-trk, \$250. M Turner, WYIC, 7641 Camberwood Dr, Indianapolis IN 46268. 317-872-3004.

**Realistic SCT-74** stereo dual deck, play/no record, \$40+UPS. L Spivey, WLLS, Hwy 231 S, Hartford KY 42347. 502-298-3268.



**Want to Buy**

**Otari 5050 BII** less than 5 yrs old. A McCarthy, KVIC, 600 E Main, Vacaville CA 95688. 707-446-0200.

**2-trk 1/2"** head stack for Ampex ATR 100; Stelavox large reel adapters for SP-7. Bob, 212-219-3671.

**Technics M85** MKII for parts, specifically capstan motor. T Melbourne, WNAA, NC A&T Univ, Greensboro NC 27411. 919-334-7936.



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Scully '100' recorders, record/play amplifiers. 8, 16, 24 track heads. Sequoia Electronics, 1131 Virginia Ave, Campbell CA 95008. 408-866-8434.

Ampex ATR100 taperecorders for parts. Circuit cards, heads, motors, machine parts, or electronic parts. Call 818-907-5161.

**CD's**

**Want to Sell**

Technics SLP 720 plyr, \$200 ea; 1200 plyr, \$700. S Southern, WCI, Box 1037, Beaver WV 25813. 304-252-6452.

Denon 950FA working when removed from svc. \$700/BO. R Rogers, KSKG, 1217 S Santa Fe, Salina KS 67401. 913-825-4631.

Numark CD-5020 dual rack mountable, \$995. Steve, RRSC, 1201 S Sharp St, Baltimore MD 21230. 800-547-2346.

**COMPUTERS**

**Want to Sell**

Wang Computer Concepts System, 8" floppy, 2 term, HD, BO, Alan, KVIC, 600 E Main, Vacaville CA 95688. 707-446-0200.

Tandy WP-2 port w/28K RAM, WP-DUET software & cable for use w/Macintosh, \$450. F Beacham, Beacham Prods, 163 Amsterdam Ave, NY NY 10023. 212-873-9349.

Victor IBM 40-MB hd drv, 5 1/4 drive, 640K RAM, green mon w/software, \$350 +s/h. J Allen, 805-253-1277.

**CONSOLES**

**Want to Sell**

McMartin B-502 5-chnl stereo board, fair cond, \$495. B Boogalu, KKKK, 385 24th St # 800, Ogden UT 84401. 801-621-3131.

Gately 16x8 w/EQ, 4 effects buss, quad monitoring Canon connectors for line/mic inputs & Canon connectors for outputs, \$1500. Art/Bill Baker, Bdct Prods of America, 804 E 38th St, Indianapolis IN 46205. 317-925-7371.

RCA 8 pot, older vintage, works, \$350 +s/h. E Stanley, 701-228-2483.

Gemini MX8200 6-chnl stereo mixer w/reverb cue & many features, \$150. J Deering, Deering Imagineering, 329 Raindrop Lane, Hendersonville TN 37075. 615-264-2886.

ADM ST 160 MKII 4-trk prod, 10-SLI modules, 2 MIS modules, 4-trk mix, (2) 1x8 modules, (2) EQ modules, pgm & aux masters, BO, J Book, WOC/KUUL, 3535 E Kimberly Rd, Davenport IA 52807. 319-344-7000.

Audio Technica ATC 820 stereo console 8x2+effects in flight case, \$1000. J Price, Price's Recording Studio, 2651 Globe Ave, Dallas TX 75228. 214-321-6576.

Harris ST 80 & BE 250 series 8-chnl stereo, gd cond. J Church, WLUM, 2500 N Mayfair, Milwaukee WI 53226. 414-771-1021.

McMartin B-802 8-pt stereo, rotary step attenuators, works great, extra carts & manual, \$1000. M Everhart, KMXI, 9500 SW Barbour Blvd, Portland OR 97219. 503-245-1433.

Sparta Cetec 3410 10-chnl stereo, \$1250; Ramko DA-6BR/E, mono 1 in/6 out, audio dist amp, \$75. M Persons, KKIN, Box 930, Aitkin MN 56431. 218-829-1326.

Russco 505M 5 pot mono, gd cond, \$500; Sparta A-20 8 pot mono, \$200; BE 4M50, 5 pot mono, \$200. S Minshall, KFIV, POB 3408, Modesto CA 95353. 209-545-5585.

Russco 505 5-chnl mono, like new, \$750. R Cowell, KNTR, POB 308, Ferndale WA 98248. 206-384-5117.

Ramko DC12 for parts. T Melbourne, WNAA, NC A&T Univ, Greensboro NC 27411. 919-334-7936.

Sparta A-15 5-pot board, mint cond, \$300; turntables & turn, will separate/package +s/h. Ronnie, Super Sonics, 1401 NE 159th St, N Miami FL 33162. 305-949-2040.

Panasonic WR-450 6-chnl 3 1/2" rack mount mixer w/oscillator, speaker & talkback, excel cond, \$325; Eddor AM-400 auto mix mixer, 4 separate/adjustable voice activated chnls, Gary, 602-258-6161.

Auditronics 200 series (1) stereo input, fair cond, \$100; (2) microphone input, gd cond, \$175 ea; (1) mono line input, gd cond, \$150; (3) stereo line output, \$175 ea/\$950 all. M Guthrie, 813-287-1047.

Gates Producer 4-chnl, mono board, \$100. M Meyer, KLOP, Box 70, Madison MN 56256. 612-598-7301.

Allen-Heath-Brenell Scepter rackmount 12x2x1, 4 auxes, 8 returns, balanced I/O w/direct outs, separate pwr supply, quiet, \$1750. M Ravain, Trinity Christian Music, POB 2479, Flagler Beach FL 32136. 904-439-3671.

Ampro AC8D mono, 32 inputs, 8 mixers, 2 prog outputs, for parts, BO. A McDonald, Audio Services, POB 160175, Altamonte Springs FL 32716.

Ramsa 8616 mainframe, pwr supply, 4 mono input mods, 6 stereo input mods, LR output, 2 yrs old, \$500/BO. D Reynolds, WGF, 1356 Mackinaw Ave, Cheboygan MI 49721. 616-627-2341.

Studiomaster series 3 6 mono x 6 stereo x 4 subs x 2 mains, excel prod board, \$2995. J Ripley, KORD, POB 2485, Tri-Cities WA 99302. 509-547-9791.

Interface 16x8, to 24 inputs, very gd cond, little use w/manual, \$1000/BO. Bob, 212-219-3670.

Audio Technica AT4462 stereo field prod mixer, vgc w/manual, \$575. C Crouse, 48 Cedar St, Dedham MA 02026. 617-461-2699.

Gates/Harris Gatesway 80 8-chnl mono, clean, gd cond, \$1000. L Nixon, Classic City Prods, 1094 Baxter St, Athens GA 30606. 404-613-6724.

Ramko SC-5M 4-chnl mono, great for prod, \$300; DC-5M5 12-chnl stereo w/digital switching & light emitting meters, \$600, both in excel cond w/manuals. R Chambers, KSUE, 916-257-2121.

Shure SR101 Series 2 port audio mixer, SS, 8-chnl mixer/preamp w/reverb, rack mount in port case, excel cond w/manual, \$395. R Sumner, CAVU, 3322 Applegate Ct, Annandale VA 22003. 703-560-0233.

Shure SR101 series 2 audio, 8 input, \$125 +UPS; Ampex 6 input mike mixer, \$125 +UPS. L Spivey, WLLS, Hwy 231 S, Hartford KY 42347. 502-298-3268.

Custom prod/news w/50A circuitry, 7 stereo chnls, extra large Gates-type knobs & p/plates for rotary controls, 38" x 8" x 12", stereo EQ, \$495. Davis, MCP, 1504 Sunset, Newberry SC 29108. 803-276-0639.

Harris Mono 5 excel cond, \$500. B Walters, WASE, POB 2087, Elizabethtown KY 42702. 502-769-1055.

Eventide H949 Harmonizer, \$500; Gates ME 1 mod enhancer, \$100. S Southern, WCI, Box 1037, Beaver WV 25318. 304-252-6452.

Ramko SC-5M 4-chnl mono board, \$300; DC-5M5 12-chnl stereo w/digital switching & light emitting meters, \$600, both excel cond w/manuals. R Chambers, 916-257-2121.

QUANTUM Series 22 console, 14 input mainframe loaded with 6 inputs: 4 mono, 2 stereo, also with master and monitor modules. This console is like new in factory carton. \$1995. Boynton Studio Inc. 607-263-5695.

AUDITRONICS 501 recording console. Great production board, 18 inputs, 16 buss out. \$2800. Boynton Studio Inc. 607-263-5695.

Gates President, W.B.D.I. Retrofit Electronics, power supply, and instruction book. \$1995 with one year warranty on electronics. B Tarsio, B.D.I., 5 Crestview Ave, Peekskill NY 10566. 914-737-5032.

**Want to Buy**

Howe 10,000 parts or whole 10,000, no 10K, A McCarthy, KVIC, 600 E Main, Vacaville CA 95688. 707-446-0200.

Tube & remote mixers RCA/WE/Collins, OP5/6/7 & 22D. B Davies, Virgo Prods, 5548 Elmer Ave, N Hollywood CA 91601. 818-761-9831.

Quantum Series 22 modules; QM-2202, QM-2205, QM-2206, will buy mods/22 working consoles. B Geyer, 606-473-7377.

Langevin AM4A w/documents. J Gangwer, 942 32nd St, Richmond CA 94804. 415-644-2363.

**DISCO & SOUND EQUIPMENT**

**Want to Sell**

dbx 208 noise reduction system, \$850 & 216/224 systems. J Price, Price's Recording Studio, 2651 Globe Ave, Dallas TX 75228. 214-321-6576.

Lexicon 200 (2) stereo digital reverbs, new, XLR I/O, programmable parameters & presets. \$1900 ea/\$3600 both. M Ravain, Trinity Christian Music, POB 2479, Flagler Bch FL 32138. 904-439-3671.

Shure Vocal Master 2-6' columns, 2-3' monitors + PA head w/6-chnl inputs, old but reliable, BO. S Winthrop, Winthrop Prods, 156 W 94th St, NY NY 10025. 212-662-8685.

EEV Delta-Max processor controlled speaker systems, 2 pairs w/2" compression driver, 1 pair 12", 1 pair 15", dedicated processors, EP-4 cabline & I/O panel for amp rack, \$7000/will separate. M Ravain, Trinity Christian Music, POB 2479, Flagler Beach FL 32136. 904-439-3671.

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CBS Volumax 4000, \$500. D Seavy, KROC, 122 SW 4th St, Rochester MN 55902. 507-286-1010.

CRL IPP-100 mic processor, \$1250; SEP 400A compressor, \$900; SEC 400A compressor, \$1200; PMC 300A w/SPP 300 NRSC, \$1000; Studio Technologies AN-1 stereo synthesizer, \$250. M Persons, KKIN, Box 930, Aitkin MN 56431. 218-829-1326.

**We buy Optimod 8000A's and 8100A's 414-482-2638**

CBS Labs FM Volumax 411 stereo peak controller, works OK. BO. A McDonald, Audio Services, POB 160175, Altamonte Springs FL 32716.

Valley People 440 compressor, very gd cond, \$350/BO. K Fitzgerald, WKGB, 495 Court St, Binghamton NY 13904. 607-723-2925.

Wilkinson LGC-1 AGC unit, mono w/manual, \$200 +UPS; BE AM 400 compressor, mono w/manual, \$200 +UPS. L Spivey, WLLS, Hwy 231 S, Hartford KY 42347. 502-298-3268.

Modulation Sciences CL803 composite clipper, \$600; CRL FM-4 w/(1) SPP800, (2) SEP-400As, (1) SMP-800, \$1200. B Bailey, KIZN, 401 Idaho St, Boise ID 83702. 208-343-5991.

CBS Volumax stereo 411, \$225; (2) 410, \$130 ea. K LaRue, KSTN, 2171 Ralph, Stockton CA 95206. 209-948-5786.

Gentner RCF-1 for Optimod 8100A w/Audio Prisms, \$100. D Reynolds, WGF, 1356 Mackinaw Ave, Cheboygan MI 49721. 616-627-2341.

Inovonics 250 5-band, set up for AM, can be converted to FM, \$2000; Inovonics 215 limiter-mono, \$100; Optimod 8000 FM stereo gen & proc. \$1200. S Minshall, KFIV, POB 3408, Modesto CA 95353. 209-545-5585.

**Want to Buy**

Valley People 440 compressor & Apex aural exciter types I/II/III/C. K Fitzgerald, WKGB, 495 Court St, Binghamton NY 13904. 607-723-2925.

Optimod FM 8100/8000 gd cond, NE preferred. P Galasso, WJLK, 605 Mattison Ave, Asbury Park NJ 07712. 908-774-7700.

UREI BL40 schematic/manual to repair, will pay +postage. E Patrucci, WBCB, 200 Magnolia Dr, Fairless Hills PA 19054. 215-949-1490.

Fairchild 670 stereo & other tube proc gear used w/mastering discs. K Gutzke, Custom Recording, 7134 15th Ave S, Minneapolis MN 55423. 612-866-6183.

Urban Optimod 9100 A/B mono/stereo with NRSC. T McGinley, WPGC, 6301 Ivy Ln, Greenbelt MD 20778. 301-441-3500.

**MICROPHONES**

**Want to Sell**

Sennheiser MD211 \$195; Teladi condenser Elektro Akustische Gerate Dusseldorf Germany w/pwr supply, BO; HME-WM 252 wireless w/SMS8, \$295; Telex-WHM 500 wireless, \$250. J Price, Price's Recording Studio, 2651 Globe Ave, Dallas TX 75228. 214-321-6576.

Electro-Voice RE-20 w/EFB boom, like new, \$400. D Morris, WKUN, 204 W Spring St, Monroe LA 70655. 404-267-6558/2035.

Beyer M500 cardioid ribbon, \$250. P Cibley, Cibley Music, 138 E 38th St, NY NY 10016. 212-986-2219.

Sennheiser MKH 40 (2) cardioid digital rec series, \$850 ea; (2) AKG 451 EB cardioid w/20 dB pads, \$375 ea. T Hoffman, Sonic Booms, 29589 Serenity Way, Wilsonville OR 97070. 503-682-6988.

Shure SM-81 (4) matched cardioid studio condenser, never used, \$1000 set/\$275 ea. M Ravain, Trinity Christian Music, POB 2479, Flagler Beach FL 32136. 904-439-3671.

RCA ribbon & others. B Davies, Virgo Prods, 5548 Elmer Ave, N Hollywood CA 91601. 818-761-9831.

Electro-Voice 671 dynamic cardioid dual Z, new, \$50. R Sumner, CAVU, 3322 Applegate Ct, Annandale VA 22003. 703-560-0233.

Atlas (3) metal stands for desk in black, \$10 +UPS. L Spivey, WLLS, Hwy 231 S, Hartford KY 42347. 502-298-3268.

RCA 44 & 44 jr; SK 76, all in gd cond. R Raines, Dixie Sound, 1002 Fulton Dr, Corinth MS 38824. 601-287-3116.

Mics; desk mics (hi2), EV-Shure mic stands, also baby booms (3); tubes, new (32) RCA, GE, Sylvania; Sams tube sub books #8 & #6; RCA tube manual; Sony head demagnetizer (new); jack femal connectors; EV 502 transformer print/sec. Mr. Oliver, 212-674-7660.

Telefunken U-47, Neumann U-67, KM-54 mint; RCA ribbon mics (2) KU3A's 10,0001, (3) 77-DX, (1) 44-BX, (2) BK-5; Altec tube mics M-11, M-20, M-30; 639 film version mic ect. Trade or sale. Tracy Eaves, 615-821-6099 (evenings before 10PM EST).

**Want to Buy**

Neumann SM 69 fet w/pwr control unit; SM 69 vacuum tube w/ w/pwr supply, willing to trade pr of UJ89 w/shock mounts for either; NS 69 control unit/pwr supply for SM 69 fet, willing to trade CU48; Z240 matrix xformers must have paired serial numbers. E Kelly, Mobile Master, POB 61, Glenele MD 21737. 410-381-0263.

EV REJ20. K Fitzgerald, WKGB, 495 Court St, Binghamton NY 13904. 607-723-2925.

Western Electro-Acoustic Labs condenser mic complement (pwr supply) #120A. R Robinson, TNA, 10 George St, Wallingford CT 06492. 203-269-4465.

Sennheiser MKE 2002 at gd price. F Beacham, Beacham Prods, 163 Amsterdam Ave, NY NY 10023. 212-873-9349.

RCA 44S/77S/WE 639S & other ribbons, working or not. B Davies, Virgo Prods, 5548 Elmer Ave, N Hollywood CA 91601. 818-761-9831.

**MISCELLANEOUS**

**Want to Sell**

NMB 5915LN-12T-B30 new 220 cfm muffin fan, 6" diam, \$31.50. C Springer, KSEC, POB 890, Lamar CO 81052. 719-336-2206.

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Gates cabinet 7' w/patch bay & rear door, excel cond. R Raines, Dixie Sound, 1002 Fulton Dr, Corinth MS 38824. 601-287-3116.

Scully capstan (2) motors, rebuilt, \$50 ea. M Meyer, KLOP, Box 70, Madison MN 56256. 612-598-7301.

GE 117KVA xformer, 3PH, dry, 230V, in cabinet, new, \$500; 6 KVA xformer, 3PH, dry, 230V, 1820/3150Y sec, new, \$200. S Minshall, KFIV, POB 3408, Modesto CA 95353. 209-545-5585.

**Rotron Blowers for Elcom, CCA, CSI, McMartin, Harris, rebuilt & new.** Goodrich Enterprises Inc. 11435 Menderson St., Omaha, NE 68164 402 493 1886 FAX 402 493 6821

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Bud PA 3101 (20) rack panels new in paper, 3/16" thick, 1 1/4" x 19", \$110. Davis, MCP, 1504 Sunset, Newberry SC 29108. 803-276-0639.

Single rack stereo, like D-60, \$100/less. P Wells, KJOY, 625 Broadway, San Diego CA 92101. 619-238-1037.

PA Equip Rider, vol I manual, \$60; RCA PA & BC sales catalog, 47-50s, \$20. B Woolf, Audio Reco Sys, 3986 Eddin Dr, Jacksonville FL 32211. 904-744-1661.

**Want to Buy**

Wiring diagram for MicroTrak console, model 6150. D Parsons, 314-686-1663.

WP Software for TRS80 model 1, and Apple IIE. E Stanley, 701-228-2483.

Manuals: Precision 98 VTVM; Presto 41 limiter; HP335B FM mon; GE BA-5; GR meter for same; replacement glass for FP 63300 lower light controllers. S Todd, 3399 Kent St #307, Shoreview MN 55126. 612-483-9163.

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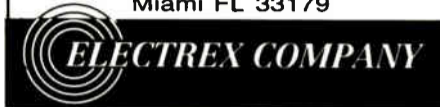
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**MISCELLANEOUS . . . WTS**

GE-Talaris PJ5155 manual. Jaye, Nimbus Prods, POB 5903, Takoma Park MD 20913. 301-507-3358.

Jazz record collections, 10" LP/12" LP bebop, swing, dixie, highest prices paid. B Rose, Program Recdgs, 228 East 10th, Nyny 10003. 212-674-3060.

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TFT 724 & 734 stereo modulation, \$500; AM 753, \$400. R Chambers, KSUE, 916-257-2121.

**BE MA-1** AM stereo, \$850; Kahn stereo, \$1000. S Minshall, KFIV, POB 3408, Modesto CA 95353. 209-545-5585.

**Want to Buy**

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Sony SRF A-100 AM/FM stereo, portable radios, quantities, \$120. C Fox, WOLF, 4853 Manor Hill Dr, Syracuse NY 13215. 315-468-0908.

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CAP RC-10A uses 1 pr, 1 xmtr unit, 2 studio units, excel cond, \$300. A Daigle, WSJR, 6 10th Ave, Madawaska ME 04756. 207-729-4000.

Moseley ARC 1600 remote control, \$1800; QEI 7775 FM ATS system, \$500; Marti RPT-1 xmtr 455.087+455.187 MHz, \$350. M Persons, KKIN, Box 930, Aitkin MN 56431. 218-829-1326.

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Marti STL-8 xmtr & R-200 rcvr both FCC type-rated, excel cond w/manuals, \$4250. R Chambers, KSUE, 916-257-2121.

Century Video (2) ABC Talkradio decoders, \$150 ea. G Jacques, KSUN, 714 N 3rd St, Phoenix AZ 85004. 602-252-0030.

Symetrix TI 101 clean w/manuals, working when removed from svc, \$150+s/h. D Moore, WDUZ, Box 310, Green Bay WI 54305. 414-468-4100.

Symetrix TI-101 telephone interface, \$349. Steve, RRSC, 1201 S Sharp St, Baltimore MD 21230. 800-547-2346.

Micro Dynamics TC8 extra-clean w/radio modules w/manuals, \$1200+s/h. D Moore, WDUZ, Box 310, Green Bay WI 54305. 414-468-4100.

Wescam 791B 2-4-wire telco hybrids, 60 db, long bal, \$50 ea; ADS 109H repeat coils, \$8 ea, both w/prints. R Weaver, 919-552-9357.

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Wegener W/1601 w/pwr supply, 1606-01 rcvr, 1645 & 1646 tone cards, excel cond, \$600. A Daigle, WSJR, 6 10th Ave, Madawaska ME 04758. 207-728-4000.

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Wilkinson late 70s mdl w/manual, \$250/BO. K Fitzgerald, WKGB, 495 Court St, Binghamton NY 13904. 607-723-2925.

BE FS30 gd cond w/manual, \$1800. B Bailey, KIZN, 401 Idaho St, Boise ID 83702. 208-343-5991.

BE AX-10 AM, \$2500; Kahn stereo/Powerside, \$5600; Moseley SCG-9, FM, \$625; Moseley SCD-9, composite demodulator, \$625; Motorola AM pkg, BE exciter & monitor, Inovonics 250 proc, \$4800. S Minshall, KFIV, POB 3408, Modesto CA 95353. 209-545-5585.

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Fidelipac carts (80) large w/5-15 min tape, excel cond, \$175 all+s/h. Davis, MPL, 1504 Sunset, Newberry SC 29108. 803-276-0639.

Libraries (2), AC on CD and cart & country on CD Golddiscs & Scotchcart II's, 6 mos old, \$4100; Fidelipac FID-MR200 200-slot mobile rack, \$150; 280 country carts, \$2 ea. B Lord, Lord Bdcgt, 13313 SE 208th St, Kent WA 98042. 206-831-2374.

Libraries of 1000+ 15 ips R-R prod music, all different, on LP/CD. Ronnie, Super Sonics, 1401 NE 159th St, N Miami FL 33162. 305-949-2040.

Agfa PEM 469 (6) 2" reels & boxes, unused, \$100 ea. Bob, 212-219-3671.

Scotchcart-II NAB Type AA 1000 carts of various 3-10 min lengths, new, \$1500/\$2 ea. F Troiani, WMRF, 12 1/2 E Market, Lewistown PA 17044. 717-248-6757.

**Want to Buy**

Fidelipac carts (500), various lengths, gd cond, \$1 ea/\$400 all. D Morris, WKUN, 204 W Spring St, Monroe GA 30655. 404-267-6558/2035.

We pay 50¢-\$100 for 45 rpm records from 50s & 60s, sleeved in nice cond. B Berry, Karavan Bdcgt, 13 Montgomery Ave, Conroe TX 77384. 409-273-2801.

**TAX DEDUCT EQUIP**

Bdcgt training school for underprivileged in need of (2): audio consoles, play only cart mchs, studio mics w/foam covers, baby booms & (1) R/P cart mach. F Smith, 615-624-7126.

Audio prod & field recording equip for intl womens radio projects. F Werden, WINGS, POB 5307, Kansas City MO 64131. 800-798-9703.

Indian educational FM station needs equip to train future broadcasters, will pay s/h. R Tohe, KGHR, POB 160, Tuba City AZ 86045. 602-283-6271.

Educ radio/TV needs any equip, espec cart, TT, stereo R-R, working, receipt/shpg provided. K West, SRSU, Dept Fine Arts, Alpine TX 79832. 915-837-8219.

Eng student desiring donation of old bdcgt equip (anything in repairable cond, will pay all shipping charges, EE student at Purdue. C Gill, POB 371, Indianapolis IN 46206. 317-923-2800.

Monte Vista Christian School, would appreciate any donations of used TV broadcast equipment. T Quinn, 408-475-0423.

Are you considering making a Tax Deductible Donation? Then please, make your donations of funds, or any broadcast equipment to, The Broadcast Training School For The Underprivileged. We need your help. Contact F Smith, President, B.T.S.U., 615-624-7126.

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| 1 kW FM   | 1978 Collins 831C2 | 1 kW AM   | 1974 Harris BC1H1    |
| 2.5 kW FM | 1978 CCA 2500R     | 1 kW AM   | 1978 Harris MW1A     |
| 10 kW FM  | 1972 Collins 830F1 | 2.5 kW AM | 1982 CCA 2500        |
| 20 kW FM  | 1973 RCA BTF 20E1  | 2.5 kW AM | 1976 McMartin BA2.5K |
|           |                    | 5 kW AM   | 1973 Harris BC5HA    |
|           |                    | 5 kW AM   | 1972 CCA AM5000D     |
|           |                    | 5 kW AM   | 1977 RCA BTA 5L      |
|           |                    | 10 kW AM  | 1972 RCA BTA 10U     |
|           |                    | 50 kW AM  | 1977 CCA AM5000D     |

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World Radio History

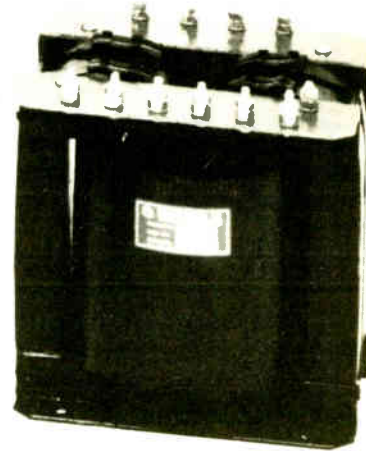
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FAX: (915) 751-0768

Circle (113) on Reader Service Card

## TEST EQUIPMENT

### Want to Sell

Hewlett Packard 333A distortion analyzer, \$695; 353 patch panel 110dB attenuator, \$125; Wavelorm 520-A RMS/DBM sensitive watt meter, \$195; Sennheiser impedance meter ZP2, \$200; Ithaco 4302 dual 24 dB/octave Hi-LO-Pass Filter 1/10 to 1 MHz, \$295; Wave-tek mdl 30 function generator sine & square wave, \$135; Weston 666 multimeter, \$100; Eico 150 solid state signal tracer, \$100; Sorenson pwr supply DCR20-25 2-meter rack mount, \$200; Heath audio generator IG-72, \$100; RCA transistor tester WT-501A in/out circuit, \$50. J Price, Price's Recording Studio, 2651 Globe Ave, Dallas TX 75228. 214-321-6576.

Goldline TS-1 RMX audio test set, rack mountable, \$149; Potomac FM-72 UHF field strength meter, \$5895. Steve, RRSC, 1201 S Sharp St, Baltimore MD 21230. 800-547-2346.

Tektronix 535A w/2 type-CA plug-in units w/type 202-2 scope cart, \$200; 575 (2) curve tracer, 2nd for parts, \$200+s/h; General Radio 1932A noise distortion mtr, \$150+s/h, all in gd cond. S Chism, WMBI, 820 N LaSalle, Chicago IL 60610. 312-329-4068.

Bruel & Kjaer 2033 high res FFT sound & vibration analyzer, 0-20 kHz, 11 baseband ranges, amplitude of 40 dB, 80 dB & linear, \$4995; Bird 6154 dummy load w/wattmeter, 150 W, 25-1000 MHz, \$335; Bird 434275-100 RF wattmeter/variable sampler, 20-1000 MHz, 1 kW, needs element, \$225; Tektronix 529 188D TV waveform mon, response to 8 MHz, multi-standard version, PAL frame selector, \$525; Philips PM3266 oscilloscope, port xfer storage, 100 MHz, dual trace, \$1995; HP 200CD audio gen, 5 Hz-600 kHz, at 600 ohms, all in excel cond w/manual. R Sumner, CAVU, 3322 Applegate Ct, Annandale VA 22003. 703-560-0233.

B&B AM2B Phascope, checks headroom, 6 mos old, \$675. B Lord, Lord Bdctg, 13313 SE 208th St, Kent WA 98042. 206-631-2374.

Heathkit ET-3100 Electronic Design Experimenter, gd for teaching/learning basics, \$50+UPS; Phone Patch HD 1515, \$20, 1 pay s/h; Deviation Meter SM-4180, \$100+UPS; Frequency Counter 1B-1103 8 1/2 digit counter, gd to 500 MHz w/manual, \$75+UPS; HP 200AB audio oscillator, works well, \$100+UPS; HP 330B distortion meter, works well, \$100+UPS; Tektronix 503 oscilloscope, gd audio scope, no probes, \$100+UPS; Precision/Paco Signal Generator E-200-C, \$60+UPS; Lii Bitly Tester, transistor, SCR, TRIAC tester, mint cond & free meter case, \$25, 1 pay s/h; SA-6 electric desolder sucker & PC BH-50 circuit board holder, \$50 both, 1 pay s/h, all VGC w/manual. L Spivey, WLLS, Hwy 231 S, Hartford KY 42347. 502-298-3268.

Leader LCG-400 bar & pulse test gen, \$1750/BO; VII mdl 536 bar dot gen, \$200/BO; Lenco PFM-300B locking gen w/modules PSS-302 pwr supply, PSG-310 locking ref, PCB-320 bar gen, PBB-312 delta, PRC-365 proc amp, full & split bars; HP-400E/EL audio AC voltmeter, \$350/BO; HP-652A, \$800/BO; Tektronix oscilloscopes 475475A, \$1500 ea/BO; 468 storage scope, \$2000/BO; 465B, \$850/BO. M Glaser, MRG Prod Assoc, 95 Colony Dr, Holbrook NY 11741. 516-447-1041.

Delta Elec RG-1B rovr/gen, \$2000; OIB-1 REK impedance bridge, \$2000; Gates 10 kW 50 ohm AM dummy load, \$1700; HP 206A signal gen, \$300; HP 332A distortion analyzer, \$930; Potomac Instr FIM-41 field intensity mtr, \$2500; Tektronix T922 15 MHz dual trace oscilloscope, \$900. A Garza, Foster Comms, 2824 Sherwood Way, San Angelo TX 76902. 915-949-2112.

Patch bays (4) ADC single inputs (24) rack mount; Dynakit pre-amp PAS 2: manuals for Ampex recorders 601, 351, 350 also for Gotham PBF 150 W amp & Neuman lathe 131 disc cutter; Ampex mixer MX-35. Mr. Oliver, 212-874-7660.

### Want to Buy

Dir LA3S mdl FL-4 manual for flutter meter. D Dintenfass, 206-784-4803.

## TRANSMITTERS

### Want to Sell

RCA BTF 40E1 combiner, great cond, only used by WMC FM, BO. D Lacy, Mountain States, 1885 Ponder Heights Dr, CO Springs CO 80906. 719-636-2470.

Exciters: McMartin B-910 tuned and calibrated to your frequency, guaranteed: Mono, stereo, SCA. Goodrich Ent. Inc, 11435 Manderson St., Omaha NE 68164. 402-493-1886 FAX: 402-493-6821

BTC B-300 new 300 W RF amp w/internal harmonic filter, C Springer, KLMR, POB 890, Lamar CO 81052. 719-336-2206.

Collins 310-22 FM exciter, 94.3 MHz, excel, \$2000; CCA FM-40E, freq agile FM exciter, excel, \$2000. M Persons, KLIN, Box 930, Aitkin MN 56431. 218-829-1326.

Collins 831-D1 2 kW, removed from svc due to pwr upgrade, \$4000. J David, KMP/LKSTG, POB 907, Sikeston MO 63801. 314-471-1520.

Harris MX-15 exciter in very gd cond w/manual, PLL design, up to 20 W C Springer, KSEC, PCB 890, Lamar CO 81052. 719-336-2206.

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Euro-Tech DB500-DB2500, 500 W, 2500 FM RF amps, new, wrnty, single phase 220 V use 3CX800/3CX3000 tubes, shipped to you, \$5000; DB PM250, 250 synthesized, 250 W FM exciter, \$2845; 20 W w/built-in stereo encoder, \$1675. A Branch, KYAY, 2402 Woodridge Dr, Decatur GA 30033. 404-325-7847.

Collins 831-01 2 kW, removed from svc due to pwr upgrade, J David, KMP/L, POB 907, Sikeston MO 63801. 314-471-1520.

### WHY PAY NEW PRICES?

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FOR DETAILS

Gates BC1G tuned to 1400 kHz, badly damaged, good for parts, you transport, BO. G Jacques, KSUN, 714 N 3rd St, Phoenix AZ 85004. 602-252-0030.

Continental 510 exciter like new, \$700. F Troiani, WMRP, 12 1/2 E Market, Lewistown PA 17044. 717-248-6757.

TTC 250-B 250 W FM, reliable, removed from svc, \$1000+s/h. T Hopkins, Alexandra Comms, 580 Roger Rd, Walla Walla WA 99362. 509-529-7094.

Bauer 707 1 kW AM tuned to 900 kHz, 3 pwr levels. L Rixman, WFLA, 304 PO Alley, Louisville KY 40202. 502-583-4811.

Harris Allied FM 35K '85 mdl tuned to 104.9 MHz, factory refurb, nominal use, cash & carry, \$22500 neg, B Thornton, KNTL, 405-789-1140.

Collins 300J, 250 W AM, \$600; 550A 500 W AM, \$600; RCA BTA-5H 5000 W AM, \$900, all need minor rpr. K Hill, WONG, POB 1151, Madison MS 39110. 601-856-5444.

Exciters: OEI 675 FM, gd cond, \$700; Harris MX-15, excel cond, \$3000, both on 92.3 w/no manual. B Bailey, KIZN, 401 Idaho St, Boise ID 83702. 208-343-5991.

RCA BTA-5H 5 kW rig complete, whole/parts. J Cole, WBTM, Danville VA 804-797-3918.

Rotron Centrimax for CCA/CSI FM, price includes s/h, \$675. L Spivey, WLLS, Hwy 231 S, Hartford KY 42347. 502-298-3268.

CCA FM 1000DS replaced due to pwr upgrade, great cond, you pick up, \$1000. D Hull, KWBR, 3195 McMillan Rd, San Luis Obispo CA 93401. 805-541-8878.

CSI 3000E FM, excel cond, D Smith, WFCB, 45 W Main St, Chillicothe OH 45606. 614-773-3000.

Harris FM-2.5K Transmitter.  
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Elcom 690 exciter, 6 yrs old, \$1550. P Posen, KEZN, 72-915 Parkway Dr, Palm Desert CA. 619-340-9383.

Nautel 1 kW tuned to 1450, new w/accessories, \$17500. T Wayne, KSGI, Box 1450, St George, UT 84771. 801-628-1000.

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- 1.0 kW FM 1972 CCA 1000DS
- 2.5 kW FM 1977 Harris 2.5H
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- 5 kW FM 1969 Visual 5KB
- 5 kW FM 1977 RCA 5E2
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- 20 kW FM 1972 RCA 20E1
- 25 kW FM 1974 AEL 25KE
- 1 kW AM 1978 Harris MW-1A
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10/20 kW excel cond, need by 3/92. D Rogers, KXAX, POB 465, St James MN 56081. 507-375-3386.

LPB/other 25+ W carrier current, F Vobbe, WLIC, Box 1689, Lima OH 45802. 419-229-7091.

20,000 W FM ary cond, esp CSI/CCA. D Smith, WFCB, 45 W Main St, Chillicothe OH 45606. 614-773-3000.

Harris MS/MX-15 for backup, must be repairable: 8000A Optimod. C Scott, WKYU, Western KY Univ, Bowling Green KY 42101.

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Gates BC5-P 5000 W AM tuned to 1470 kHz, \$5000; Phelps Dodge 5-bay circ polarized FM tuned to 103.7, \$2000. S Southern, WCIR, Box 1037, Beaver WV 25813. 304-252-6452.

Used Transmission Line, many sizes & lengths, many like new. 816-635-5959.

Dummy Load, 20 kW electro air cooled AM or FM in excel cond. Goodrich Ent Inc, 11435 Manderson St, Omaha NE 68164. 402-493-1886.

### Want to Buy

CSI 1 kW/less for standby, gd cond. Haley, Polk Co Bdctg, Box 111, Livingston TX 77351. 409-327-8916.

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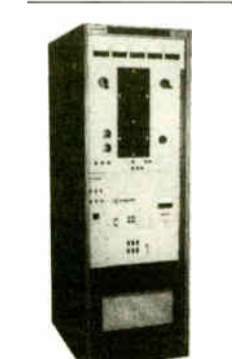
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500 W FM (1) stereo or (2) 5000 W FM stereo. L Maierhofer, VITGC, 101 Armory Blvd, Lewisburg PA 17837, 717-523-3271.

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McMartin AM/FM xmtr, any model, exciter or stereo modules. Goodrich Ent., 11435 Manderson, Omaha NE 68164, 402-493-1886.

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Russco Cue Master (1) pr w/ tone arms/cartridges, \$195. Davis, MCP, 1504 Sunset, Newberry SC 29108, 803-276-0639.

Sparta (2) 3-spnd, ea w/2 tone arms, \$150 both +s/h. Ronnie, Super Sonics, 1401 NE 159th St, N Miami FL 33162, 305-949-2040.

Collins 12" (2) 3-spnd, for parts, BO. A McDonald, Audio Services, POB 160175, Altamonte Springs FL 32716.

**Want to Buy**

Schematic & repair for Technics SP10MK2A. R Taylor, WHEN, 620 Old Liverpool, Liverpool NY 13088.

Fairchild tone arms, mono/stereo cartridges, esp 500/501/XP4/232 arms, F-7 cartridges+misc, any cond. D Bisbee, 685 S Roys Ave, Columbus OH 43204, 614-279-6163.

Rec-O-Kut, Shure 16" tone arm, J Panza, LZZS, Box 9847, Kansas City MO 64134, 816-767-1118.

Svc manuals/parts for Grey viscous damped & regular tone arm, 16" transcription unit, circa 1948-1955. L Van Luven, 60 Rochelle St, Rochester NY 14612.

RCA Presto & other disc recorders & assoc equip, blanks, needles, pre-recorded 16" transcriptions, acetate/pressed. B Davies, Virgo Prods, 5548 Elmer Ave, N Hollywood CA 91601, 818-761-9831.

**VIDEO PROD EQUIP**

**Want to Sell**

GVG 3400 dist amp, tray w/(4) 3403 DA's & pwr supply, \$1000/BO. MRG Assoc, 95 Colony Dr, Holbrook NY 11741, 516-447-1041.

Adda VW-3 synchronizer w/manuals; Harris 550-VT dig TBC, both \$900 ea/BO. M Glaser, MRG Prod Assoc, 95 Colony Dr, Holbrook NY 11741, 516-447-1041.

**VIDEO TAPE RECORDERS**

**Want to Sell**

Sony U Matic VP 5000 3/4" play w/RM 580 remote control, mint, 25 hrs head time, \$1500. Pegi, Global American, 1768 Coral Way N, Vero Bch FL 32963, 407-231-4800.

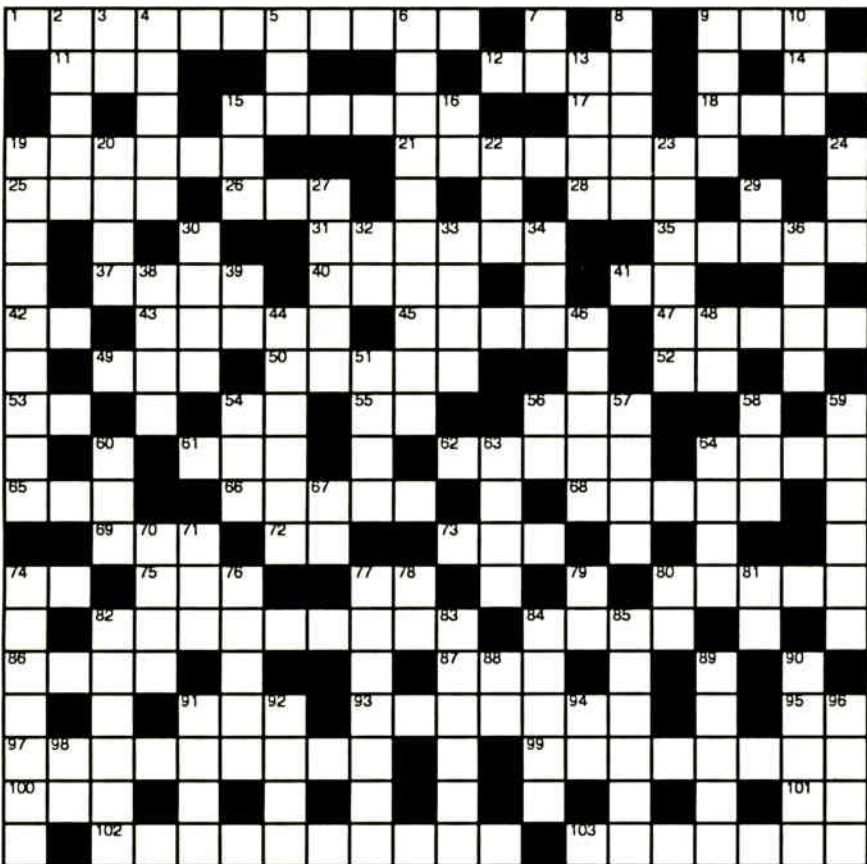
NEC 3/4" U Matic time lapse, \$350 +s/h. J Baltar, ME Reel Video, 67 Green St, Augusta ME 04330, 207-623-1941.

Panasonic AG-1950 VHS in perfect cond, less than 50 hrs w/operation & svc manual. R Larson, Larson Prods, 3 Braden St, Presque Isle ME 04769, 207-764-3770.

NEC VCR variable spd 3/4" U-Matic, \$400. J Baltar, ME Reel Video, Augusta ME 04330, 207-623-1941.

## This Month's Crossword

by Steve Walker



**ACROSS**

1. "Clean as your audio"
9. Makes XIOO chip
11. Wrote "The Raven"
12. Quiet
14. Transmit
15. Censors
17. Individually; abbv
18. Often used in paper caps
19. Money for airplay
21. Station owner
25. Resistance units
26. A hard disk interface
28. Digital Equipment Corp
31. King's network
35. Answers questions
37. Something you learn in 1st grade
40. Add
41. Article
42. You're reading it
43. Cease
45. Difference; RF products company
47. Copy exactly
49. In voluntary cooperation...
50. Above; over
52. About
53. Rock band, \_\_\_\_-Top
54. close to
55. Like
56. Government agency against pollution
61. Abbr. for one or more radiating elements
62. New Gentner stereo generator
64. Feeble
65. Recording format
66. Spell; amulet
68. Noble gas
69. Audio processing
72. milliwatt
73. Acronym--computer connections

**DOWN**

2. Famous TV talk show hostess
3. Negative
4. Phone box
5. Current-mode logic
6. Waveform magnitudes
7. Audio measure
8. #degrees lead or lag
9. Healing cactus plant
10. Family of logic chips
13. Emit; issue
15. Builds "Live Assistant"
16. Semiconductor material abbr.
19. Only works one way
20. Non-profit youth group
22. "Simply The Best"
23. Tube reloads
24. Regulates the air
27. All gone
29. Thomas Magnum

74. What you need before you build
75. Engineer's group
77. Not down
80. Standings
82. The old gray cart and the new DCR-1000
84. Supply line
86. Utensil
87. Bullfight cry
91. Rock
93. Prisoners
95. 3D unit of measure (abbrv)
97. Removing unwanted components
99. Connector tools
100. Back; to and \_\_\_\_\_
101. Tries to duplicate human thinking
102. Console manuf; breadrock
103. \_\_\_\_\_ Development Group is on the "Cutting Wedge" of acoustics

30. Polychlorinated biphenyls
32. Safety organization
33. Operator
34. Many
36. Worthless
38. Newborn
39. Thus, hence
44. Time; cadence
46. Grand master
48. 30-300kHz
51. Two
54. Oscilloscope connector
56. Perry Como, Andy Williams,...
57. Computed by integrals
58. Sister
59. Go around
60. Series 99, Delta, Series 1,...
63. New AM
64. Left side
67. "\_\_\_\_\_ , shucks!"
70. Bar; power supply line
71. Special purpose rectifier
74. Disconnects
76. Cut
77. Standing
78. Amplification system for public speaking
79. AudioVAULT digital audio
80. State whose capital is Pierre
81. Non-direct current
82. Go after
83. System ground
84. Get
85. With little difficulty
88. Where David Duke is
89. Enter data
90. Get lost
91. Hereditary factor
92. Money factory
94. Emergency Room (abbrv)
96. Cow-headed goddess
98. Radiation of longer than visible wavelengths perceived as heat

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Our model A-500 is a thoroughly engineered on-air console: it delivers the level of performance your clients now expect, and DAB demands. All components are selected for long life—gold bus connectors, gold I/O connectors, all gold contact switches, gas-filled relays, triple burned-in integrated circuits, solid state ON/OFF lamps, and precision laminated Lexan control surfaces for a lasting, wearproof finish. And we back that up with a 3-year parts and labor warranty, complete with

factory support from a technically competent and responsive staff.

We've also handled your special requirements as well with a super family of accessories, including a choice of three different telephone modules, an intercom module, an off-line mixer module for your remote feeds, talent control stations, accessory panels, failsafe power supplies, and auto cart and CD sequencing options.

**So take a close look:** we've got the quality, we've got the innovations, and you've got our commitment to top-notch support.



# *The Better We Look!*

*A-500*

# The New Wheatstone Production – Air Console



## *In Fact, a Whole New Console Family...*

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Beyond its on-air capability the SP-4 is a powerful production console offered in 2, 4 and 8-track formats. Production crews will love the smooth sounding equalization, the auxiliary send buses, and, of course, the full on-air type machine and console logic. There's also plenty of room for those special functions: like a phone module that can handle multiple callers, yet

doesn't tie up your line inputs; an intercom module that lets you communicate with other Wheatstone consoles and rackmount locations throughout your facility; plus a studio control module, line preselectors, tape controllers, and automatic timers.

And, of course, there's the componentry: all gold contact switches for the ultimate in reliability, gold bus connectors, gold I/O connectors, solid state on/off lamps, and triple burned-in ICs. Naturally, each console is also triple-tested.

**The fact is,** Wheatstone's got the features, the componentry, the reliability, the performance and the reputation you can depend on.

Call us.

*SP-44/4-Track*