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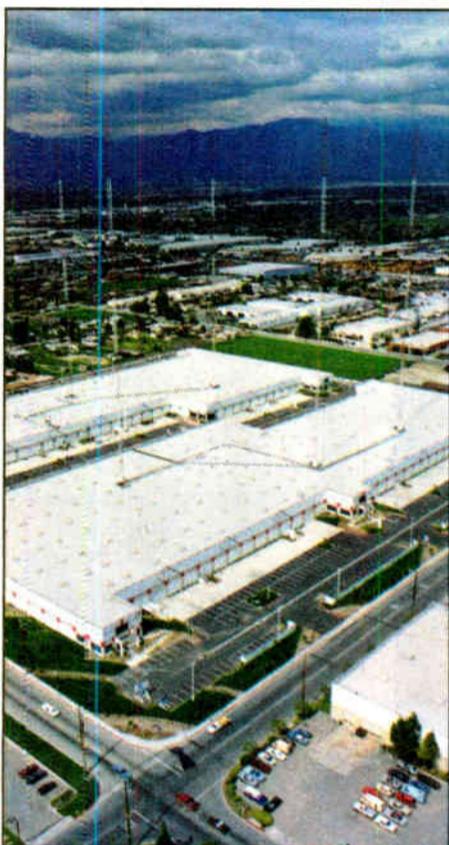
SBE CONVENTION WRAP-UP

Radio World®

Vol 15, No 21

Radio's Best Read Newspaper

November 6, 1991



Rising Above the Terrain
This California industrial complex was actually built around an existing five-tower antenna farm. To find out how, see p. 9.

L-Band Reception Close to FM

Canadian Signal Tests Yield Surprising Results

by Alex Zavistovich

HOUSTON Preliminary findings of Canadian L-band (1500 MHz) analog signal propagation tests seem to indicate that digital radio reception at that frequency may be similar to FM and UHF signal reception at comparable ERP, according to

an engineer connected with the tests.

The test findings also indicate that L-band signal permeability is better than had been speculated, and is not appreciably degraded by obstructions such as tree foliage.

Francois Conway, an engineer with the Canadian Broadcasting Corp., shared the L-band findings at a digital radio broadcasting session held during the Society of Broadcast Engineers (SBE) convention here.

Conway stressed that the findings are preliminary. A final report was expected by late October, he said.

The L-band propagation tests were launched in Canada with an eye toward using the band for digital audio broadcasting (DAB). Coverage area and signal permeability were among the topics investigated.

Although he acknowledged that no L-band allocations are available to broadcasters yet, Conway said Canadian researchers believe the FM and VHF bands have insufficient bandwidth to meet all their desired DAB service requirements. In addition, he said, using the UHF band for DAB would impact NTSC low-power TV stations and advanced television system implementation.

The Canadian tests were conducted using an assumed field strength of 35 dBu, with a receiver threshold of 39 dBu. Coverage analysis measurements were made in Ottawa and Montreal with a mobile receiver setup (see RW, Aug. 7, 1991).

Agreements Highlight 1991 SBE Convention

HOUSTON National and international agreements marked the latest Society of Broadcast Engineers (SBE) convention, held here Oct. 2-5.

In one case, fortunate timing allowed the SBE to score a coup over the other trade shows held during the season. Francois Conway, an engineer with the Canadian Broadcasting Corp. (CBC), shared preliminary results of the CBC's recent L-band signal propagation tests for the first time at the SBE conclave (see separate story, this issue).

On some fronts, however, the convention was less successful than its organizers may have hoped. The trade show featured fewer than half of the 250 exhibits promised in the convention's promotional materials, and the overall number of attendees seemed down from last year.

Although final attendance figures were unavailable at press time, SBE Executive Director Steven Ingram said attendance was "about the same as last year." For exhibitors, that meant slower traffic than they had hoped.

Some of the problems the SBE has had in developing the trade show portion of its convention may be alleviated by an agreement the society has reached with the Radio-Television News Directors Association (RTNDA).

(continued on page 8)

Good correlation

In citing test findings, Conway said coverage measurements correlated well with an initial propagation model, and signal propagation at L-band was found similar to that of the UHF-TV band. Further, no "shadow loss" of signal could be confirmed by the tests, he said.

According to Conway, the L-band signal consisted of two components—a direct signal and a low power composite multipath signal, in general, above the receiver threshold. The signal was not affected by obstructions or tree foliage, he added.

(continued on page 7)

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Fee Options Studied

WASHINGTON A House-Senate conference committee has rejected a plan to raise half of the FCC's funding through a host of license fees, but such a plan is still alive on Capitol Hill.

At a recent meeting, the conference committee approved a plan appropriating \$126 million for the FCC's 1992 operations. The plan now goes before the Senate and the House for a final vote.

Another spending plan already has received House approval, however. That plan seeks to raise \$65 million in revenue through a host of annual fees on broadcasters, cablecasters and telecommunications operations.

The proposed fees include \$2,000 for television stations and between \$100 to \$500 for radio stations. (See RW Sept. 11, 1991.)

Another FCC funding bill is pending before the Senate, but the bill does not include such fees.

The NAB, which has vigorously opposed broadcast fees, congratulated the conference committee members, but cautioned against thinking the license fees were dead this year.

"Although some might think this is a final victory, we do not view it as such," said Jim May, NAB's executive vice president of government relations. "We must continue to be vigilant as the FCC authorization bill makes its way to final passage."

Ritter Wants Engineer on FCC

by Alex Zavistovich

HOUSTON Lawyers and FCC commissioners might feel a little uneasy around Congressman Don Ritter.

At a banquet concluding the SBE convention here, Ritter (R-Pa.) urged the preservation of localism under any accepted DAB scheme, supported a requirement to have an engineer among the FCC's commissioners and railed against the pervasiveness of litigation in the United States.

Ritter is a member of the House Energy and Commerce

Committee and the Telecommunications and Finance Subcommittee.

Speaking before a receptive audience of broadcast engineers, Ritter advocated the rapid adoption of a DAB system. He said that the question of how such a system should be delivered—by satellite, over the air, or by cable—is "answered by the intent."

If DAB is intended as a supplement to conventional broadcasting, then a national (satellite) delivery system could be used, Ritter conceded. He

stressed, however, that if it is intended as a replacement, the delivery must be locally-oriented.

"Local radio is a national treasure," Ritter said. "We must preserve localism in radio under any DAB plan."

As for the spectrum at which DAB would operate, Ritter said that U.S. World Administrative Radio Conference (WARC) recommendations will include DAB allocations in the L-band and the S-band. Unfortunately, he noted, some current users—particularly NASA—are reluctant

to move from that spectrum.

The National Telecommunications and Information Administration (NTIA) may be able to convince NASA to move from the spectrum under HR 531, the Emerging Technologies Act, Rit-

Turning his attention to the FCC, Ritter bemoaned the fact that, since its creation in 1934, only eight of 64 commissioners have had any engineering background.

At least one commissioner

"Local radio is a national treasure. We must preserve localism in radio under any DAB plan."

— Rep. Don Ritter (R-Pa.)

ter said. The act tasks the NTIA with finding 200 MHz of government spectrum to reallocate to new technologies, he explained.

should be required to have such a background, he insisted. Such a criterion would bring a "new level of technical sophistication to the eighth floor" of the FCC.

Ritter said his recently-introduced "Federal Communications Commission Engineering Sciences Qualifications Act" would require at least one commissioner to have a B.S. degree or be a registered engineer. "It's plain common sense," Ritter said, receiving a standing ovation.

Ritter's bill has a counterpart at the FCC. A proposal to have an engineer on the commission was submitted to the FCC by Dane Ericksen, of the engineering firm of Hammett & Edison, on behalf of the SBE earlier this year.

That such an act has to be suggested at all, Ritter said, points to the pervasiveness of the legal profession in the U.S.

"We are crawling coast to coast with an overburden of litigation you wouldn't believe," Ritter noted. America's growth has been "stunted" by lawyers and litigation, he continued, a situation that is "not affordable in a highly competitive global economy."

According to Ritter, for the bill to pass into law a "large-scale grass roots effort" is required. He urged those in attendance to contact their representatives and actively encourage co-sponsorship of the bill.

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Field Inspections on the Rise

by Alex Zavistovich

HOUSTON In 1992, the FCC Field Operations Bureau (FOB) plans to conduct more station inspections than it has at any time in recent memory.

During an SBE convention session titled "The Regulation Front," Lloyd Perry, an engineer with the FCC's Houston field office, described some of the areas the FOB has targeted for inspections for the coming year.

In fiscal year 1991, the FCC conducted 263 inspections of broadcast facilities—AM, FM, FM educational and TV stations, Perry said. Of those, 157 resulted in violation notices or fines.

The FOB's inspection process has four phases, Perry explained. First, a survey is conducted to pinpoint violation areas, then compliance efforts are undertaken, followed by a determination of the effects of those efforts. Finally, Perry said, the efforts are adjusted, if necessary.

Perry outlined four areas of inspection at a typical station: inside, outside, EBS and technical. Violation rates of 10 percent or more as determined by survey indicate the areas to be investigated.

Based on the FOB's most recent survey, under the category of "inside," field inspectors will look at whether an operator is on duty, remote control and the public file. Although Perry acknowledged that engineers may not be

able to control access to a station's public file, the violation rate for that aspect of station operation is 25 percent, and that is "way out of hand," he said.

FCC inspectors will look "inside" and "outside" of stations to determine compliance.

"Outside" the station, the inspectors will look at the ground system, AM tower base fencing and tower paint and lights. Perry said "there's not a lot of leeway" with tower fencing. The fence must be able to prevent people from walking up to the tower.

Perry reminded the audience that in the case of a tower violation, every licensee on the tower is fined.

EBS inspection areas will include verification of a current checklist and verification that tests were received, conducted and logged. Checks will be made to determine whether EBS monitors are missing, malfunctioning or tuned to the wrong station.

Under "technical" criteria, transmitter under- or over-power will be checked, Perry said. For directional stations, directional parameters and monitoring points will be examined. According to Perry, directional stations are targeted for inspection in the coming year, particularly

those in Houston.

FCC compliance efforts include inspections and fines (which have recently increased), he said. In addition, the FCC

The FCC is also interested in using education to ensure compliance. It is easier and more cost-effective than other methods, Perry explained.

Stations can lower the chances of inspection by lowering the violation rates in specific areas, he said. By keeping violations low, the FOB won't be as motivated to conduct inspections of broadcast facilities.

Perry summarized the FOB's reasons for conducting inspections to ensure compliance by quoting a Vidal Sassoon slogan.

"If you don't look good, we don't look good," he said.

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Did Someone Mention the D Word?

by Judith Gross

FALLS CHURCH, Va. Are you as sick of DAB as I am?

Not that it isn't mighty interesting and all. Heck, without controversy where would we be? Doing crossword puzzles and cleaning the lint from relay contacts, no doubt.

But those three little letters have caused more than their share in the last



year, don't ya think? And, I mean, there's a whole world out there, a whole universe that doesn't really revolve around whose system and what frequency and all.

So how about it? A non-DAB Earwaves, OK?

We were hoping for a glimpse of the NAB's super tuner at one of the fall shows, but Denon has the prototype and it was in Japan, so, no go.

OK, and a nifty product that was not at the shows but that has been brought to my attention anyway by Mike at Enberg Electronics, is something for those of us who are a bit near-sighted. It's a giant LED VU meter.

Really. It's actually a billboard with a working VU meter tuned to your station. So as your listeners drive or jog or roller blade by, they can see the station on the air from the humongoid red LED lights flashing. No kidding. Here's one from KSHE in action. Give Mike a call at 317-253-3866 for more info.

And what's next? How about an Empire State Building-size microphone? "Helloooo. This is King Kong, playing the hits."

Before I forget, I wanted to give you a

chance to enjoy some radio history and contribute to a worthy cause. The Broadcast Pioneers' Library, just across the river in D.C., is going to preview a documentary: *Empire of the Air: The Men Who Made Radio*.

It's from the book by Tom Lewis, who produced the drama along with Ken Burns (PBS's *Civil War*). It'll happen on Nov. 19 at Washington's Carnegie Institute. Call Catherine Heinz, the library's director (202-223-0088) for the details and help keep the library going strong.

Don't know about you, but my feet are awfully happy the fall show circuit has wound down. I mean, there are only so many press receptions you can go to, only so many little hot dogs wrapped in bacon you can wolf down before you're ready to cry "Enough already!"

But let's see, there was the SBE in Houston, where JG was there in spirit, at least, if not in the flesh. Larry Hinderks from Corporate Computer Systems, oh excuse me, I mean Dr. Hinderks, did his song and dance on compression, I understand.

Larry, who has MUSICAM working down at unbelievable bit rates, got the laughs in the usual places and had the engineers understanding compression just like they'd invented it before the session was through, I understand.

Word from Houston was that the show drew a decent crowd (although I understand that the closing entertainment had folks looking for the exit signs). Next year it's on the west coast, but the buzz is that two years hence the show will combine with the Radio and Television News Directors Association in Miami.

Now, combining this show with another national gathering is not a bad idea. But last I heard, the RTNDA had ceased most of its equipment emphasis and was more of a programming and promotion for news affair. That, and the fact that radio news as we know it, except on all-news and public stations, has all but disappeared, make this a strange choice.

At the AES, you couldn't tell there's been a slow economy or anything. I mean, crowded!

Interesting buzz and a few new playthings from AES. Format support seems to be shifting from DAT to DCC, and there are questions in a lot of audiophiles' minds about how successful the Sony mini-disc will be in that climate.

Of course compression algorithms were dirty words to the ears of the purists. Yes, I know, you don't end up with a true representation of audio. Yes, we know that.

An honest-to-goodness giant VU meter for the world to see.



But now tell that to broadcasters who have to squeeze 10 pounds of audio into a five-pound bag, and make it sound like a CD at that. It's a tough trade-off.

Let's see, what else? Oh yes, I heard from Orban that the company has begun shipping its digital Optimod, after successful beta tests.

Also heard grumblings from some exhibitors about the NAB's plans for a radio show next year in June in Montreaux, Switzerland. Supporters of the AES European show aren't too happy about it, and there's outright opposition from a group of British companies.

Now I wish we could have the best of both worlds. Let's combine the shows, with the best features of each, and split the difference. On the NAB's side, we have the fact that it's a radio show and the fact that it's in June, with nice weather.

On the AES European show's side, how about the fact that they move it

around to all kinds of great cities like Paris and Hamburg? Hmmm, Paris in June.

A couple of nifty products from the Noo Yawk AES. How about a box that will eliminate that pesky feedback from the sound system when you're on those remotes or other live mic situations?

Sabine Musical (904-371-3829) has the FBX Feedback Eliminator, which does that with nine notch filters. You can actually increase mic gain while the box notches out the feedback.

OK, and the latest craze sweeping the bars? Straight from Japan, it's Karaoke singing.

You see there's this sound system with recorded music tracks minus the vocals. And the really sophisticated versions send the missing words up on a video monitor so you, too, can be Madonna or Michael Bolton (or Elvis, for us older

folks).

Peavey Electronics (601-484-4103) had its own Karaoke machine, but of interest to broadcasters is that this one "strips" the vocals out of your source material.

You just hook up a CD player or put in a cassette with the full recording, and out comes the mix-minus. Next thing you know, you've got those jingles and music beds and song parodies down in no time.

Of course, if they'd let me add more reverb, I could pretend I was singing my heart out in my shower—but that's between me and my rubber ducky.

Have a juicy tidbit, wisecrack, rumor, innuendo or something silly to say? Spill those guts out to Earwaves by faxing JG at 703-998-2966, writing to P.O. Box 1214, Falls Church, Va. 22041, calling 703-998-7600, or whispering to the wind. Maybe there's a RW mug in your future.



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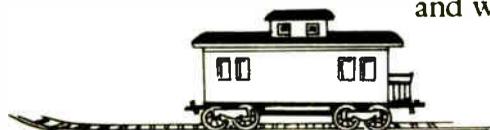
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Clean up your audio act

Dear RW,

I read Frank Beacham's article about the Paul Simon live broadcast from Central Park (RW, Sept. 25, 1991) with interest and amusement. I too compared the Westwood One radio feed with the audio from HBO and came to a significantly different conclusion than Leonard Bellezza and Mr. Beacham.

Up here in the boondocks the radio feed was far superior to the HBO TV feed! My colleagues agreed that the HBO feed was noisy (probably due to video crosstalk, sync buzz, etc., as received by cable TV), and heavily squashed, compressed with obvious breathing. The Westwood One feed was clean, with only a hint of excessive density.

Why were our observations so different? Well, I was not listening to the off-air signal of a heavily processed major market radio station. My source was a feed directly from a Scientific Atlanta DAT-32 digital satellite receiver. It sure sounded like CD quality to me!

My observation of excessive density probably came from the live mix, which

had a lot of PA system and stage monitor ambience. I also suspect that Dolby Surround Sound encoding increased the apparent ambience, causing straight stereo playback to sound a bit busy.

Quoting Mr. Bellezza, who felt that the HBO TV audio was superior, "The FM does limit the quality of the signal..." Did anyone bother to tell him that TV audio is also an FM transmission, but of reduced carrier deviation, which translates as less dynamic range and more noise than its radio counterpart? FM radio does not have to limit the quality of the signal as much as TV.

The lesson to be learned from RW's taping of an inferior product off of WXRK-FM in New York City is that, like their AM cousins, FM broadcasters will have only themselves to blame if they lose their listeners (to DAB or digital cassette car stereos). It is time to forsake loudness wars and clean up your audio act.

Ira A. Wilner
Wilner Associates
Putney, Vt.

The SBE's traditional convention goal of educating its members took a different slant this year. Attendees were reminded throughout the show that they should work to convince GMs that engineers are part of the profit team rather than an expense.

That's in keeping with the SBE's desire to improve the status of engineers at radio stations, which is a laudable aim.

After all, when engineers suggest that their stations purchase a particular piece of equipment, it's not that they'd like a new toy with which to amuse themselves. Engineers want to make their stations sound as good as possible—that's their calling. It's not easy, and it ought to command greater respect.

But, as new SBE President Richard Farquhar recently pointed out, one can't push new technology on management. Why not? Because force is met with resistance. In-

stead of pushing new technology on management, engineers must lead management into accepting it.

It's likely that the reasons an engineer would find persuasive for buying new technology would be unimpressive where management is concerned. A convincing argument for managers appeals to a different set of values—in particular, long-term profitability.

That a piece of equipment will make a station sound better is of secondary importance to management thinking. An engineer who wants to be considered part of the profit team must be able to explain why spending money on equipment now will actually earn the station money in the long run.

A station that wants to see increased profitability cannot have it if everything is kept at status quo. Advertising rate increases cannot be justified to clients if there is nothing new with which to entice them. An engineer must be prepared to show how new equipment will help improve the station's market dominance (through improved fidelity, better coverage, etc.), which is the key to justifying increased ad rates.

Thinking in terms of long-range profitability is not foreign to most engineers, but expressing it in language a manager can understand may be. And yet, if engineers want to be considered part of the team and to be treated with the respect team members command, they must learn to adapt to the language the rest of the team uses.

The SBE clearly understands that concept, and is to be commended for trying to pass it on to its membership.

—RW

Becoming Part of The Team

Take Part in the EBS Inquiry

by Gerald LeBow

STAMFORD, Conn. How many times have you moaned and groaned about the Emergency Broadcasting System (EBS) and those disruptive weekly tests that send your audience to the other end of the dial?

Did your operator log the incoming EBS test? And how about fines the FCC has been handing out for failure to comply with EBS?

Even worse, what happens when you depend on the EBS in an emergency and it fails? It failed during the San Francisco earthquake, it failed during Hurricane Hugo, it failed during the Santa Barbara fires; and just a few weeks ago, it failed during Hurricane Bob in New York.

The good news is that the FCC has opened a Notice of Inquiry (NOI) to review EBS, with an eye toward radical technical improvements to benefit both the broadcasters and the public. In the NOI, the FCC considers a number of important issues including the types of technology that could replace the existing system, the loosening or elimination of operator requirements at radio and TV stations, and automating the emergency alerting process with improved technologies. The notice also asks whether standardization of an improved system should be voluntary or mandatory.

As broadcasters, it is imperative that you respond to the FCC's inquiry and state your requirements for a modernized EBS.

Broadcasters need an emergency system that will perform flawlessly under all emergency conditions. Every time the EBS system fails, broadcasters get a "black eye." A good example is the recent failure of the EBS system when

Hurricane Bob swept the New York metropolitan area.

Although New York State spent over \$1 million to install a new satellite interconnect system, the system failed because of the outdated EBS daisy-chain concept. Several of the CPCS-1 stations in New York City did not transmit the alert; therefore, the messages never got to the secondary stations or to the public.

At Sage Alerting Systems, we feel that any new system must depart from the linear daisy-chain method of activation and go to a multiple primary station concept. A new system ought to explain the nature of the emergency, the area of impact, and the timing for the upcoming

end of the emergency alert process should be automated, but the receiving end as well—by having "smart" radios that can be turned on selectively any time of the day or night to deliver emergency messages.

Within the Notice of Inquiry the FCC focuses on three alerting technologies: WRSAME, ICEBS, and the Sage system. Both WRSAME and ICEBS use audible tones on the main channel of radio and television stations to carry alerting and testing information. WRSAME and ICEBS have a relatively small data throughput which limits what information and functions can be transmitted.

The Sage system has a comparatively larger data throughput and can operate with all AM, FM and TV stations. A transparent digital data subcarrier self-tests the system 10 times per second. An information channel gives broadcasters details about the upcoming alert and continuing status reports, and the system provides frequency and space diversity utilizing multiple CPCS-1 stations.

The FCC will undoubtedly hear from government agencies, emergency management offices, and other users of the Emergency Broadcast System. You as broadcasters must make your voices heard in the selection of a successor system, whether it's WRSAME, ICEBS or the Sage system. After all, we all will probably be living with it for the next 10 or 15 years.

To obtain a copy of the Notice of Inquiry, call the FCC EBS office at 202-632-3906.

■ ■ ■

Gerald M. LeBow is president of Sage Alerting Systems, Inc. and executive vice president of Sage Broadcasting Corporation. Sage Broadcasting Corporation owns radio stations in Texas, Florida and Vermont. LeBow can be reached at 203-357-1464.

GUEST EDITORIAL

alert. Automating EBS requires advanced information to allow broadcasters (or their automation systems) to create a natural transition from normal programming to the alert messages.

A new system must be much more robust, rugged, reliable and selective than the old EBS. Testing the system once a week provides little indication of the system's integrity, nor its readiness for emergency use. Testing with disruptive on-air tones both desensitizes listeners to real emergency alerts and drives them from your station.

Remember, emergencies rarely occur Monday through Friday, 9 a.m.-5 p.m. At two o'clock in the morning, when a tornado comes through your town, how many people have their radios or televisions turned on to hear the alert? Sage Alerting feels that not only the transmis-

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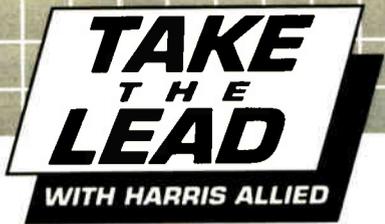
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New, Existing Products at SBE

by Alex Zavistovich

HOUSTON While there weren't many product introductions on the SBE exhibit hall floor this year, the show offered attendees a chance to catch up on recent innovations in broadcast gear.

A number of new products were on hand in the area of test and measurement gear. Holaday Industries displayed its Model HI-3012 isotropic broadband field strength meter, designed to measure electromagnetic fields to the proposed new ANSI exposure limits.

Potomac Instruments featured the 1900 series of digital antenna monitors, which can provide a digital display of ratio and phase for up to 12 towers with the same phase accuracy as the company's AM-19 model.

Audio Precision showed the Portable One Plus, a generator/analyzer with 12 basic measurement functions in a single portable unit. The Portable One Plus

provides sweeping functions and print-out capability of measured data.

New to the radio broadcast industry was Riser Bond Instruments, which showed its line of time domain reflectometers, or cable fault locators. Of particular interest was the Model 2901B+, a digital readout unit that lists for \$945.

Speaking of cable, Gepco showed its line of thin profile twisted pair shielded wire, as well as other cable varieties. The company will cut wire to any length, freeing engineers from buying longer runs than they actually need.

Nemal Electronics International also showed its line of wire, cable and accessories.

New from Delta Electronics was the Model ASE-2 AM stereo exciter, a single rack unit C-QUAM exciter with a high level RF output option. The ASE-2 is available from Delta for \$4,000.

Among console manufacturers, ATI premiered the latest model in its Van-

guard series of consoles, a six-channel board with 10 inputs, designed as a lower-cost alternative in the Vanguard line.

Wheatstone showed the SP-4 production-air console, which comes in two-, four- and eight-track configurations. In addition to multitrack production capability, the SP-4 provides program and audition busses, enabling it to double as a back-up air console.

Dolby showed its DSTL digital STL, formally introduced at Radio 1991 in San Francisco. Although not yet available for shipping, deliveries of the product, which uses Dolby's own AC-2 compression, are expected to begin by the first quarter of 1992.

A popular attraction at the Moseley booth was the company's DSP 6000 digital STL system, comprised of a digital encoder and a separate decoder. The DSP 6000 was first shown at the NAB convention in Las Vegas this year.

The 9200/9205 series monaural STL unit from TFT was shown for the second time in three weeks to broadcasters at the SBE convention. Unveiled at Radio 1991, the STL features a frequency synthesized transmitter and receiver.

New from Intraplex, but as yet unavailable for shipping, was the 4800 DDAT discrete digital audio transmission link. The 4800 is a digital audio T1 link for 15 kHz audio transmission.

Harris showed its Digital 50 FM exciter and Platinum Series transmitter, as well as the AKG DSE 7000 workstation and other broadcast products.

Broadcast Electronics displayed its AM-1, a 1 kW solid state AM transmitter. First shown at Radio 1991, the AM-1 features a built-in C-QUAM AM stereo exciter and lists for \$18,000. BE also demonstrated software modifications to its AudioVAULT hard disk record and playback system.

Fidelipac provided SBE attendees with a look at its digital audio player and separate record unit. Employing apt-X com-

pression technology, the Fidelipac device records on 3.5-inch disk media. The unit boasts a streamlined design first shown in San Francisco last month.

New from Wohler Technologies is the ARS 1 R.U. audio routing switcher, a single rack unit device that can be configured with up to 20 mono or stereo inputs with one or two stereo outputs.

Mark Antennas featured a newly-developed truncated eight-foot STL antenna, designed to meet FCC category A requirements.

Comrex had its all-in-one Talk Console and phone system on display, as well as its new codec. Rohde and Schwarz showed its DMC 10 Radio Data System (RDS) coder.

Finally, Audio Animation displayed its paragon-transmission audio processor. The paragon had its industry debut at last year's SBE show in St. Louis.

L-Band Similar to FM

(continued from page 1)

In fact, he said, the effect of tree foliage was "practically unnoticeable," even when the field strength was low.

Actual coverage area of the L-band signal was close to the predicted coverage area, Conway said. In some cases, there were no coverage gaps in places where such gaps had been predicted.

L-band propagation also was found to be similar to the predicted coverage area for FM, he said. The coverage range was 45 to 60 km, based on an ERP of 8 kW from an antenna height of 260 m. Further, Conway added, the service gaps that were found at L-band are similar only to those found for FM service, and no worse.

Indoor reception

Indoor reception or permeability tests were conducted on "ferro-concrete" structures built with a variety of exterior materials, Conway said. These structures included office buildings as well as houses.

The permeability tests showed that "there was no location where field strength was not at least 10 dB above the receiver threshold," with the exception of basement floors, Conway said. In the worst case, maximum variation across a floor was 30 dB for an office building and 15 dB for a house.

According to Conway, rooms with windows boasted 15 dB to 20 dB higher field strength than rooms without windows.

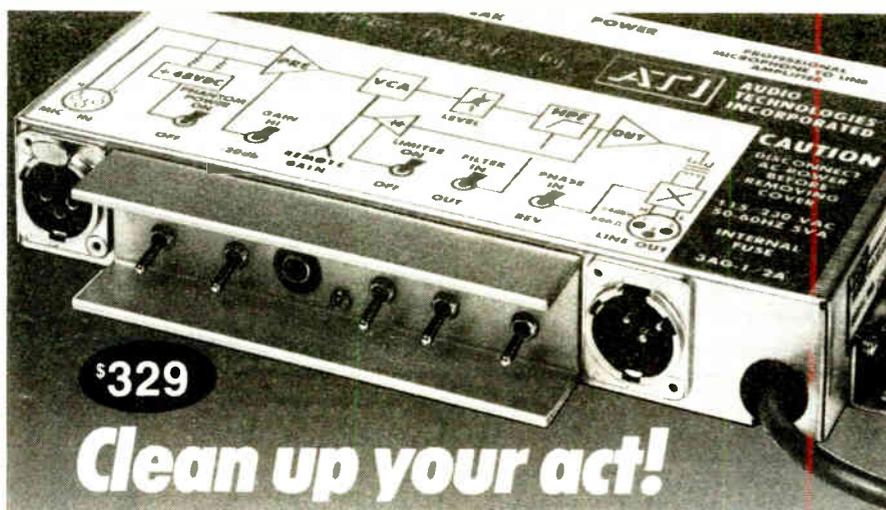
In conclusion, Conway—a self-described skeptic at the outset of the tests—said that L-band signal propagation appears to be similar to that of UHF-TV. He suggested that, at L-band, "digital radio reception would be better than

UHF-TV (reception)." In buildings with windows, digital reception may be "comparable to, if not better than" FM reception, he added.

During the same session, however, a presentation by USA Digital Radio (Project Acorn) concluded that L-band would require large amounts of power, based on its calculations using CCIR models.

The videotaped presentation maintained that to provide a coverage area of 36 miles (using an area of New York as an example), an L-band system would require 3.6 million watts of power. If gap fillers were used in place of such a very high power transmitter, a honeycomb network of 66 repeaters would be necessary, according to USA Digital's calculations.

That same coverage area could be attained with 10 watts under the Project Acorn in-band FM system, the presentation noted.



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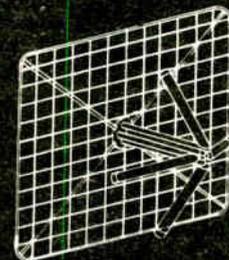
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SAT CD Seeks DAB Carrier Role

by Judith Gross

WASHINGTON Satellite CD Radio has shifted its focus away from proposing a specific digital audio broadcasting (DAB) service and instead wants to be the "passive" carrier of the DAB system chosen by the radio industry.

Satellite CD, which began the DAB debate with its petition to the FCC in 1990, is anticipating a spectrum allocation at next year's WARC conference and would proceed after that, according to the company's president, Martin Rothblatt.

He said that while the company's service is proposed for L-band spectrum, it could be used in S-band as well.

Robert Briskman, also representing Satellite CD, commented at AES that moving the plans to S-band "would cut the number of feasible channels in half."

Rothblatt noted that the company has a "strategic agreement" with Rogers Cable in Canada, and planned now to implement digital audio service on a "shared North American basis." He said the 100 channels, 33 per beam, would reach both countries from a single satellite.

He also said that Satellite CD had signed its first contract with a West Coast program provider who seeks just the western beam.

Passive carrier

Rothblatt also noted that Satellite CD was no longer locked into the DAB sys-

tem developed by Stanford Telecom, a frequency hopping DAB modulation scheme which is considered competitive

tal's Project Acorn, because it does not require new spectrum.

"I think it is very much a foregone con-

Satellite CD Radio has decided to become a DAB "carrier," rather than a system proponent.

with Eureka 147 in CCIR considerations.

"We will uplink and downlink any system anybody wants to modulate, just like the service now offered by Hughes Galaxy or GTE Spacenet," Rothblatt explained. "We will provide satellite delivery as a passive carrier."

He said Satellite CD could accept any system which meets its power flux density, which he noted that most of the "spread spectrum-type" DAB approaches do. He also said the service offered must be CD quality and must be able to be received by the flat-patch antennas being designed for car reception.

"The advantage of our new approach is that now we can go ahead and build the satellite without waiting for a system to be chosen," Rothblatt said.

Acorn likely de facto

He noted, however, that the situation would be simpler, and receiver costs lower, if one DAB system is chosen as a standard. Rothblatt said he believed the most likely choice would be USA Digi-

clusion that they (USA Digital) will prevail and our engineers are completely convinced that it works," Rothblatt said. He added, "It's inconceivable that the FCC will allocate additional spectrum for DAB, so we anticipate Acorn becoming a de facto standard."

Agreements Highlight SBE

(continued from page 1)

Under that agreement, The SBE will merge the exhibit portion of its convention with that of the RTNDA, beginning in September 1993.

According to SBE VP Jerry Whitaker, the SBE will still hold its 1992 convention in San Jose, Calif. In 1993, however, the joint SBE-RTNDA event will be held in Miami, Fla. In 1994 the gathering will move to Los Angeles, and then to Cincinnati in 1995.

Only the exhibition hall will be shared, according to a statement issued by the SBE. Each group will continue to maintain separate convention programs.

The SBE also signed agreements with AMITRA and KBETA—the society's Mexican and Korean counterparts, respectively—to share technical information with each other, and to help establish SBE chapters abroad.

In remarks during the SBE's national membership meeting, outgoing President Brad Dick reflected on the society's accomplishments over the past two years.

Rothblatt noted, however, that if a single DAB system is not selected, mobile radios would have to automatically switch between several systems, "which could add \$100 to the cost of a receiver," he said.

As for the service provided by Satellite CD, Rothblatt said "the fact that we are hiring executives with the words 'commercial-free' in their titles should be an indication of the kind of audio service we want to provide." He also maintained that "there is no way terrestrial interests can stop satellites."

Rothblatt expected the FCC to grant Satellite CD Radio a license shortly after the World Administrative Radio Conference (WARC) proceedings and that the company is already in negotiations with satellite builders. He anticipated launching the service in late 1994 or early 1995.

According to Dick, membership has increased this year by 18 percent, and some 60 percent of its members have earned professional certification.

Other advances for the association included the approval of a strategic plan by the SBE's board of directors, improved financial planning, and enhancement of international relationships and membership alliances.

Dick urged those in attendance to meet the challenge of increasing the SBE's membership further still, improving the national stature of the organization and advancing the perception among station management of engineers as "part of the profit team."

He then passed the gavel to Richard Farquhar, the SBE's new president. Farquhar pledged his commitment to move the association forward. Farquhar detailed the key point of the SBE's strategic plan, which is the development of a public relations program to increase the awareness of engineers and the SBE.

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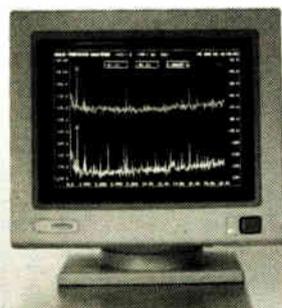
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Mixing Business with Towers

by Pamela Watkins

CITY OF INDUSTRY, Calif. If you drive by the 23-acre industrial park at East Julian and Sixth Avenue here, you will notice five 500-foot towers looming above the warehouses. A short four years ago, these towers, owned by KTNQ, were just about the only man-made structures on the property.

Thanks to some innovative engineering, KTNQ was able to sell this prime commercial property for development, but keep their towers and transmitter intact.

According to KTNQ officials, the station had looked at selling the site and acquiring another to relocate the towers and transmitter, but land was scarce—and very expensive.

Prior to the \$11.5 million construction project, the 23-acre site consisted of a 30'x40' transmitter building with the five tower array designed in a basic parallelogram formation.

Completed in March, the industrial park now houses two warehouses, each 940 feet long by 300 feet wide, two other buildings and a 210-foot truck yard, as well as the station's five tower array.

A whole new concept

KTNQ hired Harve Rees to oversee that side of the project and interface with developer Trammell Crow Co.'s contractors, including general contractor Prizio & Prizio, who hired renowned RF specialist Ogden Prestholdt.

Rees designed the new transmitter room and provided on-site, day-to-day consultation to KTNQ. He said it was a difficult project, but the design works very well for both the station and the occupants of the industrial park.

KTNQ management's intention was to complete the project in as little time as possible with minimal effect on the station's day-to-day broadcasts, according to Rees.

"The towers were left on their original bases. We constructed tilt-up walls, 16 feet on each side and 33 to 34 feet high and locked them together around the towers. This left the towers virtually protected," he explained.

To shield the buildings from the towers, Rees said the foundation pads were constructed to help support the shielded wire mesh, tilt-up walls.

Shielding the buildings

"These walls were approximately 150-foot tilt panels, 24 to 25 feet wide and locked together with tabs coming out of the concrete. The tabs could be tied to the floor slabs, which also consisted of shielded wire mesh," Rees said.

"The roof structure was put on, and the shielding was applied on top of the roof structure—that is, the roof top was sealed with a waterproof material, and then the actual roof was put down over the shielding," he explained.

The project resulted in the two warehouse buildings being completely RF-shielded from the towers. In fact, according to project participants, the RF in the buildings is equal to the energy being radiated over the air one mile away.

"We obtained about 23 dB of attenuation inside both buildings," Rees said. "The tower array is unbelievably stable

and efficient because of the ground system," which is distributed through 90 guy wires.

Rees said the basic challenges were to keep the radio station on the air as well as to shield workers from RF radiation during and after construction.

The wire mesh shielding system devised for the walls, floors and roof was not the only RF safeguard, Rees noted. When construction workers were working on each building, the towers would be shut down around that building.

During that phase, the station cut its 50,000 watt power in half in the function-

ing towers to further safeguard the workers, Rees said.

Not a wire showing

The new transmitter facility is 48 feet wide by 88 feet long and is housed in one of the warehouse buildings. "There is not a wire showing; everything is piped in conduit," Rees said. "The tower rooms, studio and terminal, which contain all the control equipment, the stereo generator, audio and everything else, also are shielded, and inside the facility the attenuation figure is 46 dB down."

Despite the measures taken by the de-

velopers, architects and engineers to limit RF exposure during construction—including encasement of the 90 guy wires—KTNQ failed its first electrical inspection. Cal-OSHA, the health and safety enforcement division of the state's Department of Industrial Relations, failed the station because the station's new transmitter was not UL approved.

Since the transmitter had been approved by the FCC, however, the station quickly obtained type acceptance documentation from the manufacturer that enabled it to pass inspection.

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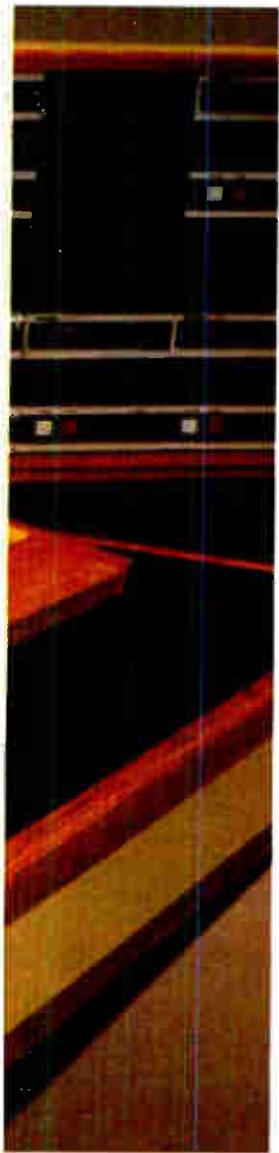
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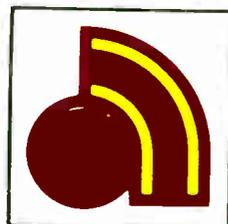
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WPR Looks to Digital Production

by Pamela Watkins

SAN FRANCISCO Leo Lee, founder and president of Western Public Radio (WPR), has devoted the last three years to pulling National Public Radio into the digital world.

"There are 420 radio stations in the National Public Radio (NPR) system and until recently digital was out there on the horizon. Everyone knew something was going to happen to analog—that digital was going to replace analog—but it was a struggle to get the stations to

realize that digital was today," Lee said.

Western Public Radio (WPR) made its first steps into the digital arena when it received a sizeable grant from the Apple Corporation three years ago. A recent \$50,000 grant from the Corporation for Public Broadcasting (CPB) added to Lee's digital project, which is aimed at training people in advanced digital audio recording and editing.

WPR's digital workshops are open to people throughout the public radio system across the

country. "We bring them here and upgrade their production skills," Lee said.

Lee runs an intense seven-day workshop, which is designed for producers, engineers, operations managers, technical directors, music recorders, etc., at WPR's six-studio facility located at the Fort Mason Center in San Francisco.

The CPB grant provides for six advanced digital workshops each year for two years with 12 participants per workshop. The emphasis is on digital design, recording and editing

with MacRecorder SoundEdit Systems. The workshops consist of hands-on instruction with three Macintosh IIx workstations, using Digidesign's digital recording hardware, SoundDesign software, Apple CD ROM drives, Dyaxis (Studer EditTech), Hybrid Arts ADAP II, AKG DSE 7000, Otari DDR-10 and Sonic Solutions systems. Panasonic has provided portable and DAT recorders.

Along with digital training workshops, WPR has also proposed a newsletter called "Dig-

ital Today," as well as a digital video training cassette, which are yet to be funded.

According to Lee, Western Public Radio has the only state-of-the-art digital training concept in the country. Recipient of the Edward R. Murrow Award in 1989 for his outstanding contributions to CPB, Lee has embarked upon creating the radio station of the future—called ADR (All Digital Radio).

While putting together WPR's digital workshops, Lee realized no software really existed that was tailored specifically for radio. The software on the market had to be adapted.

"That's why people are still trying to make up their minds about what hardware to buy—because there is nothing that says radio," explained WPR's design engineer, Dave Harris, formerly NPR engineering vice president and Lucas Film design engineer.

Harris' challenge as Western Public Radio's design engineer is to create the software needed for digital radio, using Digidesign and Macintosh to step into the 21st century. Harris noted that the hardware already worked well together.

"This software will use the already proven hardware that Digidesign has produced," Harris said. "The product will have four modules: a production module, an on-air module, a traffic module and a master control module to handle the switching necessary to take in satellite feeds and to feed the satellite. The software will work in a multi-user configuration with a mirrored backup on the hard disk to make sure the station is not running without a net."

"It's a hard disk-based system where the sound is on the hard disk of the computer and can be pulled out in pieces and fed over the air," Harris continued. "And while this is going on, an on-air person can pick up a late breaking or last minute edited piece and insert it—all without touching tape."

The digital on-air control room of the future will be without tape decks or cart machines, Harris predicted. "There won't even be a console," he said.

Both Lee and Harris are excited about this project and foresee the production and on-air modules available for testing sometime in early 1992. Along with the software program, Harris and Lee plan to visit stations throughout the NPR system to train people in digital applications.

Although the ADR project is separate and is not funded by the CPB, Lee believes the two projects (digital training and digital software development) are intertwined. Indeed, according to Lee, who has been on the innovative edge of radio for the last 40 years, digital is today.

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Tubular Reasoning

by John Gatski

WASHINGTON In the early 1960s, I remember trips with my dad to the local supermarket whenever the TV broke down. There, I would watch with amazement as he placed each television tube into a test socket on the tube tester to see which suspect was the culprit responsible for the interruption of Saturday morning cartoons.

Eventually, such trouble-shooting became unnecessary as solid state took over. For the most part, tubes and tube testers disappeared by the 1970s. Some people, however, have stayed with the tube concept, and over the past few years, there has been a resurgence in tube products—especially in high-end audio.

They are not selling in the millions like the solid state components from Japan or Taiwan, but there are hundreds of products out there on the market. Many of the products are from U.S. companies

Esoteric companies are producing tube amplifiers and pre-amps that cost thousands of dollars; even mainstream companies are producing a variety of tube components ranging from amps to pre-amps to CD players.

Some specialty electronics stores are even restoring and selling old tube radios, touting them as higher fidelity than those being produced today. Aficionados also point out that many guitar amps still use tubes, and there are even new tube output professional audio products being introduced at trade shows.

So just what is about those cylindrical, glowing glass tubes that many audiophiles describe as "warmer" and "more lifelike" in sound than solid state?

Ed Dell edits and publishes a small but rapidly growing publication called "Glass Audio" in Peterborough, N.H., which specializes in how-to articles on

old and new tube audio products.

Dell, who got into tube equipment in the 1950s, said his publication is the result of renewed interest in the old-fashioned technology. He attributes the continued success of tube products to several factors.

Much of the interest has been fostered by engineers who got their start in tube technology during the 1940s and 1950s, but were left behind when solid state took over, according to Dell.

These guys are now combining what

CUE and REVIEW



they learned then with the modern engineering techniques of today, he added. And with the improvement of companion electronics, tube products sound better than ever and are more reliable than they were in their heyday, Dell said.

Kevin Hayes, president of VCA, a high-end audio company based in Sarasota, Fla., said the "smooth" sound of a tube product is attributable to its superior capacitance characteristics. He added that the frequency response accuracy also has improved with better quality tubes and complementary circuitry being developed for today's products.

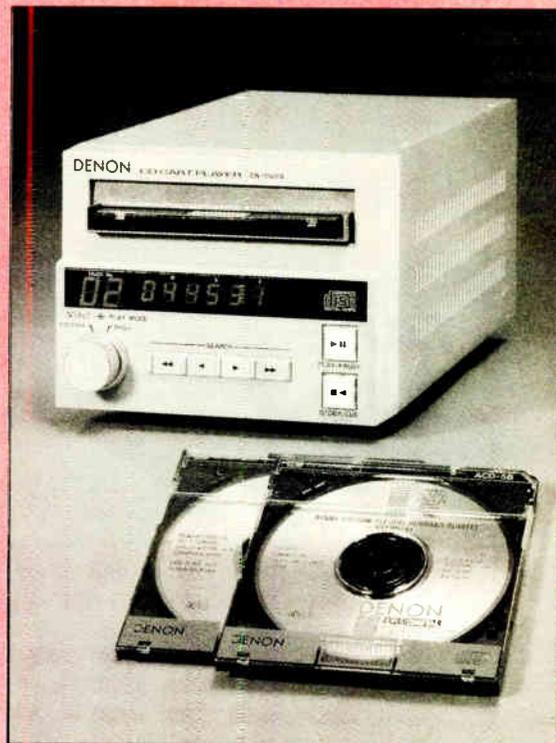
It seems a lot of tube proponents emphasize many of these same subjective descriptive words in explaining the tube sound, but there are some objective characteristics of tubes that are different from solid state. Whether these characteristics make a tube amp sound better has not been proven—not to me, anyway.

Fact 1: Tubes produce even-order distortion harmonics, rather than the odd-

(continued on page 14)

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Improvements List Eyed

by Nancy Reist

SAN FRANCISCO Although DAB and its potential to shape radio's future dominated the recent Radio 1991 show here, many managers were more concerned with improvements they can make now.

A panel of legal and technical experts convened at Radio 1991 to described improvement options for stations.

Attorney Linda Eckard described options for managers of Class A FM stations who want to upgrade to 6 kW, but don't meet the new spacing rules:

- Find a different Class A channel in your community. If you can upgrade to

6 kW, you can now substitute one Class A channel for another.

- Negotiate an agreement with another Class A that also wants to upgrade. Two stations can agree to accept each other's interference in order to increase to 6 kW. They also can negotiate an incremental increase.

- Upgrade on your own, if the other Class A consents. You don't need the consent of Class B or C stations if you want to remain at your existing site. However, if you want to relocate to increase to 6 kW, you have to prove that there is no alternative site that better protects Class B and C stations—usually a

very difficult undertaking.

- Finally, if you can't get consent for the increase, you can attempt to use the contour protection method to demonstrate that you won't interfere with the protected contours of other stations.

The panel also discussed the option of improving an FM signal with a translator. FCC Chief of Audio Services Division Larry Eads stressed that the FCC has reconfirmed that FM translators can only be used to fill in dead spots or to broadcast to areas where services are limited. In the second case, the primary station cannot own the translator, nor can it provide funding, equipment or staff.

The panelists pointed out that many station modifications are blocked not by FCC regulations, but by the FAA, on the grounds that radio interference may pose an air hazard.

Eads explained that the FAA developed a computer model, which predicts interference to the airspace "virtually everywhere." He said the FCC strongly disagrees with some of the assumptions used in the model and has met regularly with the FAA to negotiate some modifications of the model.

Eads expects the FAA to release a new version of the model soon and he hopes broadcasters will see some improvements. "It's a long, slow process working with the FAA. We are encouraged, though, that we're beginning to see a new attitude there at the working level, a little bit of a thawing, perhaps a little more concern that they need to make some changes in dealing with broadcast facilities."

Reasons to Go Tubular

(continued from page 13)

order distortion produced by transistors. Even-order is considered less unpleasant sounding than odd-order distortion, or so I am told.

Fact 2: Tubes also clip more gracefully than transistors, which, when overdriven, cut off the waveform. Tube components "round" off the waveform, causing less "harshness."

Of course, solid state manufacturers and many audio critics are quick to point out that solid state amplifiers are capable of such massive amounts of continuous and dynamic power at low distortion that they need never be driven to clipping.

Tube critics claim that much of the "warm" sound is attributable to the amp/speaker compatibility, which in tube amps can vary, causing a "bump" in the midrange, making it more pleasing to the ear, but less accurate. Solid state amps, however, tend not to vary their frequency responses as much under a variety of different speaker loads.

No matter. Let the critics argue. I think there is room for both types. I have listened to high-dollar tube amps such as Conrad Johnson and I have listened to very expensive solid state amps, a la Mark Levinson. They both sound excellent. If you can shell out that kind of money, who cares if it's tube or solid state? You like what you like.



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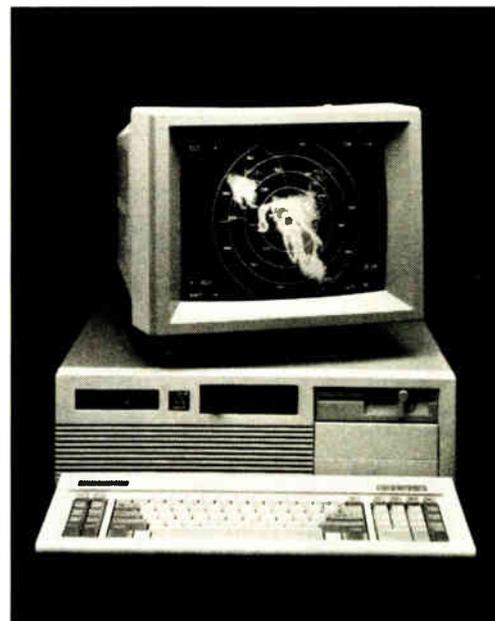
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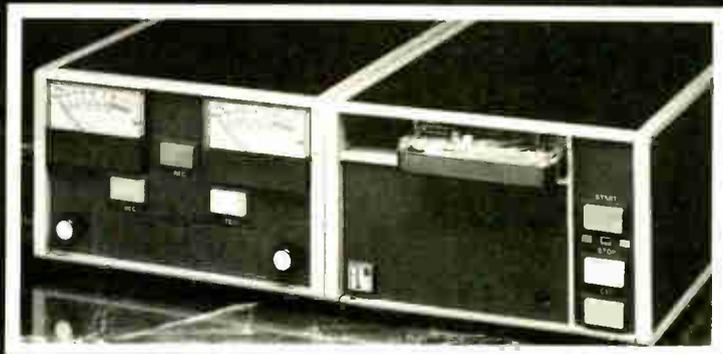
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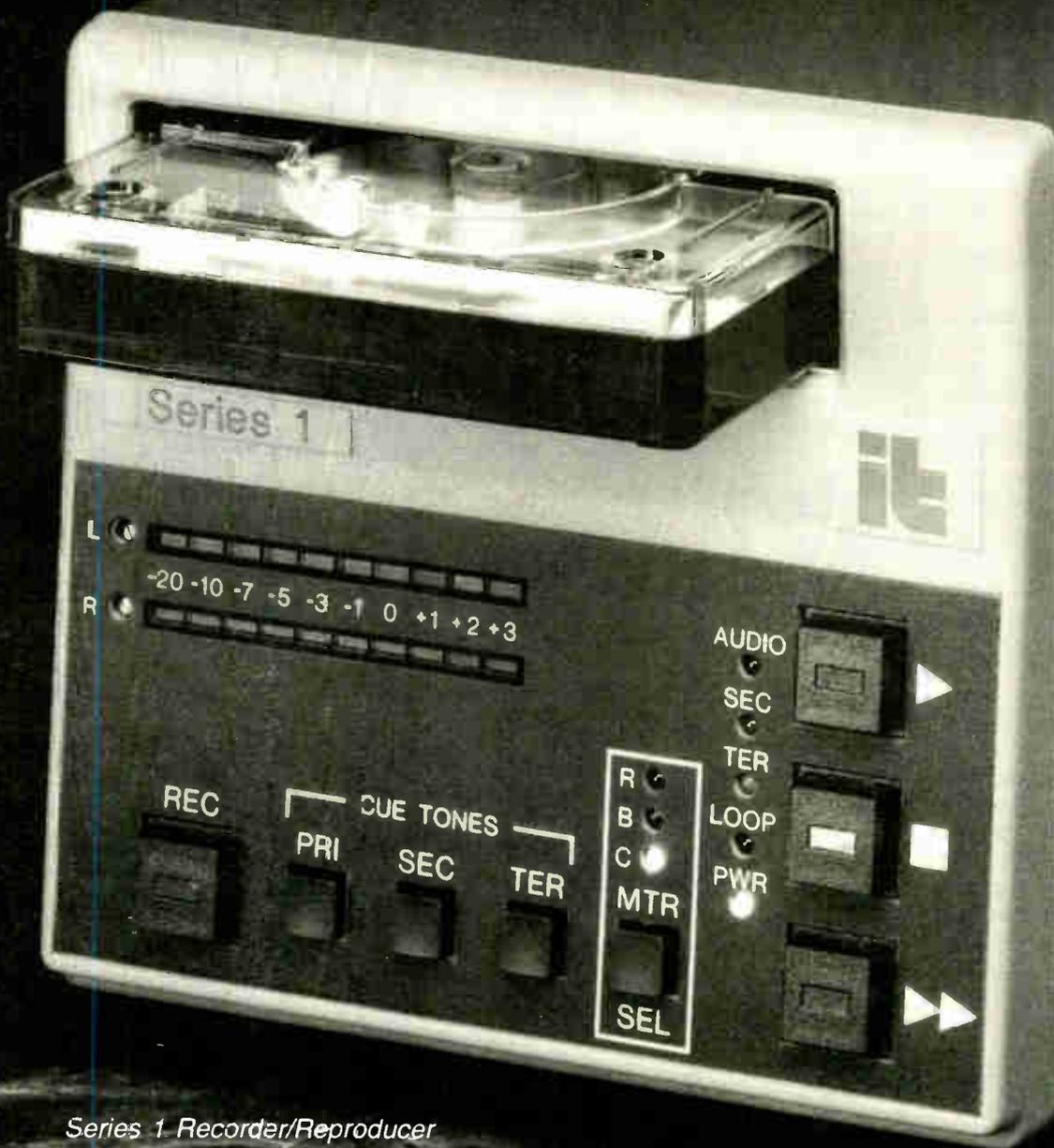
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Digital Makes Inroads at AES

by Mel Lambert

STUDIO CITY, Calif. Aside from our pilgrimages to the annual NAB conventions, plus the occasional radio conferences and SBE gatherings, I would suggest that the Audio Engineering Society's fall convention and exhibition is becoming an essential venue for radio station personnel.

Not only are the technical papers and workshop sessions extremely useful for keeping us up to speed in subjects ranging from acoustics to digital signal processing, the accompanying commer-

cial exhibition attracts firms whose products are of direct relevance to our industry.

The society's 91st Convention, held in New York in early October, was no exception.

A digital-ready facility

Of specific interest to stations contemplating designing or re-equipping a digital-ready facility were products from NVision and Leitch. NVision unveiled the new NV4448 Digital Audio Sample Rate Converter, which accepts any sampling rate between 28 and 54 kHz.

Specific conversions—such as 44.1 to 48 kHz, and vice versa—can be performed on a fully synchronous basis with 24-bit resolution. Output rates can be selected automatically from the front panel or via remote control.

The unit's input automatically phase-locks to the incoming bitstream, while the output data can be ratio-clocked to the input (synchronous mode), free running, or locked to an asynchronous external reference. The NV4448's clock stability meets the new AES 11-1991 Grade #2 specifications.

Other useful systems on display included the NV3512A Digital Audio Routing System, which provides switching for up to 512x512 AES/EBU-compatible input and output channels at data rates up to 50 Mb/second for larger plant operations; the NV3064A Digital Audio Routing Switch, which handles 64x64 AES/EBU I/Os at data rates up to 10 Mb/sec; and the EM Series of modular, single- or dual-channel analog-to-AES/EBU converters, DACs, seven-way distribution amplifiers, high-stability AES/EBU Reference Generators and other useful digital "building blocks."

Digital hardware

Leitch, Inc., is handling U.S. and Canadian distribution of the Pro-Bel range of digital hardware manufactured in England, which includes the Model 5245 digital audio reference signal generator, Model 5241 10-output digital distribution amplifier and HD Se-

ries of digital audio routers. All systems are designed to handle AES/EBU-format I/Os, and allow signals to be routed over medium- to long-distance balanced cable runs throughout a multi-room facility.

The Model 5245 generator features a Grade #1 reference conforming to AES11-1991, and the unit's output can be locked to NTSC or PAL video references.

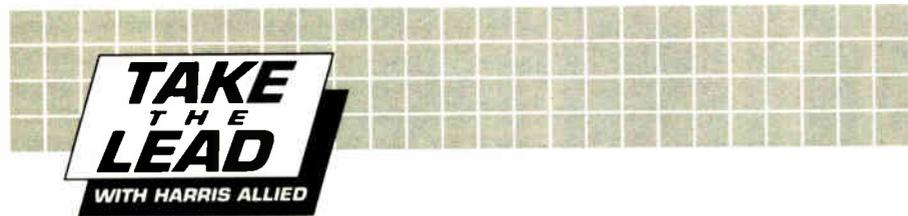
DIGITAL DOMAIN

The HD Series is available in three mainframe sizes: 64x64, 128x128 and 256x256 with full crosspoint selection between AES/EBU-format I/O signals. Also available is the Pro-Bel Model 5120/5121 stereo oversampling ADC, which features 128 times Delta-Sigma conversion, 20-bit resolution, 44.1 and 48 kHz sampling rates, plus AES/EBU-format outputs.

For conversion between AES/EBU, consumer-type S/P DIF and SDIF-2 (Sony PCM-1610/1630-compatible) I/O formats, Lexicon now offers the new LFI-10, which handles unidirectional and bidirectional conversion between all three formats.

In addition, channel status and user block data can be accessed and modified as necessary, including emphasis, copy prohibit, sampling rate, time-of-day code and CRCC. A total of 10 user registers and seven factory presets allows storage within the unit of parameters for frequently used interfaces.

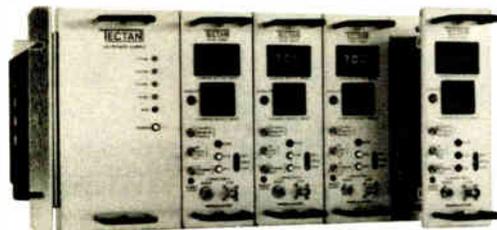
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TOPS IN AUDIO PERFORMANCE TOPS IN QUALITY

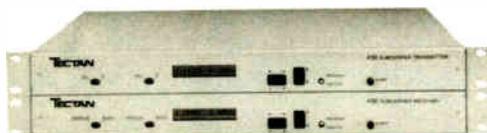
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(continued from previous page)

External remote control from PCs and other computer systems also is offered. For custom applications involving the direct design of AES/EBU-compatible I/O ports, several chip manufacturers were showing new parts that can be incorporated into existing or planned hardware.

Footprint package

The new Motorola DSP564401 AES-EBU-CP 340 digital audio transceiver, being shown in prototype form, will be supplied in a 68-pin, small footprint package for surface-mount or socket, and features a full-function transmitter, receiver and companion clock circuits.

The part interfaces directly with Motorola A-to-D converters and DACs, and can be fully programmed to handle all channel status and other non-audio data transmissions.

Also being shown by Crystal Semiconductor was the new CS8411/12 digital audio interface receiver for AES/EBU, S/P DIF and CP-340 I/Os, plus the companion CS8401/02 transmitter chips.

Of the various new or enhanced digital audio workstations being demonstrated at the AES convention, the new Spectral Synthesis Audio Engine is worthy of attention. Up to 256 internal tracks are available from the 386/25- or 486-33 host CPU and hard disk system, with up to 16 active channels (four per hard disk).

Internal digital mixing, real-time DSP (equalization, dynamics, delay, reverb and pan) are featured, with sample-accurate editing, crossfade and click removal. The modular system can be supplied with between four (stereo I/O) and 16 direct channels.

Several firms were demonstrating high-quality, stand-alone A-to-D and D-to-A converters, including Apogee Electronics, Yamaha and Pygmy Computer

Systems, while traditional chip manufacturers such as Analog Devices, Ultra Analog and Crystal Semiconductors, showed enhanced component designs for use in OEM systems.

Audio Processing Technology demonstrated a new 12:1 digital audio data reduction system that has been designed specifically to allow 20 kHz bandwidth 16-bit signals (705.6 kbps) to be carried over single 64 kbps ISDN (Integrated Services Digital Network) and Switched-56 kbps lines.

Still under development, the new apt-X 64 system is based on a proprietary Transform Coding algorithm with psycho-acoustic modeling. Dolby Laboratories also was displaying its full range of digital audio transmission and compression products based on the firm's AC-2 Transform Process, including units with low coding delays for backhaul and STL-based applications.

Other interesting announcements: Digidesign's new Master List PDS software allows direct connection between its Mac-based hard-disk recorder/editor and a Yamaha CD-R drive, for preparing Red Book standard CDs in a production studio; the new Kenwood CD-R system, which comprises the DA-7000A encoder and DD-7200A CD writer, plus IBM-compatible software; and Panasonic's new SDT-390B, IBM-compatible Software Developer's ToolKit of programing utilities designed to simplify the development of stand-alone applications for the serial-capable SV-3900 Pro-DAT, including broadcast automation system and workstation transport controls.

■ ■ ■
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.

The Audio Engineering Society's fall convention and exhibition is becoming an essential venue for radio station personnel.



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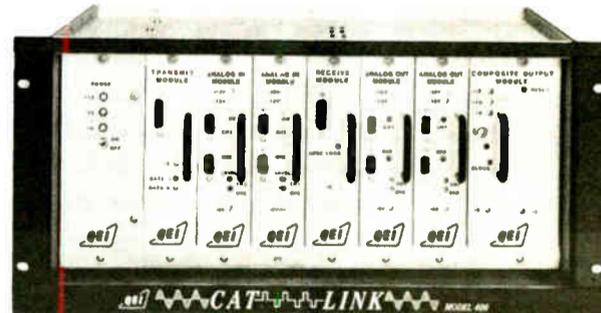
CAT-LINK is cutting phone bills for stations that don't have a clear microwave path. With CAT-LINK, a single bidirectional DS1 line replaces multiple Class A telco lines, providing multi-channel STL and TSL over the same link. Already available virtually anywhere, DS1 service is getting cheaper every day.

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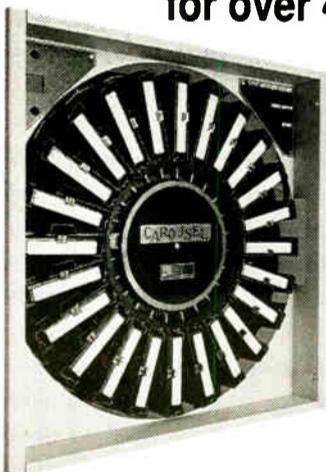
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Filling in Interference Holes

by W.C. "Cris" Alexander

DALLAS Last month, I wrote about a midwestern FM station that suffered signal problems because of a mix between two other stations. In effect, this station had a big hole punched in its coverage

FEED LINE

area. Even within its 3.16 mV/m (city grade) contour, the interference caused problems.

How do you fix a problem such as this? Getting rid of the interference is impractical: It would involve a reduction in power or a site change by one or both of the contributing stations, or the installation of an attenuator in the receive antenna line of every receiver in the interference area used to listen to the troubled station.

So we can't get rid of the interference, but maybe we can move it. Through the use of synchronous booster stations, it is theoretically possible to fill in the interference areas.

On-frequency boosters

Several years ago, the FCC changed its rules to allow FM stations to operate on-frequency booster stations with power up to 20 percent of the maxi-

mum ERP for their particular class of station.

A Class B station could, under the rules, operate a booster station with up to 10 kW ERP. The catch is that the booster station cannot extend the predicted 0.5 mV/m contour of the main transmitter (0.7 mV/m for Class B1 stations and 1.0 mV/m for Class A and C stations).

As good as this sounds at first, operating a booster station on the same frequency across town is not the answer in every case. In fact, booster operation is practical in only a few cases. Here are some of the theoretical considerations:

You probably already have guessed that synchronization of the booster carrier to the main transmitter carrier is required. The main reason is that when two equal strength unmodulated carriers are fed to an FM detector, artifacts containing modulated noise will be decoded. The product is equal in frequency to the absolute value of the difference in frequency between the two carriers.

For example, if one carrier is 200 Hz above and the other carrier is 300 Hz below the channel center frequency, the FM detector will produce a 500 Hz modulated noise at its output. Synchronization will eliminate the resulting product from the unmodulated carriers.

When we add deviation to each of the two carriers, the amount of deviation on each carrier must exactly match the other's. Consider that one carrier's peak deviation is 75 kHz (100 percent) and the other's is 74 kHz (98.6 percent). On modulation peaks, the two carriers will be 1 kHz apart, and a 1 kHz tone will be produced at the out-

Through the use of synchronous booster stations, it is theoretically possible to fill in the interference areas.

put of the FM demodulator.

This tone will be constantly changing in frequency, depending on the instantaneous deviation of the two carriers.

In a real world circumstance, of course, what a receiver will produce generally is a noise-modulated artifact, dependent upon the variables of the FM signal environment.

As you can see, the deviation of the two carriers must be carefully matched.

With the frequencies synchronized and the deviation of each carrier carefully matched, we are left with two car-

riers that, if received in phase, will complement one another. If received out of phase, however, the weaker will subtract from the stronger.

In and out of phase

If the two signals are equal and in phase, the signal strength will be double the signal strength of either carrier by itself. If they are equal and out of phase, they will cancel each other completely.

As you can imagine, in a mobile environment where the receive antenna will move between peak and null areas every 2½ feet, this would sound terrible. In areas where the signal strengths from the main and the booster are nearly equal, the signal will be just about unlistenable. These areas are the interference areas created by the booster, and in many cases, they are larger than the interference or low signal areas the booster is designed to correct.

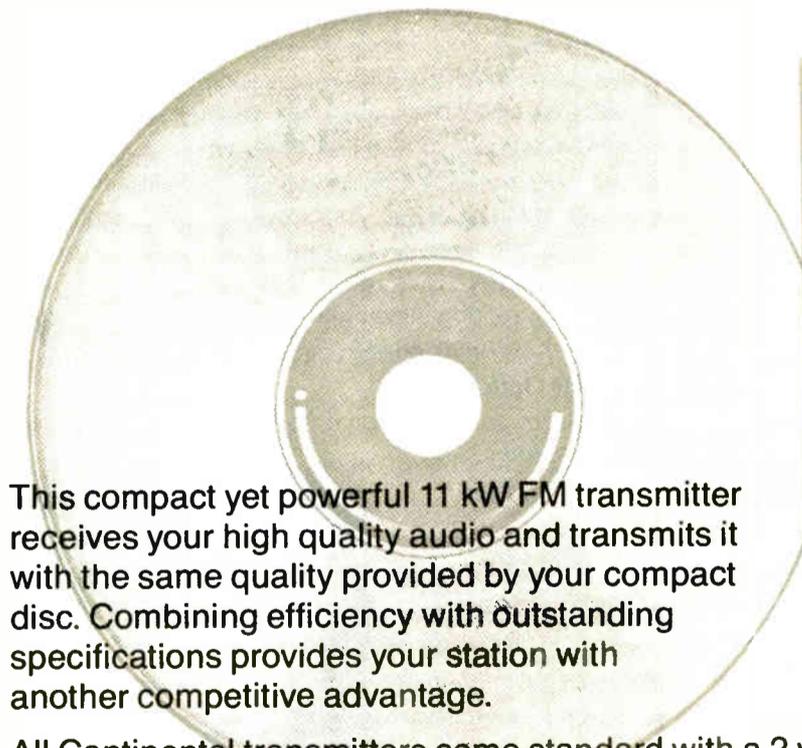
Still, even with all these difficulties and limitations, FM boosters are useful in some cases. Through use of directional antennas, group delay and other techniques, the location of the booster-caused interference area can be controlled to a certain extent.

Unpopulated areas

If the booster station can be so engineered that the interference area falls in an unpopulated area while boosting the signal in the coverage "hole," the addition of the booster will have achieved the desired end. The net

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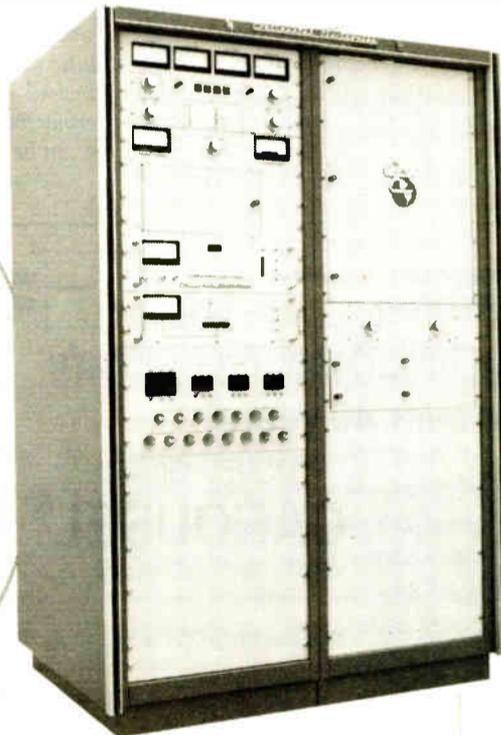
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says Wilbur Brann, Director of Engineering for Capitol Broadcasting Company, Inc. “Our first was an Auditroneics 110, serial 0039 for WRAL-TV5 right here in Raleigh. And it’s still performing as well today as our new 200 at WWMX in Baltimore.”

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- Jumper set logic
- Outboard power supply
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Numark SOUND CHECK

SAVE UP TO 60% ON NUMARK DJ-APPROVED AUDIO SYSTEMS

This jam-packed edition of *Numark Sound Check* comes with a stunning array of savings on a full range of Numark pro DJ and home mixing components. Discounts start at 20% on the selected items in this edition, and they're available



right now at a participating Numark Dealer near you. For extra deep discounts, check out the items marked by the starbursts. For full price and availability information, call or visit your local authorized Numark Dealer.

Numark: 100% Made In The USA

In a major move to upgrade customer service, Numark has just completed relocation of its manufacturing facilities from Tokyo, Japan, to Valencia, California. The brand new plant features state-of-the-art machinery, including sophisticated wave soldering technology. For Numark customers, the new factory means a dramatic increase in support and service capabilities, along with faster response to the demands of the North American market. The new plant began production this September. Numark maintains its R&D facility in Tokyo.

LOOK INSIDE FOR HANDY DJ TIPS ON SAMPLING, MIXING & MORE!

Throughout every edition of *Numark Sound Check*, you'll find handy how-to boxes covering everything from mixing and sampling to building your first sound system. These special features are designed for both professional and personal DJ-ing.

In this edition, look for an intro to developing sampling style on Page 3, "Beat Mixing Made Simple" on Page 5, tips on selecting audio components on Page 7, and a complete chart and guide to sound systems for pro DJs and personal DJs on the Back Cover.



Numark's Original \$100 Rebate Offer Is Still In Full Effect!

Unbelievable but true - with the purchase of a top-of-the-line Numark CD6020 Twin Transport CD Player, you'll be eligible to receive a rebate of \$100 in cold cash, direct from Numark PPD. See Page 2 of this edition for details! This is a limited time offer. Don't delay!

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✓ A WORD ON CD MIXING

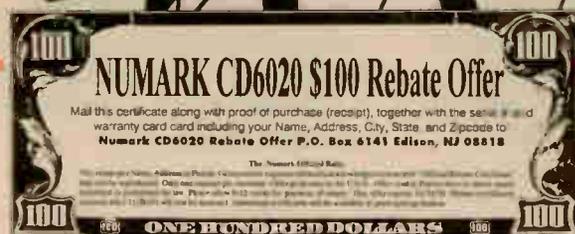
With Numark's CD6020 and CD5020 twin-transport CD players, mixing CDs can be performed with the same ease as mixing records. Both units feature sliding pitch controls offering $\pm 8\%$ speed variation and large dual-function stop/start buttons for lightning-fast mixes. Modular design enables you to mount the remote control unit away from the transport module for greater space saving convenience and ease of operation.

CD6020

**The World's First
Twin-Transport CD
Player**

The CD6020 will go down in the history books as the CD player that completely revolutionized CD mixing. The first of its kind to introduce Twin Transport design, the CD6020 offers DJs and home recording enthusiasts everything they need to mix and blend CDs. DJ can now enjoy the same creativity as with records. It comes complete with two fast-acting pitch controls, Beat Synch™ and Integrate™ for completely computerized and hands free beat mixing.

Numark CD PLAYERS



CD5020

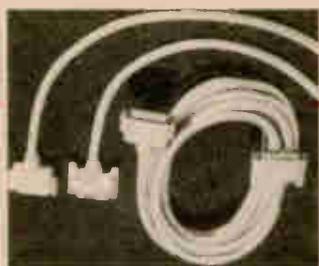
The Budget-Priced Performer for CD Mixing

The CD5020 puts the power of twin-transport CD mixing in your hands at a price that won't put you in the poor house. It offers the same performance and functionality as the CD6020, but without Beat Synch™ and Integrate™. Plug it into your mixer and you're ready to enjoy the finest in professional-quality CD mixing.



CDSR10

For convenient mobile mixing applications, the CDSR10 enables you to mount the CD6020 and virtually any 19" rack mountable mixer in this sturdy, road-ready console. This carpeted enclosure features heavy duty handles, removable front and rear panels, and sloped console for increased mixing ease. Can be used in conjunction with



CDX45

With CDX45 extension cables, you can locate the CD player's transport module up to 18 feet away from the remote unit. Ideal for use in permanent club or home installations.

Numark DIGITAL SAMPLERS & SAMPLING MIXERS

SAMPLING STRATEGIES

Sampling is the most powerful weapon in every record producer's arsenal. Now, with your Numark DD series professional sampler, you can be the producer...live or on tape.

The best way to develop your own sampling style is to experiment, improvise – and don't worry about mistakes. Sampling is as simple as snapping your fingers: tap the trigger button when you want the sample to start, tap again to end it. Here are some sampling ideas to start you off...

LOOPING

A beat pattern that goes on forever is called "looping". Use it to extend the break on a song. Record your sample by tapping on and off on the beat. Switch the sampler to Repeat Mode. If your timing was right, you can fade out the record or CD and your loop will continue the song forever!

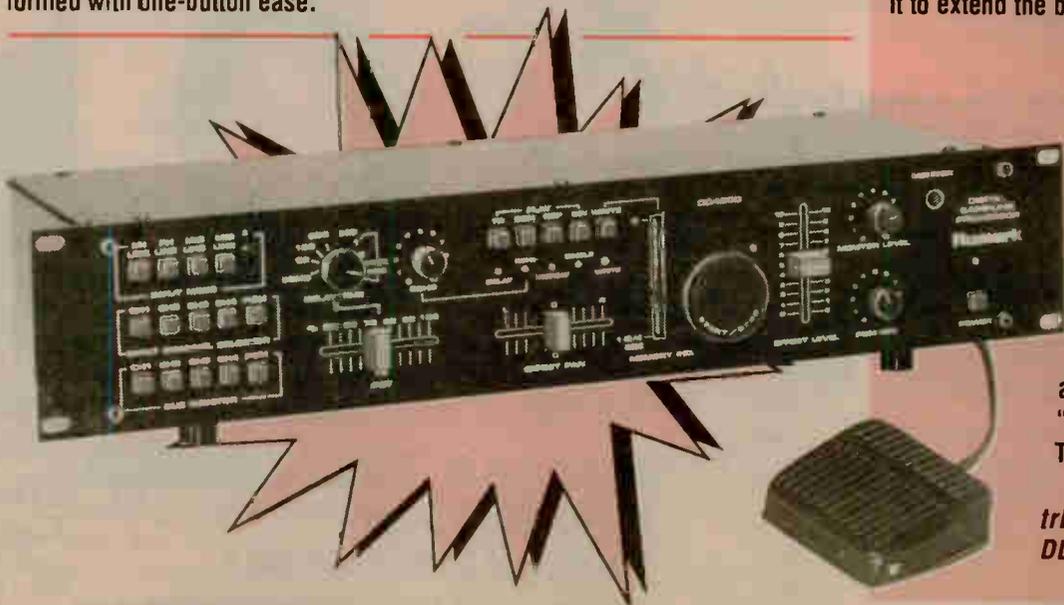
STUTTER & STAB

For a stutter or stab effect, sample a section of music, then experiment with the Trigger button on playback. For instance, sample a short vocal phrase like "hit it". You can then inject "hit it" as a stab whenever you want, or create a stutter – "hi-hi-hi-hi-hit it" – by repeatedly tapping the Trigger.

For many more DJ-oriented sampling tips, tricks and techniques, consult the Numark DD4000 or DD8000 Owner's Manual!

DD8000 8-Second Digital Sampler

This studio quality sampler offers the perfect combination of features, functionality, and operating ease. It features 8 seconds of sampling time in mono and 4 seconds in stereo. Four memory presets let you store up to four 2-second samples for added mixing creativity. Mixing effects include delay, echo, and single and repeat playback. Start and stop triggering of the sampler is performed with one-button ease.



DD4000 4-Second Digital Sampler

The DD4000 offers the same studio quality performance as the DD8000 but with 4 seconds of sampling time. It features 16-bit/48kHz digital technology for better-than-CD quality sound. Triggering can be performed remotely and hands-free with an optional FS775 foot switch. Both the DD8000 and DD4000 offer inputs for 2 balanced and unbalanced mics, 2 phone and 4 line sources.



DM1700TX Sampler Mixer

The DM1700TX was the first mixer to feature a built-in sampler for live digital effects, including delay, reverb, echo, and single and repeat play. For added control the DM1700TX features a processor loop, 6-band graphic equalizer and defeat switch.

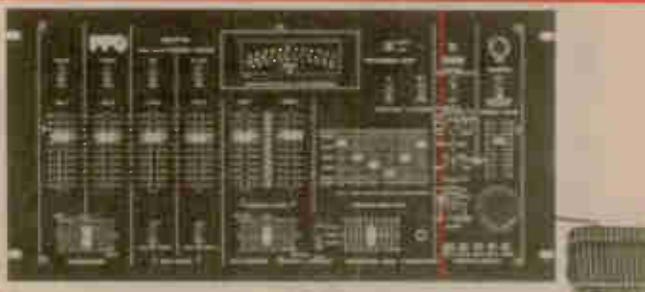


DM1975 4-Second Sampling Mixer with Four Memory Presets

The DM1975 has been recognized by industry professionals and leading publications as the "DJ's workstation". This stereo preamp mixer features a built-in, 4-second sampler with single play and repeat functions along with four memory presets. With it you can store up to four 1-second samples which can be played back individually or collectively for added mixing excitement. Push-button controls let you quickly assign any input source to the effects send and provide punch in monitoring in the left or right channel. The crossfader is completely assignable and is complemented with Beat Blend. Beat indicators and a 6-band assignable graphic equalizer complete this package.

DM1775

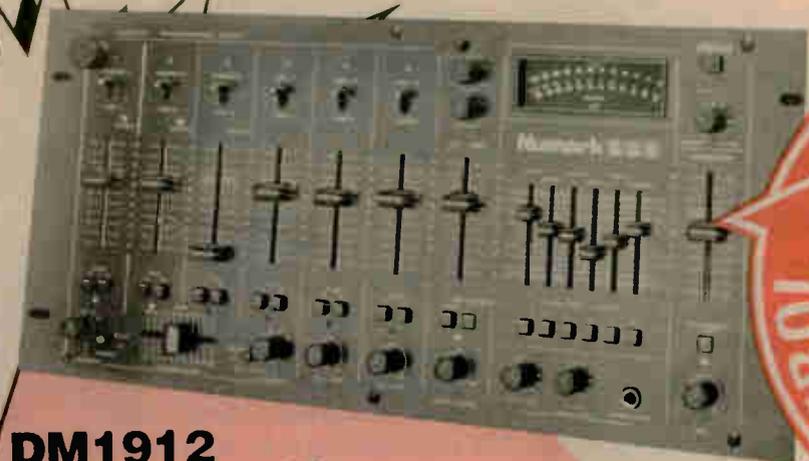
The DM1775 is designed for the serious musician who wants to add sampling effects to home recordings or live mixes. It features the same high quality circuitry as the DM1975 and features single button start/stop triggering, 6-band graphic equalizer, and bass and treble for the DJ mic. The optional FS775 foot switch also provides hands-free triggering of the sampler's start and stop functions.



DM1150

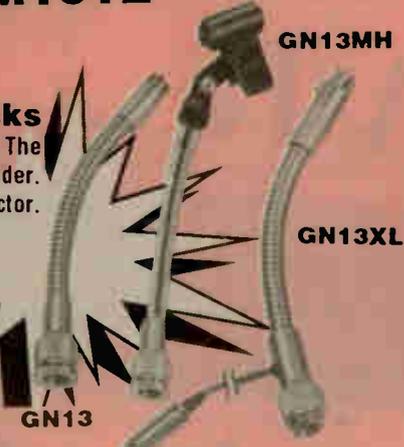


DM1912



Microphone Goosenecks

The GN13 is a 13" Gooseneck with stand 5/8"-27 thread. The GN13MH is equipped with a Universal Microphone Holder. The GN13XL also includes an XLR to 1/4" connector.



UD-9200 Unidirectional Dynamic Microphone

List \$45.95 Special \$36.00

A highly versatile personal microphone with wide frequency response and unidirectional pick-up – suitable for indoor or outdoor use. Comes complete with wire mesh windscreen, and XLR to 1/2" Phone connector.

HV115A Ultra Thin High Velocity Stereophone

List \$34.95 Special \$21.95

Superb reproduction, a 15Hz-22kHz frequency range, lightweight 7 oz. design, and a 10' connector cord add up to a highly flexible unit equally suitable for monitoring or personal listening.

CDM500 Compact Stereophone

Designed to capture a wide range of digital CD with a 20Hz-20kHz frequency range. Comes with stereo plug and 1/4" connector.

List \$29.92 Special \$19.95

UD940A Cardioid Microphone

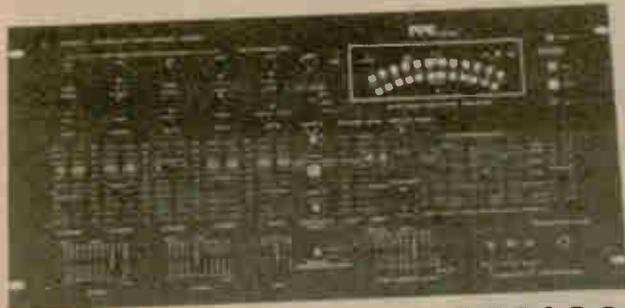
Great for vocal and instrumental recording applications, this high quality mic features a cardioid polar pattern for unidirectional performance. Comes complete with mic stand adapter, XLR to XLR-balanced cable, on/off switch and built-in wire mesh wind screen.



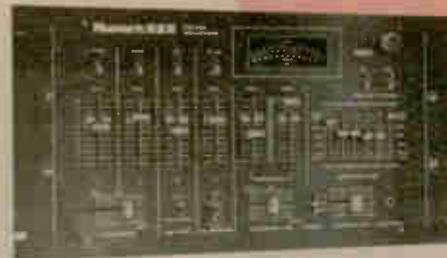
DM1075



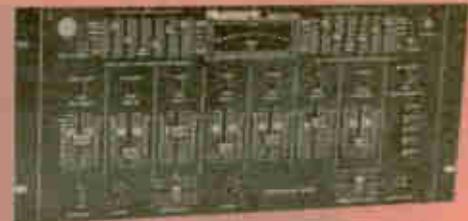
DM1950



DM1900



DM1760



DM1175

COMPARISON CHART

MODEL	INPUTS	CROSSFADER	METERS	EQUALIZER	OUTPUTS
DM1950A	3 Phono, 2 Mic, 4 Line	Yes	Peak Hold, Beat Indicators	4-band graphic, 2 parametric	Processor Loop, House, Booth
DM1912	3 Phono, 4 Mic, 6 Line	Assignable	Peak Hold, Beat Indicators	Assignable 6-band graphic	Balanced Program, Loop, Booth, Cue
DM1900	3 Phono, 1 Mic, 5 Line	Yes (2)	Peak Hold	6-band graphic	Processor Loop, House, Booth
DM1760	2 Phono, 2 Mic, 4 Line	Yes	Peak Hold	6-band graphic	Program
DM1650	2 Phono, 2 Mic, 4 Line	Yes	Peak Hold, Beat Indicators	6-band graphic	Program
DM1550	2 Phono, 2 Mic, 4 Line	Yes	2 VU	6-band graphic	Program
DM1275	2 Phono, 1 Mic, 3 Line	Yes	Peak Indicating	2-band graphic	Program
DM1175	3 Phono, 1 Mic, 5 Line	Assignable	Peak Hold	Dual 6-band graphic	Program
DM1150	2 Phono, 1 Mic, 2 Line	Yes	Peak Indicating	—	Program
DM1075	3 Phono, 1 Mic, 3 Line	Assignable	Peak Hold	Base/Treble	Program

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ATH 910



audio-technica.

ATH900 Series Professional Stereophones

The ATH900 Series stereophones were designed solely for studio and professional monitoring. Each offers superb reproduction accuracy, yet all are ruggedly built to withstand heavy field and studio usage. These stereophones are unusually comfortable to wear and easy to adjust. The closed-back design plus specially-formulated ear pad material offer excellent isolation with unusual comfort.

Low Price, Call!

ATH909 Open-back 30 Ohms
List \$79.95

Buy 1 \$38.95
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Buy 3 \$34.95

As Low As,
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ATH910 Closed-back 30 Ohms
List \$99.95

Buy 1 \$49.95
Buy 2 \$45.95
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\$39.95

AKG C414B/ULS Microphone

FET condenser microphone with large diaphragm capsule, providing four selectable patterns (omni, cardioid, hypercardioid, figure), with three position bass-rolloff switch (flat, 75Hz, 150Hz) and 0, -10dB, -20dB attenuator switch. For 9-52V low-current drain phantom powering. Complete with W-26 windscreen, SA-18/3 clamp stand adaptor and case.

Low Price, Call!



AKG
C414/
ULS



AKG
K240M

AKG K240M

An excellent sounding and very comfortable semi open air design. Self adjusting headband and Cardon swivels locate the earpieces precisely regardless of head or ear shape, long term wearer fatigue is eliminated. Patented design combines main transducers and 12 passive diaphragms. 600 ohm. 20 to 20,000 Hz. less than 0.3% distortion at 95 db SPL. 8.5 oz. weight.

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EV RE20



ElectroVoice RE20 Dynamic Cardioid Variable-D

Created for critical recording, broadcast and sound reinforcement applications, will take levels in excess of 160db, has no proximity effect, built-in blast filter, very flat on and off axis. 45-18,000 Hz. Steel body.

Low Price, Call!

SHURE

Shure SM7

Shure SM7



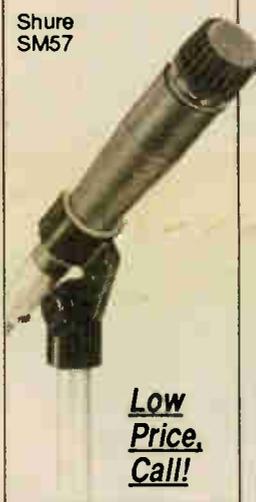
A fixture in studios around the world, the "smooth and silky" SM7 is famous for making voices sound their best. Extremely popular for radio and television work, especially voice-over recording. Unique graphic tailoring switches (for presence boost and low-end rolloff) permit the choice of four different response curves. Yoke assembly allows exact positioning. Acclaimed as one of the finest dynamic microphones in use today.

Low Price, Call!

Shure SM58

The unsurpassed first choice of professional performers around the globe, the SM58 is a genuine world standard and a true audio legend. Although the "58" is often imitated in appearance, its lively, intelligible, powerful sound and rugged reliability have never been duplicated. Makes rock, r&b, pop, and country vocals sound their best.

Shure
SM57



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Shure SM57

The classic SM57 is the "workhorse" microphone of stages and studios worldwide. Its carefully contoured presence rise means clean, beautifully defined instrumental reproduction and rich, warm vocal pickup on lecterns. The standard for drum and cymbal miking.



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Shure
SM58

Full Compass is one of the largest microphone dealers in the country. Call!

SENNHEISER

MD421U Dynamic Microphone

One of the most popular microphones among professionals. Ruggedly constructed to precision standards, no other microphone is as immune to overload. A rising high frequency response improves definition, a 5-step low frequency control tailors response for various conditions. Used in broadcast, recording and in on the road sound reinforcement, for both vocal and instrumental applications. The housing is high-impact scratch resistant ABS material.

Low Price, Call!

Sennheiser
MD421U



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DAT Headquarters

TASCAM

DA-30 RDAT Recorder

Specifications:

- Quantization bit: 16 bit linear
- Sampling rate: 48kHz (play/record); 44.1 kHz (play/record); 32 kHz (play, record from digital inputs)
- Frequency response (record): 1 Hz - 22 kHz +/- 0.5 dB
- Signal to Noise Ratio: >94 dB
- Total Harmonic Distortion: < .004% (1 Hz)
- Channel Separation: >94 dB (1 kHz)
- Wow & flutter: <.001%
- Weight: 21 lbs.
- Dimensions: W 19" x H 5-1/4" x D 13-3/4"



The DA-30 RDAT recorder is ideal for professional digital mastering applications. It combines high tech, high quality A/D converters using 64x oversampling Delta Sigma modulation, with 18 bit 8x oversampling D/A converters to deliver the industry acknowledged "best sounding DAT." The DA 30 can also directly interact with other professional digital equipment via the AES/EBU interface.

FEATURES: • AES/EBU digital interface bypasses copy prohibit code • Consumer type coaxial digital inputs and outputs • +4 dBm XLR balanced analog inputs and outputs • -10 dBV RCA inputs and outputs • Independent left and right A/D and D/A converters • Wired remote control controls all functions, including numeric keys for direct search and playback • 15 pin parallel I/O port allows external transport control • 3x normal speed cue and review; 9x search • Standard 19" rack mountable

Low Price, Call!

CASIO

DA7 Portable DAT Recorder

Field portable, both line level RCA and microphone level 1/4" jacks at the side, digital SCMS input jack, LCD display of absolute, remaining and program time. Separate headphone jack and level control allow monitoring, 2 hours of operation are possible from the included rechargeable battery pack and continuous operation is possible from the included AC adapter-charger. A carrying case is included.

Low Price, Call!



FOSTEX

D20 DAT Mastering Recorder

This is the first professional DAT recorder to offer the ability to synchronize with SMPTE based audio and video equipment. Both parallel and serial RS422 interfaces are supported. Off tape monitoring (confidence heads) allows the engineer to hear playback at the same time as recording. Pitch control with digital readout, instant punch-in/out, 44.1 kHz or 48 kHz recording, AES/EBU digital jacks, balanced analog connectors.

Low Price, Call!



Sony PCM2700



SONY

Sony PCM2700 Professional DAT Machine

- 4 head design for read/write real time recording
- 4 direct drive motor transport
- Newly developed 1 bit D/A converter
- Adjustable Digital Fader
- Long Play Mode--up to 4 hours
- 3 sampling frequencies (48, 44.1, 32)
- Keypad for Cue point access

Low Price, Call!

Panasonic

PANASONIC SV3700

Professional rack-mount for studio application. Standard features include front panel shuttle wheel, high speed transport with 400 ties fast wind, AES/EBU digital I-O, analog recording at 44.1 kHz or 48 kHz, high performance 1-bit A-D, and D-A converters, balanced input and outputs, error rate display. An infrared wireless remote control is included, and a hard-wired remote jack is on the back side.



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RDAT Tape at terrific prices!

AMPEX 467 RDAT Digital Audio Cassette

Order Number	Length	Description	Each	Quan	Price	Quan	Price
003-467-RO45P	45 min	Pro packaging	8.03	10	7.42	20	7.11
003-467-RO60P	60 min	Pro packaging	9.27	10	8.56	20	8.20
003-467-RO90P	90 min	Pro packaging	11.12	10	10.26	20	9.83
003-467-RO120P	120 min	Pro packaging	12.97	10	11.98	20	11.48

BASF/AGFA RDAT Digital Audio Cassette

Order Number	Length	Description	Each	Quan	Price	Quan	Price
232-RDAT-60-Pack	60 min	Plastic boxed	8.13	10	7.50	20	7.19
232-RDAT-90-Pack	90 min	Plastic boxed	9.62	10	8.88	20	8.51
232-RDAT-120-Pack	120 min	Plastic boxed	11.05	10	10.20	20	9.78

D.I.C. RDAT Digital Audio Cassette

Order Number	Length	Description	Each	Quan	Price	Quan	Price
713-DIC-1.3GB	120/60 min	DAT data cassette	11.10	10	10.25	20	9.65
713-DIC-15MQ	15 min	Master quality	5.12	10	4.62	20	4.28
713-DIC-15XR	15 min	Plastic boxed	5.12	10	4.62	20	4.28
713-DIC-30MQ	30 min	Master quality	6.84	10	6.31	20	5.89
713-DIC-30XR	30 min	Plastic boxed	6.29	10	5.81	20	5.42
713-DIC-45XR	45 min	Plastic boxed	6.51	10	6.01	20	5.61
713-DIC-48MQ	48 min	Master quality	7.07	10	6.53	20	6.09
713-DIC-60XR	60 min	Plastic boxed	7.12	10	6.58	20	6.14
713-DIC-62MQ	62 min	Master quality	7.75	10	7.15	20	6.68
713-DIC-90XR	90 min	Plastic boxed	8.26	10	7.62	20	7.11
713-DIC-92MQ	92 min	Master quality	9.22	10	8.51	20	7.94
713-DIC-120XR	120 min	Plastic boxed	9.71	10	8.96	20	8.22
713-DIC-122MQ	122 min	Master quality	10.54	10	9.73	20	9.08

FUJI RDAT Digital Audio Cassette

Order Number	Length	Description	Each	Quan	Price	Quan	Price
487-DAT-R60	60 min	Plastic boxed	8.02	10	7.40	40	6.91
487-DAT-R90	90 min	Plastic boxed	9.63	10	8.89	40	8.30
487-DAT-R120	120 min	Plastic boxed	11.43	10	10.55	40	9.84

PANASONIC RDAT Digital Audio Cassette

Order Number	Length	Description	Each	Quan	Price	Quan	Price
068-RTR46P	46 min	Plastic boxed	7.91	5	7.36	10	6.81
068-RTR60P	60 min	Plastic boxed	9.35	5	8.70	10	8.05
068-RTR90P	90 min	Plastic boxed	10.79	5	10.04	10	9.29
068-RTR120P	120 min	Plastic boxed	12.23	5	11.38	10	10.53
068-RT-RCLP		Cleaning tape	13.00				

SCOTCH-3M DAT Digital Audio Cassette

Order Number	Length	Description	Each	Quan	Price	Quan	Price
080-PRO-DAT46	46 min	PRO DAT TAPE	7.75	10	7.44	40	7.13
080-PRO-DAT60	60 min	PRO DAT TAPE	8.93	10	8.57	40	8.21
080-PRO-DAT90	90 min	PRO DAT TAPE	10.75	10	10.32	40	9.89
080-PRO-DAT120	120 min	PRO DAT TAPE	12.49	10	11.99	40	11.49

TDK RDAT Digital Audio Cassette

Order Number	Length	Description	Each	Quan	Price	Quan	Price
769-DAR-60	60 min	Cassette	7.80	10	7.20	20	6.72
769-DAR-90	90 min	Cassette	9.36	10	8.64	20	8.06
769-DAR-120	120 min	Cassette	10.92	10	10.08	20	9.40

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OTARI MX5050BIII

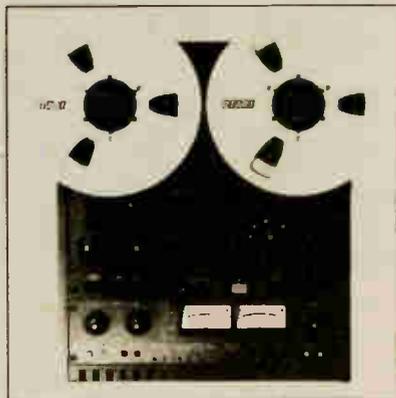
The newest of a tradition of standard broadcast workhorses.

Professional Broadcast Standard 2 channel tape recorder with optional 1/4 track play back head. (Full track version also available) Every feature has been upgraded, all electronic switching. Mini auto-locator with 3 points +RTZ-3 speeds in 2 speed pairs, front panel record adjustments, built-in 1kHz & 10kHz test tone oscillator +/-4dbm/-10dbv I/O level switch, dynamic braking, mic inputs with 20db pad and mic line mix, +20% varispeed and much more.

Rack Mount Kit: RK2B
Roll Around Stand: ZA52L22

Remote: CB127

Low Prices, Call!



NAKAMICHI

NAKAMICHI MR1 3-head Cassette Recorder

Professional, rack-mount, balanced and unbalanced in and out, hardwired remote control jack, dual capstan transport, direct-drive capstan motor, Dolby B and C, playback 6% pitch control.

Low Price, Call!



NAKAMICHI MR2 2-head Cassette Recorder

Professional, rack-mount, unbalanced in-out, high performance electronics, bias tune control, 6% playback pitch control, Dolby B and C, audio repeat, wired remote ports allow multiple deck control from one remote control, headphone output with separate level control.

Low Price, Call!



Marantz PMD221

Marantz PMD-201 Portable 2 head mono cassette recorder

Ultra compact, 2 speed, 4 way power, built-in speaker, direct telephone input, separate AC supply included.

Marantz PMD-221 Portable 3 head mono cassette recorder

marantz. Same features as PMD201 plus 3 head monitoring, variable speed and memory rewind.

Marantz PMD222 Similar to the PMD221 with XLR mic connector

Technics

TECHNICS SLPS50 CD Player CLOSE-OUT, limited quantities

A great CD player, very few left, center mounted transport and Full Anti-Resonance Construction. MASH 4-DAC 4-times oversampling D-A converters, linear motor transport, optical digital output terminal, peak level search, wireless remote control, repeat, auto-cue, headphone jack with volume control. 103 db signal to noise ratio, 96 db dynamic range.

List 329.95

Sale 229.95

TECHNICS SLPS70 CD Player CLOSE-OUT, limited quantities

All the features of the SLPS50 plus, 8-DAC 8-times oversampling D-A converters, heavier chassis, 112 db signal to noise ratio, 100 db channel separation.

List 449.95

Sale 329.95



CLOSEOUT!

TASCAM

TASCAM Production Recorder BR-20T Low Price, Call!

Specifications •Tape: 1/4", 1.5 mil •Track Format: 2-track plus Center Timecode Track •Maximum Reel Size: 10.5"(NAB) •Tape Speed: 7.5 IPS/15 IPS •Head Configuration: 3 (ERASE, REC/SYNC, REPRO) •Frequency Response (15 IPS): 35 Hz-22kHz (+/- 2 db @ 0 VU) •Total Harmonic Distortion: 0.8% (0 VU, 1 kHz) •S/N: 71 db (NAB A WTD) •Channel Separation: <60 dB @ 1 kHz

Weight: 44 lbs •Dimensions: 19"W x 17 1/2"H x 7 1/16"D

The BR-20T offers the same professional quality and performance as the BR-20, with the addition of a center timecode track, for professional users who require timecode synchronization. Its in-line head configuration and time code waveform optimization system eliminate the need for internal delay circuits and timecode level monitoring and adjustments and assure error-free sync and control operation.

FEATURES: •Balanced XLR and unbalanced RCA inputs and outputs •Independent left and right reel size selectors, record function switches and monitor selector •Pitch control (+/- 12%) •Parallel port for synchronizer control •Gapless punch in/out •Spot erase •Headphone monitoring •Built-in rack mount ears



Marantz PMD-420 Portable 2 head stereo cassette recorder

Portable 2 head stereo cassette recorder, Dolby B noise reduction, ultra-compact, built-in speaker, 4-way power and separate AC power supply included.

Marantz PMD-430 Portable 3 head stereo cassette recorder

Ultra compact three pound unit operates on internal batteries and includes an external AC adapter and carrying case. Features include three heads, Dolby B and dbx noise reduction, metal tape capability, memory rewind, limiter, fine bias control and pitch control.



Marantz PMD 420

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AB INTERNATIONAL

AB International Precedent
Series Power Amplifiers
600LX Limited time offer



We have a very limited quantity of these great power amplifiers in stock to sell at a very low price due to the manufacturer's over stock. This is a fantastic industrial power amplifier with great features, heavy duty metal cabinet, torroid power transformer, balanced XLR inputs, front level controls, clip indicators, DC/Latch/Thermal protection, large aluminum heatsink, fan cooling, 36 month warranty. The power rating is 270 watts into 8 ohms, 425 watts into 4 ohms, 750 watts bridged mono into 8 ohms. Weight is only 33 pounds.



List 899.00

Sale price is so low we promised not to print it, so call, hurry, they won't last long.

SYMETRIX

SYMETRIX SX208 Stereo Compressor Limiter

1/2 rack sized, with exceptionally low noise and distortion, balanced and unbalanced in and out, variable ratio control, fast or slow response, program controlled attack and release times, RMS and peak detection, great for recording, broadcast, reinforcement and paging applications.

Low Price, Call!

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250	Portable 8" 2-way speaker
List 125.00	Buy 1 49.95
	Buy 4 45.95
	Buy 8 39.95
	Buy 16 35.95
260	Portable paging horn, 8 ohm, cord 1/4" plug
List 80.00	Buy 1 29.90
	Buy 4 25.95
	Buy 8 22.95
	Buy 16 19.95

Full Compass does it again! These are an incredible buy and they're going incredibly fast!

Prologue 250

A full range 2-way vented loud speaker. 8" woofer, 3" tweeter. Scuff resistant finish with stacking feet on all corners. Only needs 5 to 20 watts for power.

Prologue 260

Horn projection voice range loudspeaker. Weather resistant with swivel bracket. 20' cable and 1/4" plug. 8 ohms, only needs 5 to 20 watts. Has a tightly controlled sound pattern and a frequency response which emphasizes voice reproduction.



As Low As
\$19.95

As Low As
\$35.95

SECK/ SOUNDCRAFT CLOSEOUTS

SAVE BIG!

Unbelievable
Discounts!

		LIST	FC Closeout Price
050-62-DEMO	6x2 mixer	1095.00	1 demo 499.00
050-242	24x2 mixer	3275.00	5 only 1695.00
050-1282	12x8 mixer	2725.00	13 only 999.00
050-1282-DEMO		2725.00	4 only 939.00
050-1882-DEMO	18x8 mixer	3750.00	6 only 1779.00
Limited Quantities First Come First Serve			

Hot Seck Mixer Close Out Multi Track Recording - Models 1282 & 1882

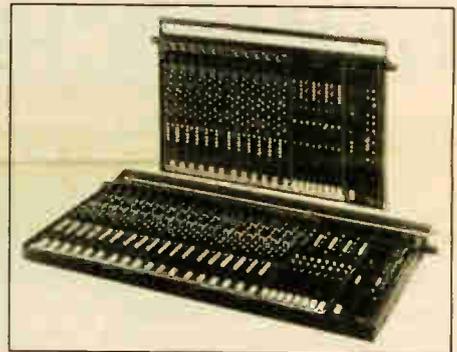
Sophisticated and versatile 8 buss consoles built for 8 or 16 channel recording. Also suitable for reinforcement. 12 and 18 input versions available.

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1282
HxDxW 1.89"x18.23"x30.35"
Weight 30 lbs.

1882
1.89"x18.23"x39.17"
38 lbs.

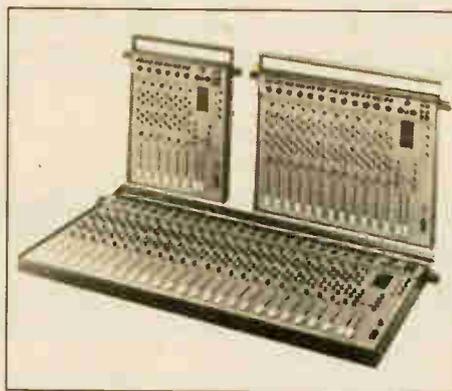
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Quantities



Sound Reinforcement - Models 62 & 242

Six and twenty-four channel stereo boards designed for live sound reinforcement. Their compact design makes them extremely portable; their engineering makes them reliable. 6 and 24 channel versions available.

Features: Phantom power • 3 band EQ with mid sweep • 4 aux sends, 2 pre, 2 post • Solo • 100mm faders • Mic/line switchable • XLR connectors on main stereo outputs • Stereo bargraph meters • 2 effects returns with EQ • Dual headphone jacks



62
HxDxW 1.89"x18.23"x14.57"
Weight 11 lbs.

242
1.89"x18.23"x40.75"
43 lbs.

Discount Prices: 1-800-356-5844

Full Compass • Consultation: 608-271-1100 • 5618 Odana Road • Madison, WI 53719



DM1550



TT1600
Professional Direct Drive Turntable

The TT1600 combines the professional performance of broadcast turntables and the handling ease you need for creative spinning. It features a digital readout of the playing speed, remote start, and pitch control. The TT1600 comes complete with Stylus Target Light headshell, shock isolating feet, and precision tonearm.



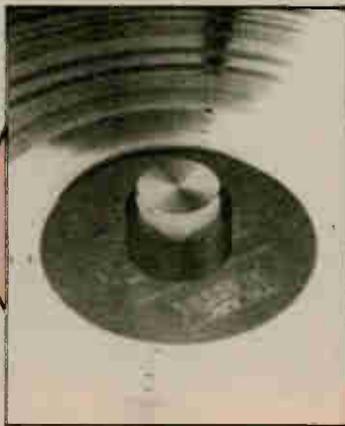
HV100
Ultra Light Weight Dynamic Stereophone

A highly portable personal listening unit. Weighs in at only 6 oz. Comes complete with an 8' connector cord.

List \$17.95 Special \$13.95

PL45
Platter Lock

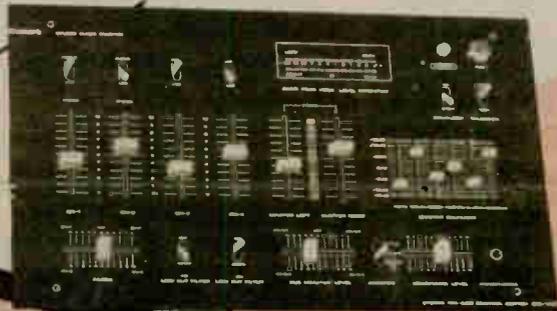
A must for mobile DJs, the PL45 locks the turntable platter securely in place for transport. It also doubles as a spindle for 45 RPM records.



Disc one

re the full sound frequency with 3.5mm 4" adapter.

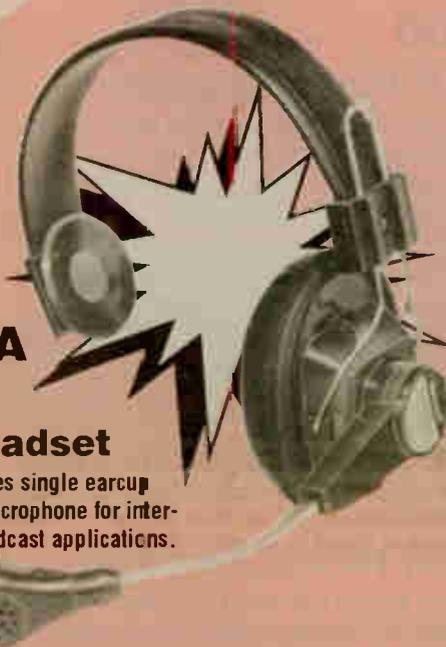
Special \$19.95



DM1650

HM6000A
Broadcast Monitor Headset

The HM6000A combines single earcup design with a boom microphone for intercom and talkover broadcast applications.



DM1275



TT1400
Professional Direct Drive Turntable

This professional turntable offers all the features you need to spin like a pro...but at a budget price. It comes with a high torque, direct drive motor for fast takeoffs and variable pitch control for $\pm 8\%$ speed variation. For pinpoint cueing under low-light conditions, the TT1400 also features a Stylus Target Light.

HS229
Universal Headshell



HS230
Universal Headshell
Features Stylus Target Light.



✓ BEAT MIXING MADE SIMPLE: 1-2-3...

With DJ-approved gear, mixing is a snap – just add a little practice...!

1. Pick two CDs or records with similar BPMs (that's Beats Per Minute which means "ter po"). Adjust the pitch on your DJ-approved players until the beats match.

2. While Disk 1 is playing, listen on headphones to Disk 2, counting out the beats in bars: 1-2-3-4. Pause Disk 2 at the beginning of a bar, then let it go to synchronize bar for bar with Disk 1.

3. Bring up the volume on Disk 2 – both songs should now be playing in synch. Look for a good moment to fade out Disk 1.

Numark PROFESSIONAL DJ ACCESSORIES



SA3200

510 Watt Power Amplifier

This professional quality amplifier features 510 watts of continuous output power per channel at 4 ohms. The SA3200 also features a 2-speed fan and thermo-protection circuitry for dependable, non-stop operation.



SA2200

375 Watt Power Amplifier

The SA2200 delivers clean, solid output power over a wide frequency range for punchy bass and sizzling highs. It also features thermo-protection circuitry and massive heat sinks for reliable performance.



SA2500

450 Watt Power Amplifier

This powerhouse delivers 450 watts per channel @ 4 ohms (280 watts @ 8 ohms) RMS continuous output, both channels driven, from 20Hz to 20kHz with less than 0.039% total harmonic distortion! Combine that with DC-coupled bipolar technology, DC and thermal protection, and clean, sleek design for "state-of-the-watt" sound!



E340C

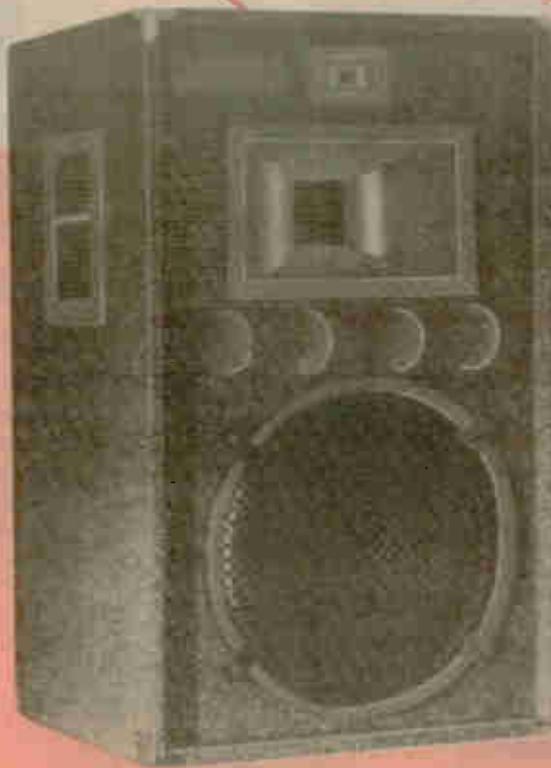
3-Way Mobile Speaker

This commercial duty mobile speaker delivers all the punch you need to handle anything from outdoor concerts to packed dance-floors. This speaker's 300 watt RMS power handling, 15" bass driver with 3" voice coil, midrange compression driver and ring radial tweeter let you pump up the volume with some serious confidence.

D25C

2-Way Club Monitor Speaker

The D25C's high efficiency woofer and exponential high frequency horn make it ideal for use with low to medium powered amplifiers. Features 100 watt RMS power handling, 8" woofer and horn tweeter.



M330C

3-Way Mobile Speaker

Heat up your next house party or club date with this high energy performer. The M330C features 200 watt power handling capacity, a massive 16" low frequency driver for thunderous bass and exponential horns for the midrange and high end.



PM330C

3-Way Powered Speaker

This unique 3-way speaker system features a built-in 225 watt amplifier coupled to a high power handling 15" woofer and mid and high frequency horn drivers. This perfectly matched combination of speaker efficiency and amplifier power offers an unbeatable blend of power, performance and reliability. Comes complete with carpet-covered cabinet, carrying handles and accepts XLR microphone cable for easy connection to your mixer.

SYSTEM SPECIAL PM200 + (2) M212C

\$1,249.00

Sugg. list \$1690

M212C

2-Way Club Monitor Speaker

This mid-size speaker system packs all the punch you need to add the excitement of high energy club listening to any social occasion. Features 150 watt RMS power handling, 12" woofer and exponential horn tweeter.



PM200

140 Watt

Powered Mixer

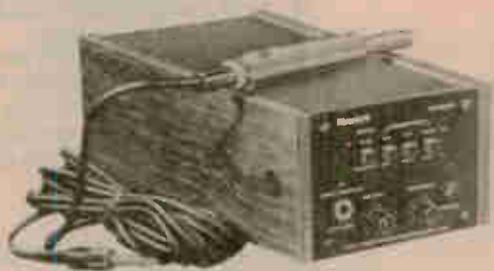
\$649

Sugg. list \$900.00

The PM200 offers everything you need to add the excitement of live mixing and

high energy listening to any occasion. Mix 2 turntables, 2 mics, and 2 line sources for hours of continuous mixing enjoyment. Ideal for the home recordist or for home studio production.





\$105

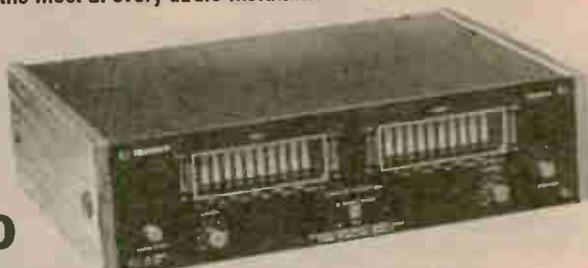
Sugg. list \$169.95

PX2626 Pink Noise Generator / Measurement Mic Amp

A specialized audiophile unit at a surprisingly popular price! Used with the Numark SD2900 (also on special, pictured below) or any other frequency analyzer or calibrated equalizer, the PX2626 lets you perfectly balance the sound for any room. Move through the sound spectrum adjusting each band to achieve ideal flat response at all frequencies. Make the most of every audio installation!

\$145

Sugg. list \$339.95



SD2900 Stereo Frequency Spectrum / Tone Computer Display

This 10-band stereo unit displays frequency response on large 3-color fluorescent meters. Used with the PX2626 Pink Noise Generator (see above), the SD2900 lets you use your equalizer to optimize your audio system to the characteristics of any space. With the push of a button, the SD2900 instantly doubles as a studio-quality stereo VU meter for precise recording level control.

\$125

Sugg. list \$389.95



NR400 Noise Reduction Processor

The NR400 is specifically designed to improve tape quality in all home recording situations. Using the compansion principle, the NR400 dramatically improves the clarity, punch and brilliance of recorded music by "squeezing" more sound onto cassette and 1/4" tape. Compact, extremely easy to use, and available now at an unbelievable price.



\$169

Sugg. list \$459.95

VS3200 Audio/Video Sound Processor w/ Graphic EQ

The VS3200 is an incredibly versatile video audio control center, equally suited to studio, club or home use. Plug in up to two record/play video decks, one playback only deck, cable or antenna, stereo tape and line. Use the 10 band graphic equalizer plus Noise Reduction, Expander, and Enhancer circuitry to improve sound quality, dub new soundtracks onto existing videotapes, even synthesize stereo sound from a mono signal! A separate video switching section delivers full flexibility when dubbing audio, video or both. It's a mini-video production studio in one unit!



\$285

Sugg. list \$539.95

VS3300 Audio/Video Sound Processor w/ Color Correction

This extremely sophisticated audio/video control center is a rugged professional unit ideal for club, production studio or home use. The VS3300 features three video inputs for use with VCR, videodisk player, TV tuner, cable TV, satellite, or home videocamera, plus a stereo audio only line input. Correct and enhance color, sharpness and horizontal/vertical balance of the video image. Use the 10-band equalizer, stereo synthesis circuitry and noise reduction to improve the audio. Video and audio faders allow fade in and out of picture and sound. The VS3300 is perfect for audio/video mixing, dubbing and pro or personal production.

Numark DJ-APPROVED SYSTEMS

Assemble your first Numark DJ System from the four basic audio groups!

Audio Sources: CD players, turntables, microphones, samplers - select the sound sources that you need!

Mixers: Your control center! Choose a mixer based on the number of Audio Sources you'll be using and the degree of sound control you require.

Amplifiers: Remember, volume isn't everything! Clean, plentiful power lets you smoothly handle peak highs and lows for the best sound at all volume levels.

Speaker Systems: Your loudspeaker selection ultimately determines the nature of your sound. Let your ears judge, but first consider carefully your playing conditions.

When building or upgrading your audio system, the Numark brandname is your guarantee of reliability, flexibility, compatibility and professional sound.



\$125

Sugg. list \$199.95

TC4100 Stereo Tape Deck Tone Calibrator/Mixer

Use this studio console to record on up to four tape decks at one time. Compare and calibrate up to four cassette or open reel decks with built-in 400Hz and 8kHz test tone oscillators for optimum recording performance. Then tape from one line source to up to four decks, or from one tape deck to three other decks. Separate VU meters for each stereo channel and individual level controls to monitor recording on each machine ensure high definition results.

PROFESSIONAL DJ APPLICATIONS

PRO SITUATIONS DEMAND NUMARK:

Club/Disco • Mobile DJ • Bar/Hotel Lounge • Radio Station • Recording Studio • A/V Studio • School • Bowling Lane • House of Worship • Roller Rink

For professional use, Numark audio equipment delivers studio quality sound and exceptionally reliable performance under the most rigorous conditions. All Numark components are field tested by working DJs around the world. New products are developed by Numark's own R&D lab to ensure state-of-the-art quality (not repackaged "secondhand" technology). Finally, all Numark equipment is manufactured in the USA, with prompt support direct from Numark Professional Products Division...

CD PLAYER

Professional twin transport CD players with variable pitch let you take advantage of the superior sound, durability and space saving characteristics of CDs. (Numark pioneered this equipment category with the CD6020 way back in 1990!)

HOME DJ TIP: Use the Numark CD6020's automated Beat Synchron™ and Integrate™ features to perform song mixes like a DJ professional.

ELECTRONIC INSTRUMENTS (Drum Machines, Synthesizers, etc)

Injecting basslines, drum fills, orchestra stabs and other "live" elements into the prerecorded music program takes dance music to a whole new level. Live musical enhancement is the DJ-ing wave of the future!

HOME DJ TIP: Your DJ control center can be as at home with an electric guitar as it is with synthesizers

MICROPHONE

Serving as the direct communication link to your audience, microphones must provide distortion-free vocals under all conditions. Consider the microphone controls on your mixer as well as the pick-up pattern and construction characteristics of the microphone itself. To select effectively, know exactly what the mic will be used for in your situation.

HOME DJ TIP: Not to be overlooked – experiment with a variety of audio productions or add that personal touch to mixed tapes!

MIXER

The control center of your system must be able to handle a wide range of input and output requirements, without adding noise or distortion along the way. High-grade parts and precision construction ensure clean, crisp studio sound – the difference you can hear in every Numark mixer! Sacrificing quality for

PERSONAL DJ APPLICATIONS

HOME AUDIO SOLUTIONS CALL FOR NUMARK DJ-APPROVED GEAR...

You need extremely flexible equipment to handle today's wide range of personal audio situations. Whether you're compiling non-stop mix tapes for your car, enjoying movie theater sound while watching a video, or laying down the music at a hot house party, Numark components provide pro solutions for home applications. Numark equipment is easy to operate, delivers exceptional high definition sound and allows you full control of your entire entertainment system. Your Numark dealer will be glad to help you choose a set-up that best suits your needs. Check the handy chart below...

POWER AMPLIFIER

The weak link in many systems – amps must deliver enough power to consistently handle the extreme highs and lows of sustained use, not just the average sound level. If your amps cut out, so do your customers!

SAMPLER

Used skillfully, the sampler is a versatile audio tool that allows the DJ to customize music to the audience by editing and remixing hit songs and inserting dramatic sound effects. A "trademark" DJ sound can be the key to a consistent full house.

HOME DJ TIP: Probably the single most fun "extra"

YOUR "DJ APPROVED" CHECKLIST...

For true pro audio performance, three essentials are required from every DJ-approved system, features you'll find in every Numark audio component:

1. **STUDIO QUALITY SOUND:** Eliminate noise pollution with precision engineering to recording studio specifications.
2. **MAXIMUM FLEXIBILITY:** Adapt to the widest range of pro and personal situations with a full range of inputs, outputs, meters and controls.
3. **100% RELIABILITY:** Ensure trouble free operation under the toughest conditions with rugged construction and the highest quality parts: Don't settle for less!

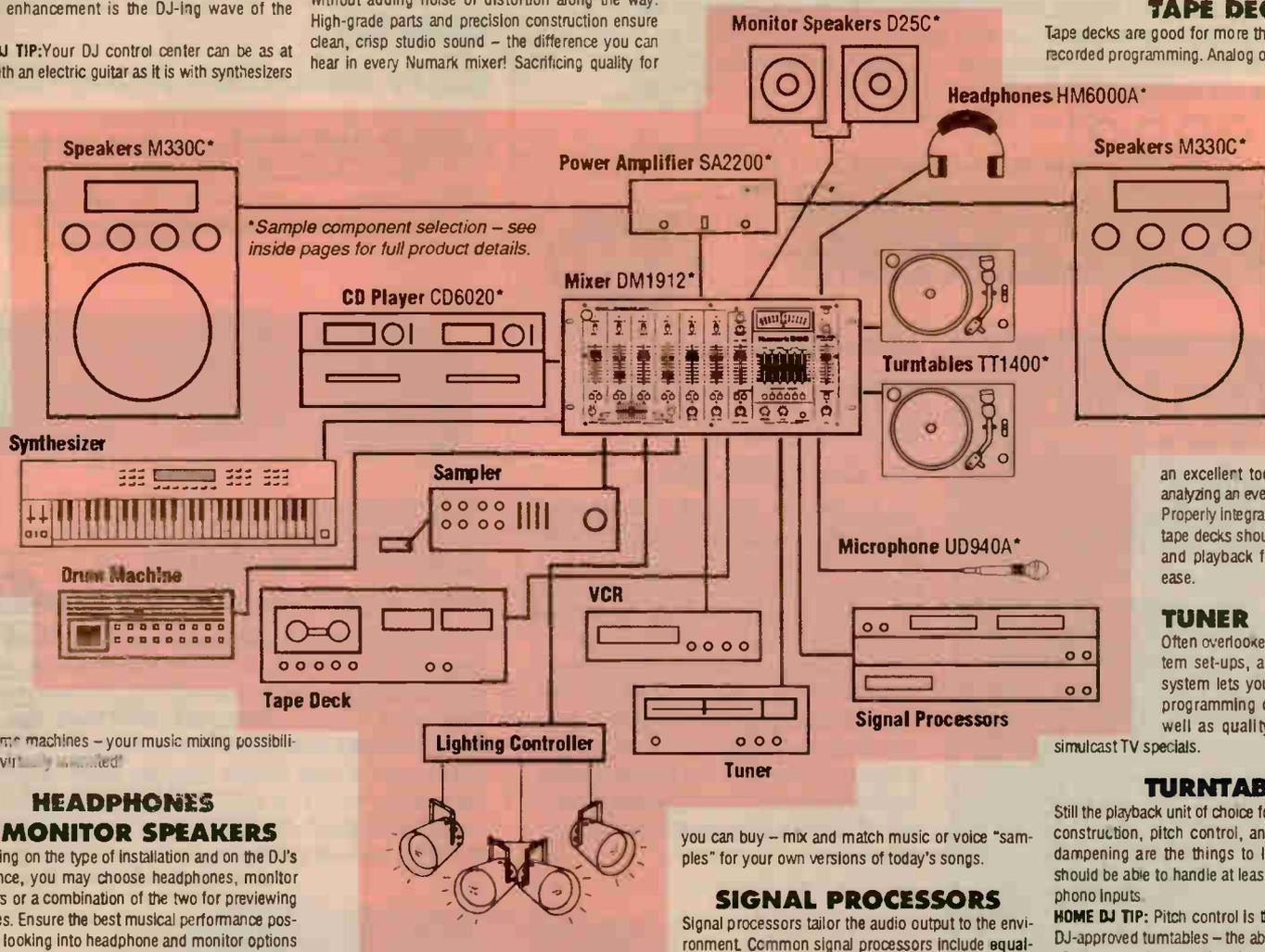
SPEAKERS

When it comes to making a difference to the ears of your audience, the loudspeaker is the single most important component in your sound system. Selecting the right units for the job involves several factors: location and type of installation (permanent or mobile), also, type of music and volume level. Never base your decision on one factor alone.

TAPE DECK

Tape decks are good for more than playback of pre-recorded programming. Analog or DAT units are also

HOME DJ TIP: Your DJ control center can be as at home with an electric guitar as it is with synthesizers



and drum machines – your music mixing possibilities are virtually unlimited!

HEADPHONES & MONITOR SPEAKERS

Depending on the type of installation and on the DJ's preference, you may choose headphones, monitor speakers or a combination of the two for previewing purposes. Ensure the best musical performance possible by looking into headphone and monitor options before you install or upgrade.

LIGHTING CONTROLLER

Sound-activated lighting systems use the audio signal to automatically control the operation of lighting effects, allowing a single person to handle both audio and lighting.

HOME DJ TIP: Keep an eye out for the growing number of inexpensive, sound-activated light shows perfectly suited for in-house use.

cut-rate brands is a sure way to sound pollution problems.

HOME DJ TIP: The heart and soul of any respectable home audio set-up, a DJ-approved mixer gives you clean, straightforward control over all your audio sources, from CD, tape and record, to videotape, video games, and TV.

you can buy – mix and match music or voice "samples" for your own versions of today's songs.

SIGNAL PROCESSORS

Signal processors tailor the audio output to the environment. Common signal processors include equalizers, noise reducers, and special effects like reverb and delay. Used correctly, various types of signal processing can correct acoustic problems in your club or home, enhance sound quality and provide added creative possibilities for DJ-ing or tape making. Outboard signal processors add tremendous flexibility to the processing features already built in to your mixer.

an excellent tool for recording and analyzing an evening's entertainment. Properly integrated into your system, tape decks should serve both record and playback functions with equal ease.

TUNER

Often overlooked in commercial system set-ups, a radio tuner in your system lets you provide FM or AM programming during off hours, as well as quality stereo sound for simulcast TV specials.

TURNTABLES

Still the playback unit of choice for many DJs. Rugged construction, pitch control, and effective vibration dampening are the things to look for. Your mixer should be able to handle at least two, possibly three, phono inputs.

HOME DJ TIP: Pitch control is the secret weapon on DJ-approved turntables – the ability match the tempo of two songs by speeding them up or slowing them down makes for miraculous mixes.

VCR

The audio from your video programs should be treated in the same way as CD, vinyl or audiotape sources. Full switching flexibility and signal processing control through your mixer can dramatically enhance video sound. When configuring your entertainment system, think of video and audio as one!

Numark

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Setting Up a Small P.A. System

by Bruce Bartlett with
Jenny Bartlett

ELKHART, Ind. As part of a DJ remote or sports-announcing job, you may be asked to provide a P.A. system. Here are some tips on setting up and running a small system for music and public address.

LINE OUT

In addition to your mixer and mics, the necessary equipment for this job includes a power amplifier, a pair of loudspeakers, speaker stands and speaker cables.

How much power do you need? A speech-only system in most rooms can get by with a power amp of 50 W continuous per channel. A disco, or a speech/music system in a gymnasium, however, might require 500 W per channel.

Horn dispersion

A small P.A. uses two loudspeakers. Typically, each speaker is a two-way system consisting of a 12-inch or 15-inch ported woofer and a horn tweeter. Horn dispersion is commonly 40 degrees vertical by 90 degrees horizontal, or 40 degrees vertical by 120 degrees horizontal.

In small systems, the speaker cabinet measures about 15 inches wide by 24 inches high by 12 inches deep, but you can use a larger system for more bass.

A typical disco system uses four large speakers, one at each corner of the dance floor, aiming in.

If you're planning a high-quality music system, consider a subwoofer/satellite configuration. One or two sub-

woofers on the floor provide the deep bass, while two smaller satellite speakers on stands provide the rest of the spectrum.

Since the ears don't localize extreme low frequencies, all the sound appears to come from the satellites. The advantage of this system is that you don't have to raise large, heavy speakers on stands.

Some well-known manufacturers of quality sound-reinforcement speakers include JBL, EAW, Apogee, TOA, Klipsch, Yamaha, Community and Electro-Voice.

Look for a speaker with a mounting bracket that accepts a speaker stand. The stand lets you raise the speaker above the crowd, which otherwise would block the highs. Portable speaker stands (such as those built by Ultimate Support Systems) are made of hollow, sturdy tubes. The stands can be collapsed and telescoped for easy transport.

Speaker cables should be thick (low gauge number) to minimize power loss through cable heating. You could use #14 or #12 zip cord (lamp cord) for most jobs, or use cylindrical speaker cable of the same gauge. In my experience, Whirlwind makes very reliable speaker cables.

Installation

Typically, you'll place the speaker stands toward the audience side of your mixing position on either side (see Figure 1). This positions the speakers toward the "dead" rear of your cardioid microphone and reduces the potential for feedback. Also, raise the speakers on the stands high enough to clear the crowd. Otherwise, people in the back will hear muffled sound because the crowd attenuates the high frequencies.

Articulation is best if the direct-sound level is high relative to the reflected-sound level. This happens if you place the speakers close to the audience, and

aim the speakers to direct their sound on the audience, not on reflecting surfaces.

At sports events, try to place the speakers so they aim across the playing field at the bleachers. That way, the players can hear what's going on, and the people in the bleachers will absorb some of the sound and reduce reflections.

Put a foam pop filter on your microphone to prevent breath pops. It also helps to talk at a 45-degree angle away from the mic, rather than straight into it. If you will be announcing sports and frequently turning your head, consider using a headset mic.

Start with the power amp turned all

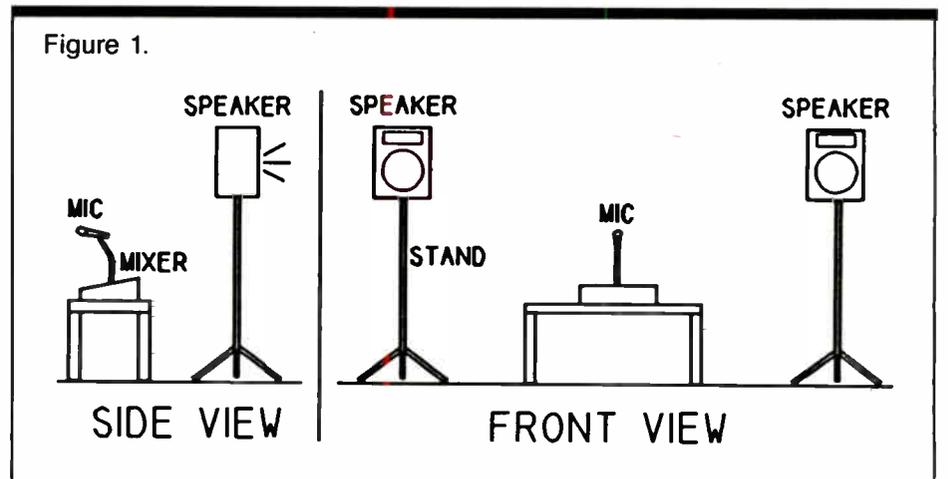
adequate volume.

As for equalization, you might want to roll off some bass on the mic if it has proximity effect (up-close bass boost). Too much bass can make words hard to understand, especially in a reverberant gymnasium. If intelligibility is poor, you may need to roll off more bass and boost the highs for clarity.

Mixer input overload

At noisy sporting events you may find yourself shouting into the mic. If so, watch out for mixer input overload. In some mixers this condition is indicated by a "clip" or "peak" LED in each input module. If this LED is flashing, switch in the pad or gradually turn down the input trim (gain) just to the point where the LED stops flashing.

If your mixer doesn't have a pad or in-



the way down. While talking into your mic and peaking the mixer meters at 0 VU, gradually bring up the power-amp gain until the sound is as loud as you want it. Or play a musical program peaking at 0, and set the power-amp gain for the desired volume.

If you turn up the power amp all the way, you might be peaking around -15 or -10 VU on your mixer to get the desired loudness. This low mixer level can result in audible hiss because the power amp has to provide more gain for

put trim, you'll have to talk a little farther from the mic or stop shouting.

There you have some tips on setting up a quality P.A. system—one that sounds natural, intelligible and is loud enough to do the job.

■ ■ ■
Bruce Bartlett is a microphone engineer and technical writer for Crown International and the author of "Stereo Microphone Techniques," published by Focal Press. Jenny Bartlett is a technical writer. Bruce can be reached at 219-294-8388.

PRODUCT SHOWCASE

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Shedding Light on Tower Lamps

by Harold Hallikainen

SAN LUIS OBISPO, Calif. In September, I suggested the possibility of using a soft start on tower beacon lamps to limit the inrush current and extend the life of the lamps.

I got a call from an engineer in Arkansas who did something similar 30 years ago. His solution was to place a large resistor (200 W or so) across the flasher. Adjust the value of the resistor so the lamps just go dark.

When the flasher turns the lamp back on, the lamp is already substantially warmed up and has a resistance much higher than the cold resistance. This limits the inrush current and makes beacons last about three times longer.

Theater lights

A similar technique is used in the theatrical lighting industry. There, the lamps are never turned all the way off. Instead, when the dimmers are set all the way down, a low current continues to run through the lamps as a "pre-heat." It does, however, get a little more complicated.

Patrick Feller of TWR Lighting tells me that FAA AC #150/5345-43D specifies that the lamp is "off" when the light intensity is less than 10 percent of the peak effective intensity. Preventing the lamp from cooling down to a low temperature may make the flashing beacon not meet the duty

cycle specifications.

Feller, as well as Richard Shutt of SSAC, said that the use of flashers that turn on the AC zero crossing extends lamp life about 10 times over a random turn on (possibly at the sine wave peak).

SSAC suggested that use of phase control to "soft start" a lamp may result in excessive radio interference. This interference could be filtered, but the cost of the additional circuitry may not be justified in terms of additional lamp life. Further, both TWR and SSAC have tower light monitoring and alarm systems. These provide a contact closure on a lamp failure.

For more information contact TWR Lighting at 713-973-6904, or circle Reader Service 56; contact SSAC at 315-638-1300, or circle Reader Service 93.

How faded?

I've always wondered how faded the orange paint on a tower must be before it should be repainted. Kelly Williams of NAB Science & Technology told me about a color chart that shows a progression of fading aviation orange. If the tower paint is more faded than the last color, it's time to paint the tower.

You can order this color chart—the "FAA Inservice Orange Color Tolerance Chart"—from Hale Color Charts, 8950 Route 108, Suite 101, Columbia, Md. 21045. Phone: 800-777-1225 or 410-997-1880; fax: 410-997-2191; or circle Reader

Service 119. The color chart sells for \$30.

Pike & Fischer (phone: 301-654-6262) now has the FCC Rules available on computer disk. This can be a quick way to find out what a particular rule actually says about a subject. Someday, I hope all public information, such as FCC Rules, Public Notices, Notices of

INSIGHT ON RULES

Inquiry, Notices of Proposed Rulemaking and Reports and Orders, will be available on-line (through a simple modem call) from the FCC.

Self-inspection report

Last month, we reviewed the first 20 or so pages in the FCC Self-Inspection Report. Again, this looks like an excellent way for the FCC to determine compliance. I hope they do put the "mail order inspection" into practice.

If you'd like a copy, send \$2 for copying to H&F, 141 Suburban Road, Building E4, San Luis Obispo, Calif. 93401-7590, and a SASE (8.5x11 inches) with \$.98 postage.

So far, they've tested the system on nine AM stations. The existing form is aimed at AM stations, especially directional AMs. Many questions, however, are applicable to all radio stations.

When the FCC first started allowing holders of the broadcast-endorsed Third Class license to operate directional stations, it required these stations to designate a chief operator that would be responsible (along with the station licensee) for the training of the duty operators.

Eventually, the FCC authorized the operation of all broadcast stations by holders of restricted permits (RP) and required all stations to designate a chief

operator. The FCC inspection report wants the name, date of birth and FCC license number of the chief operator. Since the chief operator also can be an RP holder, and RPs do not have numbers, the space for license number is marked "if applicable."

Note that General Radiotelephone licenses issued after Dec. 31, 1985 carry an endorsement prohibiting the operation of broadcast stations. Holders of these licenses must also have an RP to operate broadcast stations.

Part 73.1870 requires all stations to have a chief operator. The "written designation" of the chief operator is to be posted with the operator license. The chief operator of an AM directional station, or an AM operating with more than 10 kW of authorized power, is to be an employee of the station—not a contractor.

It appears that the FCC is relying on the Internal Revenue Service's definition of an employee. The IRS makes the distinction between an employee and a contractor based on the degree of direction provided by the employer.

Once someone is determined to be an employee for IRS purposes, that individual is issued a W-2 tax form at the end of the year. If the contractor is indeed a contractor and not an employee, then the employer typically issues an IRS form 1099. The IRS typically requires a 1099 to be issued if \$600 or more was paid (in the year) for services (as opposed to merchandise) to an individual, a sole proprietorship or a partnership.

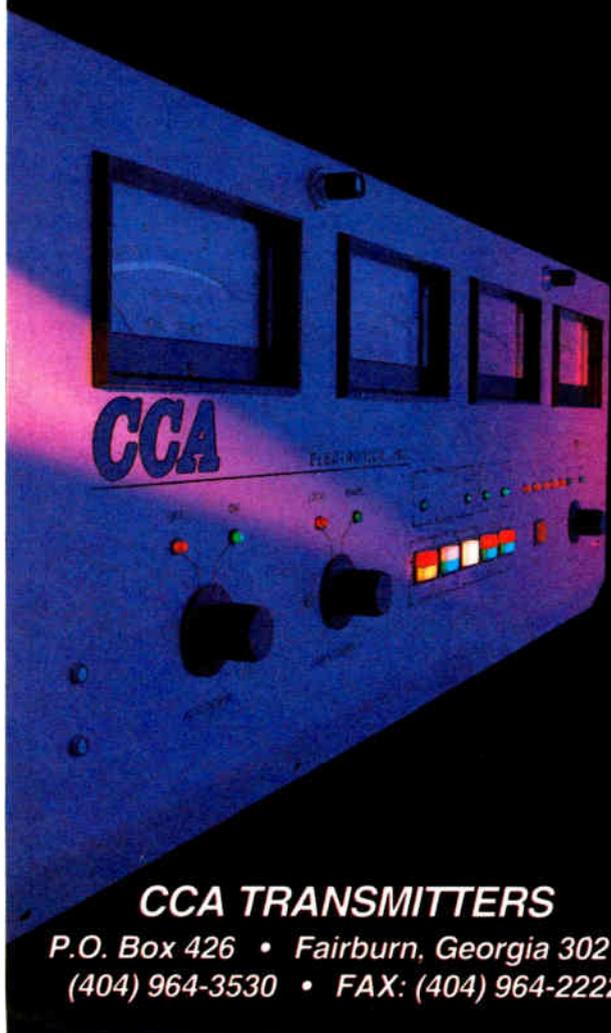
You are an employee

The 1099 need not be issued to corporations. So, for our purposes, we might say that if you get a W-2 from the station, you are an employee, satisfying 73.1870(b)(1) for directional or high power AM stations.

The designation of the chief operator must be in writing and be posted with that operator's license. If the operator is a contractor instead of an employee, a written contract must be "in the

(continued on page 26)

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Staying Alive at the Transmitter

by John "Q" Shepler

Part V

ROCKFORD, Ill. As these columns on lightning protection continue, we're about to deal with lightning energy that gets through your outdoor defenses and into the transmitter room.

Before you think about adding protections for the equipment, however, it's time to think about protecting your greatest asset: yourself.

Every few months I read a terse account of another broadcaster who was killed "while working on the station's transmitter." It's unnerving. I don't know these

equipment or antennas during thunderstorms.

That sounds sensible. Why would anyone violate this common sense principle? Easy. Pride can override even natural instincts. We're all proud of our professionalism. We're proud of our technical savvy. We're proud that the staff is proud of us for keeping them on the air. The gut reaction when transmitters go down is to pop the interlocks and get to it. Careful.

Can you hurry?

I remember a day not so long ago when all hell broke loose. I was home when the first line of storms hit. The phone rang. "We're off. Can you hurry?" Sure.

It was quiet when I got to the transmitter site. The parking lot was slick, but no storms; just a little rumbling in the distance. The 3 kW FM was quiet. The blower and filaments came on but the plate supply wouldn't hold. I pulled the breakers and popped the back to take a peek. One of the power supply chokes was held up by drinking glasses.

Apparently, it had shorted to the chassis during a previous strike. It seemed likely the other choke had met the same fate this time.

As I scrounged around looking for some insulators, I became aware that the rain had started again and the sound of thunder was getting louder. I took a quick look outside. The sky was dark and foaming.

Flashes of lightning were apparent.

I looked back at the transmitter. This station had no backup. I started to rationalize how important it was to get this baby back on the air. After all, the listeners needed to be warned about the storm. Advertising dollars were being lost. Listeners were tuning away. The technical magician needed to work his magic.

Flash and crash

A bright flash followed by a loud crash stopped me short. With one last sigh, I came to my senses and pulled the transmitter building door shut behind me.

It was more than an hour before the sky cleared again. With the sun peeking through the clouds, it seemed OK to try again. This time the building smelled funny. Sort of a burning plastic smell seemed to be coming from the top half of the cabinet. It got stronger when I pulled the back of the plate cavity. It was a melted mess in there.

Yes, this story has a happy ending. The GM's brother donated some tumblers to insulate the second choke. Some of the plate insulators we just did without; others got rigged enough to get back

(continued on page 26)

Q-TIPS

people. I do know the chill one gets in one's back when a big flash snaps between the PA tube and the grounding stick. "There but for the grace of God . . ."

Are broadcast transmitters inherently dangerous? You bet they are. Do they have to be lethal? I don't think so. I believe you can stay employed and healthy as long as you give yourself as many protections as possible.

Common sense rules come first. Rule Number One: Don't work on transmitting

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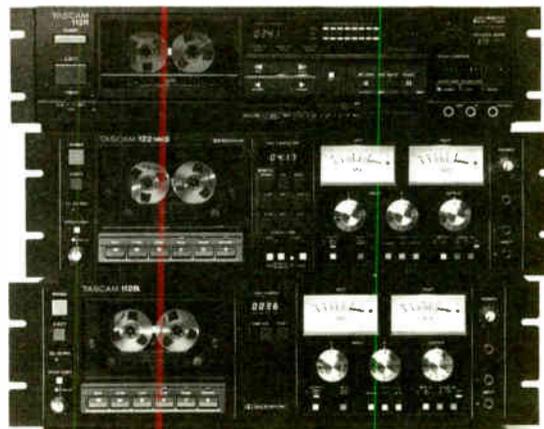
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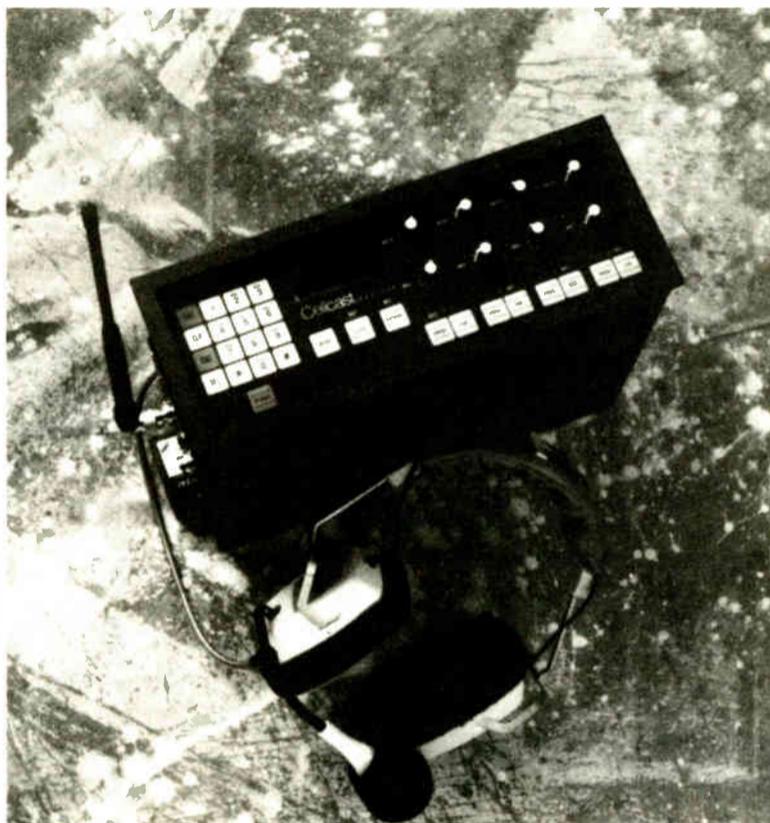


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Security Should Come First

As Attacks, Burglaries and Vandalism Increase, Stations Should Implement Safety Procedures

by Barry Mishkind

TUCSON, Ariz. At one of the NAB conventions, I asked a number of engineers about the security situation at their facilities. I'd been thinking about it for some time and was interested in the subject from several viewpoints.

ECLECTIC ENGINEER

What sparked my thoughts initially was the recent theft of a station's entire ground system. About \$20,000 worth of copper had disappeared. All that was left was tire tracks.

Of course, copper was not all that was stolen. Everything from mailboxes to transmitters is being vandalized, stolen or destroyed all over the country.

However, another important concern was related to the increasing number of attacks on station staff while on station business, or even while entering and leaving the facility. The need for security has become a costly and inconvenient fact of life for many stations.

What can be done to prevent bad

situations and protect station personnel?

Stations without a plan are living in a past when it was possible for the public to walk into virtually any station at will. Those days are long gone; it's just not a safe practice to allow unlimited access.

Less safe

While it's true that life in general is less safe than 20 years ago, because broadcasting is often a 24-hour-a-day, seven-day-a-week endeavor, there are many more situations where a single person is entering or leaving the studio or transmitter. This is especially true of news and sports personnel. They come and go at irregular, unpredictable times.

Thus, there is a real danger from thieves and muggers. Worse yet, hostage-takers attracted by the possibility of being able to broadcast their demands live on the air have tried to gain access to radio and television studios.

Last time, we briefly related the incident at KOOL-TV, where a gunman walked into the air studio and took hostages until he was put on the air. Shortly thereafter, most TV stations in Phoenix responded by hiring a secu-

rity guard to screen visitors and walk staff members to their cars. It was part of a trend underway across the country.

The station also put up a security room protected with bullet-proof glass, where the receptionist would control entry through an electrically locked door. Combined with a telephone or intercom speaker, staff would have no contact with visitors until they were reasonably sure of safety.

A variation might be to have video cameras mounted in the station and fed to a monitor or VCR (as banks or convenience stores have), to identify anyone who might attempt to cause

a problem. Back entrances and studio wings can have combination locks on them, both to prevent access to unauthorized persons, and to permit quick keyless entry to staff.

Unfortunately, many stations have not seen the need to implement all or any of these sort of precautions. Management at a small radio station may not feel that it can provide a guard to ensure staffers get to their cars safely.

Nevertheless, there are a lot of ways to provide security for even the smallest station, without spending a billion dollars.

A well-lit parking area is a good start. If it's enclosed, so much the better. For example, a garage with an automatic door could easily provide safe entry and exit for several cars at night and weekends.

(continued on page 27)

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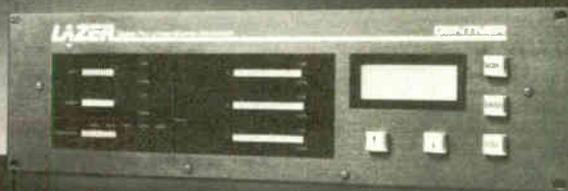
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Keeping Yourself Alive

(continued from page 23)
on the air.

The happiest part is that everybody is still here. It was only after getting back home that I found out this was the worst storm of the year. A tornado touched down only 10 miles away. Every station was knocked off. There were two distinct lines of thunderstorms to catch the unwary.

This particular station went down the first time because a power surge zapped the insulation on a filter choke in the PA supply. But it got nailed the second time by a strike to the tower that came down the antenna and into the PA.

Imagine what would have happened to a dedicated engineer who had pulled the breakers for safety and was diligently working on the PA supply when that surge came blasting through the antenna port.

You may also have been through a few of these hair-raisers. Think a minute about how close you really came to disaster. Will you be as lucky next time?

Risky to secure

Let's review a few steps that can improve your chances of survival from risky to secure:

- Don't work on equipment during thunderstorms. Don't go anywhere near antennas.
- Turn off the power before you take off the protective equipment covers. Look out for extra AC circuits powering the crystal heaters on older transmitters.
- Short the PA plate, IPA plate and high voltage capacitors to ground with the shorting stick. If you hear a snap, stop. Find out what is wrong with the automatic discharge system before proceeding.
- Don't trust the shorting stick. Always connect a big screwdriver between the chassis and the power tube plates. Only use one with a plastic handle and always have it make contact with the chassis before the plates.

That screwdriver has been my number one lifesaver. Some transmitters don't have built-in shorting sticks. One such transmitter had an open bleeder resistor

in the PA supply. The capacitors stayed charged even with the power off.

- Keep one hand behind your back when doing the protective shorts with the screwdriver. Don't give electricity a path through your heart from one hand to the other.
- Don't start thinking that line circuits are safer because they are not "high voltage." Shut them all off.
- If at all possible, have somebody around for company. They might just save your life.

Next month we'll look at some technical measures that will help keep lightning out of the transmitters.

■ ■ ■

John Shepler is an engineering manager, writer and longtime RW columnist.

A Focus on Tower Lights

(continued from page 22)
station files."

This need not be in the public inspection file. Lots of people tend to put almost everything in the public inspection file. The contract must, however, be available during an FCC inspection. Further, the contract must be with an individual operator, not with a company. The FCC does not issue operator licenses to companies, and the chief operator must be licensed.

The inspection form goes on to request day and night phone numbers for the chief operator. The rules do not require the chief operator to have a telephone, though it certainly seems helpful. You also may want to list a pager number.

Part 73.1870(a) further states, "At times when the chief operator is unavailable or unable to act (e.g., vacations, sickness), the licensee shall designate another licensed operator as the acting chief operator on a temporary basis."

Of course, it seems more appropriate to designate an alternate chief operator before the chief gets sick. The inspection form asks for the name, date of birth and license type and number for the "designated Acting Chief Operator."

Next month, we'll continue discussion of the FCC Self-Inspection Report.

■ ■ ■

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Security Should Come First

(continued from page 25)

Again, a video camera with a monitor in the control room will help a lot, allowing the person inside to ensure that the area is secure for others to come and go. The cost is quite moderate. An outdoor speaker will enable any cries for assistance to be heard inside.

Other options include two-way radios or mobile telephones to alert someone in the building that you are arriving. Some stations use motorized gates with a card reader. There are many other ways to protect the studio.

Now, how about the engineer?

Secure engineers

If it has been hard to get stations to spend money on studio security, you can imagine how the manager might feel about the transmitter site. The comings and goings there are even more unpredictable than at the studio. This means solutions will be different for each facility and engineer.

But, then, how about when the engineer is "out in the open," as it were, taking field measurements or setting up remotes? There are reported incidents where someone walked or drove up to an engineer taking measurements and

Filling in Noise Holes

(continued from page 18)

effect is to move the coverage problem to an area in which it has little impact.

If you think that this doesn't work too well in areas of flat, unbroken terrain, you're basically correct. However, new techniques, including the use of extremely directional antennas, audio time alignment and the like, can be used to tightly control interference in certain areas. Still, reflections from buildings and structures can thwart the designer's best efforts.

Perhaps the ideal situation for implementation of a booster is one in which terrain shielding is the cause of the coverage problem. The same terrain that causes coverage trouble for the main transmitter site often will shield the rest of the coverage area from the booster signal and the interference it causes.

An omnidirectional booster antenna can then likely be used, along with a good deal of power, without much booster-to-main interference.

In discussing boosters, a friend suggested operating the main transmitter using a horizontally polarized antenna and the booster with a vertically polarized antenna. This certainly would cut down on the booster-to-main interference (20 dB or so, assuming a truly horizontal or vertical receive antenna), but it would also knock the wind out of the main's mobile coverage area. Still, it is an interesting idea. Does anyone care to try it?

One final note: A booster station will not fix multipath problems. The addition of a booster to a high-multipath situation will only provide even more signals and reflections to add to the already complex signal environment. The result will almost always be multipath that is worse, not better.

■■■
Cris Alexander is director of engineering for Crawford Broadcasting Co. in Dallas.

pulled a gun on him.

Some engineers carry a firearm with them. Others may have a trained dog. Yet, if the idea is to prevent problems before they start, a second person is often one of the best solutions.

At a few stations, a utility person, or someone from the intern staff is assigned to be available for transmitter runs, remote setups, etc. Not only is this good for security, but that second person can be very valuable in case of an accident while repairing the transmitter.

However, more often, the engineer ends up going to the transmitter on his own. Just as at the studio, there are some

simple ways to improve the security at the transmitter. Fences, lights and electric gates come to mind immediately. But ultimately, if the engineer is on his own, he deserves more.

For example, using one of the common home security units, floodlights can be turned on before the engineer leaves the vehicle. If vegetation is cut back appropriately, it should be easy to see whether anyone is in the area.

Another cheap, good security device is a motion sensor. Hooked to lights or even one of the contacts on the remote control unit, it warns of someone moving suddenly into the area. Some units

can be obtained that do not react to small animals or RF fields, so choose carefully.

Also, supplying the engineer with a two-way radio gives him the advantage of instant communication with the studio if problems arise. In fact, by going through a routine of calling in to the studio as soon as he arrives on site and periodically checking in, false alarms are prevented and the engineer has the security of voice contact.

We'll consider more ways to protect the transmitter site, the engineer and the equipment he carries, in our next installment.

■■■
Barry Mishkind, aka RW's "Eclectic Engineer," is a consultant in Tucson. He can be reached at 602-296-3797 or 1:300/11 on FidoNet, or "barry@coyote.datalog.com" on Internet.

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World Radio History

Coming to Terms with Circuits

The First Step to Learning One's Way Around Electronics Is to Understand the Associated Terms

This is the second 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.

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by Ed Montgomery

Part II

ANNANDALE, Va. Several terms need to be learned when studying electronics. Words such as volts, amperes, watts and ohms are important to understanding what is going on in any electronic circuit.

The difference between the deficiency and surplus of electrons (or positive and negative charge) is known as potential or electro-motive force (EMF). In scientific terms, a charge is measured in coulombs.

A coulomb is defined as 6,280,000,000,000,000,000 (6.28x10¹⁸) electrons. The

symbol for charge is "Q" standing for quantity. Charges can be positive or negative. Opposite charges create a force that attract, while like charges will repel each other. Electro-motive force is a measurement of the ability to move charge. It is measured in voltage.

In scientific terms, one volt is equal to one joule (0.7376 foot pound) of work per coulomb of charge. Most often the term voltage is used in electronics. Electro-motive force or potential difference must exist before electrons can move through a conductor from negative to positive. The electronic symbols most used for voltage are "V" and "E" for Electro-motive force (EMF).

Current

Electron flow from negative to positive is known as current. The flow of electrons is actually electricity in a form that can perform numerous tasks, from illuminating lamps and heating surfaces to sending signals through wires and making motors operate.

Scientifically, current flow can be defined as the number of coulombs passing a given point on a conductor in one second. One coulomb per second is equal to 1 ampere. The force required

to move one coulomb per second through a conductor is 1 volt. The electronic symbols most often used for current are "A" for amperes and "I" for the Intensity of the electron flow.

Current flow is dependent upon the amount of potential available, as well as the conductor's ability to pass elec-

is equal to 746 watts.

Most electrical appliances, lamps, amplifiers and transmitters specify the amount of work they perform in watts. The electronic symbols for power are "P" and "W."

Often in electronics, one will find that is impractical to work in units of volts,

Term	Measurement	Symbol
Voltage	Volts	V,E
Current	Amperes	A,I
Resistance	Ohms	R,Ω
Power	Watts	P,W

Prefix	Symbol	Significance	Example
Giga	G	Equals 1 billion times a given term	4GHz = 4,000,000,000 Hz (1Hz = 1 cycle per second)
Mega	M	Equals 1 million times a given term	5MW = 5,000,000 W 35MΩ = 35,000,000 ohms
kilo	k	Equals 1 thousand times a given term	35kV = 35,000 V 8 kW = 8,000 W
milli	m	Equals 1 thousandth times (.001) times a given term	3mV = .003 V 350mA = .35 amperes
micro	μ	Equals 1 millionth (.000001) times a given term	62μA = .000062 amperes 7.3μW = .0000073 W
nano	n	Equals 1 billionth (.000000001) times a given term	3nA = .000000003 amperes

trons. In everyday situations, no perfect conductor exists. Electrical conductors have a limited ability to pass electrons. The opposition to electron flow is known as resistance and is measured in ohms. The electronic symbols most often used for resistance are "R" and the Greek letter Omega (Ω).

Voltage, current and resistance create another factor that must be considered: a way to relate electricity's work to equivalent, alternative forms of energy. The work that electricity does when a motor operates machinery, illuminates a lamp or runs an amplifier is known as power. Power can be defined as the rate of doing work. In scientific terms, it is measured in joules per second.

The watt

The term used for power in electronics is the watt. One horsepower

ohms, amperes and watts. Most electronic equipment today operates with only a fraction of an ampere of a volt, while employing a rather high resistance. Other devices employ extremely high voltages and very low current, such as the cathode-ray tube in a television or computer.

To keep these figures accurate on schematic diagrams and data charts, several prefixes have been adopted to reduce the possibility of error. These prefixes are illustrated in Figure 1.

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

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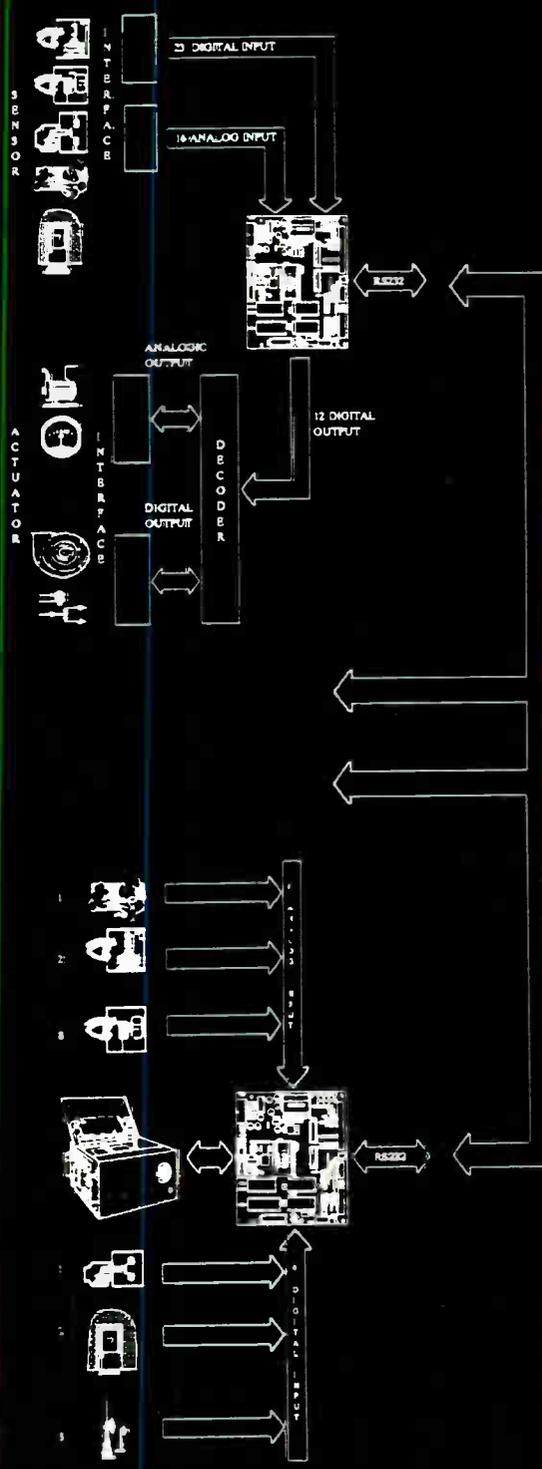
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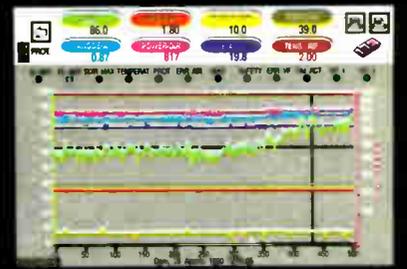
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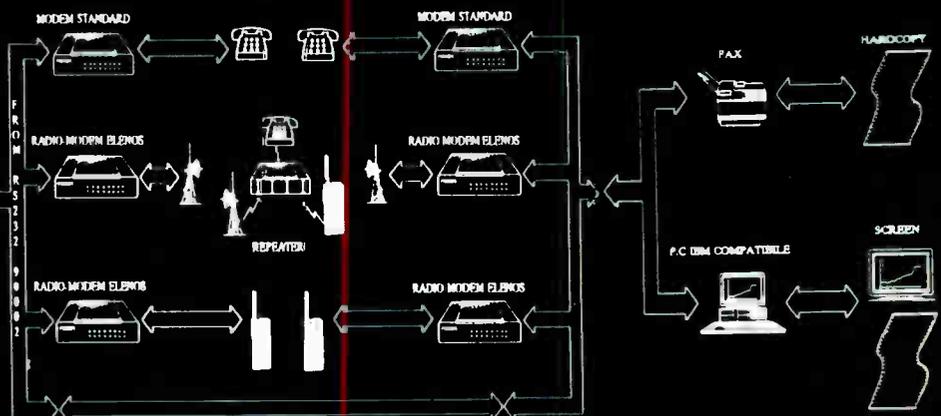
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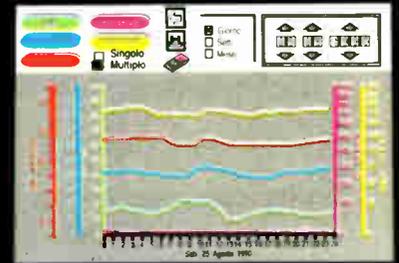
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COMPROT: features a screen that displays a protection event triggered by the grid power. The cursor on one point of the graph displays the pertinent values of the plotted parameters.



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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.



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



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WORKBENCH

How to Beat the Surge

by John Bisset

FALLS CHURCH, VA. Last month, we suggested using an Archer battery-powered amplifier to serve as a monitor on an audio analyzer. Phil Wells, engineering manager at KJQY-FM in San Diego, Calif., writes to say that the Archer (Radio Shack) Cat. No. 32-2031 amplifier, fitted with a mini-phone to alligator clip cables, makes an excellent Hi-Z tracer.

Phil went on to write that older pairs of Sennheiser HD414 headphones have a 1K ohm impedance. If you wire each side in series, you have 2K ohms—and an excellent tracing tool for either low level or interstage tracing of signals. In fact, Phil says you can yell directly into a mic connected to the cans and hear it.

For DC blocking, put a 0.01 MFD in series with the tip and mount it inside the adapter (See Figure 1). Phil Wells can be

reached at KJQY-FM in San Diego. Call him at 619-238-1037.

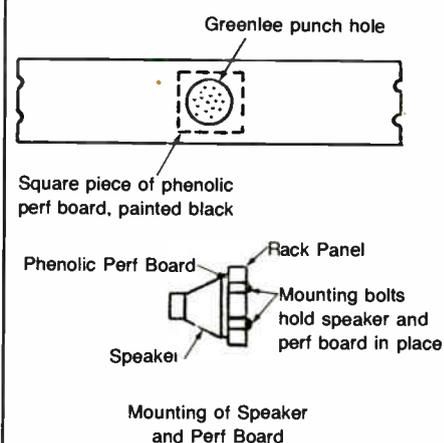
Looking for a jock-proof, yet cheap way to rack mount a speaker? Take your Greenlee punch and punch a hole the size of the speaker in your rack panel. Then take a piece of perf board and spray paint it black. Cut the perf board into a square and drill corresponding mounting holes to match those of the speaker.

Mount the perf board against the rear of the rack panel, and the speaker up against the perf board. The perf board will permit the sound to be transferred from the speaker, but its "heavier than grill cloth" construction means idle fingers, pens, pencils, etc. will not puncture the speaker cone (See Figure 2).

Next time you lose the pass transistors in the power supply of MCI JH-110 reel-to-reel machines, watch out for the replacement. A garden variety 2N3055 will not do—make the replacement a 2N3055H for best results.

Now that the thunderstorm season has passed (with the exception of our readers in Florida), it might be a good time to

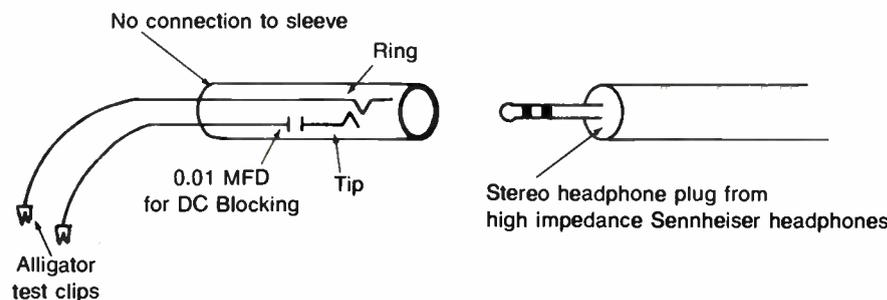
Figure 2.



surges. The Dale arrestors are available from Allied Broadcast. Contact your Allied sales rep for more information, or circle Reader Service 18 for additional information.

While we're talking about line protection, how about your remote control lines? GE-L8 MOV devices are ideal for bypassing between both sides of the control loop

Figure 1.



spend a few bucks protecting your incoming power at the transmitter site. Dale SPA-100 120VAC RMS surge arrestors are a good start.

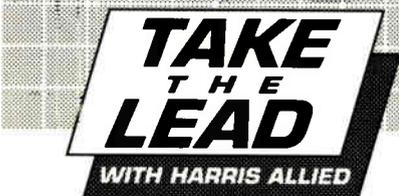
They mount easily in the knockouts of the electrical main or disconnect box, and take a good bite out of electric

and ground. They can be found at most parts houses.

Got an idea, a tip or a circuit that saved you time? Share it in the pages of Workbench. Fax it to 703-998-2966.

■ ■ ■

John Bisset can be reached at 703-379-1665.



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McGohan MS1006 4-chnl 100 W amp, vgc, \$250; McIntosh MC-250 pwr amp, vgc, \$250. D Lundy, POB 408, Heidrick KY 40849. 606-546-6650.

WE tube mono amp (2), made by McIntosh, 19" rack mounting, service info, gd cond, \$200. R Glenn, WTGR, 1718 Shandoha, Wimauma FL 33598. 813-634-1940.

Want to Buy

Denon POA8000 (2); Sansui B2301, BA5000, C2301; Marantz x-overs; Crown DL2 phono module; Burwen TNE7000; Hartsfields. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 213-859-5543.

Langevin AM-101 series pwr amp (tube) schematic & data. B Leslie, Pro Rcdng Service, 13709 Maple Leaf Dr, Cleveland OH 44125. 216-662-1435.

McIntosh, Marantz, Harmon-Kardon & Dynaco tube amps, preamps, tuners, tubes & manuals. R Glenn, WTGR, 1718 Shandoha, Wimauma FL 33598. 813-634-1940.

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Crown D60 stereo amp, vgc, \$200. L LeBlanc, WKXL, 603-225-5521.

McIntosh MA-320 preamp & amp w/7591 output tubes, wrkng cond, cracked glass, \$225/trade; Leak Point 1 stereo vacuum tube preamp, classic English sound, \$125/trade. J McLane, Oddeo Eng, 115 W Gutierrez, Santa Barbara CA 93101. 805-963-3941.

McIntosh MC2500, black, factory sealed, \$3975; (2) MC240, \$1175 ea; (3) MC40, (2) MC-225, \$575 ea; (2) Krell Altair w/outboard pwr supply, \$3375 ea; (2) Spectral DMA50, \$1475 ea; Spectral SMA100 Mk II, \$2975; Threshold S500, vry sim to S550E, \$2475/BO/trade. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 213-859-5543.

Altec 361 & 1593A, need fuse holders, \$100 both/BO. M Muderick, 101 Earlington Rd, Havertown PA 19083. 215-449-6970.

Heath W-7-A tube pwr amp (2), vg & excel cond, \$150/pair+shipping; Scott 121-C mono hi-fi preamp, mint cond, minor input mod for stereo cartridge, \$75+shipping. B Leslie, Pro Rcdng Service, 13709 Maple Leaf Dr, Cleveland OH 44125. 216-662-1435.

Crown Micro-tech 1200, 2 rack stereo power amp, 320 watts per chnl at 8 ohms, 495 watts per chnl at 4 ohms, excel cond w/balance of 3 yr transferrable warranty remaining. B Fisher, KPOK, POB 477, Bowman ND 58623. 701-523-3883.

Martí PGM-20 line amp, \$40. P Wells, KJOY San Diego, 619-238-1037. FAX: 619-238-6157.

Henry Eng INF-Pro/Pro-INF interface amp, never used, \$85. J Lee, JL Prod, 208 Hampton Circle, Jupiter FL 33458. 407-575-1828.

RCA BTE-15A w/(2) SCA gen, extender board & book. D Lang, 503-774-0459.

HH Scott LK-150 150 W stereo pwr amp, tube type, gd cond, new capacitors & 7199 tubes, \$175. D Kromquist, D&D Prod, 7028 W 70th Ave, Arvada CO 80008. 303-425-6851.

Halco PB-2T R/PB amp, BC; Altec 1569-A 75 W amp tube, like new, BO; United Audio/UREI 176 tube type, excel cond, \$450. F Virtue, Virtue Studios, 8809-11 Rising Sun Ave, Philadelphia PA 19115. 215-763-2825.

Dynakit PASII pre-amp, new & used cable w/Canons 3 prong; manuals for Ampex 351/350/601 & mixer MX-35; Pultec EQP1A; Univox headsets, new, stereo or mono guitar; monitor panel for 8 trk recorder through speakers to stepdown to 2 trk, or whatever. Mr. Oliver, 212-874-7660.

RCA BA-21A mic tube pre amps (9) w/connectors & racks; (2) RCA BX-21A tube pwr supply's w/connectors & racks; (6) RCA tube program amp BA-23A; (2) FCA tube pwr amp SA-35A; (3) RCA tube pwr amp SA-751; Altec A-326; (6) Altec 1564A; (3) Altec 1567A; (8) Altec 1561A; Altec tone pre amp 1562A; Altec 1520A; Dynaco stereo 70, mint. Tracy Eaves, 615-821-6099 (evenings before 10PM EST).

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Potomac AM-19 (204) 3-twr AM antenna mon, excel cond, \$850. J Salov, SHGR/WUPS, 517-740-1165.

Utility 340, 300' of 18" tower near Enid OK, \$5000. Brian, WWNH, 603-742-8575.

ERI/Harris FMXL-3E 3-bay FM antenna, rototiller style, on air at 93.5, w/1.5588 pwr gain, 1-5/8" end input, you ship, \$4000/BO. S Mattingly, WWWO, 5216 Bradburn Dr, Muncie IN 47304. 317-289-9500.

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Phelps-Dodge FMHP-8 8-bay on 93.3 MHz. C Springer, KSEC, Box 890, Lamar CO 81052. 719-336-2206.

Rohn 45G tower, 300', w/lighting kit, guys, EQs, beacon, \$8000; ERI Rototiller antenna on/ear 97.5 MHz, 3 bays. R Wright, WLLX, Lawrenceburg TN 38464. 615-762-2916.

World tower, 240' standing, 60' on ground, 24" face, excel cond, BO. L Smith, WCSS, 6 Genesee Ln, Amsterdam NY 12010. 518-843-2500.

Guyed/self-supporting tower, 180', on ground, w/in 200 miles of S IN, 18-24" face at top, med/hvy duty. B Hawkins, RR2 Box 232, Edinburg IN 46124. 317-684-6668.

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Universal Audio 1008 tube mic preamps, \$200 ea; Langevin AM-16 mic preamps, \$150 ea; APSI 559 graphic EQ, \$300 ea. M Linett, Yr Place or Mine, 1600 Las Flores Dr, Colendale CA 91207. 818-244-1909.

Howe 2100 Phase Chaser w/all connectors & manual, \$550. S Schweiger, WXL0-FM, 146 Worcester Ctr, Worcester MA 01608.

Orban 536A 2-chnl de-esser, excel cond, \$225+shipping; Crown UFX stereo crossover, \$75+shipping. B Seifried, Eclair Eng, 101 Prospect St, Northampton MA 01060. 413-584-6767.

Eventide 1745M digital delay line (2), need work, \$200. S Russell, 60410 Klerr Dr, Decatur MI 49045. 616-782-9258.

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Circular FM med pwr 8-bay antenna on 107.5 MHz; also, 350' tower on ground w/lights. J Ingram, WBLE, Box 73, Batesville MS 38606. 601-563-4664.

UHF TV brdcast/translator antennas on old chnl 70-83 band; Scala parapanel, any chnl; Scala SL-8 chnls 19-23, 32-36, 60-64; Bogner B series, chnls 20-30, 31-42, 55-69; Bogner LPS 1, 2 & 4; Thomas UHF panels, any chnl; Emcee DGA-10 corner reflectors. J Powley, WIIM TV, 1536 Logan Ave, Altoona PA 16602. 814-944-8571.

Guyed tower, 100-200', to hold 6-bay antenna; FM brdcast 6-bay omni-directional antenna tunable to 103.9 MHz; 3-1/8 xmission line. C Hall, KCDH, POB 165, Nephi UT 84648. 801-623-4010.

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Rohn 8R-4R self-standing 100' tower, 1 yr old, new cond; RCA 5BTFD 5 kW tuned to 92.7 MHz, gd cond; Shively Labs 6813 3-bay tuned to 92.7 MHz; 70' 1-5/8 air coax. C Hall, KCDH, POB 165, Nephi UT 84648. 801-623-4010.

Gates FMC 4A 4-bay antenna, tuned to 103.1, \$1000; guy wires for Rohn 55 tower, 200', \$250. B Dierking, KNDY AM/FM, RR3, Marysville KS 66508. 913-562-2361.

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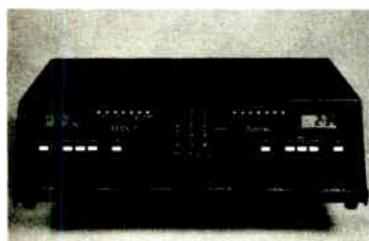
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Ham radio operators looking for surplus audio processors, mixers & mics, as well as other inexpensive gear that could help boost engrs play radio at home among enthusiasts for vintage AM. Please write wofferings. WA3WJB, Box 73, West Friendship MD 21794-0073.

AUTOMATION EQUIP

Want to Sell

ATC Harris SP-10 system: (3) Scully, (5) Carousel, cart, RA-5, SP-10, gd wrking cond, w/spare RA-5, SP-10 & Carousel, \$2000/complete, will consider selling items separately. G Williamson, WASK, POB 7880, Lafayette IN 47903. 317-447-9504.

SMC SSP 3060 automation stepper w/AS-10 audio switcher, controls 10 sep sources, \$2000/BO; (2) SMC 250 Carousels, stereo PB, \$350 ea/BO; SMC 350 Carousel, stereo PB, \$475 ea/BO; (3) SMC RSC-50 50-step Carousel controllers, \$200 ea/BO; SMC mounting rack, \$200; all of above for \$1500 incl cabling. B Williams, KPSM, 2009 W Gary, Broken Arrow OK 74012. 918-455-9522.

SMC automation system: SSP 3060 stepper, AS-10 switcher, (2) SMC 250 Carousels, SMC 350 Carousel, (3) RSC-50 50-step random access controllers for Carousels, (2) SMC 700 series sngl P cart machines, SMC 700 series R/P cart machine, (2) system real time clocks, plus much more, all equip listed is stereo, wiring harnesses & manuals incl, \$7000/BO. B Williams, KPSM, 2009 W Gary, Broken Arrow OK 74012. 918-455-9522.

Shaffer 903 brain, keyboard & (4) Shaffer R-R, xtra source cards for carts, etc, w/manuals, wrking when removed, BO. P Delaney, WOSX, Box 921, Marshfield WI 54497. 507-895-2065.

Broadcast Auto 2501-G tone gen (2), need little work, \$30. P Barzizza, KJBR, 603 Madison, Jonesboro AR 72401. 501-935-5598.

Complete automation pkg: BAI brain, (3) Otari reels, (3) Carousels, single play, all new or rebuilt, w/music, used less than 3 yrs on Sundays only, \$12,500 incl shipping. J Alsip, KSCQ, Box 1528, Silver City NM 88062. 505-538-3396.

Instacart (2), 48-hole, '84, w/Sentry IBM compatible firing system; also, a R-R, Dale, 503-774-0459.

SMC 350RS Carousel (4), fair cond, \$1000; DP1 & DP2 for parts, \$500; Instacart interface, \$100; Schaffer 903 w/Revox input cards, \$1500; (4) Scully R-R, new heads, \$500. D Rose, KAAA-KZZZ, 2534 Hualapua Min Rd, Kingman AZ 86401. 602-753-2537.

Harris System 9000: event controller for 12 sources, source cards, system computer cards, pwr supply, cables for (4) Otari ARS-1000 stereo reel decks, (4) Carousel 24 cartridge units which may need work, data entry CRT workstation, (2) standard system equip racks, BO, cashiers check, buyer ships. K Eiert, KWED, 609 E Court St, Seguin TX 78155. 512-379-2234.

Schafer 903-E Deluxe, w/Extel logger, (6) Rev-vox I/O cards, (3) ITC/UMOC I/O cards, studio/met I/O card, (2) Audiofile 2-A, (3) blue Schafer racks, manual control panel, spare parts, all manuals, wrking, \$4000. B Kingman, KRL7/KOWL, Box 15460, S Lake Tahoe CA 96151. 916-541-6681.

SMC 250 Carousel (3), in rack, \$200+shipping. D Morgan, KNZZ-KJYE, 1360 E Sherwood Dr, Grand Junction CO 81501. 303-241-9230.

Schafer 903-E, (4) racks, all but R-R equip, gd wrking order, spare parts, manuals, BO. K Browall, KTRZ FM, Box 808, Riverton WY 82501. 307-856-2922.

Otari ARS 1000, in use, tone sensors, 5 yrs old, clean; also, MW Persons Programmer 3A, recently overhauled, \$600; (4) R-R, \$850 ea; \$3700/complete package. B Hickman, WMFM-FM, POB 16928, Hattiesburg MS 39044. 601-545-1063.

SMC 350RS Carousel, \$400+freight. D Vernier, KUNI, Univ N IA, Cedar Falls IA 50614. 319-273-6400.

SMC TG-25 25 Hz tone gen, BO. L Penke, WKTT-FM, POB 26, Cleveland WI 53015. 414-693-3103.

SMC DP-2, (4) Carousels, (4) reels, DS-20. C Springer, KSEC, Box 890, Lamar CO 81052. 719-336-2206.

IGM-EC automation system: Alpha 250 UPS, (4) stereo Go-Cart 24s, (2) racks with A/C, Panduit & (2) side panels, PC422 I/O card, interconnect cabling & spare parts kit, \$10,000/BO. L Martino, 714-889-2651.

Schafer 903-E, (18) sources, 3-day memory, logger, (2) Audiofile 2-A random access stereo 48-tray cart handlers, part & manuals, \$4000/BO. B Kingman, KRL7/KOWL, Box 15460, S Lake Tahoe CA 96151. 916-541-6681.

SMC 350 Carousel (2), fair cond, \$225/ea+shipping; various SMC stereo automation components, call for faxed price list. P Bammerlin, WRQK, 4111 Martindale NE, Canton OH 44705. 216-492-5630.

Instacart, 48-hole (2), w/Sentry firing system & IBM-PC w/software; Otari R-R, D Lang, 503-774-0459.

SMC DAS-12 audio switcher, MSP-12 video programmer w/Amdex 300A video mon, (3) BE Series 3000A cart machines, (3) SMC 452 Carousels, all mounted in (2) racks. F Earls, WBCA, POB 426, Bay Minette AL 36507. 205-937-5596.

Want to Buy

Small automation system or Carousels in gd cond, note: lw budget. Brian, WWHN, 603-742-8575.

Cetec 7000 Level 1 or 2 system, left-end rack w/monitor panel, card cages, pwr supply, doors, terminal w/CPU board, SIO board, RTC board, RAM & ROM boards, PIO board, VEL board, minimum memory of 3680, & universal source cards, audio control, monitor & distribution boards. D Williams, Lincoln County Broadcasters, 1103 Utah Ave, Libby MT 59923. 406-293-6234.

Modulation Associates mutual network tone decoder cards. T Fernandez, WKXY, 2500 10th St, Sarasota FL 34237. 313-366-4422.

Hazeltine/Beehive Level 1 slave terminals for Cetec 7000 automation. R Gnad, WOLF/WCCY, 313 Montezuma, Htn MI 49931. 906-482-7700.

CAMERAS (VIDEO)

Want to Sell

RCA TK-760 studio camera (2), w/lens, CCUs, cables, cases, new tubes, complete, \$3500/par. C Polorti, Polorti Video, 10005 Lacy, Morrisville PA 19067. 215-945-3990.

Sony DXC-6000 k/1, high resolution motorized 10x f1.6 zoom lens, lw light, pro brdctst ENG, excel cond, w/case, tripod bracket, cable, battery pack, \$5000. Jaye, Nimbus Prod, POB 5903, Takoma MD 20912. 301-507-3358.

JVC KY-2000 3-tube camera w/pwr supply & case, \$800; Hitachi FP-10 1-tube camera w/pwr supply & case, \$500. J Soyk, Soyk Adv, 525 Main, Lewiston ID 83501. 208-746-8134.

IVC color camera (3), (1) for parts, others w/all access, cables, manuals, etc, nice glass, \$1000. Bud, TV-40, 4237 Airline, Norton Shores MI 49442. 616-733-4040.

Want to Buy

Panasonic AG-450, Bud, TV-40, 4237 Airline, Norton Shores MI 49442. 616-733-4040.

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CART MACHINES

Want to Sell

ITC R/P-0004 Premium series, stereo, 3 tones, excel cond, gd heads, vy little DSP, \$1600/BO. C Jennings, WQLA, Box 1530, LaFollette TN 37766. 615-566-1000.

Spotmaster TP1-B cart tape reloading machine w/timer; Spotmaster S-302 3-deck, mono, excel cond; (2) Spotmaster 500C open top mono cartridge recorder. C Freinwald, KBSG, Seattle. 206-343-9700.

Tepecaster X-701 RPS tape cart machine, used less than 1 yr, nearly new, \$650. L LeBlanc, WKXL, 603-225-5521.

ITC SP record amp for use w/SP series cart equip. C Freinwald, KBSG, Seattle. 206-343-9700.

SMC 700 series stereo cart PB (2), 3 tones, \$500 ea/BO. B Williams, KPSM, 2009 W Gary, Broken Arrow OK 74012. 918-455-9522.

ITC 99-B stereo R/P deck w/manual, new, \$3600. Donovan, KSKS, 5265 W Magill, Fresno CA 93722. 209-233-9393.

UMC 11-113 mono repro, 3 tones, \$295; set LEL alignment gauges for Ampro cart decks. \$15. P Wells, KJOY San Diego, 619-238-1037. FAX: 619-238-6157.

Spotmaster 500 P/B (3), all gd cond, free shipping, \$300/all; (4) Beaucart P/B, (1) needs minor work, (1) for parts, (2) gd cond, \$100 all+shipping. J Deering, Great Corn, 114 Walton Ferry Rd SE #B, Hendersonville TN 37075. 615-264-2886.

Collins PB150 & ORK 301, both need repairs, \$50/both. M Muderick, 101 Earlington Rd, Havertown PA 19083. 215-449-6970.

Spotmaster 505, (2) R/P, (1) P only, gd cond, \$200 ea; Sparta cart delay, like new, \$500. R Meyer, Benchmark Comm, 4700 SW 75 Ave, Miami FL 33155. 305-264-5963.

ITC SP (2), late model w/3 tones, 99B style head block & improved cart hold down, recently relapped, \$775 ea. P Hess, 134 Deroyent Dr, Pittsburgh PA 15237.

Ampro cart tape reloader, gd cond, \$150. D Collins, 3354 Cove Lake Dr, Lexington KY 40515. 606-293-4250.

RCA BA27, P only, wrking, \$50+shipping. J Cunningham, YSDA San Salvador, Rt 2 Box 113B, Stonewall OK 74871. 405-265-4496.

BE 5301B 3-deck cart machine, mono, all tones, \$1500; also, BE SW5E audio switcher, combines output of all 3 decks, \$250. L Fuss, WDTL AM/FM, POB 159, Fayetteville GA 30214. 404-460-6159.

BE 2100RPS stereo R/P, gd cond, \$995. Gary/Mike, KFYI, Phoenix AZ. 602-258-6161.

Want to Buy

ITC Omega series R/P cart machine, excel cond. K Conlin, WJKC, 449 Caromar Dr, Madison WI 53761. 608-233-6185.

CASSETTE & REEL-TO-REEL RECORDERS

Want to Sell

Ampex AG440 1" 8-trk rcrdr, 10 hrs on relapped heads, excel cond, \$3800. B Seifried, Eclair Eng, 101 Prospect St, Northampton MA 01060. 413-584-6767.

Metrotech 400 logger w/books & months worth of tapes, gd wrking cond, \$500. M Vanhooser, KSKY, 4144 N Central Exp #266, Dallas TX 75204. 214-827-5759.

Revox A-77 1/4-trk, in walnut case, excel cond, \$500; (2) Tascam 22-2 1/2-trk stereo, 7.5 & 15 ips, excel cond, \$400 ea. C Jennings, WQLA, Box 1530, LaFollette TN 37766. 615-566-1000.

ITC 770 2-trk PB (4), rack mount, almost new heads, gd cond, BO. P Lierman, KCSP, 601 W Collins Dr, Casper WY 82601. 307-265-5414.

Tascam 40-4, grt shape, BO. S Winthrop, Winthrop Prod, 10 W 94th St, NY NY 10025. 212-662-8685.

Otari MX-5050, wood cabinet, manuals, wrking when removed, gd cond, \$475 incl shipping. J Alsip, KSCQ, Box 1528, Silver City NM 88062. 505-538-3396.

Scully 270 R-R PB only (4), \$300/BO; Scully 270 R-R PB only for parts, \$200/BO; all (5) for \$1200; also, (2) dual 25 Hz tone sensors for above decks, \$200/BO; (2) SMC mounting racks, \$200; buy all for \$1500. B Williams, KPSM, 2009 W Gary, Broken Arrow OK 74012. 918-455-9522.

Otari MX-5050 QXD 4-trk, mint heads, vgc, \$1500. B Hanson, 314-449-8433.

Ampex 351 FT, excel cond, transport w/tube electronics, \$300; w/Inovonics, \$450. L Beigel, On-Cue-Rcrdrng, Call/fax: 800-726-9813.

Teac X1000R 1/4-trk R-R, top shape, \$600/BO. J Messenger, KZMX, Box 611, Hot Springs SD 57747. 605-745-3637.

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Tascam 112 w/manual, new, \$400. Donovan, KSKS, 5265 W Magill, Fresno CA 93722. 209-233-9393.

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Tascam 34 1/4" 4-trk rcrdr, \$650/BO. J Lang, PSI, Box 4085, Anchorage AK 99501. 907-333-2221.

SMC 700 series stereo cart R/PB (2), 3 tones, \$650 ea/BO; Sony TC-560 7" 1/4-trk, 7 ips max, ESP auto rev, \$250/BO; Teac 2300-A 7" 1/2-trk, 7 ips max, \$350/BO; Pioneer RT-1050 10" 1/2-trk, 15 ips max, \$500/BO; Pioneer cassette deck, hi-speed dubbing, Dolby B-C, \$75/BO; (3) Otari ARS-1000 R-R PB only, w/tone sensors, \$750/BO; Gates mounting rack, \$200; buy Otari decks & Gates rack for \$2100. B Williams, KPSM, 2009 W Gary, Broken Arrow OK 74012. 918-455-9522.

Telex 300 stereo w/master & 5 copiers in 3 cabinets, blowers in ea cabinet for air circ, excel cond, BO. G Kristiansson, Villa Skansen, 122 Fairmount St, S Burlington VT 05401. 802-864-9779.

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Teac A-3340S, 4-trk, 4-chnl simul-sync, built into factory travel case, incl wired remote, like new cond, \$850/BO. D Deuth, Audio Prod, 1801 Commerce Blvd, Mound MN 55364. 612-472-1619.

Ampex AG-350 in console, \$400; AG-440, \$500; Sony TC-854-4S w/dbx 4-chnl, \$900; Crown SX-701, \$250; Crown 800TX w/4-chnl elec, lots of parts, \$200; Telex 235, (1) master, (1) slave, R-R 2-chnl duplicator, new, \$500. J Krepol, RNDL, 7 Dustin Dr, Wilmington DE 19703. 302-798-4076.

Ampex AG440 w/console, 4-trk record, 2-trk P/B, once in Johnny Cash studio, needs VU meter, \$450+shipping. J Deering, Great Corn, 114 Walton Ferry Rd SE #B, Hendersonville TN 37075. 615-264-2886.

Sony TC-42; Superscope C106; Martel UHER 4000L 5" R-R; \$150/BO. M Muderick, 101 Earlington Rd, Havertown PA 19083. 215-449-6970.

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Audiotronics AV123-4TS 1/4-trk; Infonics RR-1, 73M, FT; Infonics RR-2, 74M, 2-trk; all gd cond, all/part, \$200 ea. R Meyer, Benchmark Comm, 4700 SW 75 Ave, Miami FL 33155. 305-264-5963.

Ampex 352 (3), w/remote start; (2) 350, (1) OK, (1) for parts; manuals incl; \$50+shipping. D Morgan, KNZZ-KJYE, 1360 E Sherwood Dr, Grand Junction CO 81501. 303-241-9230.

MCI JH-110B FT stereo for 14" reels, in metal roll-around cabinet, \$1875/trade for computer, etc. P Wells, KJOY San Diego, 619-238-1037. FAX: 619-238-6157.

Presto 800 R-R, 7.5/15 ips, mono &/or stereo, perfect cond, \$500. B Rose, Program Rcrdrngs, 228 E 10th St, NY NY 10003. 212-674-3060.

Revox A77 1/2-trk stereo, 7.5/15 ips, wood cabinet, carrying case, needs work but gd heads, motors & output elec, \$300. P Paquin, Sound Dynamics Assoc, Box 132, Acushnet MA 02743. 508-763-3447.

Revox PR-99 MK II 1/2-trk stereo P (5), \$1200 ea FOB. D Peluso, KJUL FM, 2880 E Flamingo Rd Ste E, Las Vegas NV 89121. 702-732-2200.

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Teac 6010 1/4-trk stereo & American Concertone 605-4R 1/4-trk stereo, both need repairs, \$100/both. M Muderick, 101 Earlington Rd, Havertown PA 19083. 215-449-6970.

Otari MX 7308 1" 8-trk, 15/30 ips, lw hrs, w/re-mote, excel cond, \$4500. L Wagner, ARN, 407-299-1299.

Akai 4-chnl R/PB, 10.5" reels; Pioneer 2-trk R/PB, 10.5" reels, 7.5/15 ips; Revox A-77 R/PB; all gd cond; \$750/all+shipping. J Deering, Great Com, 114 Walton Ferry Rd SE #B, Hendersonville TN 37075. 615-264-2886.

Studer/Revox HS77 Mk IV FT mono, 10 hrs use, as new, \$975/BO/trade; portable case for A77 w/mn spkrs & pwr amps, excel cond, \$375; Nakamichi 1000ZXL computer-controlled cassette deck, top-of-line, w/NR100 Dolby C, rackmount w/rosewood case, lw hrs, \$1375/BO/trade. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 213-859-5543.

Ampex 440-B R-R in Ruslang cabinet, runs grt, mono, \$325. J Lee, JL Prod, 208 Hampton Circle, Jupiter FL 33458. 407-575-1828.

Scully 284B-8 8-trk 1" deck, 3.75-30 ips, vry clean, less than 100 hrs, all manuals, \$5500; MCI JH110A 1/2" rcrdr, 9 yrs old, 7.5/15/30 ips, analog meters, manual w/schematics, gd cond, \$2500 incl crate. T Sherry, 415-969-3030.

Scully 280 (2), for parts, \$400+ shipping/both; (2) ITC 750 PB, gd cond, \$200/ea+shipping. P Bammerlin, WRQK, 4111 Martindale NE, Canton OH 44705. 216-492-5630.

Scully 280 4-trk, in console cab, gd cond, BO. F Virtue, Virtue Studios, 8809-11 Rising Sun Ave, Philadelphia PA 19115. 215-763-2825.

Teac A-450 2-head stereo cassette deck (5), top load, new heads, rebuilt motor & transport recently serviced, \$140 ea; Sony TC-580 7" reel bidirectional R/P, vgc, recent service, \$200; Revox A77 MKIII, 7.5/3.75 ips, 1/4-trk stereo amps & speakers version, vgc, recent service, \$260; you pay shipping. A LeFay, APC Prod, POB 371, Walnut CA 91788.

Crown vintage tube machines (5); LL802, 751, BX801, LL822, GCSX, \$250/all. Ron, WAWZ, 908, Weston Canal Rd, Zarephath NJ 08890. 908-469-0991.

ITC 750 Series stereo R-R (7), vgc, \$550 ea; Ampex AG 440-B FT console, \$450; Ampex AG 600-B stereo, BO; Marantz 5030-B cassette rcrdr, vgc, rack mount, \$100. D Lundy, POB 408, Heidrick KY 40849. 606-546-6650.

Systems Marketing 512 tape deck (2), rack mounted, manuals, \$50 ea; (2) Spot Master 505-BS tape decks for parts, \$50 ea. Bud, TV-40, 4237 Airline, Norton Shores MI 49442. 616-733-4040.

Ampex AG350 stereo 1/4", \$650, console avail; Ampex 354-2 stereo 1/4", 4 heads, \$975; Ampex 01-96440-04 mic preamp, 60 db, \$75 ea. T Rose, Joiner-Rose Group, 4125 Centurion, Dallas TX 75244. 214-392-7800.

Telex 3:1 cassette duplicator, excel cond, needs minor work, \$500+shipping, S Russell, 60410 Klett Dr, Decatur MI 49045. 616-782-9258.

Otari ARS-1000 DC (4), PB only, w/one sensor, mounting brackets, auto rewind, excel cond, \$800 ea. B Christie, Grande Radio, 2510 E Cove Ave, La Grande OR 97850. 503-963-4121.

Telefunken M15A 1/4" stereo, 15/30, in console, w/xt meters & remote, \$4000/BO; Tandberg 84 1/4" stereo, 7.5/3.75/1-7/8, \$200/BO. R Rhodes, R Rhodes Music, POB 1550, NY NY 10101. 212-245-5045.

MCI JH-110B 2 trk in factory, metal roll around cabinet, Well maintained & in great shape w/complete spare set of fully working transport & audio boards, \$1500. S Beverly, Flamingo Prod, 210 NE 57th, Ft. Lauderdale FL 33334. 305-537-3617, FAX 305-492-9447.

Want to Buy

Ampex PR-10 manual & schematic. L Johnson, 3928 Red Oak Dr, Doraville GA 30340.

Stellavox SP7 stereo; ABR large reel adapter for SP7; Stellavox TD88. R Cummins, 212-219-3670.

Rheem Califone SS 70-TC in gd wrking order. E Ford, KBPK, 321 E Chapman, Fullerton CA 92634. 714-992-7418.

ITC-750 stereo R-R PB, gd wrking order. K Brownell, KTRZ FM, Box 808, Riverton WY 82501. 307-856-2922.

Webcor 80 wire rcrdr; Magnecord PT-6 thru PT-63AX, Brush BK-401 Soundmirror rcrdr; Ampex 200 & 300; any Fairchild tape rcrdr. D Igo, KMMX/KCHL, POB 1067, San Antonio TX 78294. 512-359-3167.

MCI/Sony capstan & reel motors, any cond., recdg heads, most mfgs, machines, new, used, Relapped then sold. Amp Services, 224 Datura St No 614, W Palm Beach FL 33401. 800-826-0601, in FL 305-659-4805.

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.

COMPUTERS

Want to Sell

Apple II+ w/2 disk drives & monitor III; w/Mountain Computer Music system & Alpha Centuri cards, \$50 ea. P Russell, Bowdoin College, Sills Hall, Brunswick ME 04011.

Laser Compact XT, 640K RAM, 10 MHz, 5.25 & 3.5 drives, CGA color mon, DOS, all manuals, like new, \$400. M Martin, 507-454-2918.

CONSOLES

Want to Sell

Sparta AS-10 stereo console, (5) pots control (2) mics & (8) sources, \$300/BO; Gates Stereo Statesman, (5) pots controlling (2) mics & (9) sources, \$650/BO; Realistic battery-operated mixer for remote use, \$15/BO. B Williams, KPSM, 2009 W Gary, Broken Arrow OK 74012. 918-455-9522.

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Gates Diplomat w/books, \$500; Ramko DC8M, touch control, w/books \$1000; both in gd wrking cond. M Vanhooser, KSKY, 4144 N Central Exp #266, Dallas TX 75204. 214-827-5759.

Peavy 720 7-chnl pwrdr mixing board, 120 Wchnl, \$300. P Barzizza, KJBR, 603 Madison, Jonesboro AR 72401. 501-935-5598.

LPB S-12 Signature II series, 5 chnl, stereo, step attenuators, excel cond, vry cin, \$975. C Jennings, WQLA, Box 1530, LaFollette TN 37766. 615-566-1000.

Tascam M-30, 8x4x2x2, gd ccnd, \$350/BO. J Lang, PSI, Box 4085, Anchorage AK 99501. 907-333-2221.

Micro-Trak 6618 6-chnl stereo, wrkg when removed, \$375 incl shipping. J Alsip, KSCQ, Box 1528, Silver City NM 88062. 505-538-3396.

Collins 212, 9 chnls, tube type, mid 60s vintage, complete, will sell cheap. P Delaney, WOSX, Box 921, Marshfield WI 54497. 507-895-2065.

BE 4S150A 4-chnl, 12 input stereo console, in use 4 months, grt cond, \$1100; (2) BE 8S150A 8-chnl, 16 input stereo consoles, 2 yrs old, gd cond, \$1000 ea; Orban 3100A/ST studio unit, gd cond, w/cards, \$500. R Clemons, 9485 Regency Sq Blvd #93, Jacksonville FL 32225. 904-727-0933.

Harris Executive 8-chnl, '81, needs work, fair cond, BO; QRK-CCA Futura 6, slide pots rebuilt to half stereo, xtra parts, \$300. G Erway, KKSJ, POB 40309, Santa Barbara CA 93140. 805-568-1444.

McCurdy SS 8500 custom 10 mixer dual stereo brdctst console, excel cond, \$4500. D Vernier, KUJN, Univ N IA, Cedar Falls IA 50614. 319-273-6400.

Shure SE30 mixer, mc/line inputs, gated compressor, VU meter, gd cond, \$225; Ramko DA6 R/E audio DA 1x6 processing mixer, clean & perfect, \$65. E Davison, 135 N Illinois, Springfield IL 62702. 217-787-0800.

Collins 808A-1 discolorated brdctst console, (2) TT, \$50+shipping. D Morgan, KNZZ-KJYE, 1360 E Sherwood Dr, Grand Junction CO 81501. 303-241-9230.

Otari MX-5050 Mark III 1/2" 4-trk, compact table top console rcrdr, dynamic braking motion sensing & transport logic, DC servo capstan system, 15/7.5 ips, excel cond w/road case, \$4250. G Fern, POB 2366, Van Nuys CA 91404. 818-778-6756.

Ampro AC6SB 6-chnl control board, stereo/mono, vgc, \$475. J Lee, JL Prod, 208 Hampton Circle, Jupiter FL 33458. 407-575-1828.

Opamp Labs 2008-4E, 20 inputs, 8 subs, stereo mix out, gd prod board, vry clean, \$3500. L Wagner, ARN, 407-299-1299.

Micro Trak Sport III remote, great for remote w/dial pad w/manual, \$100. Donovan, KSKS, 5265 W Magill, Fresno CA 93722. 209-233-9393.

Classic British Helios 24/16/24, circ 70s, many updates/models, w/documentation, discrete mic preamps, (9) sep pieces, w/wood rack cab, mahogany desk, \$9500/BO/trade. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 213-859-5543.

Autogram AC-6 stereo console, never used, mint cond, \$3500/BO. W Blackwelder, 903-581-0606.

Ramsa WR8816 16x4x2 mixing console, lw hrs, like new, \$2950/BO. G Jones, SW Mediacast, 110 Sierra Rd, Kerrville TX 78028. 512-367-4587.

Yamaha PM-700 12x2x2 stage mixer, \$400; Shure 8x1 rack mount audio mixer, \$200; Audix MXT-1000 8x2 recording studio board, \$1400; UREI Cooper Time Cube, vintage, delay line & mixer flanger doubler, \$500/both. J Krepol, RNDL, 7 Dustin Dr, Wilmington DE 19703. 302-798-4076.

Shure M67 mixer (2), vgc, rack mount, \$100 ea; (2) Shure M610-2E feedback controller, vgc, rack mount, \$100 ea. D Lundy, POB 408, Heidrick KY 40849. 606-546-6650.

Ramsa WR-8210 10x4 mixing console, 3 band EQ/chnl, effects, sub-mix, solo XLR mic ins, RCA line I/O, like new, \$950/BO; Arrakis mic preamp mixer, (5) I/O, will mix inputs to sngl output, requires ±15 VDC, \$75/BO. M Friend, WTJU, Box 711 Newcomb Hall, Charlottesville VA 22904. 804-924-0885.

Wheatstone 3224: 32-chnl mainframe, 24 chnls installed, many spares & xtras, 2.5 yrs old, \$4000. Falk Rcrdng Studio, 502-239-1044.

Want to Buy

Shalco stereo pots w/cue. B Arnold, 700 Prod, 105 Dorado Court S, Middle Island NY 11953. 516-924-9020.

Sunn mixing board, 8-chnl, S Russell, 60410 Klett Dr, Decatur MI 49045. 616-782-9258.

Collins 212B; Altec 230B. R Osborne, WMOU, POB 667, Ravenswood WV 26164. 304-273-2544.

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

DISCO & SOUND EQUIPMENT

Want to Sell

Oberheim DX drum machine, lots of alternative sound chips, BO; Shure PA system, (2) lrg columns, (2) mon & PA head, gd cond, BO. S Winthrop, Winthrop Prod, 10 W 94th St, NY NY 10025. 212-662-8685.

CRL DX2 NR or Symetrix 511A, excel cond; Symetrix SX201 parametric EQ (2), excel cond. B Tidwell, WAFT, POB 338, Valdosta GA 31603. 912-244-5180.

Fostex 3030 dual 10-band EQ, \$170; Yamaha E1010 analog delay, rack mount, remote foot switch, \$225; L1 Sound Thompson Vocal Eliminator D2, \$200; dbx 224 Type II NR, recording tech series, \$200; Sony NR-115 stereo Dolby unit w/CAL tapes, \$95; dbx NX-40 NR, \$85; Ultimate Support Systems TS-33 Tripod, 9'+base unit, w/8' ext & case, \$175. D Deuth, Audio Prod, 1801 Commerce Blvd, Mound MN 55364. 612-472-1619.

Rane ME-15 stereo EQ, excel cond, \$200/BO. M Osborne, WKSQ, POB 9494, Ellsworth ME 04605. 207-667-7573.

JBL 4312 (2), latest version of L-100, 4311, etc, deluxe studio 3-way mon, new, under warranty, will ship UPS, \$550/pair; Yamaha NS-104 2-way studio mons, pair avail, will ship UPS, \$280/both. C Keith, ALI, POB 313, Keane NH 03431. 603-352-8460.

dbx 150X NR (2), vgc, \$325; Yamaha SPX90II special effects box, 99 presets, mint, \$500. B Hanson, 314-449-8433.

Roland DEP-3 effects processor, DEP-5; Yamaha SPX-90, \$275; Roland DEP-5 effects processor, \$275. J Lang, PSI, Box 4085, Anchorage AK 99501. 907-333-2221.

EMT 240 Gold Foil reverb, needs work, you ship, \$500. S Russell, 60410 Klett Dr, Decatur MI 49045. 616-782-9258.

Shure SR-107 graphic EQ, 10 band, rack mount, excel cond, \$125; DOD-Digitech 831-C 31-band graphic EQ, as new, \$150; DOD-Digitech 855 4-chnl mixer, as new, \$150; Rane PE-15 5-band parametric EQ, as new, \$250; buyer pays shipping. B Leslie, Pro Rcrdng Service, 13709 Maple Leaf Dr, Cleveland OH 44125. 216-662-1435.

Gemini 6-chnl stereo mixer (2), almost new, \$250/both+shipping. J Deering, Great Com, 114 Walton Ferry Rd SE #B, Hendersonville TN 37075. 615-264-2886.

Fairchild 658 spring/rack mount reverbs (2 ea), BO. B Arnold, 700 Prod, 105 Dorado Court S, Middle Island NY 11953. 516-924-9020.

Dolby 361 Type A NR, new stereo pair, \$1400; dbx K9-22 cards for above, \$250 pair. E Davison, 135 N Illinois, Springfield IL 62702. 217-787-0800.

RCA BCM-2A aux mixer, (5) pots & (6) preamp cards, no pwr supply & upper front panel, orig RCA blue paint & vry clean, \$500/BO; RCA 243471 PA tuning screw for BTF-10E, black nylon, new, \$75/BO. K Eiler, KWED, 609 E Court St, Seguin TX 78155. 512-379-2234.

Studio Sound S-305 passive filter sets, matched pair, consec #, rack mount, vry rare, \$375 ea. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 213-859-5543.

Snake 16 phantom-pwrdr inputs w/xt ps, 250' Belden 19-pair cable w/ml connectors & strlss-steel strain reliefs, 10' Neumann XLR snake mates w/box or Belden snake, excel cond, \$775/BO/trade. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 213-859-5543.

Bose 802 Series II spkrs & 802/302 EQ, Ultimate 12" stands, like new, excel cond, orig cartons, lifetime warranty, \$1600 firm. P Paquin, Sound Dynamics Assoc, Box 132, Acushnet MA 02743. 508-763-3447.

Nova NCM 508 8 chnl PAR & RAIN light controller w/memory, audio chase, program chase, fade, blackout, etc, includes pair of Sunn PS-300 1200 watt digital dimmer packs, BO. B Fisher, KPOK, POB 477, Bowman ND 58623. 701-523-3883.

UREI 529 EQ (2), excel cond, BO. F Virtue, Virtue Studios, 8809-11 Rising Sun Ave, Philadelphia PA 19115. 215-763-2825.

UREI 527A 1/3 octave graphic EQ (2), excel cond, \$250 ea; Ectentive H949 Harmonizer, works perfectly, \$1200. G Guarino, Sorcerer Sound, 19 Mercer St, NY NY 10013. 212-925-1365.

Altec N501-8A 2-way crossover networks, new in orig box, never used, \$60/pair. S Lawson, KAK Prod, 928 Hyland Dr, Santa Rosa CA 95404. 528-4055.

Kenwood system: integrated amp, 90 W RMS/chnl, tuner, tape deck, TT, spkrs, rack, shipping xtra, \$300. M Starin, WGOT TV60, 457 Varney St, Manchester NH 03102. 603-625-1165.

ApheX Type C aural exciter, \$75. Falk Rcrdng Studio, 502-239-1044.

CRL DX2/Symetrix 511A NR, excel cond; also, (2) Symetrix SX201 parametric EQ, excel cond. B Tidwell, WAFT, POB 338, Valdosta GA 31603. 912-244-5180.

SAE 5000 impulse NR, removes clicks & pops, \$125; JBL 4312-A 12" 3-way studio mons, 035T1 tweeter, 3 yrs old, grt cond, \$500/BO. R Glenn, WTGR, 1718 Shandoha, Wimauma FL 33598. 813-634-1940.

Want to Buy

SAE 2800 EQ, vgc. R Glenn, WTGR, 1718 Shandoha, Wimauma FL 33598. 813-634-1940.

FINANCIAL SERVICES

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LIMITERS

Want to Sell

Auditronics 201 rms/peak limiter, \$500 ea; API 525 limiter, \$340 ea. M Linett, Yr Place or Mine, 1600 Las Flores Dr, Colendale CA 91207. 818-244-1909.

CBS Audimax stereo compressor, \$200/BO; CBS Volumax stereo limiter, \$200/BO; \$350/both; also, (2) Marti CLA-40H compressor-limiters, mono, \$75 ea/BO. B Williams, KPSM, 2009 W Gary, Broken Arrow OK 74012. 918-455-9522.

Optimod 8000A
\$1495 & UP
414-482-2638

Orban 464A Co-operator transparent AGC/limiter, excel cond, \$600/BO; Texar RCF-1 replacement card 5, \$350. M Osborne, WKSQ, POB 9494, Ellsworth ME 04605. 207-667-7573.

Optimod 8100A/ST audio processor, BO. L Penke, WKTT-FM, POB 26, Cleveland WI 53015. 414-693-3103.

Pacific Recorders ML-FM multi-limiter, works, BO; CBS Volumax 400, BO. B Schloss, KRRO, Sioux Falls SD. 605-335-6500.

Gates Solid Statesman, \$275. P Wells, KJOY San Diego, 619-238-1037.

CRL SEP400B, lw hours, clean, excellent shape, w/manual, \$350. P Hess, 134 Derovent Dr, Pittsburgh PA 15237.

Gates Solid Statesman, needs parts, \$50. G Muse, KMRF, POB K, Marshfield MO 65706. 417-468-6188.

Quad-8 Cleg compressor/limiter/expander/gate modular units, console/rack mountable, not used, \$150 ea/trade. J McLane, Oddeo Eng, 115 W Gutierrez, Santa Barbara CA 93101. 805-963-3941.

dbx 165 comp/limiter stereo pair (2), new, \$350 ea. E Davison, 135 N Illinois, Springfield IL 62702. 217-787-0800.

CRL FM4 system, SPP-800, SEP-400A (2), SMP-800, Dynalex DX-2 NR unit, \$2600; Valley People 440, gd cond w/manual, mic processor, \$250; UREI 535 stereo EQ w/manuals, gd cond, \$200. Donovan, KSKS, 5265 W Magill, Fresno CA 93722. 209-233-9393.

Orban 8000A, excel cond, \$1300. Ron, WAWZ FM, Weston Canal Rd, Zarephath NJ 08890. 908-469-0991.

dbx 166 dual gated compressor/limiter, like new, \$500. B Dierking, KNDY AM/FM, RR3, Marysville KS 66508. 913-562-2361.

MICROPHONES . . . WTS

Altec 639 (2), classic ribbon Y dynamics, \$400 ea. L Beigel, On-Cue-Rcdng, Callfax: 800-726-9813.

EV RE-20, mint cond, \$275; Valley People 400 mic compressor, vgc, \$300. B Hanson, 314-449-8433.

Sennheiser 421 w/case, \$200. J Lang, PSI, Box 4085, Anchorage AK 99501. 907-333-2221.

Sennheiser 441-U new in box, \$200. Donovan, KSKS, 5265 W Magill, Fresno CA 93722. 209-233-9393.

EV 1776; RCA 44DX; Altec Salt Shaker; \$225/all+shipping. J Deering, Great Com, 114 Walton Ferry Rd SE #8, Hendersonville TN 37075. 615-264-2886.

Beyer 101 omni mic, gd cond in case, \$100. P Paquin, Sound Dynamics Assoc, Box 132, Acushnet MA 02743. 508-763-3447.

Telefunken/Schoeps CM-61 tube mic, very rare, uses std 6AU6 plug-in tube, w/cables/pwr supply, mint cond, \$975/BO. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 213-859-5543.

Shure Unirion 330 vintage late 40s-early 50s ribbon mic, excel cond, w/original box & spec sheet, \$275. J Lee, JL Prod, 208 Hampton Circle, Jupiter FL 33458. 407-575-1828.

AKG D224E (8), all need about \$200 in repairs, \$125/ea/BO. G Tyson, AMP Rcdng, 307 W Main St, Maple Shade NJ 08052. 609-667-1667.

Altec M-11 pwr supply system for '48 era tube mic, \$125/trade. J McLane, Oddeo Eng, 115 W Gutierrez, Santa Barbara CA 93101. 805-963-3941.

Shure SM57, special made 12" dynamic, perfect, \$75; (2) Shure 548 special made 11", as new, \$75 ea; Shure SM82 12" interview cardioid, line level out, new, \$100; Shure wireless hand-held WISH7/58/W20R, 1000' range, 177.8 MHz, new, \$525; (2) Shure SM54 dynamic quality mic, mint cond, \$150 ea. E Davison, 135 N Illinois, Springfield IL 62702. 217-787-0800.

EV 635A, as new, orig box & access, \$50+shipping. B Leslie, Pro Rcdng Service, 13709 Maple Leaf Dr, Cleveland OH 44125. 216-662-1435.

Electro Voice 666 (2), gd cond, \$40 ea. T Rose, Joiner-Rose Group, 4125 Centurion, Dallas TX 75244. 214-392-7800.

Neumann U-67, excel cond, pwr supply, \$3000; Sony C-35P excel cond, pwr supply, like new, \$325. F Virtue, Virtue Rcdng, 8809-11 Rising Sun Ave, Philadelphia PA 19115. 215-763-2825.

Presto 45 rpm adapter sleeve for 6N disc cutter, new; manuals: Sencore tube conductance analyzer, Sams transistor sub book #8 & #6, RCA tube manual. Mr. Oliver, 212-874-7660.

EV 630/635 w/cable; RE10 EV-desk mics, EV & Shure all very reasonable; baby booms (3). Mr. Oliver, 212-874-7660.

Want to Buy

Telefunken/Schoeps CM-61 tube mic pwr supply & cable. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 213-859-5543.

American Mic D-33 & DR-330, gd cond; also, Shure 333 & Greybar heavy boom stands. D Igou, KMMX/KCHL, POB 1067, San Antonio TX 78294. 512-359-3167.

WE/RCA tall boom stand, over 15' tall for field prod, any cond. P Jacoby, 803-881-1160.

MISCELLANEOUS

Want to Sell

RDG FR-10 flanger, rack mount, works OK; TWR DIML-865 twr-top mounted med/lw intensity strobe light system (2), w/190' cable, dual lighting controller, etc, used couple mnths, in dry storage. C Freinwald, KBSG, Seattle. 206-343-9700.

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

GKI K80 1 1/2" tape eraser, rack mount, top shape, \$450. Gene Sive Prod, 619-749-7662.

Ellason E250 color weather radar, complete system provides adjustable range, sensitivity, antenna tilt, automatic operation, assume remaining debt only. B Beasley, WJMH-FM, 4002-E Spring Garden St, Greensboro NC 27407. 919-855-6500.

Potomac FIM21 AM FS meter, excel cond. Kevin/Correy, 512-345-9300.

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FAX 616 692 6789
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Sony RMM501 rack mount kit (5), new Type 5, never used, (2) in orig boxes, \$800. D Jordan, WDTM Inc, POB 3417, Jackson TN 38303. 901-668-1153.

Radio Design Labs pods to make up (2) audio control boards, modular design, new, unused, \$10,000 FOB; Sparta Elec Corp misc audio & RF tech manuals; call/write for compl list. D Peluso, KJUL FM, 2880 E Flamingo Rd Ste E, Las Vegas NV 89121. 702-732-2200.

Several audio xformers: Ampex 15095 & 4580116-20, Triad A10J & A11J, \$15/ea. S Lawson, KAK Prod, 928 Hyland Dr, Santa Rosa CA 95404. 707-528-4055.

Digital LED up timer (5), 2", resets to 0 when 9:59 is reached or momentary closure made, self-pwr'd, \$5750 ea prepaid, UPS. D Peluso, KJUL FM, 2880 E Flamingo Rd Ste E, Las Vegas NV 89121. 702-732-2200.

Blower, BVD B25A, rack mounting, 2 speed, gd cond, \$35. E Davison, 135 N Illinois, Springfield IL 62702. 217-787-0800.

GKI K80 1 1/2" tape eraser, rack mount, top shape, \$450. Gene Sive Prod, 619-749-7662.

TV station surplus equip: Drake 2220 sat rcvr freq agile; cassette decks, Scala CL-1483 antenna UHF; Scalla chnl 35 xmit antenna; Sony VO-4800 3/4" rcrdr; Wegener 1601 mainframe; (3) Unicrom 2 W 2-way radios; call for list/BO. John, 509-826-0100.

Stancil-Hoffman mag film/video degausser; music library of (95) 15 ips tapes, (48) 12" dbl-side records; (2) lrq matching audio spkrs; aluminum pole-cat set; much more, send for list. B Howard, Academy Film Prod, 3918 W Estes, Lincolnwood IL 60645. 708-674-2122.

Audio xformers: (4) Ampex 15095 line input; (9) Ampex 4580116-20 bridge input; (2) Triad A-10-J; (2) Triad A-11-J; \$15 ea. S Lawson, KAK Prod, 928 Hyland Dr, Santa Rosa CA 95404. 528-4055.

Dummy load ME-82/U, 120 W, 52 ohm, 50-600 MHz. Bud, TV-40, 4237 Airline, Norton Shores MI 49442. 616-733-4040.

Onan series OT pwr sentry/automatic xfer switch, #OTUDD225-4/1202B, 225 amp, 120/208 3-phase, 4-wire, wrking when removed, BO. D Culp, WRQX, Washington DC. 202-686-3100.

Xmas tree terminal block (18), ADC, A-66, 6x20, \$350 ea; (12) PJ318 dbl row jack field, \$15 ea. T Rose, Joiner-Rose Group, 4125 Centurion, Dallas TX 75244. 214-392-7800.

Electro Impulse DPTC 10 kW FM dry dummy load, wattmeter incl, \$450. Ron, WAWZ FM, Weston Canal Rd, Zarephath NJ 08890. 908-469-0991.

Want to Buy

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.

MONITORS

Want to Sell

McMartin TBM3700 FM mod mon & matching TBM200A stereo mon. B Schloss, KRRO, Sioux Falls SD. 605-335-6500.

Want to Buy

Any older McMartin mod monitors. C Goodrich, 11435 Manderson, Omaha NE 68164. 402-493-1886.

MOVIE PROD EQUIP

Want to Sell

Bolex H165 (2), w/400' mag port, drive & mag motors, battery packs, 17-85mm zoom w/rt angle view finder, voltage regulators. K West, SRSU, Dept Fine Arts/Comm, Alpine TX 79832. 915-837-8219.

Cine Kodack Special II, 100' mag lens & case, vgc, clean, 16mm, \$250. C Potorti, Potorti Video, 10005 Lacy, Morrisville PA 19067. 215-945-3990.

B&H 16mm 202 opt/mag proj, w/sync motor for interlock, M-H 816 hot splicer, Beaulieu R16E camera w/ang 12-120 zoom lens, Hollywood rewinds, sound readers, split & solid reels, send for more info. B Howard, Academy Film Prod, 3918 W Estes, Lincolnwood IL 60645. 708-674-2122.

RECEIVERS & TRANSCEIVERS

Want to Sell

Yaesu FRG7700 comm rcvr, 10 kHz-30 MHz, w/o memory freq, digital readout, AM/FM/SSB, mint cond, \$350; Kenwood R1000 comm rcvr, 10 kHz-30 MHz, digital readout, mint cond, \$300. E Davison, 135 N Illinois, Springfield IL 62702. 217-787-0800.

AM STEREO RECEIVERS Portable, Home/Studio, Auto RRADCO GROUP 708-513-1386

Wacom WP-641 VHF duplexer, on 154 & 155 MHz, will tune to 150-156 easily, like new, \$350. P Russell, Bowdoin College, Sills Hall, Brunswick ME 04011.

Motorola Moxy 25 W SS under-dash mobile radio (3), on 161.640 MHz, w/base station mic & pwr supply, base station vertically polarized antenna w/6 dB omni-directional gain & adjustable radiation pattern, much more, \$1000/BO. B Williams, KPSM, 2009 W Gary, Broken Arrow OK 74012. 918-455-9522.

High quality micro-miniature 67 kHz SCA decoder, about 1" square, prewired and ready to install, \$15. D Jackway, Background Music Eng, 5742 Fair oak, Springfield MO 65810. 417-881-1846.

GE MPI (2), UHF hand-helds, 2 W, 2 chnl, xtra batteries, chargers, \$150 both. P Russell, Bowdoin College, Brunswick ME 04011. 207-725-3066.

Precision PE112A AM/FM tuner, rack mounting, SS, gd cond, \$35. E Davison, 135 N Illinois, Springfield IL 62702. 217-787-0800.

Want to Buy

Realistic STA-2100D FM/AM tuner w/full controls & 240 W amp, 120 Wchnl. L Van Luven, WGMC, 60 Rochelle St, Rochester NY 14612.

Zenith Stratosphere AM/SW radio, '36; also, EH Scott/McMurdo silver rcvr; can pick up. D Hauff, Jcvz 16351, Minneapolis MN 55416.

REMOTE & MICROWAVE EQUIP

Want to Sell

Moseley MRC1600 remote w/16 chnl control/telemetry/status, gd cond, BO. P Delaney, WOSX, Box 921, Marshfield WI 54497. 507-895-2065.

COMREX RENTALS

1, 2 and 3-Line Systems
Call Steve Kirsch for details
Silver Lake Audio
(516) 623-6114

Gates RDC-10 remote, plus 1 for parts, \$100; (2) Comrex telephone coupler with 1/4" line out jack, \$50 ea. B Williams, KPSM, 2009 W Gary, Broken Arrow OK 74012. 918-455-9522.

TFT 7601 systems: (2) 7601-C & (2) 7601-R, both complete, excel cond, vry cln, \$1600/BO. C Jennings, WQLA, Box 1530, LaFollette TN 37766. 615-566-1000.

Moseley TRC-15 remote control system, 12 yrs old, wrking fine, gd cond, \$750. M Clites, WCBC, Box 1290, Cumberland MD 21502.

Hallikainen PCC180 processing control computer, permits automatic logging operating w/Moseley TRC-15 remote system, wrkd grt when removed in '89. C Freinwald, KBSG, Seattle. 206-343-9700.

Hallikainen DRC-190, brand new deluxe R/C w/computer, printer, CRT, all manuals, \$1200; Moseley TRC-15 studio & xmr units w/manuals, set-up for Teko, wrk grt, \$400. J Salov, SHGRWUPS, 517-740-1165.

Moseley SCG-8 FM subcarrier gen & SCD-8 FM subcarrier demod, 110 kHz, like new, P Bailion, 612-222-5555.

Moseley PCL-606/606C manuals (4 sets), new, \$35. K Eilers, KWED, 609 E Court St, Sequin TX 78155. 512-379-2234.

Moseley MRC-1600 digital remote, \$2000. L Penke, WKTT-FM, POB 26, Cleveland WI 53015. 414-693-3103.

RCA BTR-30A remote system, suitable for parts, make offer. B Schloss, KRRO, Sioux Falls SD. 605-335-6500.

Gentner SPH-3 Phone System telephone interface, never used, \$380. B Hickman, WMFM-FM, POB 16928, Hattiesburg MS 39404. 601-545-1063.

Moseley PCL 505C STL system, w/xmr, receiver & antennas, on 951.0 MHz, gd cond, upgraded to comply w/FCC STL rules, Dan/Paul, KRDI, Decorah IA 52101. 319-382-4251.

Marti RMC-20 remote system, cosmetically lacking, functionally perfect, w/(4) RY5T relay panels, all manuals, \$500. S Schweiger, WXLO FM/AM, 146 Worcester Ctr, Worcester MA 01608. 508-752-1045.

Moseley TRC-15AW remote, excel cond, w/manual, \$750/BO. T Bryan, KARO, 503 Old 63 N, Columbia MO 65201. 314-442-3116.

Marti R10/STL10 monaural STL system, recently aligned & tuned on 950 MHz, \$2950. A Thompson, KXDD/KUTI, 706 Butterfield, Yakima WA 98901. 509-248-2900.

Moseley PCL-SCG-6 135 kHz subcarrier gen; SCD-2 135 kHz subcarrier rcvr; \$250 ea. Ron, WAWZ FM, Weston Canal Rd, Zarephath NJ 08890. 908-469-0991.

Stromberg Carlson PABX dial phone system w/(5) 6-line phones, complete, \$1000; (50) GTF LC-4003 phone line cards, wrking, \$10 ea. Bud, TV-40, 4237 Airline, Norton Shores MI 49442. 616-733-4040.

Mork STL dish, 5', \$450+shipping. D Donovan, KCGR, 1620 American Bank Plaza, Corpus Christi TX 78475. 512-888-8555.

Harris satellite dish, 3 meter delta gain white, solid, durable, set on concrete slab, \$900. 816-359-2261.

Want to Buy

Marti 26 MHz xmtrs & receivers w/manuals, will consider 161 MHz w/right price. F Vobbe, WLIO TV, 1424 Rice Ave, Lima OH 45805. 419-228-8835.

Gates RDC10 studio & xmr units, must be in gd wrking order. A Calisti, WBCW, Jeanette PA 15644. 412-527-5656.

EMPLOYMENT

To place ads in this section, use the ActionGram form. To respond to box numbers, write Radio World, PO Box 1214, Falls Church, VA 22041, Attn: _____

POSITIONS WANTED

Attn N Mich FM owners, want long term market dominance, untapped nat'l accounts, pro image, reduced overhead, spin of income, nat'l recognition? Joseph, 517-379-4803.

Medium/major market wanted, 22 yrs exper, i.e. KFVY-Phoenix & KOIP-Odessa TX, TV/VO, prod director. R Lane, POB 2764, Odessa TX 79760.

15-yr host of oldies show on college FM lost time slot, seeking weekends w/in radius of St Louis. D Hogenmiller, 4612 Theiss, St Louis MO 63128. 314-894-8194.

Straight annrc w/20 yrs exper seeks On-Air pos w/mature station, NW AR, SW MO, NE OK. T Horne, 501-337-7218.

Run it lean, exper radio pro knows how to lwr overhead, increase sales/audience, former owner/operator lknng for new challenge, reply in strictest confidence. MMAS, POB 77, Spofford NH 03462. 603-256-6929.

General Manager, experienced all phases. Sales manager, salesman, trainer, 25 yrs in radio, prefer Florida or Georgia. Write to: Radio World, POB 1214, Falls Church VA 22041. Attn: Box #911-011RW.

SATELLITE EQUIPMENT

Want to Sell

Scientific Atlanta satellite rcvr system w/Voice Cue, Data, SEDAT & 15/75 kHz DAT cards installed, used by NBC Talknet/ABC/CBS sports affiliate w/switchable crystals, \$5500. J Zecherle, WKTS, 414-457-5561.

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Scientific Atlanta DAT-32 receiver, 15 kHz stereo audio card for use w/all major networks, like new cond, \$1000/BO. Chip, KCPS, POB 946, Burlington IA 52601. 319-754-6698.

CA Microwave AD-2 downconverter for satellite system, \$200/BO; Amplica CD-304302, LNA, 120°, s/n 558, \$75/BO. K Eilert, KWED, 609 E Court St, Seguin TX 78155. 512-379-2234.

Drake ESR 2240 satellite receiver, receives A/V signals. P Bailion, 612-222-5555.

CA Microwave satellite receiver mainframe w/PS 01 pwr supply module, SQ 01 cue chnl module, (3) SD 153 prog chnl modules w/freq of 64.0 MHz, 64.4 MHz, 76.7 MHz, 77.9 MHz (primary), wrking when removed, \$1500/BO. K Eilert, KWED, 609 E Court St, Seguin TX 78155. 512-379-2234.

Wegener 1601 satellite receiver for SMN Stardust, compl w/all cards & manuals, \$1200. S Schweiger, WXLO FM/AM, 146 Worcester Ctr, Worcester MA 01608. 508-752-1045.

Fairchild DART-384 digital audio rcvr, Salcom 1-R cards, \$5000. L Penke, WKTT-FM, POB 26, Cleveland WI 53015. 414-693-3103.

Wegener 1601, w/SMN cards, ready to wire up, \$800. G Muse, KMRF, POB K, Marshfield MO 65706. 417-468-6188.

Dart 384 w/15 KHz, +75 KHz, voice cue card, complete. D Lang, 503-774-0459.

Want to Buy

Varian or MCI pwr supply for Klystron TV uplink, need 8200 V at 1 amp, 3 phase reg; also, 5 meter TV uplink dish antenna, C-band, folding on trailer OK. U George, Ugly George Satellite TV, 314 W 52 St, NY NY 10019. 212-969-0240.

Satcom 1-R 7325 7.5 kHz decoder, will trade Satcom 1-R 7325 digital processing unit, 15.0 kHz, dual audio decoder, never used. J Swartz, WCSM AM/FM, Meyer & Schunk Rds, Celina OH 45822. 419-586-5133.

Scientific Atlanta 6600 satellite receiver. J Wagner, WMBI AM-FM, 820 N LaSalle Dr, Chicago IL 60610. 312-329-4279.

Scientific Atlanta Unistar AM-only format receiver. C Tarkenton, WCOH/WMKJ, 154 Boone Dr, Newnan GA 30263. 404-253-4636.

SOFTWARE

Want to Sell

Wire service capture and news editor. Save on paper! Computer and software: lease \$60 month, purchase \$1,495. Software only, \$495. Info: FAX 605-892-2669.

FOR SALE: Ron Balonis' Broadcast Engineer's Computer Toolbox for IBM compatible computers. For details, send name and address to COMPUTER TOOLBOX, Ronald F. Balonis, 118 Rice Street, Trucksville PA 18708-1628.

Blues & jazz host/producer, in depth collection & knowledge. PT OK, San Francisco/North Bay area. S Lawson, 928 Hyland Dr, Santa Rosa CA 95404. 707-528-4055.

Top 40, A/C college & sm market prod, DJ, 6 yrs exper, will relocate anywhere in US, any market, FT only. M Allyn, 708-673-0783.

If PT eng is needed for older tube-type equip, have tubes & can travel in N New England. Mark, 603-625-1165.

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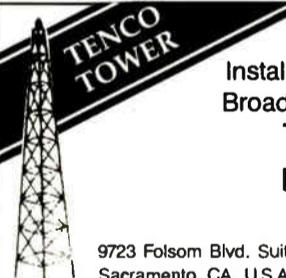
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STATIONS

Want to Sell

SHORTWAVE STATION

Shortwave Radio Antenna/Transmitter site in New Jersey Wetlands next to Station WOO, Ocean Gate, NJ. State approval for 6 towers & transmitter building. Information: Mr. Knox, POB 250, Toms River, New Jersey 08754 or call 908-349-1100.

CALIFORNIA WINE COUNTRY Cable Radio in over 100,000 homes. Target Audience M/F 25-54. 714-848-7887.

AM daytimer in NE TN serving 5 counties, 1 kW, county of license population: 45,000+, vry lw operating overhead, relatively new studio facilities in modern mall, Continental 314R, AM xmt, less than 5 yrs old, station owns satellite facilities, terms neg w/sm down payment, shown only by appt, ref req'd, serious inq only. B Mountjoy, POB 1240, Elizabethon TN 37644. 615-543-8449.

New 50K FM in Southern Missouri Lakes area. 417-273-4308 (evenings & weekends)

50 kW AM clear daytime, 500 Watts DA night southern gospel in bible belt, some financing. 919-734-8000.

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Class A, WIST 94.3 FM, Lobeville TN w/50 kW CP on hand is once again being offered at a reasonable price of \$150,000. We will consider \$50,000 down, balance on easy terms w/references required. Located 1/2 way between Jackson & Nashville TN, just 10 miles south of I40 & the famous Loretta Lynn's Dude Ranch. Call for appointment today & inspect this nice facility. Bill Coleman Jr, 615-593-2294.

AM & FM in stable TX market, owner financing possible, grt opportunity for owner operation, real estate & home incl. 216-331-8012 or 305-296-7575.

Want to Buy

FM CPs wanted in sm, med, lrg markets, college/resort preferred, will consider dark/bankruptcy. E Pollock, 1st Brcdstng, POB 691, Wilmette IL 60091. 312-263-6868.

AM/FM/combo wanted to take over w/no down, owner financing. L Haber, POB 136, Woburn MA 01801. 617-246-5634.

LPTV CPs, in AZ, CA, CO, FL, TX, exper brdcast seeking gd father/daughter operation, send compl details w/\$. J Powley, WIM TV, 1536 Logan Ave, Altoona PA 16602. 814-944-8571.

AM, FM, AM/FM combo, no cash down w/some owner financing, prefer an owner ready to retire or pursue other interests, all areas considered. K Weiss, POB 550515, Jacksonville FL 32255. 904-928-3257.

STEREO GENERATORS

Want to Sell

McMartin SCA gen on 67 kHz, like new, \$750/BO. B Williams, KPSM, 2009 W Gary, Broken Arrow OK 74012. 918-455-9522.

Marcom/Rood SC 203 w/manuals, new, \$2000. Donovan, KSKS, 5265 W Magill, Fresno CA 93722. 209-233-9393.

Moseley SCG-4T 67 kHz subcarrier gen; **McMartin BFM-2001 67 kHz subcarrier gen**; **Johnson Elec 1C-1 67 kHz tuner**; **Belar SCM-1 SCA mon**, BO. Ron, WAWZ FM, Weston Canal Rd, Zarephath NJ 08890. 908-469-0991.

Want to Buy

Optimid 8000A, will pay cash, leave message at 703-276-0125.

SWITCHERS (VIDEO)

Want to Sell

JVC KM-2000 w/special effect gen, almost new, 8 video inputs on A/B/C buss, use w/1/2 or 3/4", genlock, \$2400. Jays, Nimbus Prod, POB 5903, Takoma MD 20912. 301-507-3358.

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Christian music library w/over 2,200 record LPs, 12" singls, & a few 45s & CDs, some never opened, several collectors items, \$3000. E Finley, KNYN, 2015 W Cactus Rd #193, Phoenix AZ 85029. 602-861-0311.

Comedy music show, 30 min weekly, well done feature, audition tape \$1, subscription \$2/week. R Schoedel, WMCR-AM, 6630 Monclova, Maumee OH 43537. After 3PM EST: 419-893-7968.

U-matic cassettes (400), 1 pass only, like new, incl library cases, some shipping cases, 5/10/15 min lengths, \$2 ea; 20/30/60 min, \$3 ea; shipping xtra. J Powley, WIM TV, 1536 Logan Ave, Altoona PA 16602. 814-944-8571.

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Ampex 642 NAB reels (500), 10-1/2", w/boxes; (100) poly cassette boxes. B Dierking, KNDY AM/FM, RR3, Marysville KS 66508. 913-562-2361.

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Large collections of 45s, '50s, rock, R&B, country. K Gutzke, Custom Rcrdng, 7134 15th Ave S, Minneapolis MN 55423. 612-866-6183.

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Portable PA system needed for missionary work in Ghana; also, need (4) Utility towers, 80-100'; C Riddle, World for Christ Radio, 703-878-4141.

Brdcast Training School for Underprivileged in need of any AM brdcast equip, will pay shipping on sm items. F Smith, 615-624-7126.

Educ radio/TV needs cart R/P & player; 78 rpm TT, stereo R-R for prod; all wrking cond; will pay shipping. K West, SRSU, Dept Fine Arts/Comm, Alpine TX 79832. 915-837-8219.

Red Cross needs video & audio equip incl video switcher & recorder, will pay shipping & provide tax certificate, call w/avail equip. G Kirby, 614-261-8871.

Educ station seeks tax deduc donation of any brdcast equip, computers, carts, etc, will pay shipping. J Violanti, WSJR, 5600 City Ave, Philadelphia PA 19131-1395. 215-660-1082.

Eng student desiring donation of old brdcast 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.

Gorman Redlich CM antenna phase mon, 2-twr, digital display. C Freinwald, KBSG, Seattle. 206-343-9700.

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ACTION-GRAM

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B&B Systems AM-2 audio phase mon, CRT XY display, w/calibrated graticule for phase, ANSI calibrated VU meters & peak meters for every chnl, magnetic & EMI/RF shielding, excel cond, \$2000. G Fern, POB 2366, Van Nuys CA 91404. 818-778-6756.

TTI/Tautron 1120 xmission test set (2). (1) AC only, (1) AC/battery, digital display of dBm & freq, 35 Hz-23 kHz, -40 to +10 dBm, 600/900 ohms, full duplex testing w/C-message, much more, call for details. \$1000. T Wright, WJJD/WJMK, 180 N Michigan Ave, Chicago IL 60601. 312-977-1800 X100.

HP 206 audio sinewave gen, uses tubes, \$300/BO; HP 330B audio distortion analyzer, uses tubes, \$350/BO. K Eilert, KWED, 609 E Court St, Seguin TX 78155. 512-379-2234.

B&W distortion meter & audio oscillator, both work, \$50 both. G Muse, KMRP, POB K, Marshfield MO 65706. 417-468-6188.

Leader LPM880 RF wattmeter, 3 scales: 0-5 W, 0-20 W & 0-120 W, new, \$150. S Lawson, KAK Prod, 928 Hyland Dr, Santa Rosa CA 95404. 707-528-4055.

Leader LAG-120B audio gen, BO. L Penke, WKTT-FM, POB 26, Cleveland WI 53015. 414-693-3103.

Tektronix 1420 vectorscope, excel cond, \$1100; Tektronix 528A waveform mon, \$1100. G Guarino, Sorcerer Sound, 19 Mercer St, NY NY 10013. 212-925-1365.

Leader LPM880 RF wattmeter, 3 scales: 0-5 W, 0-20 W & 0-120 W, \$150. S Lawson, KAK Prod, 928 Hyland Dr, Santa Rosa CA 95404. 528-4055.

HP 8690 B sweep gen mainframe, \$450; HP 8699B 100 MHz-4 GHz YIG tuned plug in, \$500; HP 8696A 19-26.5 GHz plug in, \$400. Gary/Mike, KFYI, Phoenix AZ. 602-258-6161.

Sencore FC71 freq counter, \$650; HP 239 oscillator, \$385; HP 331A distortion meter, \$500; HP 400E voltmeter, \$200. B McKenney, 501-967-5451.

Knight KG-635 oscilloscope, \$50. Bud, TV-40, 4237 Airline, Norton Shores MI 49442. 616-733-4040.

Fidelipac 390 flutter meter; Heath IM-58 harmonic distortion meter; Heath IG-72 audio gen. P Wahl, WWIB/WOGO, 5558 Hallie Rd, Chippewa Falls WI 54729. 715-723-1037.

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Continental 27.5 kW FM xtrm, '87 model, excel cond. Kevin/Corey, 512-345-9300.

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

McMartin B-910 exciter. B Schloss, KRRO, Sioux Falls SD. 605-335-6500.

Gates TE-1 exciter & stereo gen, \$500/BO; Collins A-830 exciter & stereo gen, \$750/BO. B Williams, KPSM, 2009 W Gary, Broken Arrow OK 74012. 918-455-9522.

RCA BTE 15A w/extender board. Dale, 503-774-0459.

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Kahn STR-84 Powerside, tuned to 1270 kHz, \$6000. J Wilks, KNWZ, POB 1270, Palm Desert CA 92255. 619-346-1270.

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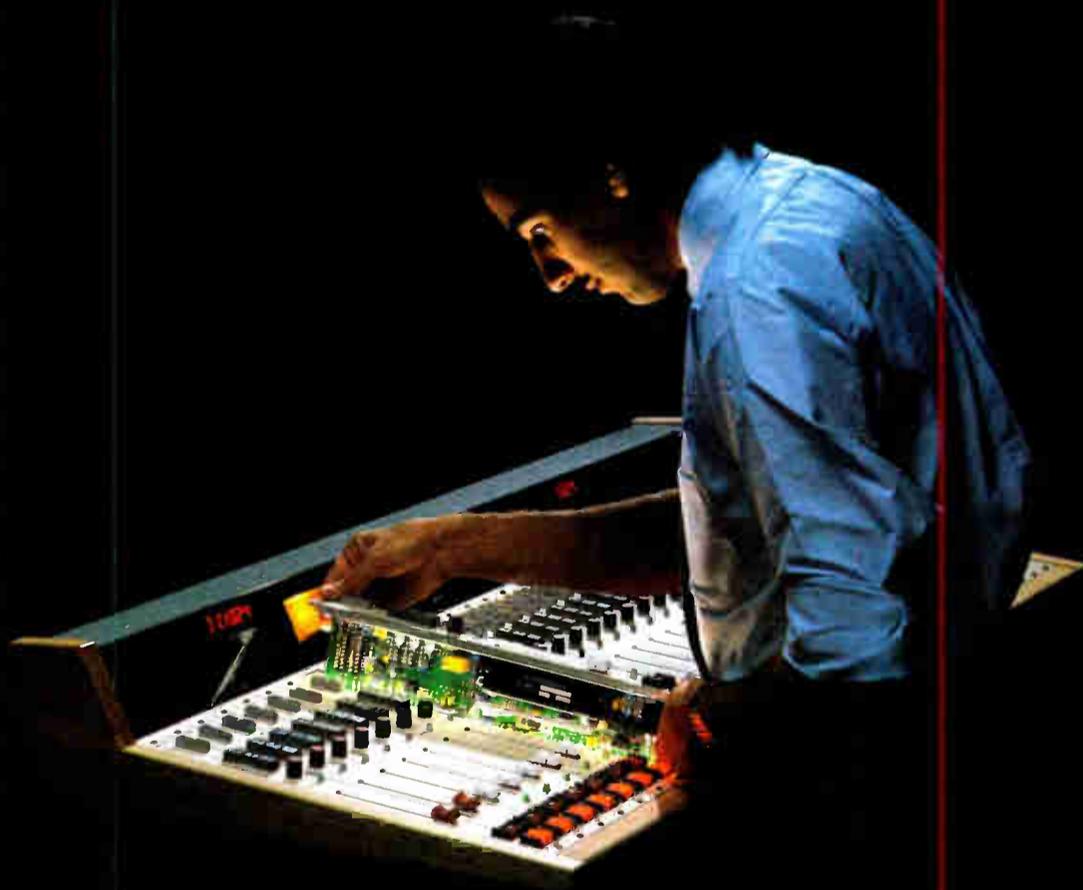
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These consoles give you full multitrack production capability while at the same time providing familiar program and audition busing so your production room can double as a back-up on-air facility. They free up your primary Air studio for routine calibration and maintenance sessions. They are a perfect solution for complex talk or news formats.

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