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Radio World



See pp. 15-25

Vol 18, No 18

Radio's Best Read Newspaper

September 7, 1994

USA Digital On-Air in Chicago

by John Gatski

WASHINGTON While the official third party testing of digital audio broadcasting (DAB) transmission moves slowly at the NASA Lewis Research Center in Cleveland, in-band DAB proponent USA Digital has been transmitting its own field test signals in Chicago.

CBS-owned WBBM-FM and Gannett-owned WGCI(AM) have been discretely transmitting the in-band, on-channel signals on the AM and FM signals for about two months. Project insiders say that the system is working very well with no problems with multipath or fitting the DAB signal on the analog signal.

Jeff Andrew, Project Acorn's project engineer and WGCI's chief engineer, said USA Digital has not made a public announcement about the broadcasts in order to determine if they would get any complaints from listeners or adjacent stations. No complaints have been made, according to Andrew.

(RW will publish a follow up story on the Chicago broadcasts in a future issue.)

Andrew said that the FM system is very immune to multipath fades—even when the analog signal fades—and the digital signal is within bandwidth of the analog channel. Andrew said the AM DAB quality approaches 15 kHz frequency response.

USA Digital's own on-air field testing is way ahead of the Electronic Industries Association/National Radio Systems Committee testing at the NASA Lewis Research Center.

Although its original testing sched-

the likely estimated completion date of just the lab tests is now the end of the year.

The EIA and NRSC are overseeing eval-

An experimental FCC license allows Project Acorn to transmit AM/FM DAB signals.



ule predicted that the DAB system laboratory testing would be concluded this month and field testing would then begin.

uation of five potential DAB systems. The proponents include USA Digital's in-band, on-channel; Amati/AT&T's in-band, on-channel; AT&T's in-band adjacent channel; the European-developed Eureka/ Thomson out-of-band; and the NASA/VOA Satellite system.

The NRSC is responsible for coordinating test results of the in-band systems. In-band is the most desired system for broadcasters because it would disrupt the spectrum structure the least, according to the NAB.

As of early August, according to NASA Lewis Research Center Spokesman Jim Holansworth, the system testing is "maybe a third of the way through." He predicted that field testing will not begin until first of the year—following completion of the lab tests.

Whenever the lab test and field tests are completed that information will be forwarded onto the EIA and NRSC, which will make recommendations that likely will be reviewed by the FCC. The FCC's course of action could range from simple technical guidelines (if in-band is recommended) to a new allocation scheme for a new band system.

In other DAB news, the EIA plans to hold a meeting with receiver manufacturers this month at the Radisson Plaza Suite in Cleveland.

The meeting's intent is to determine procedures to deploy digital radio technology that account for technical, economic, marketing, and legal/regulatory objectives.

Contractor Ins, Outs In NAB Book

by Tom McGinley

WASHINGTON In the frenetic pace of broadcasting today, most station owners and managers tend to focus all their energy on choosing and managing sales and programming personnel, while the technical needs are lucky to command only cursory consideration for a few brief moments of a given day.

When it comes to choosing and using a consulting or contracting engineering service, many station managers simply call a few fellow managers and if a recommendation on a readily available firm is favorable, it is usually hired. This can often lead to disappointing and sometimes disastrous results.

Overdue book

The NAB recently released a long overdue and extremely useful publication which could easily remedy this situation. Authored by Andy Butler, the book is titled, "Practical Tips for Choosing and Using Consulting and Contracting Engineers." Butler is well-known in the industry and has worked as a station chief engineer, a major group director of engineering, an independent international broadcast consultant, and staff engineer for the NAB's Office of Science and Technology. He recently left the NAB to join Broadcasting Electronics.

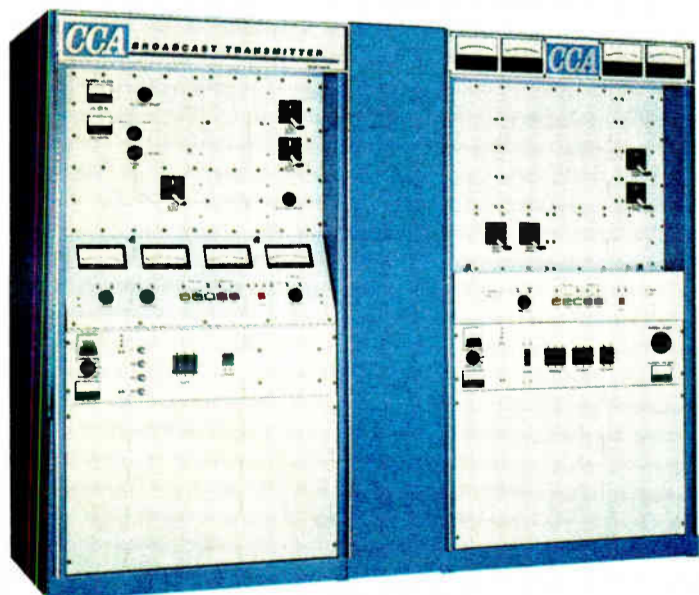
"Practical Tips..." is a must read for any owner or general manager who is getting started with a new station or who has had trouble finding and securing the best technical consultant or contract engineering service provider for his or her station's specific needs. Although they are not the target audience of this book, most contract engineers would also greatly benefit from the valuable insights and suggestions offered by the book.

Contractor or consulting

What really is the difference between a consulting engineer and a contract engineer? Butler identifies and details the specific services offered by most traditional consulting engineering firms, as well as those available from the newer, more broadly and loosely

continued on page 6 ▶

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NEWSWATCH

FCC Lifts Freeze on Comparative Applications

WASHINGTON Following a decision not to appeal a court decision invalidating much of the FCC's policy on evaluating "competing applicants," the commission decided to lift the freeze on applications that might be subject to competitive filings.

A 1993 U.S. Court of Appeals decision held that one of the principal criteria used in evaluating competing applicants, the "integration of ownership into management" factor, was unlawful. Earlier this year, the FCC suspended most "comparative" considerations of station applications.

Generally included in the freeze were: new station applications; issuance of cut-off lists; FM and TV filing windows; all AM station upgrades; some FM station upgrades, and comparative renewal applications.

The FCC is still writing a new set of policies for dealing with comparative situations, but for now has decided to limit the scope of the original freeze order.

The commission resumed processing of applications for new AM, FM, and TV stations, upgrades and major modifications of existing stations, and requests for rulemakings to amend the TV or FM Table of Allotments. As it had prior to the freeze, the commission will resume

issuing AM and TV cut-off lists and will open FM filing windows.

Processing will, however, be suspended if the applications are, or later become mutually exclusive with other applications.

Debate Sponsorship Guide Available from NAB

WASHINGTON Broadcasters wanting to organize station-sponsored political debates now have "A Broadcasters Guide to Debate Sponsorship" available to them. The National Association of Broadcasters (NAB) distributed the how-to, pocket-size pamphlet to radio and television stations last month.

The free guide was prepared for NAB by The Commission on Presidential Debates.

The guide provides practical, step-by-

step advice on event budget, debate preparation, candidate negotiations, debate site and choice of format. NAB members can obtain copies by accessing Help-Fax at 301-216-1849; non-members can call 202-429-5350.

1994 Radio Revenue Still Climbing Fast

NEW YORK The first half of 1994 proved a banner six months for the radio industry. According to the Radio Advertising Bureau, combined local and national spot revenue increased by 11 percent over the same period in 1993. June 1994 revenue, while softer than previous months, grew at an overall rate of 9 percent.

Local revenue was up 11 percent for the first six months of 1994, and national spot radio grew 12 percent, for the combined rate of 11 percent. Revenue gains, said the RAB, were relatively consistent across all regions of the U.S.

Local revenue for the month of June grew 9 percent over June 1993, with three regions posting double-digit gains. National revenue growth in June was 8 percent over June 1993.

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

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

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The Phantom can retime spots to fit them cleanly into a satellite break without inserting silence, overlapping, or running late. The Phantom



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

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

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

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

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Expanded Band, EBS Rules Still Pending

Radio Stations Ready to Move to New AM Band; EBS Rule Implementation Was Slated for Spring

by John Gatski

WASHINGTON Two significant radio actions that have been on the FCC's agenda for months still have not been resolved: adoption of EBS rules regarding new technologies and final approval of the expanded AM band allotment process.

As of early August, both rulings had been completed by FCC staff and left in the hands of the FCC commissioners.

Dr. Helena Mitchell, chief of the EBS division said that she thought a ruling would have been issued on the new EBS technology several months ago, but the commissioners are still considering it.

Some FCC staff members privately admitted that higher profile issues, such as cable regulation and PCS spectrum auctions, have eclipsed pending radio

rulings. Also, the FCC may be delaying a decision until the newest commissioners become versed in the vast number of communications issues.

The NAB also has pressured the FCC not to adopt rules that would force stations to

A new Emergency Broadcast System technology or technologies would increase reliability, according to proponents.

choose a new EBS system that requires a major investment.

In the FCC staff's proposed ruling on EBS, the FCC would allow TV and radio stations to choose new technologies, such as RDS, to relay alerts to the public. EBS

has been controversial in recent years with detractors claiming that EBS has broken down during actual emergencies. A new technology or technologies would increase reliability, according to new technology proponents.

New EBS technologies tested by the FCC in 1993 included the Emergency Warning System by Sage Alerting, an RDS system, which (requires new

enactment in the spring because some of the initial recommendations were "deficient"—especially those that require expensive new equipment.

Umansky referred to another alternative: Vice President Al Gore's announcement that billions of dollars would be put into the existing National Weather Service communications system to make it an "all-hazard" alert systems. "The FCC ought to take that into consideration," Umansky said.

As for the expanded band 1605 kHz-1710 kHz, FCC AM Branch Chief Jim Burtle said that the computer-calculated allotment plan is now before the commissioners, but there are some reconsideration petitions that have to be settled including one challenging the preference criteria used in the proposed allotment scheme.

Although about 600 stations initially applied for the expanded band, the initial allotments will number less than 100, according to the FCC.

"I'm hoping they'll release (the allotment scheme list) shortly," Burtle said in early August. Even if it is approved right away, he said, a 60-day reply comment period has to take place, which means the earliest stations could begin broadcasting on the new band is early 1995.

AM Transmitters Get Reprieve from the FCC

by John Gatski

WASHINGTON The FCC has ruled that its field inspectors will take into account the type of transmitters being used by AM stations when they are found not to be in compliance with the NRSC-2 mask. The NRSC-2 occupied bandwidth requirement went into effect June 30

The ruling was prompted by the NAB (RW, Aug. 10), which asked the Commission to grant some kind of relief for stations using Harris MW-1 and Continental 317s, which may not meet the occupied bandwidth parameters of NRSC-2. About 600 Harris MW-1 and 300 Continental 317 are still in use.

In its response to NAB request, the FCC said: "If a station is found not to be in compliance with Section 73.44(b), FOB (the Field Operations Bureau) will issue a Notice of Violation and request an explanation from the licensee."

The letter further stated: "If the violation has not caused interference to another party, is a consequence of transmitter design rather than lack of maintenance, and the licensee can establish that it is working diligently with the transmitter manufacturer to correct the problem, FOB will not issue any Notice of Apparent Liability for that particular violation."

The FCC said it will apply its case-by-case approach until January 31, 1995, at which time it "will re-examine the issue."

Harris and Continental said they are working on upgrades that hopefully will be economical for stations to implement.

John Marino, manager for technical regulatory affairs, NAB, said the FCC made a correct decision on giving stations extra time to try and correct problem. "I think it's fair. As long as they give broadcasters time to resolve the issue," he said.

**RW
update**

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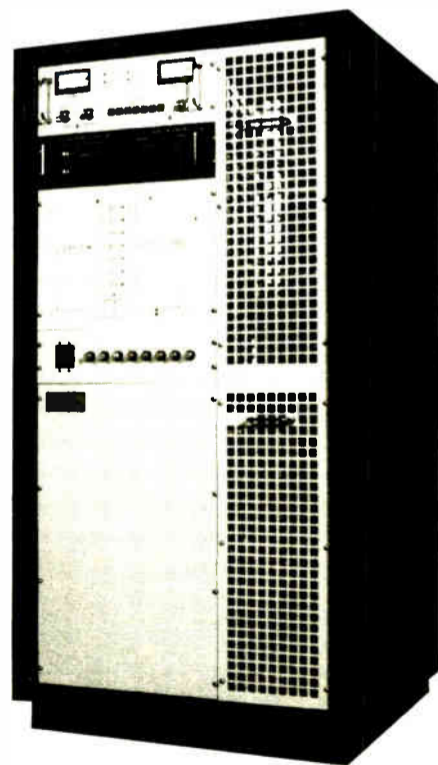
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Michigan Plays Ball on Public Radio

WASHINGTON Baseball may be on strike, but the show must go on. Lucky for radio, football preseason is underway, and disappointed fans can turn to pro or college football for their sports entertainment fix. Even on public radio.



Now, sports fans might not equate public radio with sports excitement, but that's just the case up in Michigan. Sept. 3 marked the return of University of Michigan football and basketball games to Michigan Radio, the University of Michigan Public Radio Stations, after a seven-year absence.

Detroit-based WJR (AM) is still the flagship commercial station for the University of Michigan Wolverines, but Joel Seguire, Michigan Radio general manager, discovered a July 1989 letter stating that WJR General Manager James Long would not object to the non-commercial broadcast of Wolverine games.

Shortly after Seguire confirmed the letter with Long, Michigan Radio announced it would resume play-by-play coverage of Wolverine football. Talk about exciting non-commercial radio!

Michigan Radio will rely on veteran announcer Tom Hemingway to call the football games (this will be his 25th season). Tirrel Burton, longtime coaching

assistant and current assistant director for the University of Michigan athletic department, will add color commentary to the games.

Engineering expertise will be provided by Peggy Watson, Michigan Radio operations manager, who will serve as broadcast engineer at the stadium.

★ ★ ★

And as radio must go on, so too must the regulatory wheels keep turning. **RW** recently began a series of articles on license renewal, authored by our former managing editor, Randy Sukow. Randy recently moved on to pursue other interests, so you'll notice a brief interruption in the renewal series. We'll pick up the series again in October.

Watch for these articles, which will cover a variety of issues that often pop up in the renewal process, including:

EEO part II, recruiting women and

basis for challenges.

Maintaining a file; demonstrating service to the community and plans for continued service. What should and should not be (legally) in the file.

Content regulations: A look at the likelihood of challenges based on indecency charges; maintaining enough news and public service on music-intensive stations.

Summary and review: a list of steps stations can take to protect themselves before the renewal process begins.

Of course, letters and phone calls are always welcome. Please share your thoughts or experiences on the issue with other **RW** readers.

On another note, don't forget that the NAB Radio Show (part of World Media Expo this year) is just around the bend. Show dates are Oct. 12-15, with technical/

engineering seminars scheduled for Oct. 11. Make your plans to attend now, and look for our preview in the next issue.

★ ★ ★

Our condolences to the family and friends of Anthony P. Catella, a retired broadcast executive and former newsman for the Associated Press. Catella, 75, died last month after a stroke at his summer home in Myrtle Beach, S.C.

Catella joined the AP in Washington in 1939 as a dictationist and worked his way up to newsman. He later helped develop the Washington "city wire," a service that included the Washington calendar of events and condensed national news stories.

In 1967, he became a broadcast executive and launched the sale of the city wire to non-news outlets such as corporations and government agencies. He retired in 1984.

Catella is survived by his wife, Tilly; daughter, Patricia; and three grandchildren.



Hyatt Regency Chicago General Manager Jerry Lewin (L) pops in on WGCI's Doug Banks on his 36th birthday. The hotel hosted a live remote in its famous BIG Bar and a Grand Ballroom birthday bash with 2500 WCGI fans.

minorities: The best sources of job candidates; demonstrating recruitment efforts; how to report your hiring history properly.

Technical rules: Details on RF radio regulations; effect of the timing and wording of the new rules; frequency with which technical grounds are the



George Barber, sales manager, WNOE-AM-FM in New Orleans, has joined the National Association of Broadcasters as vice president of radio membership.

Barber, who replaces Donna Leonard, has a long career in radio, including stints as an announcer, sales manager and general manager. He spent 13 years with Mutual Broadcasting and NBC (both owned by Westwood One Radio Networks), holding several positions in station relations.

Bob McNeill, a consultant with McVay Media, has been named vice president of programming for Westwood One Radio Network

Formats.

McNeill is a 25-year industry veteran, including time spent as vice president for programming of the Viacom Radio Group.



Bob McNeill
Westwood One Radio Networks

Scott Martin will join the digital audio division of CBSI/Custom Business Systems Inc. Martin will coordinate sales for Digital Universe, CBSI's digital audio management and storage system for radio stations.

Martin most recently served as vice president for sales at Fidelipac Corp.

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France is calling

Dear RW,

I am interested in corresponding and exchanging programs with U.S. disc jockeys and programmers. I think it would be a good experience to have contact with American radio.

I can be reached c/o Radio PAC, BP 28, Studios de la Forêt, 19231 Pampadour Cedex, France.

Frederick Boucher
Pampadour Cedex, France

Wolfman Memories

Dear RW,

Alan Haber's article on Wolfman Jack in the July 27 issue of RW was great. It brought back memories of listening to the Wolfman late at night when I was in high school (1960 - 1961) beaming into my home in the San Fernando Valley. In retrospect, wasn't it XERB as opposed to XERF? Maybe both?

Alan H. Frank, director of broadcasting
WMLN-FM Curry College
Milton, Mass.

Defining indecency

Dear RW,

In his article of June 29, Charles Taylor is correct in his reservations about government regulation of broadcasters, but he is also a bit short-sighted.

It is true radio can "responsibly draw the line without the government playing referee" and that "parents must take control of their children's values and not expect the government to do their job for them." But simply saying the remedy to offense is our "ability to change the dial" really does not address the root of the issue of offensive broadcast material. If broadcasters would "just say no" to certain programming there would be less dial changing required.

The "right of free speech" assumes a responsible frame of reference, and the exercise of personal restraint. But no matter

where one decides to draw the line, there will always be others willing to go further. Laws are necessary to restrain unbridled extremism. A right without responsibility is not a right, it is a selfish abuse. The problem is who is to define what is and is not responsible.

It is not that the FCC cannot define "indecent," it simply has not defined it, at least not yet.

This issue is ultimately rooted in the question of morality and ethics. Pluralism dominates America (everyone is entitled to an opinion and all opinions are equally valid) and few seem willing to define standards to which we all become accountable. There has to be some standard to refer to. Relativism eventually erodes into chaos and anarchy. Even our founding fathers acknowledged America's system of government required a framework of Judeo-Christian values.

"Indecent" needs to be defined, then we can work to make it as fair as possible to as many as possible.

Duane L. Burgess
Tucson, Ariz.

Valuable early tool

Dear RW,

Read G. Burgen's review of the early Brush Soundmirror tape recorder (RW, July 13) struck a familiar chord. It was one of this very model that displaced our Presto "instantaneous transcription" acetate disc recorders, circa 1948 when I was working at WPIT-AM-FM in Pittsburgh, and provided my first hands-on experience with tape equipment. While consistently acceptable recording was always an art with disc equipment, such early tape machines as the Brush reduced it to a predictable process.

The recording volume indicator on the Brush machine was the "magic eye" cathode ray variable-shadow tube used as tuning indicators in radios of the '30s and '40s, as well as in later consumer-model recorders by Wilcox-Gay, Pentron and even Magnecord. As for the cork capstan surface, I originally surmised that if the oxide surface of recorded tape came into intimate contact with a steel surface, the steel could "short out" some of the magnetic pattern, thereby partially erasing it. Maybe Brush thought so too. Of course, later machines quickly dispelled this supposition.

Burgen did not mention that the earliest tape was paper-backed and tore quite easily. Early publicity touted ordinary cellophane tape for convenient splicing; only by experience did we learn that in time it bled tenaciously to adjacent layers. Melting of the plastic reels was not a problem; I believe early tape came on metal reels. I did not recall that the take-up reel on the Brush full track machine would tape oxide-out, but I am reminded that before standardization, some early machines required "A-wind" supply reels, while others were designed for "B-wind." One was wound oxide-in and the other oxide-out.

I cannot confirm Burgen's frequency response statistics for the Brush, but I still remember doing a spot check with an oscillator (at full recording level) and being appalled, on playback, by spurious

Stay Ahead of The Game

Interested parties should be encouraged with the news on digital audio radio. Systematic progress is happening around the globe toward the selection of a digital broadcasting system. Be it L-band, S-band or in-band, governments and broadcasters want to find the right digital radio system and are willing to work at it.

Here at home, official third party testing of digital audio radio transmission moves slowly at the

NASA Lewis Research Center in Cleveland. The work must go on objectively and carefully, but it must continue to move forward or risk losing valuable ground.

In Europe, where the future of Eureka-147 Digital Audio Broadcasting seemed unclear just 12 months ago (due to financial restraints) pilot projects now are planned in many nations and more manufacturers are developing equipment.

Receiver development continues apace with the transmission work. In addition to the previously announced development of Pioneer L-band receivers in Japan, German manufacturer Grundig announced it will deliver 3,000 to 5,000 consumer DAB receivers for a pilot project set to start in Bavaria next year.

BBC Research and Development also is hard at work on equipment. According to the BBC, it has developed an experimental DAB COFDM generator and multiplexer. These units allow a flexible choice of multiplex configurations and will accommodate use of 2 megabits per second data links for distribution.

Digital radio interest is also spreading out from Europe and Canada to other nations, such as the Arab States, Australia and even both India and China.

Digital radio will arrive here as well, but it may not be the same transmission as the rest of the world or be implemented on the same timetable. U.S. companies, however, should endeavor to keep pace. We need to complete tests here in a comprehensive and timely fashion, while keeping an eye on progress elsewhere to learn from the trials of others.

It is imperative that until a digital radio system for the U.S. is chosen, the testing bodies and companies involved continue research work without undue outside pressure. But let's make sure the research progresses in a systematic fashion towards the ultimate goal: the selection of a digital radio system.

-RW

tones, audible beats between applied tones and the bias oscillator. Despite its faults though, the Brush was a valuable addition to budget stations until Magnecorders came along.

R. H. Coddington
Richmond, Va.

Radio dreamin'

Dear RW,

I read with some interest your Aug. 10, editorial, "Writer Rules that Last." A nice dream perhaps, but a dream. There are several reasons why that has not happened in my 30 years in the broadcast industry...nor will it any time soon.

The first, clearly, is advancing technology. A moving target itself, technology would be held back even more than it is now by rules which, if left unchanged, would ultimately remove many economic incentives from research and development. Look what the new rules did for FM and TV stereo. Look at what their absence did to AM stereo.

Another is our "public" and our world. Complex and often deeply divided, its best interests are not always met by an industry governed by rules of a previous generation. With apologies, "This is not your father's Conelrad."

By far, the most compelling reason for continually shifting regulatory sands is that the FCC itself is a political animal. Increasingly, appointments have been subject to political scrutiny in the Senate and political comment in the press. More now than at any time in history, the FCC is being asked to help advance social agendas that have nothing to do with radio interference, directional antennas or frequency tolerances. Affirmative action,

content regulation, and file management are demanding more of the commission's—and the broadcaster's—time. I do not expect this will change much.

I suspect that for a long time to come, folks like Harry Cole, Harold Hallikainen, Pike and Fischer and I will have plenty to write about.

Jim McDonald, Editor
The Broadcaster's BIGBOOK Project,
Loveland, Colo.

DXing anyone?

Dear RW,

My hobby is AM/FM DXing. I've enjoyed this activity for more than 20 years. This is not a crowded hobby. Most folks ask, "What's DXing?" When I tell them it is picking up distant radio stations and keeping a log of them, they ask, "Why?"

I would like to see you print an article on distant AM/FM listening. I would love to see an article on FM skip. What has always fascinated me is the ability to pick up a low-wattage FM station 1200 miles (or more) away, crystal clear, even in stereo.

Whatever salute you would care to give DXing would be greatly appreciated. Thanks for a great publication.

Dave Lanham
Corbin, Ky.

Editor replies: Dee McVicker recently saluted DXing when she wrote about a DXers Club in the May 4 issue of RW. To find out more about the National Radio Club's monthly DX magazine or its annual "After Dark" series, write: National Radio Club, Publications Center, P.O. Box 164, Mannsville, NY 13661.

Radio World

Vol. 18, No. 18

September 7, 1994

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Radio World (ISSN: 0274-8541) is published bi-weekly by Industrial Marketing Advisory Services, Inc., 5827 Columbia Pike, Suite 310, Falls Church, VA 22041. Phone: 703-998-7600, Fax: 703-998-2966. Second-class postage rates are paid at Falls Church VA 22046 and additional mailing offices. POSTMASTER: Send 3579 forms and address changes to Radio World, P.O. Box 1214, Falls Church VA 22041. Copyright 1994 by Industrial Marketing Advisory Services, Inc. All rights reserved.

—PRINTED IN THE USA—

**Next Issue of
Radio World
September 21, 1994**

Contract Engineering Book by NAB

► continued from page 1

defined arena of broadcast contract service providers. Many functions now overlap these two groups as full service and special service contract operators now offer some of the services usually associated with established consulting firms.

Contracting is a relatively new field in broadcasting and came about to fill technical needs as modern equipment required less attention. Deregulation allowed most stations to scale back their technical maintenance operations and eliminate full-time engineering positions. Traditions and operating practices in this field are not yet well established. Contractors range from individual equipment operators and repairmen, to multi-state corporations with staffs and skills capable of planning, designing, and building complete broadcast facilities. Butler delineates all the variations of skill levels, abilities, and services consultants and contractors typically provide.

"Evaluating Consultants and Contractors" is perhaps the most important chapter in the entire book. Butler offers a well organized, step-by-step discussion of how the station owner or manager can best meet the challenge of accurately identifying the abilities of the consultant or contractor and making certain they

match the station's needs.

Critical in this process is weighing the advantages and disadvantages inherent in selecting an individual contractor versus a larger multistaffed firm. Many of the tips offered are strategies most would have never considered on their own.

After the station enters into an agreement with the selected contractor or consultant, the owner or manager must maintain awareness and control of their activities and their impact on station operations if the relationship is to be successful.

Small-market concerns

The only area Butler did not address here often affects small market stations. What can a small station do in areas where no qualified or acceptable contractors are available to serve its needs? Perhaps identifying and cultivating a relationship with a competent local radio/TV repairman, a two-way radio shop, a ham radio operator, or retired broadcast engineer living in the area is all that can be done. The key in those situations would be making sure such an individual had competent electronic repair skills and took a genuine interest in the station's well-being.

The book identifies compensation as the single-most contentious issue between stations and contract service providers.

Fundamental to a good relationship is a thorough understanding of all compensation arrangements, reduced to writing as part of the service contract or agreement in advance. Because the nature of technical service needs is often unpredictable, contingencies must be provided for. Butler offers some very sound guidelines for both the station and the contractor so that each of their particular interests are protected. They range from establishing a clear definition of what is to be covered under a basic retainer, if one is used, to specific charges for extra project or emergency work and attendant expenses incurred.

Butler details the various combinations of compensation arrangements in use by contractors, ranging from straight hourly or monthly fees to per project and blanket on-call retainers. The strengths and weaknesses of each arrangement are clearly spelled out. He also discusses non-cash and trade agreements and how they can be advantageously used as well as the pitfalls when they are sometimes abused.

An important section included in this chapter is a listing of suggestions on how to best manage and regulate costs for both consulting engineering work, including speculative projects, as well as those for contract service providers. The common thread running through all of them is simple: Take time to understand the work being done and plan carefully to maximize the return on the money spent.

Billing practices of contractors are a

common source of complaints by stations and often leave much to be desired, further antagonizing the station/contractor relationship. Butler again offers the common-sense advice that contract engineers need to devote more time developing easily understood, and clearly itemized billing statements, while station managers need to take more time to understand and track the contractor's work before it reaches the billing stage.

Looking at insurance

A chapter on insurance covers a sorely overlooked and misunderstood topic for contractors. While many consultants carry a form of malpractice (errors and omissions) and/or liability insurance, most contractors operate without any such protection. Liability for accidents and personal injury are also an important issue. Most stations should check to see if their insurance covers outside contractors while working on their premises. Butler includes a detailed insurance issues and procedures section in this chapter with specific suggestions for both stations and contractors. It is extremely valuable reading and the knowledge gained here could easily prevent a nasty law-suit from occurring in the future.

A chapter titled "Liability, Confidentiality, and Availability" carefully dissects these thorny issues and how they can easily adversely impact a station. Both consulting and contract engineers perform work that their client may not fully understand. Often, the service provider has to make judgement calls which the client is not in a position to judge independently. And there are legitimate factors that make it difficult for the

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service provider to fully determine all possible consequences of the work or advice they dispense. Uncontrollable or unanticipated events may produce results that are not in the client's best interests.

Because broadcast contract engineering is still a relatively new enterprise, there are few established operating traditions and legal precedents which can be used to settle disputes which sometimes result in lawsuits. Case law is still very young. Butler discusses some general guidelines which will lessen the likelihood of disputes and advises that clarifying terms and limitations in writing at the beginning of the relationship will be rewarded by fewer difficulties in the future.

Confidentiality is another issue often overlooked by contractors and their clients. While consulting firms have long practiced a strict creed of treating each client's information as confidential, contractors have no such established code of conduct and can unwittingly carry sensitive and confidential information between competing clients. It is the assumed responsibility of the contractor to maintain the security of such information, but it is probably wise for the station to articulate the limits of this requirement in writing.

Availability of prompt technical service, especially in emergencies is a critical concern for broadcasters. Butler shares a valuable overview of situations and solutions to the universal problem of a station needing immediate response to equipment breakdowns versus the contractor's ability to provide affordable and realistic resources and manpower for the fix. Both stations and contractors need to work together on planning for the unexpected, because it always happens at exactly the worst time, plus providing for redundancy and contingencies.

Project planning

The book includes a very useful guide to successful project planning and work structuring in Chapter 7. All station managers need to know how to plan and provide for the proper and efficient execution of construction projects for the station, both large and small. Butler guides you through the various issues and considerations to be confronted in this area and provides tips on how to best select and utilize the most appropriate contractor for a given project. The best bottom-line advice in the entire book occurs at the end of this section: "To be successful, all parties must be fully aware of the expectations of the others and those understandings should be reduced to writing in a letter of agreement or formal contract before any work begins."

Specific and invaluable suggestions on crafting that all-important written agreement are contained in Chapter 8, titled "Supervising and Evaluating Service Performance." While such documents need not be arduously long and complicated, they should not leave out important issues often overlooked, including availability, confidentiality, insurance coverage, reporting of activity, the buying of parts, and the all-important provision of who at the station is authorized to engage the contractor for work beyond the basic retainer services. A sample agreement is included in the book's appendix.

An important section on spare parts, supplies, and purchase procedures is included. After compensation and billing disputes, this is the most common source of friction for stations and contractors.

Butler gives a good recap of the three approaches most widely used, plus their pros and cons: 1-stock your own spares, 2-have contractors stock and provide all parts, 3-buy only as needed. Butler also includes suggestions on how to best provide for and manage the needs for special tools and test equipment. In addition to the station or the contractor furnishing these separately, sometimes a partnership can be forged to save both parties money and make equipment repair and testing more efficient.

Know your rules

Butler concludes "Practical Tips..." with a discussion of the importance of stations understanding and providing for FCC Rules compliance. "As a licensee, you cannot subcontract your responsibility for rules compliance. It needs to be managed on a continuing basis by someone at the station, just like the other basic necessities of billing, traffic, sales, and programming."

He offers various strategies to help enable this requirement, such as read NAB's "Guide for Broadcast Station Chief Operators," and consider hiring a consultant to do occasional "mock FCC inspections." He also suggests establishing an on-going compliance program to keep everything legal, since failure to comply can easily result in very expensive fines and/or possibly jeopardize the station's license renewal efforts if the infractions are serious.

The book's appendix offers a listing of practicing consultants and contractors. This is by no means an exhaustive list, and contractors not appearing on the roster can contact the NAB to have their firm added. The NAB makes no representation that any firm or individual listed is in any way recommended, certified, or approved, other than the professional engineering registrations of the full members of AFCCE (Association of Federal Communications Consulting Engineers).

□ □ □

Tom McGinley is chief engineer for WPGC-AM-FM in Morningside, Md. (Washington, D.C.) and technical advisor to RW.

Looking at Bandwidth With the Loop Device

by Chris Scott

BOWLING GREEN, Ky. The first round of AM bandwidth measurements are behind us, and my associate, Roger Hall, and I have learned important lessons about the best way to approach these new tests.

We tested a number of stations and gained some practical knowledge in this area and identified some potential pitfalls. About 30 percent of the stations we tested initially failed, with about an even split between bandwidth and harmonic related problems. In all cases these problems were curable—the testing led us to transmitter defects, usually modulator problems or harmonic trap misadjustments.

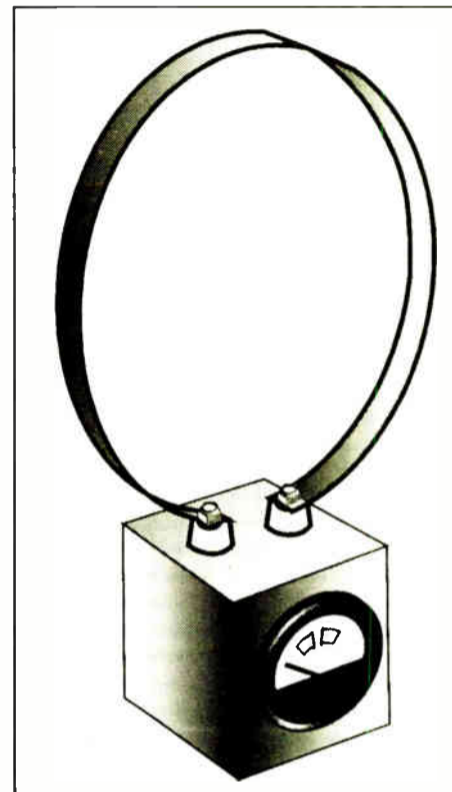
Aside from simply meeting the spectral purity rules, these tests had beneficial side-effects: true defects were identified and repaired. According to Bernie Stuecker, chief, equipment and standards branch at the commission, low signal-to-noise, interference from near frequency stations and the sometimes misunderstood effects of antenna factor are probably the most common culprits affecting accuracy of these measurements.

Acceptable procedures

Stuecker sets testing standards and procedures to be used by field operations personnel when determining station compliance. While at his office discussing AM bandwidth testing methodology, I asked him about the once common practice of using a communications receiver to check harmonics. Specifically I asked him if it was an acceptable practice.

"We would see [harmonic measurement] reports on file at the station indicating that the second harmonic was barely audible or was so many S units below carrier. If it is anything other than inaudible, how do you know if it meets the attenuation specifications?" Stuecker asked.

continued on page 9 ►



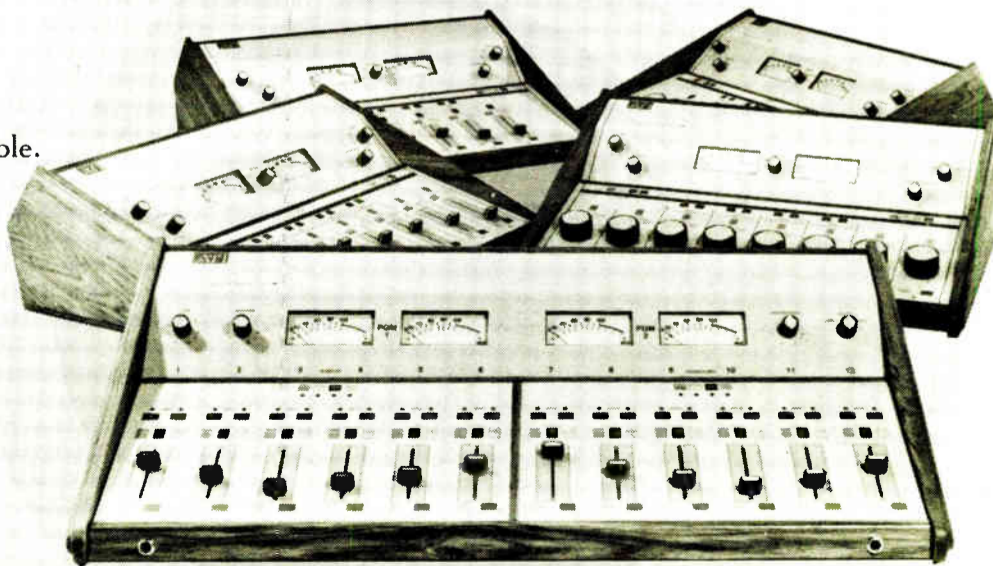
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Shielded Loop Yields Real-World Numbers

► continued from page 7

He indicated that they use a field strength meter to check harmonic levels. The receive antenna used with the spectrum analyzer when making these tests is critical; our experience comparing various antenna types used with the Tektronix 2712 showed that a broadband, shielded loop is arguably the best choice.

Signal-to-noise important

June was our busiest month conducting these measurements, and nearby thunderstorms contaminated the noise floor on more than one occasion. Locations away from power distribution systems and industrial areas were naturally the best. Achieving proper signal-to-noise and confirming that the client station was actually generating the recorded energy were probably the most important tasks.

In difficult cases we found it necessary to shut off the station to verify the emission source. Normal considerations for taking AM field strength measurements apply, and we found best results locating at the specified one kilometer or closer; when measuring the bandwidth of omnidirectional stations we found that proximity as close as one or two wavelengths showed the same results as at one kilometer, but with fewer noise problems.

The rules specify "approximately one

kilometer" for operating stations, and in my opinion this is a repeatable compromise between high signal-to-noise ratio and being representative of the signal that is radiated into the far field. It is easy to mistake ambient or electrical noise for the station's emission; if the measurement is erratic, it pays to corroborate it at a higher signal-to-noise location or with a dummy load sample.

The level that a sample port provides should be checked before connecting a spectrum analyzer direct because many instruments will be permanently damaged by more than a hundred milliwatts.

When chasing harmonic problems with a load tap, the engineer should note what type of pickup is used; a reflectometer port normally exhibits a 6 dB per octave increase in sensitivity, while resistive dividers should be flat. Equipment power came from a fairly large UPS that produced a sinewave output and was well shielded. Some units radiate and should be tested prior to beginning a measurement series.

Adjacent frequency

If the major noise source is another local station, the 20 dB null obtained with the shielded loop will not be enough to reduce it to near the level of the ambient noise. Obviously, arranging for the interfering station to be off the air during

the measurements will eliminate the problem, but if it happens to be the competition, it may be difficult to convince them to do this in the middle of the day, particularly if measurements need to be repeated for any reason.

In this case, with the client station off the air, it's best to record a spectral plot of the ambient RF environment and include it in the final data, demonstrating what cannot be blamed on the station. We usually recorded a plot for report inclusion showing the station at least nulled 20 dB to identify what signals followed the null.

One way to couple RF energy into a spectrum analyzer is to use a simple whip antenna connected directly to the 50 ohm input of the instrument. While this may be useful for quick and dirty checks, attempting to get meaningful harmonic level data this way will be misleading, often mistaken by 10 or even 20 dB.

At least two things must be known about the test antenna: The antenna factor, or relationship between its output and the field that it's placed into, and the impedance match which affects performance with various lengths of coax, and what mismatch loss needs to be considered. This information can be measured over the frequency range of interest (in our case, 500 kHz to 5 MHz) and combined into a calibration factor. Commercially available antennas are somewhat costly, so we developed and calibrated our own.

Although the FCC rules granted a grace period for measuring close-in bandwidth, yearly harmonic measurements were still required. Now that the June 30 deadline

has passed, both close-in bandwidth measurements and harmonic measurements are required. It is important for stations to note that the FCC requires stations always to be in compliance with regard to these two areas, even though measurements are only taken yearly. Our experience showed that if stations are in compliance at the second and third harmonics, higher order products were the same level or weaker.

Favorable locations

The most favorable locations for close-in bandwidth tests are less than ideal for harmonic measurements because ground-wave attenuation increases with frequency and is particularly noticeable at the third harmonic.

In one case while corroborating data recorded at one kilometer, measurement at three showed several dB improvement. Whether or not separate measurement locations are acceptable to the commission remains a question; this practice should probably be the exception, used only when compelling reasons exist.

Transmitter power levels of 5 kW and above must meet the full 80 dB specification. These often have harmonic traps and, once properly adjusted, usually have no trouble with compliance. Transmitters without traps may be more difficult to adjust. If all else fails, adding a trap to the antenna tuning unit should effect a cure. Although we used a Potomac FIM-41 for harmonic data, accurate measurements are available from a spectrum analyzer with a proper antenna. One caveat here: We saw some artificially high harmonic indications which were created in the RF front end of the spectrum analyzer.

Nature of the RF

As good as modern spectrum analyzers are, accurate 80 dB on-screen dynamic range may be a stretch under certain conditions. We initially increased the input attenuation, which changed the ratio more than the input level; this is the tip-off. Selecting a lower first mixer level helped some, but to get consistently accurate information, we needed an external tuneable bandpass or notch filter.

We experimented with both and found that each worked well, with the choice dependent upon the nature of the actual RF environment. Filter insertion losses should be measured in the lab and tabulated for field reference. One final point is the effect of various program material. Many stations are now tending toward talk. This restricted bandwidth audio paints a much rosier spectral picture than music.

We measured bandwidth differences between different music reel sources. More repeatable results can be obtained using the pulsed USASI noise as recommended in NRSC-2. However, the rules again are mute as to whether this program source is acceptable.

The second part of this article will detail construction and calibration of two loop antennas: a shielded receiving loop and a constant current transmitting loop used to generate a reference standard field.

□ □ □

Chris Scott is the chief engineer at the Public Radio Service of Western Kentucky University. He specializes in RF Systems and somehow manages to keep the network on the air most days. He can be reached at 502-745-3834, or via the Internet: SCOTTCR@WKUVX1.WKVU.EDU.

Easy Minibrige to Measure Resistance

by A.W. Edwards

CORPUS CHRISTI, Texas I have built and used Wheatstone bridges, and precision decade boxes to give high accuracy and flexibility to them. Even with this experience, I constructed the minibrige after observing some results with a prototype circuit. Despite the minibrige's small size and

function, as it is excellent for the purpose. If you do this, install two pin jacks (to accept the DVM probes) at the removed meter's posts.

With a little practice you can find the true balance point quite well, even with the standard type meter. One aid in doing this is the "needle nudger," or null test switch S₂. To be sure you have nulled out the resistors, press the switch. If the needle moves even slightly, you are to one side of the null. If correct, there is no change in the needle nudger.

The ratio potentiometer must be precisely as linear as possible. Do not use cheap potentiometers, as these may be quite nonlinear, and that will impair the accuracy of all your readings. I used a Mallory 10 K pot I found in my junk box, and it was very good. The Ohmite No. CMU1031 is a good selection. (Strange as it may seem, the actual resistance of the pot is not important. What is important is that it be linear over its entire range, and that you define its exact midpoint and make that 50 on the scale.)

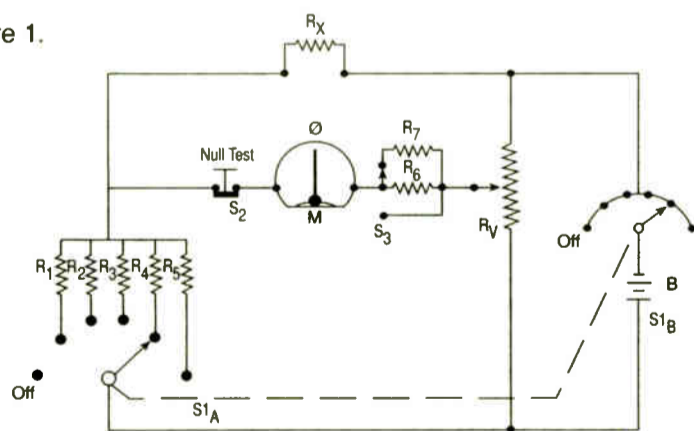
You must use a dial plate that is calibrated from 0-100, and whose range coincides with the potentiometer shaft rotation. Ohmite part No. 5000 is such a plate. When you attach the knob, make sure as mentioned, that when it indicates 50, that

is the exact midpoint of the potentiometer's resistance range.

If you do not want to buy high precision resistors, there is a viable alternative. Use any resistors in the ranges shown, but have these measured by someone who has the precision setup. For example, instead of 500 ohms for the lowest range, you might use a regular nominal 510-ohm unit. When this resistor is measured accurately, you may find it is actually 565 ohms.

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Figure 1.



(all fixed resistors 1/2 W)

R ₁	500K ohms	M	50 or 100 microamperes, center zero
R ₂	50K	R _V	10K linear (see text)
R ₃	5,000 ohms	S ₁	Radio Shack 275-1386
R ₄	500 ohms	S ₂	Radio Shack 275-1548
R ₅	50 ohms	S ₃	Radio Shack 275-325
TB	Binding posts	B	Supply 3-9 VDC

economy of parts, I found it can measure resistances to better than 5 percent.

The keys to obtaining good results from any bridge are the accuracy of the resistors used for the comparison function, and a sensitive indicator. The rest is technique. In the minibrige (see diagram) I used a 50 microampere, zero center meter as the indicator. The indicator may be less sensitive—up to 0-1mA. Best of all, you can use your digital voltmeter for that



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KEYBOARD CONNECTION

Electronic Version of FCC Rules Is Available

by Barry Mishkind

TUCSON, Ariz. One of the most boringly annoying tasks I can remember in my radio career was the bimonthly updating of the station's copy of the FCC Rules and Regulations.

The big problem was this task had to be performed regularly. Otherwise the packets of updates would tend to stack up. And even if none of the changes affected my station, it would take forever to get all the updates sorted and ensure the right ones got inserted instead of in the trash.

Nevertheless, each station needs to have a copy of the FCC rules. This is not just because it's required, but because it makes operations easier and less dependent on the Washington Attorney. Now, a new computer product takes the drudgery out of updating your copy of the rules and makes accessing them much easier than ever before.

Rules ready to go

Of course, there are some pretty good services available to provide up-to-date hard copies of the FCC rules. For example, I've long recommended Rules Service Company (RSC) to client stations. The service has proved to be reliable and reasonably priced. But, as I passed its booth at this spring's NAB Convention, my eye was instantly caught by the display.

The company displayed a Microsoft Windows-based set of FCC rules, using

the Folio Views infobase compiler. This combines two of the more powerful computer aids you can have to assist you in searching and reading the FCC rules.

First, because it is an infobase, this means the compiler has a power search engine built in with its own index of every word. By typing a few words, you can quickly locate every rule that applies to whatever subject you may be researching. Folio speeds that by showing you two pieces of information as you type. First, it tries to guess what word you are typing, scrolling down a list to the closest match with each letter. Secondly, a number representing the matches or "hits" is shown, and this helps narrow the focus in your search.

Friendly searcher

For example, if you needed to find the section dealing with EBS activation procedures, typing "ebs" would show 89 possible matches. Then typing "activation" and "procedures" reduces this to three. Pressing enter takes you right to Section 73.909 and then to 73.961. In less than 10 seconds you are in the right place to find the information you need.

Looking for the rule on station identification. There are 928 places where "station" is used in the rules, and 34 "identification." This results in 20 places to look. But typing "when" or "hour" and two "hits" remain, leading you right to 73.1201.

Now the second key feature comes into play. By using the Windows GUI (graphical user interface), the RSC FCC rules package permits easier reading and output.

Indeed, GUI applications permit some nice touches on the screen. Different colors help to highlight the various features, such as the "links" to other sections with information on the topic you've selected. Also, "pop-up" boxes are linked to the text, so you can see when a particular change went into effect, for example.

And, if you're one of those who want or need to know what changes have occurred, the redlining feature in the RSC FCC rules allows you to see the current and previous reading of a particular section. This can quickly answer questions raised when two or more people remember a rule in different ways.

With a few keystrokes, or mouse movements, sections of important information can be selected for saving or printing. The value of a Windows-based package really can be seen in this feature because the user easily can change the size and characteristics of the text, even "highlighting" areas you need to reference from time to time so they stand out.

Additionally, it is easy to select passages and drop them into memos to staff members who need to know anything from the rules on station identification to EBS procedures to lotteries. When the program director asks if the new contest is legal, typing "lottery" and pressing enter will take you right to 73.1211. A

few more keystrokes and you can print the section out for staff discussion. Want to make a point stand out? Just make the text larger or add bolding or italics. Attention will be directed to the key information.

Backtracking allowed

Sometimes you can find yourself rechecking the same sections of the rules several times as you follow links. The RSC FCC rules makes this even easier with a "backtrack" feature, as well as listing of recent actions, so you can retrace your steps at any time.

And the best part of all this is that every other month, there are no pages to insert. Instead, you get a diskette in the mail that updates your subscription instantly and accurately.

Of course, some of you have older, slower machines or just don't have Windows on your machines. You are not left out: a very similar package based on the Folio Views DOS Version 3 is available. While it lacks a few of the finer touches like the pop-up notes, backtracking or highlighting, it nevertheless accomplishes the main task of accessing the rules quite well.

If you'd like more information of the Rules Service Company FCC rules on diskette, call 301-424-9402. Each part of the rules is priced individually so you only purchase what you need.

□□□

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

63 Years Ago

Reprinted from Radio World October 3, 1931.

Editor's note: The RW of old, printed for a time in the 1920s and 1930s, and today's RW are unrelated except in name.

OUTLAW SOVIET AND DRUG RING RADIOS FOUND

Washington.

Station Directs Agents

Two outlaw radio stations, one in regular communication with the Soviet authorities in Moscow and the other directing, it is alleged, a gigantic narcotics ring thought to be under Japanese auspices, have been discovered in New York City, according to reliable information.

The Soviet station, which, it is alleged, is operated by the Amtorg Trading Corp., the Soviet agency in this country, has been under investigation for more than a year, operatives of the Department of Justice and the New York police cooperating. Due to the relations between Russia and the United States government, the State Department has also been consulted during the investigations.

The existence of the narcotics station was discovered only a few months ago. Apparently this station has been used to direct agents of the ring throughout the country and for communicating with ships at sea and through them with the sources of supply of drugs in foreign countries.

The two stations have been operating in the amateur band where they did not interfere with commercial traffic and where they were comparatively safe from discovery. They have also been using the beam system making detection still more difficult. Once the Russian station was traced down to a point in Manhattan but when the police arrived to the place where it should have been, there was no trace of the station. The operators had become suspicious and had moved the station to a suburb.

Secrecy Maintained

The utmost secrecy has been maintained by the government in gathering evidence against the stations and their operators. The key men are known and it is expected that court action will soon be taken against the principals in the Federal District Court at New York.

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STATION SKETCHES

Grid-Dip Meter: Valuable and Basic

by Tom Vernon

HARRISBURG, Pa. With all the computer-based high tech test equipment available these days, it's easy to forget that some very basic instruments can be extremely useful. I wonder how many newcomers to broadcast engineering have used or even seen a grid-dip meter? This time out I'd like to introduce the oft-forgotten device.

The grid-dip meter, or grid-dip oscillator (GDO), is a relatively simple circuit and is illustrated in figure 1. It's no more than a simple oscillator with a meter for

relationship is illustrated in figure 2.

The most common use of grid-dip meters is to determine the resonant frequency of tuned circuits in transmitters and other RF devices. The coil of the GDO is placed close to the circuit under test, and the tuning dial is adjusted for a dip in grid current. The frequency is then read off the calibrated dial.

Care must be exercised when using this technique, to get just enough coupling between the GDO and the circuit under test to see a dip on the meter. Too much coupling will cause the oscillator to be

using tuning charts indicating capacitor values and number of turns to be attached on the coils. This method makes rapid manufacture possible but seldom yields perfect results. Efficiency can often be improved by making slight adjustments to tuned circuits so the GDO meter dips exactly at the transmitter's operating frequency. Harmonic traps may be checked in a similar manner.

The grid-dip meter may also be used to determine the resonant frequency of antennas. Sometimes the effect of concrete piers with ground strap and lightning rods is not taken into consideration when the height of AM towers is calculated, also degrading efficiency. A loop may be connected from the antenna to ground, loosely coupled to the meter, which is tuned for a dip. If this null occurs at some point other than your assigned frequency, check with a consultant on necessary steps to shorten or lengthen the electrical length of the tower.

Check the frequency

A GDO may also be used to check the resonant frequency of RF components. To check coils, simply place the coil close to the meter and tune for a dip. It's that simple. Capacitors are a little more involved. Connect the unknown capacitor across a coil of known inductance. Measure the resonant frequency of the circuit and solve for C_x in the formula:

$$C_x = \frac{2}{25,000/(fL)}$$

Where C is in picofarads, L is in microhenries, and F is in megahertz.

Communications receivers may be aligned with a grid-dip oscillator. With the receiver power off, couple the meter to the last IF stage and adjust slugs for a dip at the IF frequency. Gradually work your way back to the antenna in this manner. To set up the local oscillator, tune the receiver to 1500 kHz. The grid-dip meter is tuned to this frequency minus the IF frequency: 1500 minus 455 equals 1045 kHz. With the meter coupled to the oscillator coil, adjust for a null at 1045 kHz.

Because the GDO radiates RF, it can also be used as a signal generator, as well as a BFO or Q multiplier for a communications receiver. By noting dips at places other than the resonant frequency, the grid-dip meter is useful for tracking down spurious radiation. Checks of crystals and filters are also possible with this useful device.

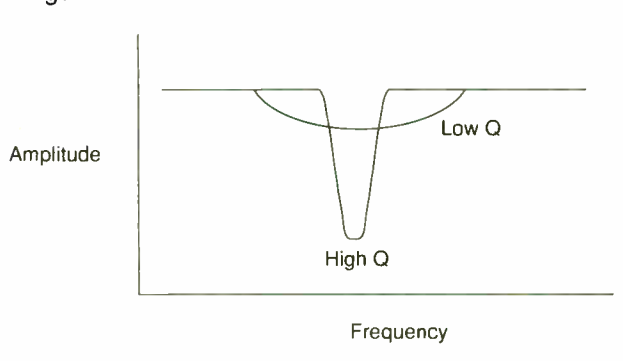
Grid-dip meters are inexpensive. These units frequently show up in government surplus catalogs and hamfests for very reasonable prices. Before making your purchase, be sure batteries for older units are still available and all plug-in coils come with the meter.

If you don't mind a few evenings' work with a drill and soldering iron, *The Radio Amateur's Handbook* contains construction plans for grid-dip oscillators. These

plans don't include coil winding data for the broadcast band, but there's enough information to figure this out.

While the GDO gives an accurate indication of resonant frequency, it is not as razor sharp as a frequency counter and should not be used for FCC-required measurements. Its real advantage is that

Figure 2.



it can give you information that cannot be readily obtained in any other way.

□ □ □

Tom Vernon has been a regular **RW** columnist for 10 years! He is occasionally sighted around the 19th-century mansion that houses WXPB in Philadelphia. Call him at 717-367-5595.

Building a Minibrige

► continued from page 9

So what? As long as you know precisely what it is, and it does not change in value, you have a "precision resistor." Do the same for the others, if you choose not to purchase resistors of 1 percent or better guaranteed accuracy. Make a record of the actual measured resistances, as you must use these values in solving the ratio equations.

When you have assembled the minibrige, practice measuring some known resistors. Select a balance point (null) that puts the dial readings somewhere between 25-75, if you can, for greatest accuracy.

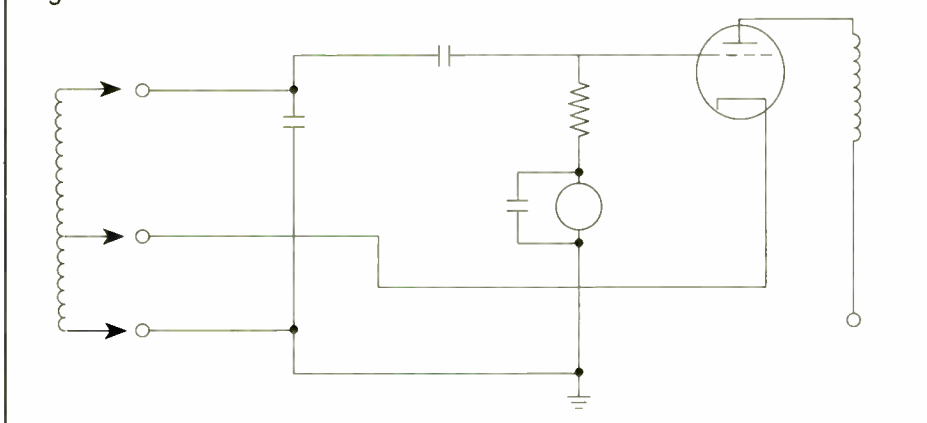
When you find the null point, read the dial. The reading from 0 to the indication is the top number for the ratio. That number, subtracted from 100 (the whole resistance) is the bottom number. As an example, suppose you find a null at 37. That leaves (100-37) 63 for the second number. Set up the equation as $X/565 = 37/63$; $63X = (37 \times 565) = 20905$ which, divided by 63, gives $X = 331.8$ ohms.

You will want a selection of switchable "standard resistors" as shown in the diagram. I suggest using values of 50, 500, 5 K, 50 K and 500 K. As for the ratio pot, 10 K is a good compromise. With a single choice for it, the left- and right-hand arms may be lopsided in resistance ranges when measuring in at the high and low extremes, but a balance, and thus a ratio, will still be possible.

□ □ □

A.W. Edwards, K5CN, retired in 1992 as a ship radio operator. He holds First Class Radiotelegraph, General Radiotelephone and Amateur Extra Class licences. First call (1946) was W5KZG. He prefers operating CW but operates phone on several bands. He was an intelligence officer/electronics engineer with the CIA during the U2 years. Later he served as editor for three newspapers, and has published two books.

Figure 1.



measuring oscillator grid (or base) current. GDOs are typically small battery-powered devices, with numerous plug-in coils for overlapping frequency bands. The dial of the variable capacitor is calibrated in kHz and MHz, with bands that match the range of the plug-in coils.

The principle of operation is also simple. Oscillator current dips when the coil is in the presence of an external circuit which is resonant at the oscillator's frequency (due to a certain amount of the oscillator's energy being absorbed by such a circuit). The sharpness of the meter's dip depends on the tightness of coupling to the external resonant circuit as well as the Q of that circuit. This

pulled off frequency, resulting in measurement errors.

Broadcast applications

Many applications for the GDO exist around the broadcast station. The electrical length of transmission lines may be determined by opening the far end and putting a loop of wire on the other end. Now tune the grid-dip meter to the lowest frequency where a dip is located. This dip is the point where the transmission line is a quarter length long.

Transmitters can be optimized for peak efficiency of RF circuits with this meter. Often tank circuits in transmitters are "ball-parked" to the right frequency at the factory

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WORKBENCH

Consider Filters for RFI Snags

by John Bisset

SPRINGFIELD, Va. I'd like to start this column off by thanking all the engineers that responded with ISDN information for their compatriot in Colorado. I've passed on the information, and hopefully, the contacts you provided will correct his ISDN problems. One of the engineers responding was Wayne Kirkwood, owner of Media Dialup. If you haven't passed Wayne's demo line on to your general manager and program director, earn another feather in your cap and do so.

Media Dialup is an aircheck alternative. You dial a number which ties you into the output of an AM/FM receiver. Using the touchtone keypad, you can toggle up and down the band and change bands, listening to stations. The Dallas-Fort Worth demo line is 214-330-8821. On the demo line, touchtone—digit 1 selects FM, 2 selects AM, digit 4 skips down the dial and 6 tunes up the dial. Media Dialup subscribers get a station guide with stations listed by frequency, calls and format.

Want to really impress your fellow managers? Suggest they aim a video camcorder at a clock face while you record the Media Dialup on the VCR soundtrack. An hour later, you've got the station's format clock. Speed searching the videotape makes timing music sweeps and stop sets easy. And who says all we think about is transmitters? Media Dialup can be reached at 214-330-8393 for sales information, or circle Reader Service 83.

★ ★ ★

Speaking of Reader Service, apologies for the absence of a reader service number for the RE America ISDN Digital Network Access Guide book. If you want a copy, circle Reader Service 160 to obtain your copy.

One thing you won't find in the RE America guide are the following translations for what the letters ISDN really stand for: It Still Does Nothing, It's Slow but Definitely Needed, It Sure Does Network, and my favorite—because it's provided by the phone company—I Smell Dollars Now!

★ ★ ★

Robin McDaniel is the chief engineer at KJRG(AM)-KOEZ(FM) in Newton, Kan. Over the years, Robin has had trouble with RF interference to

the solid state flasher on their "hot" AM Tower. Both the AM and the 100 kW FM backup interfered with it. Robin tried the standard factory suggestion of "0.1 to 0.5 MFD cap between Terminal 2 and/or terminal 3 and the mounting surface." It was ineffective for this application.

Instead, Robin was able to

correct the problem by installing a 0.01 MFD, 1000W VDC disc cap between Terminal 1 and the mounting surface. Prior to this fix, the lights had flashed irregularly and at less than 10 fpm. After several months with this capacitor in place, not a single failure has been noticed.

If you're encountering RFI

problems with telephones, here is an update of companies who manufacture RFI filters and their numbers. Industrial Communications Engineers I-800-ICE-COMM; COIL Sales and Manufacturing Company in Rolling Meadows, Ill., telephone: 708-806-6300; Keptel Inc. in Tinton Falls, N.J., telephone: 908-389-8800. A recent addition to the list is the AT&T Model Z-100B1 Radio Interference Filter. These filters are sold at any AT&T store and

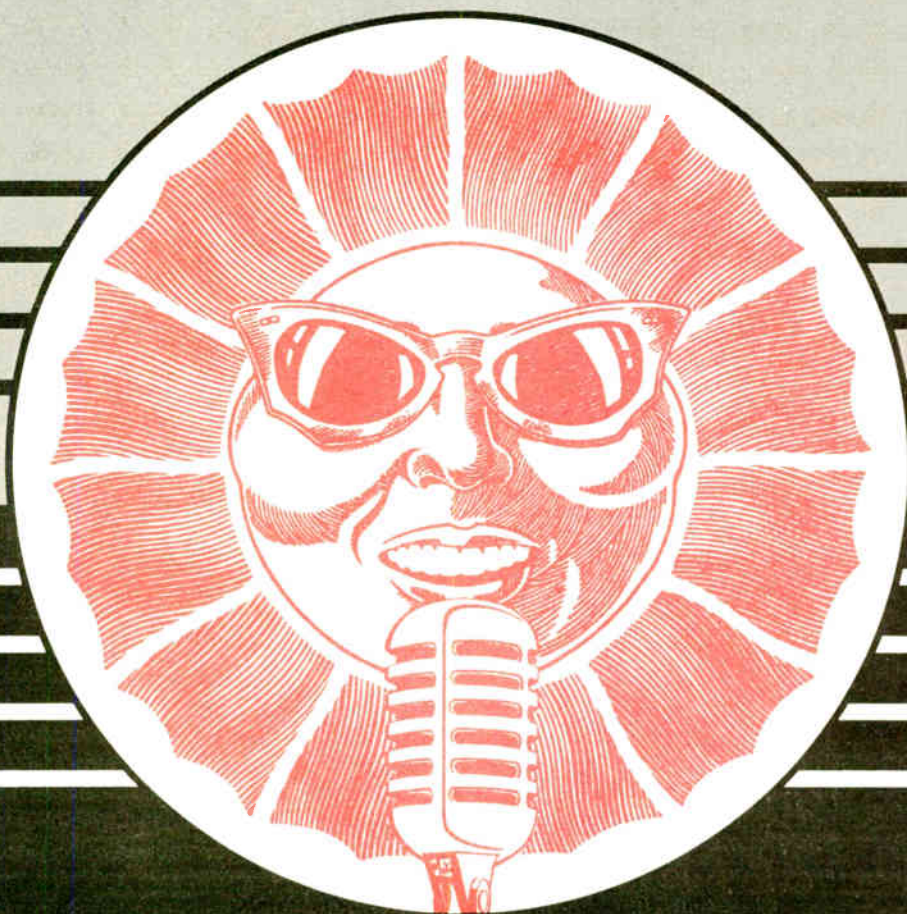
have been very effective in reducing AM RFI.

★ ★ ★

Do you ever wonder how you ever lived without a fax machine? Comrex has added a new twist to facsimile. The company sponsors a Fax-on-Demand hotline service that not only offers product literature but also engineering and application notes. Because we're speaking of RF, request No. 201—R.F. Problems With Frequency

continued on page 25 ►

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See p. 20.

Equipment and Applications for Radio Production and Recording

PRODUCT EVALUATION

Fostex RD-8: An ADAT with SMPTE

by Ty Ford

BALTIMORE In case you haven't followed the swell of interest in linear digital audio technology, here's the deal. With the licensing of ADAT technology to Fostex for the more feature-laden RD-8, Alesis both insures its own survival, and stakes out a larger territory in the low-cost, linear digital-audio marketplace.

At first glance, the RD-8 looks remarkably similar to the Alesis ADAT I tested last year. A quick comparison of the back-panel, however, reveals that the Fostex RD-8 is more fully prepared to deal with the interconnectivity demands of video, digital audio and MIDI control.

up to about 50 minutes of eight-track digital audio at 44.1 or 48 kHz per chassis. Each time you use a new tape it must be formatted; a procedure that takes several minutes. It's actually a good idea to format the entire tape at one time, but you can do it on the fly after the basic format data is recorded in the first few minutes.

Multiple chassis can be synced together using DB9 sync cables and eight-track proprietary optical I/O. While Fostex says the RD-8 can be synced to other RD-8s or Alesis ADATs, make sure you confirm that the software versions of each machine allow compatibility. Fostex currently has software Version 1.04 in beta test. Their hope is that it will eliminate potential inter-machine conflicts.

Around back

The RD-8 has BNC connectors for Digital Word IN and OUT and Video/VITC sync IN (with a 75-ohm termination switch). These connections are used to resolve the speed of the system to an external digital sample rate, or to provide the digital input of another system with the proper sample rate.

The RD-8 automatically recognizes NTSC, PAL and SECAM. The back panel has a standard, two XLR balanced SMPTE I/O. Time code IN is for receiving an LTC or VITC feed to resolve the speed of the system to time code or to chase. Time code OUT is used for SMPTE control of another device. The RD-8 reads and writes 24, 25, 29.97, 29.97df, 30 and 30df SMPTE and has a front-panel adjustment to control the output level of the time code. It will read incoming time code at up to 50 times play speed. The

RD-8 also supports the recording of user bits.

There are also MIDI IN and OUT ports to handle MMC (MIDI machine control) and MIDI time code, and to upload and download System Exclusive MIDI dumps. A DB9 connector for RS-422 communication allows the RD-8 to be connected to and operated from a video

respectively, the Alesis unit uses 1/4-inch jacks; the Fostex unit uses RCA cinch jacks, which afford the RD-8 back panel the space it needs for additional connectivity.

Both machines currently use the same tape drive mechanism. In the RD-8, the additional sync board is mounted on a set of stand-off hinges that allow easy access to the large printed circuit board below. The normalised RCA jacks are part of a separate circuit board that is securely fastened to the inside of the back panel.

Both machines produce about the same amount of physical noise, comparable to that of a standard VCR. If you have a one-room operation and you're recording very low level sounds, you'll probably want to put the decks in a machine room.

Front panel

The front-panel of the Alesis machine is almost spartan when compared to the extra buttons and display features the Fostex RD-8 requires to control and oversee the extra intelligence it offers. As busy as the front panel is, however, you can easily identify the source of sync (internal, time code, word clock or video), the sample rate (44.1 or 48), chase/lock mode and presence of digital input, by a quick glance at the respective indicator lights.

The extra front-panel indicators occupy more space, which results in smaller track level LEDs. Whereas the Alesis ADAT uses 15 LEDs for its -60 to 0 VU range, the Fostex RD-8 uses 12 LEDs for its -38 to 0 VU range. In both machines, the red 0 VU LED is set for peak hold, so

continued on page 23 ►



Fostex RD-8 multitrack recorder

Product Capsule: Fostex RD-8

 Thumbs Up	 Thumbs Down
<ul style="list-style-type: none"> ✓ SMPTE capability ✓ very good sound ✓ price 	<ul style="list-style-type: none"> ✓ No AES/EBU or SPDIF digital I/O

For more information, circle **Reader Service 151**; or call Fostex at 310-921-1112

Fostex chose to build in the necessary SMPTE and MIDI circuitry. In addition, the RD-8 offers pull up and pull down for film to tape transfers, auto-record using SMPTE in/out points, variable cross-fade times for punch in/out, ±6% varispeed in record and playback, and delay of individual channels of up to 170 milliseconds in 0.1 second increments. The extra ports, and the extra technology attached to them from within the RD-8, are reflected in the RD-8's higher list price (\$4,995).

The Fostex RD-8 uses 120 and 150 minute S-VHS video cassettes to record

editor or edit controller, providing the master device can communicate with the RD-8's Sony BVU-950 P2 protocol.

Like the Alesis ADAT, the Fostex version also has the proprietary, eight-track, serial, optical I/O ports, DB9 meter bridge ports, small remote control jacks, punch in/out footswitch jack, and a pair of DB9 sync ports used to sync up to 16 RD-8s (128 tracks) together. Each track has its own A/D and D/A converter and can be recorded separately.

There are a few obvious differences: While the Alesis ADAT uses one ELCO multi-pin connector for its balanced analog I/O, the Fostex RD-8 uses two DB 25 connectors. While both units share the clever normalising scheme that directs audio to tracks 1, 3, 5, 7 and 2, 4, 6, 8,

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Logical Approach to Troubleshooting

by Doug Fearn

POCOPSON, Pa. Despite the reliability of most professional electronic equipment, when you're dealing with something as complex as a recording or production studio, things are bound to fail from time to time.

Equipment problems are bad for everyone. The client is annoyed, the artist is upset, the producer gets angry, the studio loses billable time, and the engineer and/or maintenance technician is put on the hot seat.

But most equipment problems need not be more than a minor glitch. The key is good trouble-shooting skills, which often require little or no knowledge of the ICs, resistors and capacitors inside the equipment.

The secret is simple: follow a logical approach to finding the problem. I've been in a studio where the engineer reacted to a dead microphone by cleaning the tape heads. This might be an extreme example of lack of logic, but all too often the first response is to do something, anything, rather than try to determine where the problem actually is. When all eyes turn to you when something goes wrong, your natural response is to do something that looks like it will solve the problem. The logical response is to find the actual source of the problem using the information available to you.

The control room is loaded with test equipment all the time. Just about every piece of gear has signal indicators (meters or LEDs) that can help you localize the trouble. It does require some basic knowledge, however. Knowledge that you may already possess—understanding the signal flow from microphone to console to outboard gear to tape machine to console to monitors.

The studio may have a block diagram filed away somewhere, or perhaps posted on the wall in the maintenance shop. Either get a copy of it, or, if one doesn't exist, get someone who knows how the room is put together to draw one for you.

Even in an unfamiliar studio, you should have a basic understanding of how the audio gets from the source to the tape. It has to go into a microphone (which may need an external source of power), through cables and connectors to the console, through switches, preamps, amps, patch points, auxiliary equipment, more amps, more switches, more patch points, connectors and cables before it gets to the tape machine. At the tape recorder, it has to make it through more connectors, amplifiers, cables, relays and heads before it is recorded on the tape. The tape has to be in proper contact with the heads and moving correctly. For playback, the journey is similar.

Typical problems

Let's take a typical studio problem: A vocal microphone is not working. First, did it work for a while and then quit? Or has it not worked at all? If it has never worked in this particular session, first look for the obvious: Is it plugged in?

As your block diagram reveals, there are many links in the chain from audio source to destination, some of which are weaker than others. Certain things, like cables permanently installed under the floor, are pretty dependable. At the opposite extreme, anything that is subject to constant handling is far less reliable. Headphones immediately come to mind, but microphone cables, too, have a definite reliability deficit. (This can be improved by using top-quality cables and

connectors and regular maintenance to inspect the connections and tighten any hardware.) Look at the trouble-prone points first: connectors, patch points and switches that are used infrequently.

What about that built-in test gear? Anything that shows whether a signal is present is useful in tracking down a problem. Does the mic audio show up on the console meter? Yes? Then it can't be the mic, cable or connectors, can it? No audio on the meter? Then look at everything in the chain prior to the console meter. There's no point in searching for a problem beyond the meter unless you have been cursed with a multiple problem.

Is the signal routing on the console mod-

ule correct? Is there processing gear patched in? Does the limiter (or whatever) meter or LED show signal level? If so, then the audio is getting into the limiter. Is it getting out? Pull the patches if necessary to isolate the source of the signal loss.

The console

Some consoles have indicators other than the main VU meters that can show signal presence. Find out where these are in the console structure so you can use them to isolate the signal loss. A problem in a console module is usually best bypassed during a busy session—just use another input. Remember to write up the trouble, both for maintenance and for the next person to use the room.

Let's assume the signal is getting to the console VU meter. Switch the tape machine meters to input. Any signal there? If not, what does the audio go through between console and machine? Noise reduction units? Patch points? It's probably one of those. Perhaps it is the tape machine itself, what then? Are all tracks dead? Yes? That might indicate a bigger problem. No? Assign it to another track and keep rolling. No empty tracks left? OK, tell everyone to take a five-minute break and then kill the power to the tape machine.

Pull the card for the defective track, and substitute one from another track. Label them, if they aren't already, so you (and maintenance) will know which belongs where. Turn the machine on and see if it works. If it does, great. But you are not done until you reset the record bias, level and equalization.

continued on page 19 ►

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You've put a lot of money into your studio... expensive consoles, recorders, processing, etc. But your recordings just don't measure up to your expectations. Chances are, the problem is with the most important (and most often overlooked) part of your signal chain... the microphones.

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SIGNAL-TO-NOISE

Shure's Presidential Mic

by Frank Beacham

NEW YORK Next time you see the President on TV, check out his microphones. Usually he speaks into a pair of Shure SM-57 dynamic cardioids, workhorses for many years in every conceivable sound reinforcement application. Recently, when chatting with Michael Pettersen, director of applications at Shure, I asked why these microphones are always used by the White House for the President.

The answer (more than I bargained for) comes in the following memo prepared by Pettersen for the technicians who provide sound services for the President:

"Assumption: The President will speak in a variety of situations, both indoors and outdoors. Weather conditions will vary from very cold to very hot; very dry to very humid; no wind to high wind. Failure of the microphone in any of these situations is unacceptable. In addition, the microphone must

endure physical abuse as it is packed and shipped throughout the world.

"It is the strong recommendation of Shure's Engineering Staff that a dynamic microphone be used when absolute reliability is demanded. While condenser microphones are a valuable tool and reliable in controlled, benign environments, condenser microphones are not recommended for critical applications where environmental conditions are uncontrolled.

"Here are our reasons. (Shure manufactures condenser and dynamic mics, so our experience is extensive with both.)

1. Mean Time Between Failures: Condenser mics are inherently less reliable because they have many more individual components than dynamics. Every condenser mic has an associated preamplifier which is made up of individual electronic components, all of which have their own rate of failure. Any one of these can cause a condenser mic to fail. The more parts, the more failure possibilities.

2. Humidity and High Temperatures: The combination of these two conditions can cause

unwanted noise (hissing, popping, crackling); or change the actual sound of the microphone (frequency response shifts, changes in transient response); or even complete failure. Any of these are likely with humidity levels of 95 percent and temperatures around 100 degrees F. Remember, these conditions can easily happen in shipping and storage.

3. Wind Noise: The mass of a condenser diaphragm (the part that moves when the President speaks) is much less than a dynamic diaphragm. Because it is lighter, it will be much more susceptible to wind noise. Therefore, a large windscreen will be necessary to cut down the wind noise. We predict it would have to be as big, if not bigger, than the A81SW (windscreen) you use now for the SM-57. Also, condensers are much more likely to pop from P-words or large exhalations of breath.

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President Clinton and SM-57s

well documented that the performance characteristics of condenser mics can often change substantially over time. This will make it imperative that you use mics together that are about the same age. New ones could sound much brighter than older ones. We imagine that would be a difficult task based on your large inventory of products. Dynamic mics are very stable as they age and tend to sound the same until they are retired.

5. Phantom Power: To operate, condenser mics need DC phantom power applied through the mic cables. (We doubt you would even consider battery-powered condenser mics!) It is unlikely that the phantom power provided by your Shure mixer would fail, but it could be switched off accidentally. More likely is noise (cracking, popping) caused by bad cables or loose/dirty connectors. This type of noise can appear when phantom power is used. But the same cable and connectors can be perfectly quiet when used with a dynamic mic, as there is no DC phantom power flowing in the cable."

At this point Pettersen's memo acknowledges a desire to have a lower profile for the President's

continued on next page ▶

Troubleshooting Logic

► continued from page 17

If all tracks are dead, don't sneak out the back door and look for another job. Is the machine on? Sounds stupid, but it happens, especially if every meter bulb is burned out. Is the tape threaded correctly? Oxide side facing the heads? If you're offended by these questions, ask any engineer who has been recording for more than six months, and he or she will probably admit that he was once caught by a dumb thing like that.

We could go on and on with examples, but I think you get the idea. The key is to remain calm, think through the problem and look at the most likely causes before pursuing the improbable ones. With a good mental picture of the signal flow, you can probably detect the problem area with just a quick glance around the control room.

Presidential Microphone

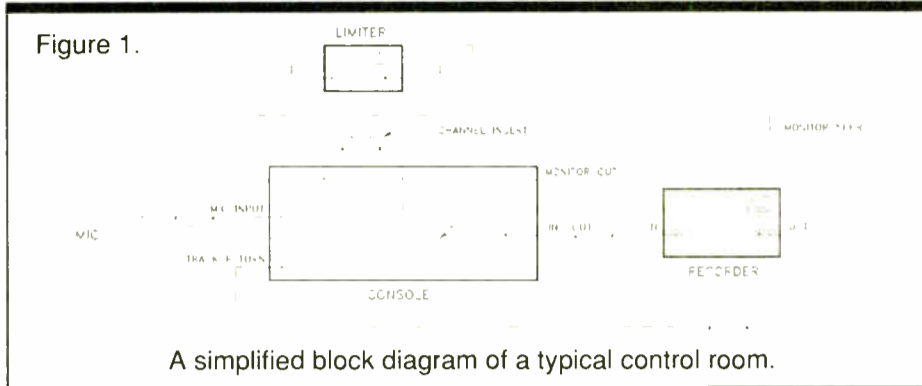
microphones, but he follows with a warning: "We strongly feel that condensers are not the way to go considering how critical the Presidential system is. Perhaps in the future condensers will not have these problems, but they do exist today."

This memo is food for thought next time you see those battle-scarred SM-57s on the President's lectern. (The Shure SM-57 has a list price of \$147, but the street price is usually well under \$100.) Shure also sells windscreens and dual and triple stand mounts like those used by the President. For information, call Shure at 800-257-4873.

□ □ □

Frank Beacham is a writer, director, producer and consultant. His address is 163 Amsterdam Ave. #361, New York, NY 10023. E-Mail: beacham@radio.mail.net.

Once you have found a real problem that cannot be repaired without stopping the



A simplified block diagram of a typical control room.

session, bypass it for now and keep going. When things get boring during the fourth hour of the background vocal overdub, pull out a maintenance request form and write down what you found, even if it's going to be you shooting this trouble at component level tomorrow. Be specific. If you have localized the trouble to the equalizer section of the console, say so.

On the bench

If you're the person who has to fix whatever is broken, you can apply the same rules of logic on a smaller scale. If a microphone cable is bad, look first in the trouble-prone areas. Usually, it is far more likely to be a connector problem than a break in the middle of the cable.

Some equipment is easy to repair on the bench. A limiter or other outboard piece can be removed and hooked up to test gear and thoroughly checked. Console modules, on the other hand, can be a pain to repair out of the console. A test setup, with the appropriate connectors and power supplies, can make the job much simpler. An oscilloscope is useful in tracing the signal. Feed a tone into the module and start with the scope probe at the input. Make sure the signal is indeed getting to the gear under test. Then simply follow it from stage to stage, amp input to amp output, switch in to switch out, until it disappears.

If you don't have an oscilloscope, a pair of hi-Z headphones with a capacitor (.1 mfd should work) in series can be used to listen to a test signal at various points in the

circuit. This isn't foolproof, however.

Failures aren't always complete, and some are intermittent. This should be described in the maintenance request. Perhaps the signal sounds thin or distorted or just "funny." That might indicate a capacitor breaking

Switches and connectors are the first suspects, but look at the IC sockets too.

Intermittent problems are the worst to find and correct. During the session, note all the circumstances that preceded the problem. This might take place over several sessions. If the nature of the problem suggests a dirty switch, it might be easiest to just clean all the switches in that part of the path and see what happens.

Like most skills in life, experience counts for a lot. The longer you work in professional audio, the more equipment problems you will encounter and you should learn something from every occurrence.

□ □ □

Doug Fearn is president of D.W. Fearn, a company that produces tube audio products. He has 25 years in the radio/audio production industry and is a contributing writer to RW.

down or a dirty connection somewhere.

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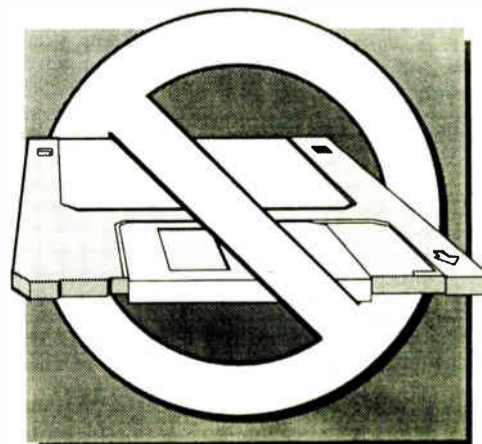
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Finishing the Teletronix LA-2A Upgrade

by John Diamantis

Part II of II

WASHINGTON In part one of "Making the LA-2A like New Again," we went over the theory of operation of the LA-2A, and replaced the electrolytic capacitors, as well as the coupling, or DC blocking capacitors. Tubes should be replaced if they are originals, but kept as

spares if they are still working. If you have a tube checker, test them for transconductance and gas, and toss any bad ones.

Finishing the upgrade

If you absolutely, positively can't wait any longer to try out your LA-2A, by all means try it out. Just listen for any unnatural sounds and beware the tell tale puff of smoke. (If you notice anything odd, turn off the unit

and disconnect it from the AC line immediately.)

For those who want to continue with the refurb, it's time to talk resistors. Ask ten engineers about resistors, you'll get ten different answers. Let's be nice and say everyone is right, but approach this area with caution. Your vintage LA-2A was assembled using carbon composition resistors, most of which are 5 percent tolerance, but there

are some 10 percent ones in there.

The biggest problem with these types of resistors, especially if they've sat around for a while is they absorb moisture and change value, or if stressed, over time will change value, sometimes dramatically. The one big advantage for composition resistors is they handle higher working voltages than comparable film resistors, a big

plus for use in tube circuits.

With the power off, and the AC cord disconnected, remove the tubes, and check the value of the resistors, especially those in the plate circuits (R9, R13, R17, R33, and R34.) If any of these have discolored, or changed value more than 5 percent, replace them. I would use good carbon composition resistors here, sealed if you can get them.

If the resistors measure okay, and the voltage test points are within 10 percent or so of the schematic values, leave them in there. If, however, you just got to have some metal film resistors in there, just make sure they have the same or higher wattage as the units they are replacing, and that they have a nominal working voltage of at least 350 volts.

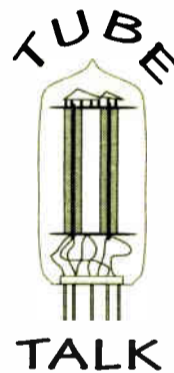
Changing pots

I recommend replacing the "gain" pot. The ones in my units are sealed, so once they get noisy there's no reviving them with today's modern miracle solutions. While you are at it, replace the peak reduction pot, too. Check R-3, the stereo adjust pot, and R-37, the limiter adjust pot as well. If these develop a dead spot, it could ruin your session.

The LA-2A achieves its dynamic "character" through means that could be called faults in other processors. This is not to suggest that the LA-2A's popularity is entirely due to romantic visions of days gone by. It is these "faults" (I prefer characteristics) that combine synergistically to create a sound that is difficult to create with other products.

These "characteristics" include a gain control circuit with moderately slow, almost sloppy, dynamic attack time, combined with a fast initial release time to create a unique "punchy" quality to the audio. The high gain, moderate feedback, vacuum tube output amplifier also contributes to this mix. The similarly designed, though solid state, LA-3A cannot duplicate this sound.

The sound of the LA-2A is clean, though leaning to the warm side—with vintage units sounding a little bit warmer and a little bit clearer. The input and output transformers seem to be the culprit here, as the original box used muscle bound UTC transformers while new LA-2As



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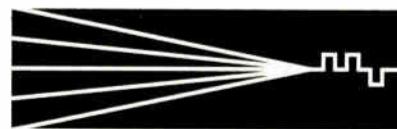
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Fostex RD-8 Adds Several Features

► continued from page 15

you have enough time after you hear a spike to quickly turn your head to check the meters.

Navigating the front-panel LCD to access the many "pages" of settings requires some patience and can be confusing until some intimacy with the machine is achieved. The DISP button, for example, toggles through the seven different kinds of time displays: Absolute, Relative, LTC on-tape, LTC from an external source, Absolute Offset, Relative Offset, and the current status of the generator's time code output.

In all, the manual lists 47 different parameters that can be stored on the header of the S-VHS tape used to record the audio. If during your session, you make changes to any of these parameters, and you want them to be in effect the next time you pop the tape in, you have to save them to the TOC (Table of Contents) at the head of the tape.

The manual earns points because it's bound so you can lay it open on a counter without having to hold it open. There are 26 pages in the "instant gratification" section to help you get up and running. The occasional random access editorial approach, exemplified by messages such as, "Return to the previous section on... for instructions," is distracting but not overwhelming. To its credit, the manual also contains an extensive applications section.

Headroom

In an effort to keep safe recording levels, the RD-8 input reference level has been set to accept a +4 dBu signal to its balanced inputs and a -10 dBv signal to its unbalanced inputs at a reading of -15dB on its meters. If you're running a limiter before the RD-8 inputs, or if your levels are very consistent, you can push the input level to the RD-8 closer to its 0 VU reading. If you cannot make that guarantee, it is better to back off and rely on the 92 dB dynamic range to keep you safe.

That faction of analog people who always "push" their projects into tape saturation will discover that, there are no "OVER" light on the inputs. Once the 0 VU lights have been lit, there's no telling when audible digital distortion will occur. During this test, when my record levels lit the 0 VU LED, there was no apparent distortion.

After recording some audio into the RD-8, one of the first things I noticed was that I heard none of the low-level noise associated with the head motor and record-ready lights I had heard through the outputs of the Alesis ADAT in last year's test. (Alesis said it has fixed the problem on its later units). There was some spin-up and spin-down noise during the tape engage-disengage processes, but it too was less than that of the Alesis unit. All in all, the digital converters in the RD-8 produced sounded at least as good as the Alesis ADAT, which is very good audio.

Features

The RD-8 has 100 locate points that can be stored on the fly, in record or playback, or they can be entered manually. Loop play requires adjustment of the Auto-Play and Auto-Return and the Pre- and Post-Roll parameters (five to

25 seconds) from the DATA Edit mode.

The subframe accuracy (100 subframes per frame) of the Auto-Record should provide enough accuracy to get in and

out points during playback.

There's enough intelligence inside the RD-8 to make those who haven't read the manual look stupid. Little things, like

For the price, and especially for anyone in need of SMPTE/MIDI lock, the Fostex RD-8 offers a lot.

out safely, but don't expect miracles. Regardless of the crossfade times used (11 and 43 milliseconds), if you're trying to punch in on a constant sound like a held synth note, you will hear the in and

leaving the Auto Return on when striping a new cassette with time code, results in the machine kicking out of record when it hits the Auto-Return "out" point, and rewinding to the preset address.

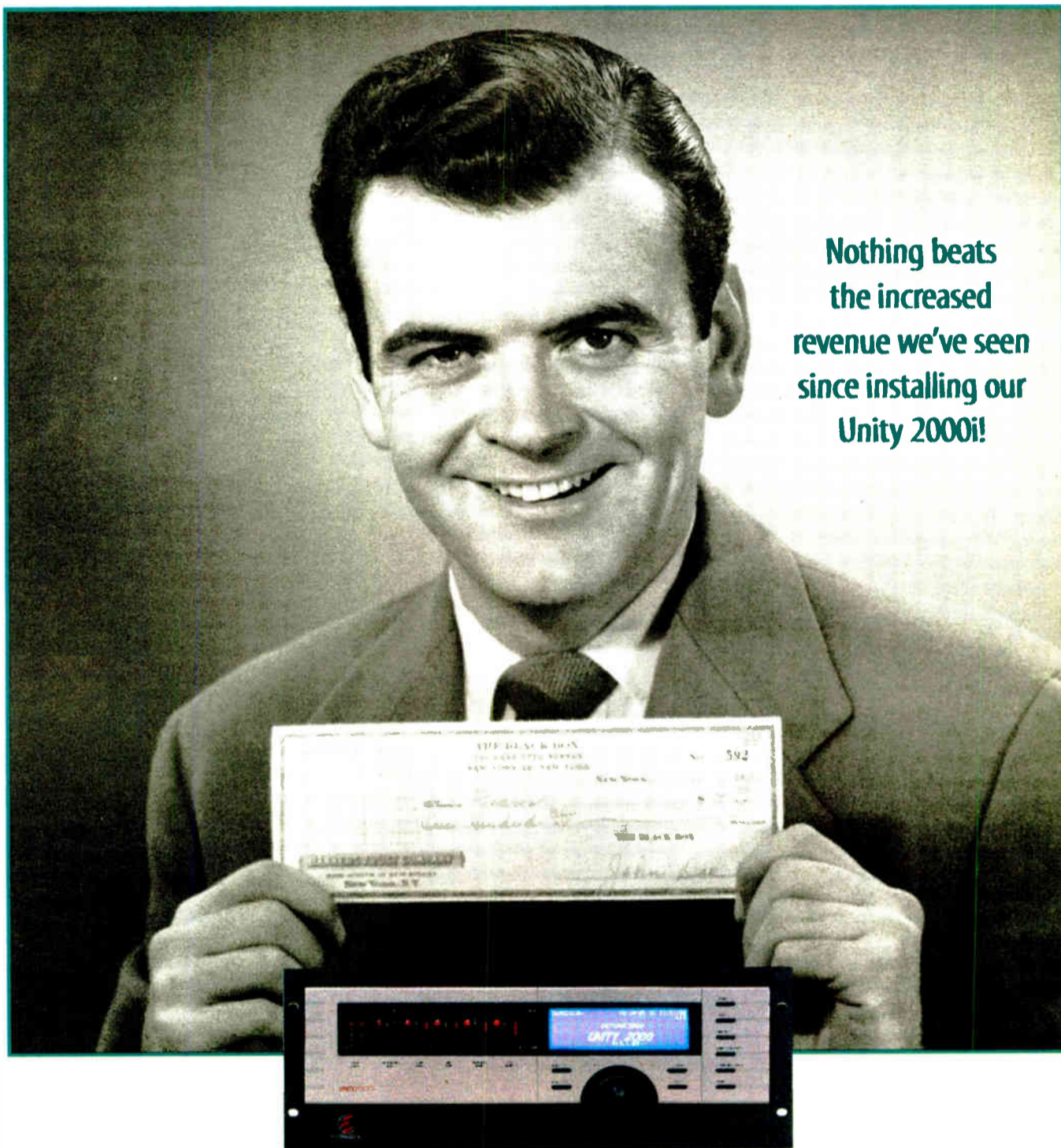
With a short deadline, I wasn't able to test every aspect of the RD-8s very comprehensive sync circuitry. I was able to determine that it took anywhere from 4 to 12 seconds to lock up to a SMPTE source.

Summary

For the price, and especially for anyone in need of SMPTE/MIDI lock, the Fostex RD-8 offers a lot. With analog tape hiss no longer a factor in using boxes such as the ADAT or RD-8, facilities seeking a further upgrade of their audio will now have to figure out what to do about pre-amp and console noise.

□□□

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Completing the LA-2A Compressor

► continued from page 20
utilize no-name iron of apparent lesser dimensions.

Subtle differences

While the differences in audio quality between vintage and current issue LA-2As are nothing to slit your wrists over if you own one type and covet the other, they do exist. It's more important, as far as I am concerned, to ensure proper tube selection for V1 (audio stage input tube). You must also make sure that V3 has enough gain, as this is the input tube for the peak controller stage, which affects the amount of "leveling."

On the back panel is a switch that allows operation as either a compressor or limiter. The difference in effect between these two choices is mostly subtle, especially if you use no more than 5 to 7 dB of gain reduction. If you drive it past 8 or 10 dB of gain reduction, the "limiter" effect becomes more pronounced, and the audio indeed becomes "leveled." In either setting, the sound of the LA-2A is not what you would call squashed, although when driven hard, 10 dB or more gain reduction, you would definitely call it punchy. Maybe even "ballsy."

Studio performance

In the studio, the LA-2A shines when used as a mic or vocal processor. I've used them for years in radio stations not only in the production room, but also in the on air mic processing chain. In this situation, coupled with a good condenser mic and appropriate preamps, a vocal presence is achieved that is virtually unbeatable.

The beauty of the LA-2A is that it doesn't dynamically fight most announcers. In fact, it sounds so uncompressor-like that most listeners, including most

announcers, think there is no compression in the mic chain. They just marvel at the clean, bright, consistent vocal presen-

constant at <0.2 percent, and doesn't change with the amount of compression, except for the very lowest frequencies.

Playing back a produced piece of production through the LA-2A adds some life and excitement.

tation of the announcers.

Playing back a produced piece of production through the LA-2A adds some life and excitement, as well maintaining a ceiling on the levels without losing the dynamics of the piece. Likewise, when recording live instruments, like acoustic guitar and piano, the LA-2A provides clean audio and consistency of levels, without the artifacts and unnatural sheen of lesser devices.

I have experimented with LA-2As in the main audio chain of FM stations, and have achieved from good to great results, mainly in use as a pre-processor. Be aware that these boxes will create a sound with a strong personality, so don't be surprised if you experience strong reactions from people, both positive and otherwise. Again, sane amounts of leveling will win out every time.

You can get into dynamic dilemmas with the LA-2A if you aren't careful. While there really are no hard and fast rules, you really can't push it past 10-15 dB of gain reduction with previously processed material (records, CDs, etc.) Also, some unusual musical combinations of heavy, percussive low frequency sounds mixed with a strong midband, can drive it wacky if you try to overdo it.

Does the LA-2A distort the audio waveform? Not really. THD + N/N is fairly

SMPTE IMD is similarly low at <0.05 percent, although this figure does increase with more compression. Maximum input and output levels with the unit terminated with 600 ohms is about +15 dBm. If you bridge the output

with a high impedance (as most of your other equipment will), you're good to the +20s. Noise in the units I measured averaged around -78 dB relative to +4 dBm, and was input tube dependent. Overall figures for both vintage and current LA-2As are about the same.

Summary

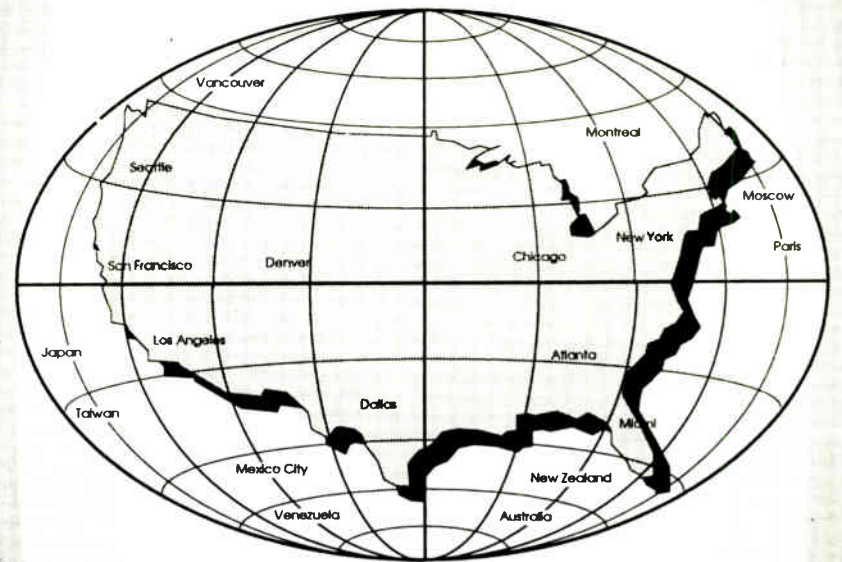
While there are other processors that will do some things better than the LA-2A, and it certainly is easier to bolt a solid state, IC-laden, also-ran squeeze box into the equipment rack and leave it there, if you're searching for that "special" sound, and can't seem to find it, try an LA-2A. I think you'll like it.

□ □ □

John Diamantis is engineering manager for WBIG-FM, WGMS-FM and WTEM (AM) in Washington, D.C.

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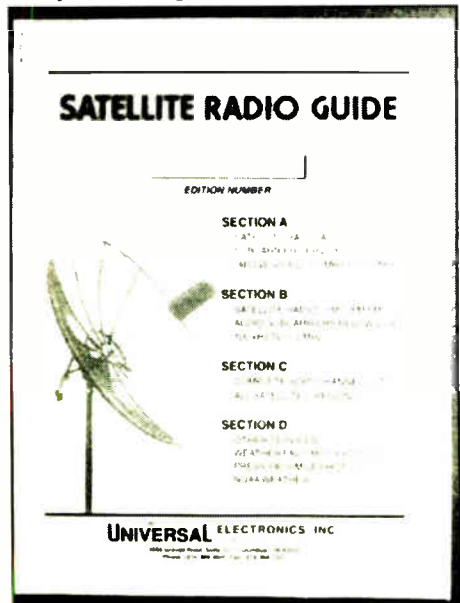
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WORKBENCH

► continued from page 13
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Universal Electronics has just released a new audio services guide for all satellite-delivered audio programming. Issued quarterly, a year's subscription is just \$25. The Satellite Radio Guide• For Audio Services lists satellite locations, transponder locations and frequencies of all audio services. This includes satellite audio subcarrier services (above video, 5 MHz to 8 MHz), satellite audio FM squared, FM/FM, Audio Subcarriers below video (100 kHz to 5 MHz) and SCPC services.

Details on other satellite services are included, such as weather facsimile photos, NOAA weather and late-breaking news. Each issue is mailed first class. If you'd like more information, circle Reader Service 92, or contact Universal Electronics in Columbus, Ohio, at 614-866-4605.

□ □ □

John Bisset is a principal with Multiphase, a contract engineering and special projects company based in Washington, DC. He can be reached at 703-323-7180. Fax submissions for the Workbench column to 703-764-0751. Printed submissions qualify for SBE Certification credit.

PRODUCT EVALUATION

Yamaha Creates Multitude of Effects

by Ty Ford

BALTIMORE The Yamaha SPX990 (\$1149) is the latest in the company's SPX Series of one rack-space, two-channel or stereo, analog I/O, multi-effects processors. A-to-D/D-to-A conversion is 20 bit at

44.1 kHz. Frequency response is quoted at 20 Hz to 20 kHz ± 0.5 dB. Dynamic range is quoted at 106 dB.

The SPX990 has both balanced XLR and unbalanced 1/4-inch analog I/Os. Input and output levels are back-panel switchable from -20 to +4. The power cord is hardwired, not IEC-standard removable.

The input is software-switchable to allow left-mono, right-mono or stereo. There are also MIDI in, switchable MIDI out/thru jacks and footswitch jacks for a dual-function bypass/program change and a trigger. There are no digital I/Os.

Three sections

The main concept of the SPX990 is simple. There are three sections: pre effects, main effects and post effects. You can choose from four pre effects, eight main programs with a total of 36 variations, and three post effects.

Conveniently, Yamaha includes 80 presets made up of adjustments and variations on the pre, main and post effects. The presets cannot be erased. You can start with a preset, modify its parameters and then save it to any of the 100 user memory locations or to a removable memory card. The removable memory card is a nice feature that lets you keep others from using your killer "zombie-howang" effect.

Pre effects include: stereo three-band, ± 15 dB, parametric EQ, stereo compressor, stereo harmonic driver, and a mono multi-effects distortion chain that lines up a compressor, distortion generator and

two-band parametric EQ, in that order. You get your choice of any one of the three stereo pre effects or the mono multi-effects distortion chain. In the stereo modes, the left and right channels can be linked so that their settings always match.

The stereo compressor offers adjustable threshold, ratio (2:1, 3:1, 4:1, 6:1, 8:1, infinity:1), attack (1 to 20 seconds), release (0.01 to 2.0 seconds), a noise gate and a make-up gain output control. There is no display that shows how much gain reduction is being applied to a source. If you

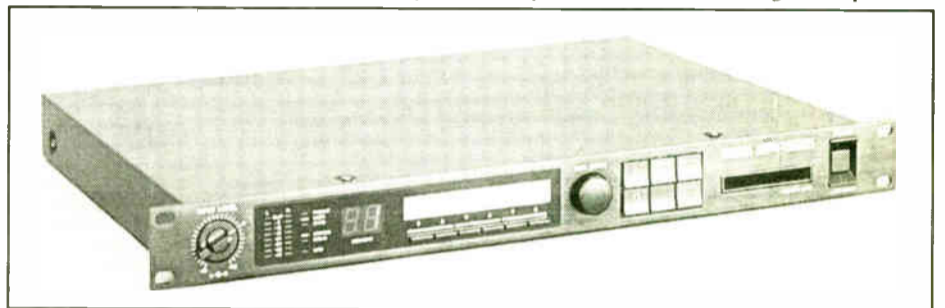
you choose the frequency (400 Hz to 10 kHz) above which harmonic distortion is generated. This section also has mix and output controls.

The distortion mode is comprised of a simpler compressor/limiter with sustain, attack and output level to distortion sections. There are five flavors of distortion, each varying in edge and intensity. Each can be altered by drive intensity, tone, noise gate and the distortion section's output level to the two-band parametric EQ.

And this is just the pre effects.

Post effects

The three post effects—stereo parametric EQ, stereo compressor and stereo harmonic driver—are set up the same way the pre effects are. Having both pre and



The SPX990 is the latest Yamaha multi-effects processor.

normally rely on those readings, you will have to adjust to tuning with your ears.

Noise gate

The noise gate is adjustable from less than a second to several seconds, but it was too slow to eliminate the background noise of a furnace on in the other room without the characteristic "rush" of audio as the gate closed on the last syllable of audio.

The stereo harmonic driver section lets

post effects sections provides a tremendous amount of control as it allows you to modify the sound both before and after the main effect.

The eight main programs—Reverb, Early Reflection, Delay/Echo, Modulation, Pitch Change, Pan, Complex and Freeze—and the 36 variations thereof, each have between nine and 26 parameters.

If you are uncomfortable with the hierarchical file concept (folders within folders) common in the computer world, navigating the menus of the SPX990 may be tortuous. If you understand folders, however, figuring out where you are and where you want to go is not difficult.

Take, for example, the hall, room, vocal and plate reverbs. With each, you can adjust reverb time; amount of high-frequency reverb; initial delay between dry sound and first reflected sound; degree of diffusion (complexity of reflections); density (time between reflections); delay time between early reflections and subsequent reverb; and level balance between early reflections and reverb.

Nice sounding

You also get high (32 Hz to 1 kHz) and low (1 kHz to 16 kHz) pass filters for the affected sound; a trigger level for opening the reverb gate; a trigger delay for adjusting when the gate opens; a hold parameter for determining how long the gate stays open; and a release parameter for determining how long it takes for the gate to close. In addition, a MIDI trigger can be used to open the gate whenever a "Key On" message is sent to the SPX990 via its MIDI input.

Without a doubt, the SPX990 reverb effects sound nice. There is even one preset with different reverb chambers on each channel. Even with mono inputs, the stereo image of the outputs was noticeably widened. This, I suspect, is due to some very carefully engineered delays.

The amount of widening depends to some degree on the nature of the input

continued on page 37



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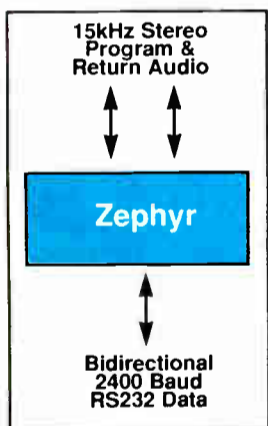
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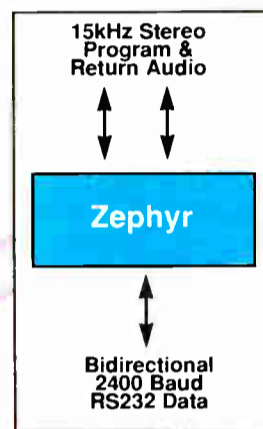


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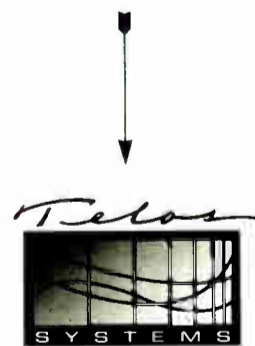


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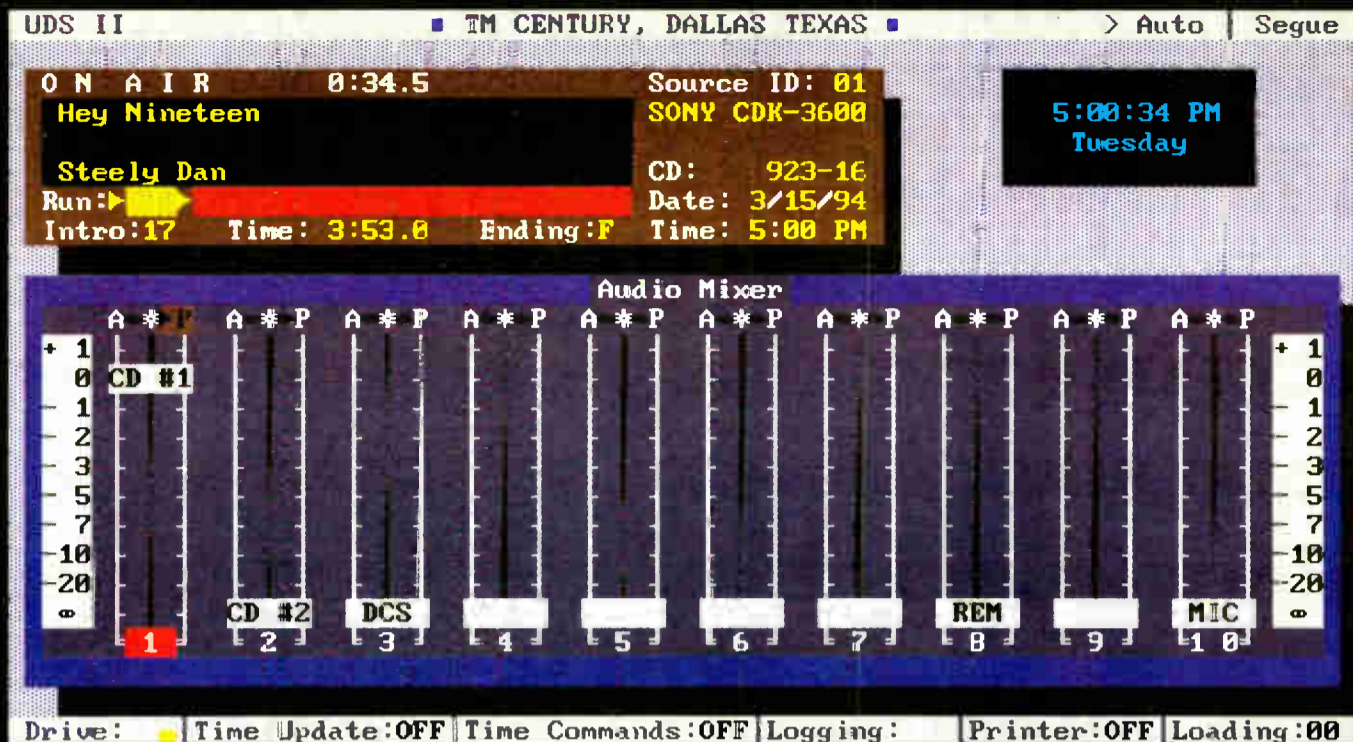
Ultimate Digital Studio II

The screenshot displays the UDS II software interface for TM Century, Dallas, Texas. The interface is divided into several sections:

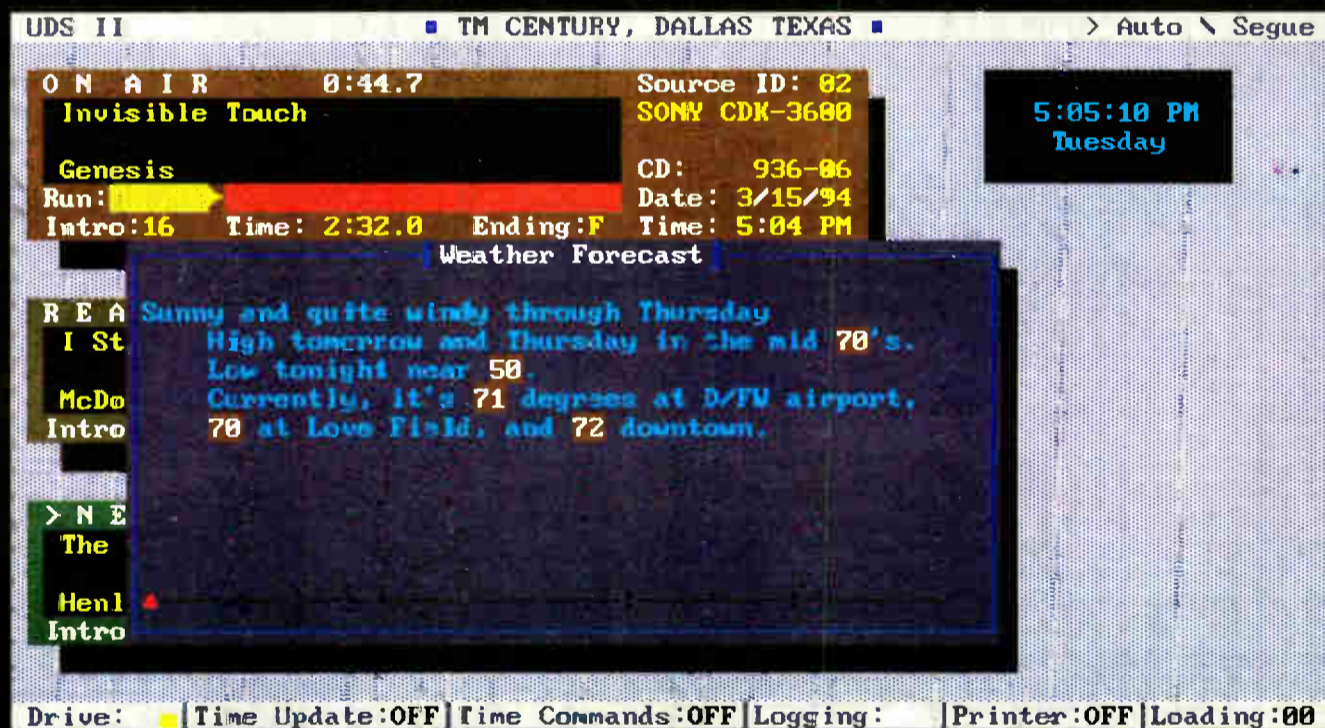
- ON AIR:** Shows the current broadcast with a countdown clock. The song "Hey Nineteen" by Steely Dan is playing. The time remaining is 0:06.7. The Source ID is 01. A large "11" is displayed in the background.
- Time:** 5:00:06 PM Tuesday.
- > NEXT TO AIR:** Shows the next song, "Invisible Touch" by Genesis, with a Source ID of 02, Sony CDK-3600, CD 936-06, Date 3/15/94, and Time 5:04 PM. The intro length is 16 seconds and the total time is 3:19.0.
- > NEXT TO FOLLOW:** Shows the following song, "I Stand For You [Edit]" by Michael McDonald, with a Source ID of 01, Sony CDK-3600, CD 949-06, Date 3/15/94, and Time 5:07 PM. The intro length is 20 seconds and the total time is 3:47.0.
- Bottom Status Bar:** Drive: [Indicator] Time Update: OFF Time Commands: OFF Logging: [Indicator] Printer: OFF Loading: 00

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INDUSTRY ROUNDUP

MIDI: It's Not Just for Keyboards Anymore

by T. Carter Ross

WASHINGTON Although MIDI has been in widespread use throughout the professional audio industry for years, its incorporation into radio production is a relatively new development. Nowadays, a wide array of MIDI-capable equipment is at the disposal of production engineers and other station personnel.

MIDI—an acronym for musical instrument digital interface—was originally developed to facilitate the interconnection

of synthesizers, musical instruments and computers. It has been around for more than a decade now.

Evolving tool

At first, MIDI emerged as a music tool—cast an eye over the liner notes to Erasure's *Pop!—The First 20 Hits* album and see how many mentions MIDI equipment and its manufacturers garner—but since then, it has evolved. Further enhancements, developments and refinements of MIDI are constantly appearing.

"MIDI jacks are on everything. It's worthwhile for radio stations to string it all together with some MIDI cable and see what they can do," said RW's resident MIDI-phile Al Peterson.

Not only are a number of digital audio workstations (DAW) now MIDI-capable, but MIDI in/out/thru ports are popping up on all other sorts of equipment, from mixers to effects boxes and equalizers, to DAT and hard disk recorders. (Even a quick perusal of this issue's *Buyers Guide* helps one see the diversity of equipment that falls into the category of

"MIDI Production Gear.") And further permutations of the MIDI protocol, for example, MIDI machine control (MMC) and system exclusive (sysex) controls, help to uncover new applications for MIDI at radio stations.

MIDI works by recording data. Instead of recording the music a synthesizer makes, the notes and all of the associated information (pitch, duration, volume, etc.) are stored as eight-bit digital data called MIDI messages. These messages are then transmitted via MIDI cable to a computer or other piece of MIDI-capable gear where the sounds can be further manipulated, shaped, morphed, etc.

Beyond its musical abilities, MIDI can be used to trigger events, automate mix-downs, change programs on a signal processor, even create special effects for better-sounding sweepers, jingles, liners and commercials. MIDI time code can be synchronized to SMPTE time code, allowing radio stations to do some audio work for television productions, if necessary.

Some manufacturers and users have even suggested the possible use of MIDI equipment for cart replacement. A small keyboard or other MIDI instrument can be installed in the control room and then used to trigger MIDI events such as liners, jingles, commercials, etc. The end result is 10, 20 or more effects available at a touch coming from a digital source.

Within means

MIDI production is also within the means of most stations. It is not uncommon to find an inexpensive, "department store" keyboard with MIDI ports in a station's production room. And while a \$100 keyboard by itself may sound cheap on-air, the addition of a \$300 MIDI module can make it sound phenomenal.

The addition of a sequencer—either a dedicated piece of hardware or a software package and a computer to memorize what you play—creates the brains that all of the effects boxes and other equipment in the production suite plug into. Once the gear is patched together, the only thing left to do is to explore the possibilities.

The end result, according to those engineers who use MIDI in their work, is smoother, quicker productions. Sound is enhanced because of the deft accuracy that MIDI control brings to manipulating audio. MMC and sysex allow the final product to be assembled rapidly and precisely. These same MIDI messages can be used to combine different effects to create sounds that might otherwise not be created.

There is one caveat, however: To fully exploit the capabilities of MIDI technology it helps to have some knowledge of music and/or a willingness to experiment.

Adapting to include new technology is something broadcasters have been doing for years. From AM to FM to digital audio radio, one can see a consistent progression toward better audio fidelity, better sound reproduction, clearer and more precise audio: MIDI not only helps increase the audio quality of in-house productions, once advertisers hear how much better commercials created with MIDI equipment sound, it may well help draw in a bit more business.



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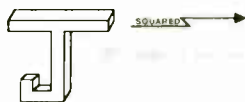
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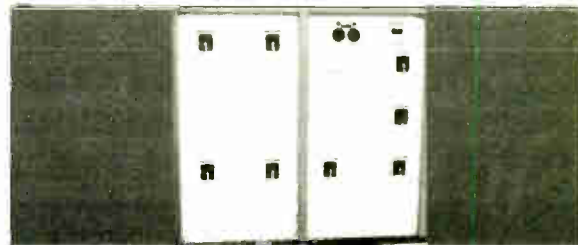
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USER REPORT

Emulator Enables Sound Morphing

by Frank Serafine
Owner
Serafine

VENICE, Calif. Audio production for video, films, TV, etc. is a challenging task requiring top-notch equipment. At Serafine, we use exclusively six E-mu Systems Emulator IIIXP synthesizers for creating all of the sound effects and music in our post production work for films, television and special venue projects, like the Space Shuttle Adventure ride we just finished for Six Flags. We use the Emulator on every project at my studios.

I first used E-mu analog synthesizers in 1977, while working with Disneyland on the grand opening of Space Mountain. Ever since then, I have worked with E-mu, helping to develop new products for post production sound and film scoring. We began using the early EIII keyboard on *Star Trek III*, *Hunt for Red October* and other movies. Most recently, we have used it on *Thunder in Paradise* and *Baywatch*.

Rendering engine

The Emulator is what I call a "sound rendering engine." It is comparable to the

rendering engines used in computer graphics to speed up the software processing on Macs, Silicon Graphics or other machines. The EIIIXP is our sound engine: We create all of our sound effects on it.

We go out into the field and record samples onto DAT recorders, come back to the studio and digitally input them right into the EIIIXP. The EIIIXP has a digital I/O port allowing us to go straight out of the DAT machine and into the back of the EIIIXP. We do not have to worry about levels or anything. The end result is an exact digital replica of what we do in the field.

I then sample all of the best stuff from the DAT tape, and the EIIIXP gives me keyboard control of all the sound effects. I can find out where everything is; I can loop certain segments; I can work with the EIIIXP's incredible EQ features and controls.

The effects are then stored to 650MB magneto-optical (MO) discs using Pinnacle Micro REO MO drives as full-on, uncompressed 16-bit digital samples. We are currently taking all our sounds, organizing them into different categories and making 650MB recordable CDs with

understand electronic musical instruments, so it feels natural for me to use.

As a sound designer, I sit down with my keyboard and create. Trying to create something on a digital audio workstation (DAW) or a computer is very difficult for me. After composing the music or effects, I use the computer to tweak the segment. But for the creative aspect, DAWs just do not have the complete control and musician's interface I desire.

For example, with the EIIIXP, I can morph sound. That is to say, I can control all of the parameters such as the pitch of the sound, its equalization, etc., in real time locked up to a sync clock. You do not have as much control with a rigid hard disk system. With the EIIIXP, I can manipulate the sound like Silly Putty.

Beyond its morphing ability, I really like the way the Emulator operates with music-oriented sequencing programs like Opcode System's Vision, which we also use for creating sound effects. Everyone here has a music background; we all think like musicians, so the music-friendly nature of the EIIIXP is a big plus. We also use the new Eventide DSP 4000 and Lexicon 60 for our special digital signal processing necessities.

Radio concept

One of the things that I do that is similar to radio production work is, for instance, a Houston Metro television spot I just

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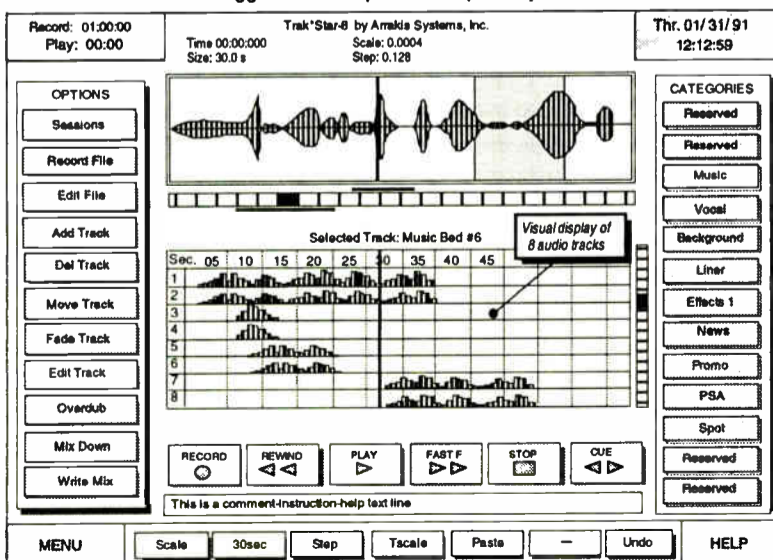
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Frank Serafine stands ready with his "sound rendering engine," the EIIIXP.

Pinnacle Micro's RCD-202 CD recorder to help better control the library. I have spent 20 years of my life gathering effects, and now it is time to organize them all.

The other EIII sound and music libraries I make use of are Northstar, Q-Up Arts, Invision and Creative Sound Design on MO carts and Sound Ideas 6000 controlled by a Gefen System 5. Also I use the Network, Hollywood Edge and File Effects CD libraries.

Consistent philosophy

The Emulator is the only American-made synthesizer left, which is something I appreciate. It is both easy to operate and easy to understand. As I have worked with E-mu products for years, it is nice to see that they have a consistent philosophy. And with each new model, all of my old sound effects are still compatible.

The sound quality of the EIIIXP is as pristine as you can get. This is a very powerful electronic musical instrument that I can apply toward my sound design. I come from a music background, and I

finished. I had to design a story with sound effects to convince people not to drive their cars to work in the morning. First I created a really far out, frantic music score and then added in sound effects like a flat tire, another tire blowing out, pistons screwing up on a car, a tow truck, etc.

I incorporated all of these sounds into the story, and then it was sent to the visual effects people who created abstract images to suit my soundtrack. That's really a radio concept. Creating a story and mood with sound and music first before the picture is created. In a sense, radio is just theater without picture: You have to tell a story in the same way.

Here at Serafine, we have several editorial studios equipped with Mackie 32x8 bus consoles. First we record Foley, which involves recreating all of the ambient sounds that you hear in movies. The second studio, equipped with Neumann KMR 81 and Equitek E-200 microphones, is an automatic dialogue replacement (ADR) room where actors are called

continued on page 37 ►



Systems with Style

When KABC/KLOS decided to rebuild from the ground up, they called Pacific Recorders & Engineering to provide its expertise in studio systems planning and execution. After all, when you're dedicated to winning, you don't gamble with success. PR&E has a proven track record of building the world's leading broadcast facilities for over twenty years. This record translates into the uncommon depth and breadth of experience which we bring to each new project. From news to rock, talk, or full-service, we're comfortable and conversant with all formats.

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DESIGNS THAT MAKE THE DIFFERENCE



USER REPORT

Band In A Box Hits Any Note

by Al Peterson
Production Director
WNNK-FM

HARRISBURG, Pa. If you operate a MIDI production room with a PC sequencer, consider adding Band In A Box from PG Music. Although this music software has been available to MIDI users for a while, its recent upgrades integrate it into radio production

studios. With Version 6.0, it is easy to sound like a musical genius.

This powerful yet inexpensive program prompts you to type in chords and then choose a music style from a pull-down menu. The computer creates bass, drum, guitar, piano and string arrangements, then plays it all through MIDI equipment.

Band In A Box speeds you

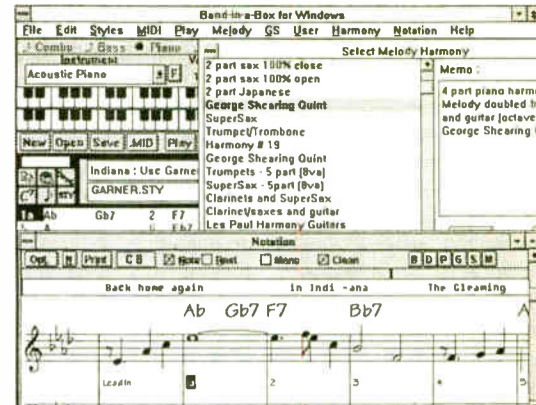
through basic elements of arranging commercial jingles, song parodies and even home-made station image ID music.

Spot bed

Imagine a client wants a spot bed with an upbeat 1960s feel without the legal hassle of actually lifting an oldie. Start up Band In A Box; type in C, F, D7 and G7 (the desired chords); pull down "Rockabilly" from

the menu; and hit "Enter." The program creates the arrangement and plays it back through a multi-timbre synthesizer or soundcard.

An on-screen keyboard shows you what is being played, and subtle improvisations and drum fills are dropped in everywhere. All you do is add



Pick any music style and Band In A Box plays along.

the melody; pick a harmony

track; fit the tempo into a 60- or 30-second spot; transpose it into a key everybody is happy with; and you are a hero.

Version 6.0 for Windows includes several dozen music styles and automatic harmony (dragging the mouse lets up to five saxophones or Les Paul-style guitars to play along with you). It also is able to print out your creation as sheet music.

Whether it is a polka, bluegrass banjo and fiddle, or a Paul Shaffer-style Blues organ, PG Music packed it into Band In A Box.

At WNNK-FM, we use Band In A Box Version 5 for DOS on a 386SX IBM-clone with a Roland soundcard. At home, I use Version 6.0 for Windows with my various Yamaha, Roland and E-mu synthesizers.

Periodic updates

PG Music issues periodic updates and new styles to keep up with musical tastes and customer recommendations. As it costs less than \$100, Band In A Box pays for itself with the first jingle you sell that was made on it.

Version 6.0 is available only for Windows, but DOS, Mac and Atari versions are being developed. You may still find Version 5 for DOS, which runs on XT and 286 machines, in stores for a good price. Naturally speed and a graphical interface are sacrificed, but the cost is kept way down. You will need the low-density diskette version to go this route (call the company for this option).

If you already own an earlier version, PG Music offers upgrades for approximately \$50.

I love working with Band In A Box because it makes me sound like a genius every time. Oh, if my clients only knew.

□ □ □

For information about Band In A Box, contact PG Music in New York state at 905-528-2368; fax: 905-577-4704; or circle Reader Service 117.

Alan Peterson authored RW's four-part MIDI series last summer. His music projects have aired throughout the Northeast and via the Premiere Radio Comedy service. He can be reached at 717-238-1041.

Be Quiet!



The original Shure FP32 set the standard in field production for portable stereo mixers. Now, with the new FP32A, you can count on getting even less. Noise, that is... 30dB less! In fact, the FP32A is so quiet and improved that it's perfect for use with DAT and other digital recording media.

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USER REPORT

Korg MIDI Gear Suits Radio Needs

by Frank Scales
Creative Services Manager
Sound Design Division
The LBJ Broadcasting Co.

board in your studio, I recommend you start. Start with something relatively simple to spots. Percussion sounds can be used to punctuate words, phrases and ideas. Or



The Korg OIR/W sound module is in LBJ's MIDI setup.

AUSTIN, Texas Have you lost your way in a world of technophobia and digi-mania? Do you long for more from your digital recorders, outboard processors and musical gear? Are you a production engineer with a need?

If you are not yet singing the praises of MIDI, it is probably because you have not had the opportunity to try it out.

Back in the day

My experiences with MIDI date back to the early days, when it was used to link up and play multiple synthesizers simultaneously. Originally MIDI just allowed you to play more than a single note at a time. For example, the synth pad on the introduction of the Prince song "1999" was the result of MIDI.

The basic premise of MIDI has not deviated much from its original goal of interfacing music gear. What has changed and revolutionized studio recording today is the widespread use of MIDI on other types of gear, and the scores of added functions that can be controlled over a MIDI network.

Korg equipment and MIDI are vital tools in my studios. At the heart of our setup is the Korg SoundLink digital workstation: Its MIDI features are extensive and useful. We make use of a 16-track MIDI sequencer that works in tandem with the SoundLink's eight-track digital recorder.

Although the main function of the sequencer is recording and playing back MIDI sound sources, I also use it to store and change program patches on my outboard gear, including a Korg AI digital/analog effects processor.

If I want a full, fat sound at the beginning of a spot and then switch to a phone-filtered effect in the middle of the spot, I can program those patch changes with the SoundLink's sequencer and have the patch change automatically during playback. Like patch changes, MIDI also allows me to make and automate volume control changes to external MIDI gear via the SoundLink's MIDI master fader.

Transfer and storage

Another great MIDI tool is sysex transfer and storage. Sysex (short for "system exclusive") could be called the DNA of each device—no two sets of sysex data are the same. Included in sysex can be a device's system software, sound patch data and sequence data.

Via MIDI, sysex data can be sent to a storage device like the Korg SoundLink, saved on a hard drive or floppy disk, and later sent back to the device. For all outboard processing patches and keyboard sounds this feature of MIDI is indispensable.

Along with the AI effects processor, three Korg sound modules—the M3R, Wavestation SR and OIR/W—are part of my MIDI keyboard setup. Without a question, I get the fullest use of MIDI when using my keyboards. After all, this is the original premise underlying MIDI. But unlike the early days of spending a few thousand dollars for another keyboard just to have newer sounds, Korg and other companies constantly update and market new "plug and play" libraries.

If you do not currently use a MIDI key-

operate. As you get comfortable with the gear and more familiar with the sounds, use the keyboard to add special effects to your

hold down a low note on the keyboard using a pad patch for a killer promo. The possibilities are limitless.

I use MIDI on a daily basis and these are just a few of the applications that are available. I recommend you at least experiment with MIDI in some way—from automation of patch changes, volume and other various parameter controls to sysex transfer, sequencing and synth module stacking. Whatever the application, MIDI makes production easier and better.

Korg musical instruments, outboard gear and the SoundLink digital workstation are a true testament of the company's commitment to providing reliable, user-friendly and cost-effective MIDI equipment.

□ □ □

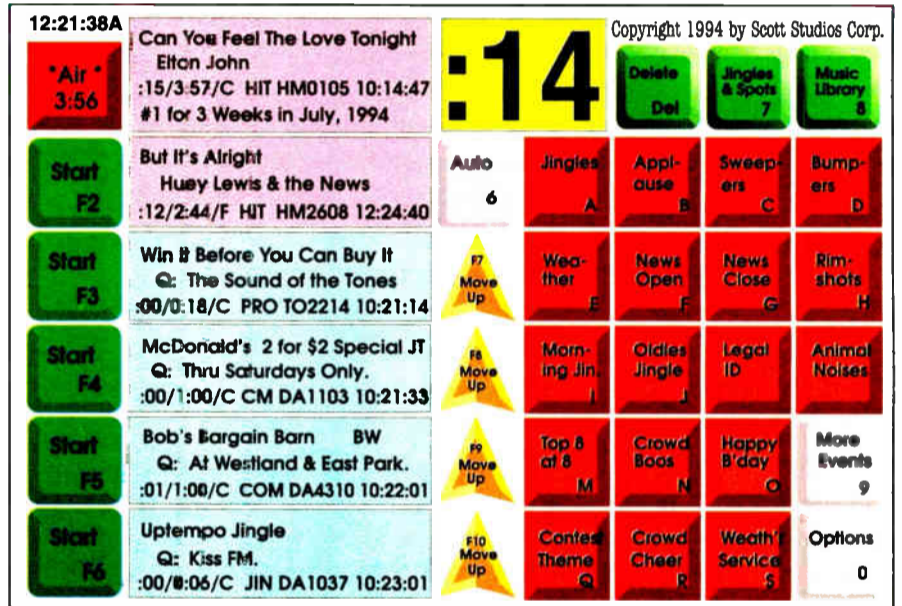
For information from Korg, contact Matt Appelbaum in New York state at 800-645-3188, ext. 280; fax: 516-333-9108; or circle Reader Service 123.

Touchscreen Plays Music and Spots Instantly from Hard Drive

Play Anything at a Touch

Nothing else makes radio as fast or easy as having all your songs, spots, sounders and sweepers start with your fingertip—**always on-line and ready** to play from hard disk. And nothing else is better for fast, exciting radio than the **new Scott Studio System!**

Here's how it works: Six buttons on the left of the computer touchscreen play what's on your program log. Your songs, spots, promos, PSAs and live copy come in automatically from your music and traffic computers. You can rearrange anything by touching arrows (at mid-screen), or opening a window with the entire day's log. On the right, **18 hot keys** start unscheduled jingles, sounders, comedy and sound effects **on the spur of the moment**. You get 26 sets of hot keys for your jocks' different needs.



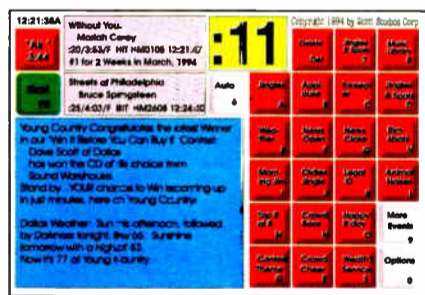
World's Fastest Requests!

Touch the Music button at the top right of the main screen to see our "Wall of Carts" with 1,000 songs (or more) **on-line!** They're displayed by title, artist, year, length, category, or any way you like. Touch the song you want and Scott Studios' digital audio hard disk plays it **instantly**.

In addition, all your comedy bits, spots, jingles, promos and PSAs have their own "Wall of Carts" so they start immediately. Or, you can pick any unscheduled song, spot, sweeper or promo and put it anywhere you want in today's log.

1, 2 or 3 Touchscreens

Teams of personalities can add touchscreens to share control. Jocks choose whether to handle sweeps themselves or let the Scott System sequence automatically.



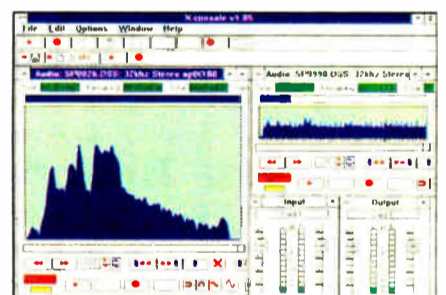
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Weather forecasts, live tags, promo copy, contest winners' lists and programming memos automatically pop up on your Scott System's screen. As an option, we can also work with your news wire to update and display selected weather, news and sports copy.

The Best Digital Audio

When spots, promos, PSA songs, or any other digital audio events are recorded, they're immediately playable in **all** your Scott System air studios. Nobody wastes time carrying carts down the hall or redubbing spots for additional stations.

Scott Studios will even pre-record your music library from CDs at no extra charge. You choose double- or triple-overlap playback (or more) while recording.



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Scott Systems pay for themselves in increased efficiency on-the-air and in production. Our graphic waveform editor quickly cleans up out-takes and works wonders with big productions.

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Yamaha's Many Effects

► continued from page 26

signal (mono, stereo and the amount of separation in the source audio). Sources with a lot of stereo activity achieve less spectacular stereo separation. The width of the effected signal also depends on the amount of diffusion, the balance of early reflection to reverberated sound and the overall balance of wet-to-dry sound.

While the SPX990 includes many options in its pitch change programs, none of the four programs I tried were able to change the pitch of a voice without audible delay side-effects.

The Freeze program, or sampler, is a good clean circuit, but it only offers 1.35 seconds of mono-only sampling. Unfortunately, there is no increased RAM option. You also cannot change pitch without changing playback speed. Pitch change is either dialed up on the unit itself or played from a MIDI keyboard.

One of the difficulties I have had with the SPX series is its lack of dedicated controls. Using MIDI, I was able to program the two control faders on my Roland U-20 Controller keyboard to remotely adjust reverb time parameters and most, but not all, of the others.

Some of the more expensive processors on the market that are engineered with larger RAM program storage allow you to switch and crossfade between two different programs. The SPX990 does not. Most of the time the outputs mute for less than half a second, until the new program is loaded.

Manual

The 70-page manual that accompanies the SPX990 lists its programs and briefly explains the range and results of each adjustable parameter. The manual and a handy four-page pamphlet list each preset and the effects involved. They also include suggestions on how they might be used.

In general, however, the manual suffers from some really poor syntax. Sentences

like "At the time of purchase, storing of program is the same as that of the pre-set program" left me guessing as to what was meant. After a few days with the unit, I

E-mu Systems EIIIIXP Enables Sound Morphing

► continued from page 32

back in to redo lines that are obscured by the plane that flew over the beach while the scene was being filmed.

We also have two editorial suites where we cut sound effects and go through the dailies that are shot on location and cut in all of the dialogue. All of this work is done on an AMS Neve Audiofile Spectra, a really powerful, professional DAW. In conjunction with the Audiofile, we are currently beta-testing Pinnacle Micro's ORRAY, a 5.2GB multiple drive MO array. It provides us with easy and fast backup capabilities for the Audiofile's hard drive.

Then we have our music room, where we create progressive and orchestral works on synthesizers. We also can record orchestra musicians there. For example, on our recent project for Six Flags, we brought in concert master violinists and horn and brass sections, recorded to a multitrack, then overdubbed them on top of themselves again and again. By the time they left, we had what sounded like a full orchestra.

MIDI driven

One of the advanced ways we work with music, and the way we use the EIIIIXP most effectively, is with Opcode's Vision software. Vision lets

us perform all our music on synths and then print out notation of the music. We give this sheet music to the live orchestra musicians and have them play it. These tools allow us to do many, many things.

It is all MIDI-driven and MIDI-interfaced, and Vision prints out these beautiful notation charts that not even the best copyist would be able to do. They are so precise, so right on. We are very impressed by the way the whole system works.

After we are done with the editorial rooms, we go to a THX-equipped film mixing stage, where we synch the picture with all of our 24-track machines. We use three 24-track Dolby SR mixing machines: the Audiofile has 16 channels of dialogue and ADR on it; and the Foley and music, which is on a Tascam DA-88, all locked up together. We have an Otari 54P Premiere 90-channel, two-man, film mixing console on the dubbing stage with moving fader automation. All the other fader channels are automated with a Penny & Giles MM16 MIDI controller.

For information from E-mu, contact John Kerry in California at 408-438-1921; fax: 408-438-8612; or circle Reader Service 205.

Partners Group and will make its next generation of user-interface software compatible with Digidesign's hardware systems including, Sound Tools II, ProTools and Session 8, as well as its own PostPro and Synclavier workstations.

Dolby Laboratories announced that, effective June 22, 1994, its professional audio product line sales to customers in Northern California and Northern Nevada are handled directly from its San Francisco headquarters.

Elsewhere in the U.S., Dolby products remain available through its dealer network.

The Corporation for Public Broadcasting (CPB) awarded Dataworld Inc. a contract to provide signal coverage information for all current and potential recipients of CPB funding.

Varian Microwave Equipment Products of Santa Clara, Calif., received ISO 9001 designation, the most rigorous and comprehensive of the ISO 9000 series.

Basic Measuring Instruments (BMI) of Santa Clara, Calif., and Electrotek Concepts Inc. of Mountain View, Calif., signed an agreement in principle for BMI to purchase Electrotek. The merge is expected to occur in October.

Telos Systems announced the addition of New York-based dealer AudioTechniques to its roster of Zephyr dealers.

Radio Computing Services acquired Mediacomp of Kitchener, Ontario, as part of its ongoing growth into the digital studio and production arenas.

People, Promotions and Appointments

Ronald B. MacIntyre was appointed vice president for worldwide sales and marketing at United Press International (UPI).

Joel Silverman was promoted to vice president of North American sales for Lexicon Inc.

E. Kirk Ellis joined Lawrence Behr Associates Inc., part of the LBA Group, as director of project engineering.

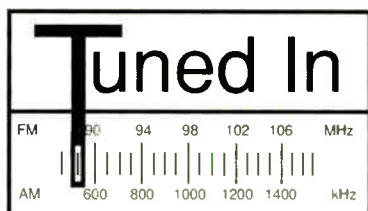
Microwave Networks Inc. (MNI) announced several new appointments. Dirk Heitkamp was appointed director of technical services; Scott Champagne to manager, systems engineering; Ronald Wagnon to manager, sales support; and Dale Platt to manager, proposals.

As part of a merger between the companies, Richard Byrne, formerly of Mediacomp, joined Radio Computing Services (RCS) as vice president of broadcast digital audio systems. Also as part of the consolidation, Nigel Atwell joins RCS' development staff for Master Control.

Company News

Svetlana Electron Devices is now the sole representative in the U.S. of ISTOK tubes. ISTOK, also known by its Russian initials SRPC, designs and manufactures klystrons, TWTs, BWOs, amplifiers, magnetrons, solid state devices and complete subsystems for the microwave and millimeter frequencies.

The Synclavier Co. joined the Digidesign Developmental



distortion chain: a variety of reverbs, flangers, delays, panners, pitch and modulation effects; and 1.35 seconds of MIDI-controllable sampling with removable memory cards. There are cheaper reverbs but not with all the features of the SPX990.

□□□

For information on the SPX990, contact Yamaha Corp. of America in California at 714-522-9011; fax: 714-739-2680; or circle Reader Service 202.

Thanks and a tip of the hat to Bradley Broadcast of Gaithersburg, Md., for supplying the SPX990 unit.

Ty Ford has been dithering the digital domain for many years, without developing warts. To find out how, call him at his studio 410-889-6201 or via MCI e-mail at 347-6635.

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Convenient tote bags make it a breeze for carrying the entire 25 foot mast into any building, elevator, up stairs or onto roof tops. A must for remote sporting events or on location live newscasts.



The EZ Raze Antenna Mast is omnidirectional. In just minutes, one person can erect a stable 25 foot antenna and you're ready to start broadcasting.

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READER SERVICE NO. 183

The Audio World™ Interface from BENCHMARK



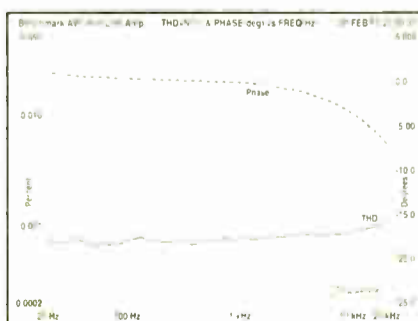
\$225

The Audio World™ Interface is a two-way recorder interface that is switchable to a line amp or a mono mix amp.

Both the balanced inputs and the electronic transformer outputs have front panel recessed gain controls. The rack mountable chassis includes LEDs to indicate signal presence, the onset of peak overload, switch position, and power presence.

Use it to mate R-DAT and analog recorders, to generate Mono from Stereo, or as a balanced line amplifier to compensate for level mismatches.

With its superlative performance and very, very low price, you'll find numerous applications for this versatile device.



BENCHMARK MEDIA SYSTEMS, INC.
Phone 800-262-4675, FAX 315-437-8119

READER SERVICE NO. 67

WorldRadioHistory

The CircuitWerkes TeleRadio Remote Controlled Listen Line



You can find out what's on the air in all of your markets without ever leaving your chair!

With the TeleRadio and a phone, you are ready to check up on your station *and* all of your competitors in real-time. You'll never have to get another station around the dial as if you were right there. When the TeleRadio answers, its internal radio begins playing down the line to you. You control the tuner with the buttons on your phone. The TeleRadio is the next best thing to being there yourself.

The TeleRadio features include:
Ten random memory presets
Remote scanning, tuning, band change & memory set.
Remote controlled external audio jack lets TeleRadio double as a standard coupler for IFB, etc.

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READER SERVICE NO. 111

TECHNOLOGY UPDATES

ALESIS

Alesis QuadraVerb 2 Signal Processor Handles Eight Simultaneous Effects

LOS ANGELES The QuadraVerb 2 (Q2) from Alesis provides eight simultaneous effects to be combined, layered or split between two input and two output channels. Each of the eight effect blocks can be programmed as a stereo or mono chorus or flanger; equalizer (multiband parametric, resonator, high and low pass EQ); pitch shifting over a two-octave range; delay (mono, stereo, ping-pong or multitap); or reverb (hall,

plate, room and reverse).

With the large custom LCD graphic display of the Q2, the exact setup of the eight effect blocks is shown at all times. The LCD displays routings as "digital patch cords" graphically drawn between blocks. Each of the 100 program memories has its own configuration of processing and routing.

The Q2 is the first signal processor to feature ADAT Optical I/O ports. It can

process signals to and from ADAT or any other device featuring an ADAT MultiChannel Optical Digital Interface—e.g., the QuadraSynth, the AI-1 AES/EBU interface or other products that use the ADAT Optical standard—without leaving the digital domain.

The Q2 provides many MIDI functions, including being able to respond to program changes, sending and receiving program information via system exclusive

(sysex) dumps and advanced real-time control over various effects parameters via MIDI controllers. The 44 effect subtypes of the Q2 each have from one to 14 target parameters and can be controlled by up to eight MIDI modulators per program, including Pitch Bend, Controllers (000 - 123), Aftertouch, Note Number, Note Velocity and two Local Generators.

For information from Alesis, contact Jeff Klopmeier in California at 310-558-4530; fax: 310-836-9192; or circle Reader Service 6.

RANE

MIDI-Capable Rane Equalizer Allows up to 128 Different Settings over 28 Bands

MUKILTEO, Wash. The MPE28 from Rane enables you to set up as many as 128 different EQ settings for under \$750. It is a single-channel, 1/3-octave, 28-band graphic EQ, housed in one rack unit of space.

The user interface consists of two LED digital displays, 24 buttons and 20 LEDs. And while it may sound daunting, programming the unit is very intuitive. The manual is thorough and laced with Rane's infamous humor.

Master levels are programmable, which is useful for balancing out different levels caused by different curves. You can set a global rate at which one program changes to another. Steps can be as small as 1 dB, which produces slow EQ changes and eliminates any pops caused by quick audio changes, all the way up to 27 dB.

The "M" in MPE stands for MIDI, and the MPE28 is MIDI-capable. The RPS4 option takes contact closure and turns it into MIDI program change information. In a broadcast application, this enables you to lock out the front panel and install a simple contact closure switch for DJs to select up to 16 different curves. Each DJ could have her or his own setting labeled on the switch plate.

For information, contact Jon Ferren in Washington state at 206-355-6000; fax: 206-347-7757; or circle Reader Service 181.

PENNY & GILES

P+G MIDI Management System Controls Complex Setups with Innovative Faders

SANTA MONICA, Calif. The Penny & Giles (P+G) MM16 MIDI Management System offers new levels of control for complex MIDI setups, combining an assignable control surface with endless-belt controllers for instant visual status feedback. The MM16's functionality is extremely comprehensive, making it equally well-suited to tasks involving the control of hard disk recording systems, sound effects management and control, and centralized control of outboard equipment.

24 dedicated pushbuttons and a backlit 2 x 20 LCD screen.

Available as a six-unit 19-inch rack-mounting unit, the system enables rapid real-time access to variable parameters in a MIDI installation, thereby simplifying the task of programming and controlling changes to synthesizers and outboard equipment.

Capable of operating as a standalone generator of MIDI codes, the MIDI Management System also operates in Update mode to facilitate sequencer and other equipment automation. It features separate Merge and Control ports, each with six-way output splitters, together with Merge In/Thru and Control In/Thru facilities.

Control assignments are stored in up to 64 programs, while data values are saved in up to 128 snapshot memories. Internal memory can be augmented with a plug-in 128K static RAM card or dumped externally via MIDI.

The unit can be designed as a system timing controller, and tape recorder-style transport keys are provided for MIDI machine control. Two footswitch sockets allow selectable operation of various facilities.

For information, contact Neal Handler in California at telephone 310-393-0014; fax: 310-450-9860; or circle Reader Service 146.



The design of the MM16 allows control positions to be instantly apparent. This is particularly true when the MM16 is configured as a MIDI mixer and when using the endless belts as channel faders and group masters.

In total, the front panel features 16 endless-belt controllers with integral LED displays, a data wheel, four data entry keys, 16 assignable keyswitches,

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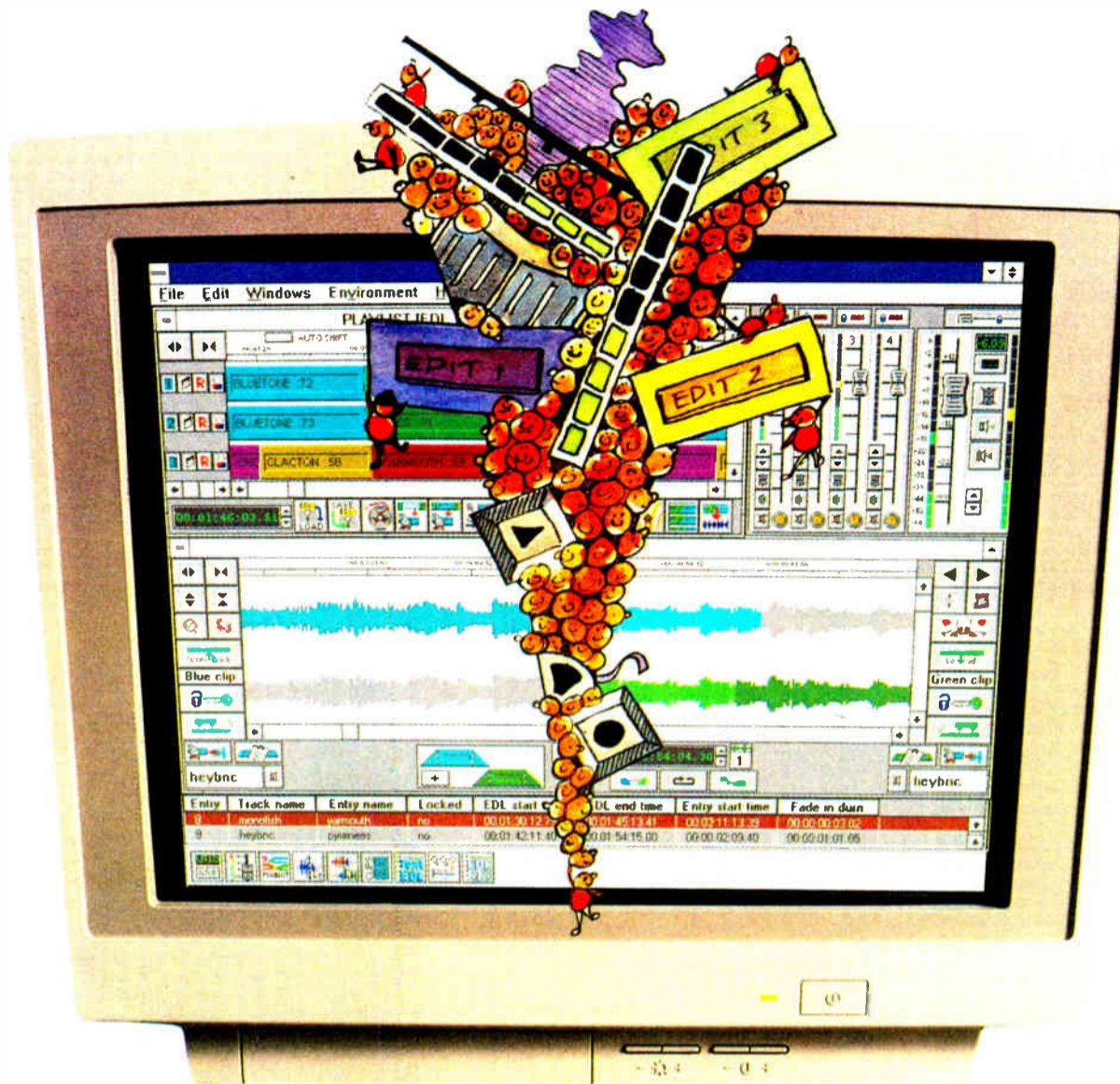
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ENSONIQ

**Ensoniq ASR-10
Combines Effects Processor,
MIDI Sequencer and
Digital Recorder**

MALVERN, Pa. The ASR-10 Advanced Sampling Recorder from Ensoniq is a complete digital production studio for producing radio spots, voiceovers, jingles or soundtracks. Available as a keyboard or rackmount, the ASR-10 combines an effects processor, MIDI sequencer and digital recorder into a single easy-to-use

instrument.

With up to 16MB of sample memory for creating high-quality 16-bit stereo samples, the ASR-10 features a powerful on-board 24-bit effects processor. Sample through effects like EQ or compression, or resample a sound multiple times through different effects for stunning multi-effects. External signals can be processed through the effects processor, providing extra value for smaller studios.

An on-board 16-track sequencer provides real-time and looped recording modes, 96 PPQ clock resolution, an

auto-locate function and a variety of editing functions.

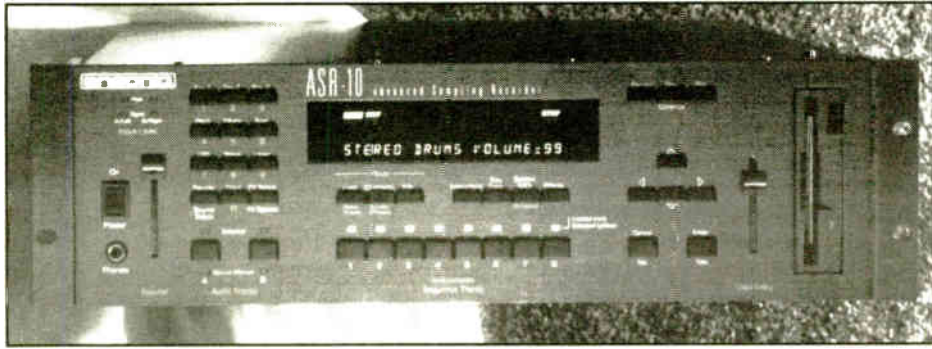
A digital audio recording feature adds

able for input sampling, audio recording and final mastering output. These features create an all-in-one production tool, without the cost of extra gear.

Ensoniq supports the ASR-10 with extensive sound libraries.

The suggested retail price of the ASR-10 keyboard is \$2,695; keyboard with SCSI is \$2,995; and rackmount (SCSI and output ex-pander standard) is \$2,895.

For information, contact Ensoniq in Pennsylvania at 800-553-5151; fax: 610-647-8908; fax-on-demand: 800-257-1439; or circle Reader Service 97.



OPCODE

**Opcode Vision Offers
Complete Control of
MIDI-Based Functions**

PALO ALTO, Calif. Vision from Opcode Systems Inc. is a complete, professional software system for recording, editing and playing back MIDI-based music. Version 2.0 boasts major new features, such as music notation, editing and printing; Track Overview; Groove Quantize; and many other enhancements. Vision 2.0 sports a new user interface that is intuitive and comfortable on the eyes.

Designed for fast and easy editing, Vision's automatic standard notation allows the user to view, edit and print one track or many. The window allows all types of editing, including attack time, duration, pitch, copying and pasting.

The Track Overview mode gives the user a quick way to perform global edits. Users can view the tracks in metrically equal blocks or in Opcode's Phrase mode.

Vision's groove quantization function lets users align their music rhythmically to another's performance. Version 2.0 comes equipped with grooves from the MPC-60, Linn 9000 and a sampling of DNA grooves from WC Music Research.

Vision has SMPTE synchronization using MIDI time code to record or play back in sync with tracks on audio or video tape. Other major features include: System Exclusive data recording and playback; tempo and meter tracks with any number of variations; unlimited sequences per file allowing sequence chaining with 99 tracks per sequence; and other professional features. Using OMS (Open Music System), Vision allows intuitive, automatic assignment and completely flexible mapping of MIDI channels.

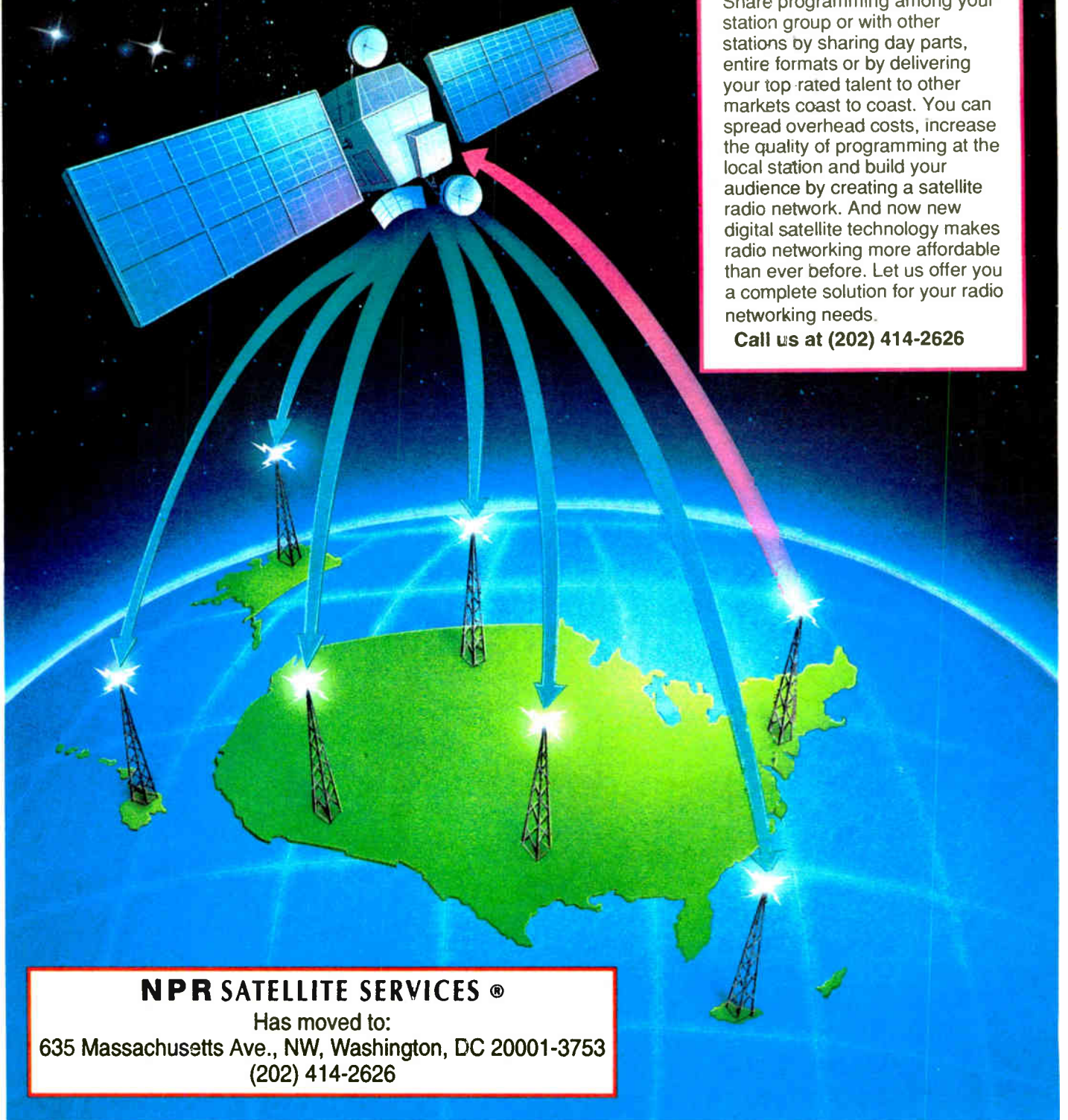
Vision requires a Mac Plus or larger computer with 4MB of RAM, System 7.0x or higher, MIDI interface and a MIDI instrument.

For more advanced MIDI applications, including 16-bit digital audio editing, Opcode also offers Studio Vision AV and Studio Vision Pro.

For information, contact Paul de Benedictis in California at 415-856-3333; fax: 415-856-3332; or circle Reader Service 186.

two tracks of live audio performance to sequenced tracks. Record direct to RAM or SCSI hard drive with the simplicity of a tape recorder, with DAT Backup/Restore capabilities. A digital I/O option is avail-

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TASCAM

M-3700 Console Uses Both Snapshot and Dynamic Automation to Facilitate Studio Operations

MONTEBELLO, Calif. The Tascam M-3700 mixing console incorporates a variety of MIDI functions and capabilities to provide maximum flexibility in the studio. As the M-3700 incorporates both snapshot and dynamic automation, its MIDI capabilities allow users to work how they feel most comfortable.

The M-3700's dynamic automation responds to MIDI system real-time messages, and MIDI Clock can be used as the time base for automating a mix. With its DIP switches set for MIDI Sync, you can use a MIDI sequencer as the master to the M-3700. It responds to all Start, Stop, Continue and Song

Position Pointer messages.

The M-3700 also accepts MIDI time code as its time base for mix automation. This enables, for example, a Tascam DA-88 equipped with the SY-88 Sync Board to directly feed the M-3700 simply by connecting MIDI cable from SY-88 MIDI Out to M-3700 MIDI In. This frees the SY-88 time code out port to feed another external device.

The M-3700 can input SMPTE time code and output it as MIDI time code. This lets you feed SMPTE directly from the time code track of an analog open-reel recorder and synchronize a MIDI sequencer to tape via the M-3700.

In snapshot mode, the M-3700 transmits MIDI Control Change Messages according to VCA fader position and mute switch settings. These messages

can be recorded by a sequencer and then played back in real time to automate the mix.

You can also change "scenes" in snapshot mode. The MIDI sequencer sends a series of program change messages. As these scenes do not incorporate time duration, a series of program change messages would be fed at the appropriate time to automate the mix. The M-3700 can send and receive on all 16 MIDI channels.

For information, contact Tascam in California at 213-726-0303; fax: 213-727-7656; or circle Reader Service 152.

ANTEX

Antex Z1 and Z.Wav Sound Modules Help Expand MIDI Functions

GARDENA, Calif. The Antex Series 3/Model Z1 sound adapter is one of the most advanced and sophisticated MPC soundboards available. It is designed specifically for professional use and includes a number of features found only on the Z1.

For example, the Z1 offers real-time data compression at a sampling rate of 44.1 kHz. By compressing audio data, Z1 users have four times more disk space in comparison with other available adapters. Compression actually reduces demand on the I/O bus, which is important in multimedia applications.

This adapter is the first DSP-based 16-bit stereo soundboard to offer compression in several formats, including ADPCM, Microsoft ADPCM, DVI ADPCM and CD-ROM XA/CDI.

The Antex Z.Wav MIDI sound module is a professional General MIDI sound

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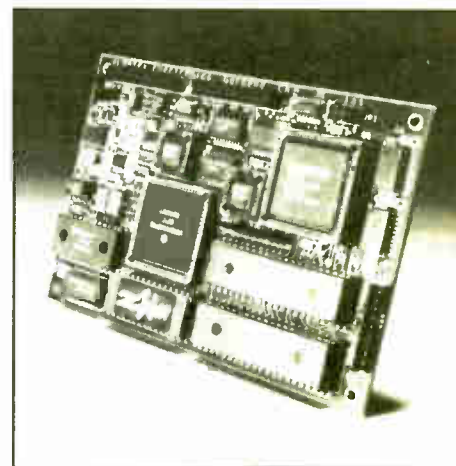
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module configured in a daughtercard design. It is designed specifically to integrate with the Z1.

Unlike other plug-in sound modules on the market, the Z.Wav features a low-profile design and does not require an adjacent open slot in the CPU. It is plug-in compatible with other soundcards, including the SoundBlaster 16.

Z.Wav incorporates wavetable synthesis for high-quality reproduction of digitally sampled instruments and sound effects. Wavetable synthesis technology is endorsed by leading manufacturers of professional studio-quality keyboards and synthesizers.

For information, contact Antex in California at 310-532-3092; fax: 310-532-8509; or circle Reader Service 218.

AKAI

MIDI Serves to Integrate Akai DR4d with Production Room

FORT WORTH, Texas The successful integration of the Akai DR4d hard disk recorder into many radio production suites is partially due to its ability to integrate with other MIDI production tools. For quite some time, MIDI sequencers have been used to record and play back music or

sound effects sequences.

The MIDI control protocol, MIDI machine control (MMC), allows sequencers and other devices to directly control the transport functions of recording devices. Version 3.0 of the DR4d incorporates MMC and is compatible with many

computer-based sequencers.

When using MMC, DR4d transport functions such as Play, Stop, Fast Forward and Rewind can be initiated from the sequencer. MMC also allows you to punch in and out on the DR4d from your sequencer. A MIDI sequencer coupled with the DR4d's built-in editing features becomes the nucleus of a powerful production studio. And you can easily create complex effects beds using the internal digital ping-pong mode.

Even if you use a sequencer that does not support MMC, you can still synchronize

your sequencer and the DR4d via either MIDI clock or MIDI time code. In this application, the DR4d is the master unit and the sequencer the slave unit.

No matter which method you use, you will find the combination of a MIDI

sequencer and the Akai DR4d offers a powerful, flexible production environment at a modest price.

For information, contact James Martin in Texas at 817-336-5114; fax: 817-870-1271; or circle Reader Service 40.



TURTLE BEACH

Turtle Beach Soundcard Represents New Standard

YORK, Pa. The MultiSound Monterey multimedia soundcard from Turtle Beach Systems represents a new standard in PC soundcards, according to the company.

Monterey features SampleStore, a technological capability of the hardware—upgradable to 4MB using standard SIPs—allowing the card to use any standard .WAV file as a MIDI instrument. This means that end users are no longer stuck with the factory sounds provided by most manufacturers. Also included is a Motorola 56001 digital signal processor (DSP) capable of 20 million instructions per second (MIPS).

Turtle Beach also added a new synthesizer to Monterey. The Wavefront sample playback synthesizer is a 32-voice, general MIDI-compatible synth.

An effects processor is included, allowing real-time synthesizer effects to be added to MIDI files. An assortment of software-upgradable reverbs and echoes can be added instantly to any MIDI file using the Monterey.

Turtle Beach also upgraded the software load included with Monterey. A patch editor is included for fine-tuning MIDI instrument sounds, as well as a front panel application for system level control of a synthesizer. MousePlayer is a new software application that lets you trigger instrument sounds without a MIDI keyboard. WAVE SE is a sample editor with a "point and shoot" sample loader that makes uploading new sample a very easy process.

ROLAND

Roland Micro Composer Sequencer Includes Many Editing, Storage and Playback Options

LOS ANGELES The MC-50MKII Micro Composer from Roland features Super MRC and Super MRP Performance System software. These appli-

ties in a dedicated unit.

Eight songs can be stored in its internal memory. Each song can accommodate 9,999 measures per song or 40,000 events. With a built-in disk drive, approximately 150,000 events can be stored on a 3.5-inch diskette. MIDI performance data can be recorded on eight independent tracks, each of which can address all 16 MIDI channels.

Any combination of the eight tracks can be assigned to either or both of two independent MIDI outputs for simultaneous control of up to 32 separate MIDI channels. A Tape Sync II system makes it possible to synchronize

the MC-50MKII with multitrack recorders or VCRs.

For modifying performance data, the MC-50MKII offers extensive editing capabilities comparable to computer-based sequencers, including event-level editing in the Microscope mode. Via the built-in disk drive, song data created with MRC-500 software can be converted for use on the MC-50MKII.



cations are built into ROM, so there is no time spent waiting for the software to load—unlike computer-based systems. It supports Standard MIDI files, allowing the transfer of song data to any software-based sequencing system.

The MC-50MKII can act as a second sequencer in a complex MIDI system or as a main sequencer, combining ease of operation and extensive editing capabili-

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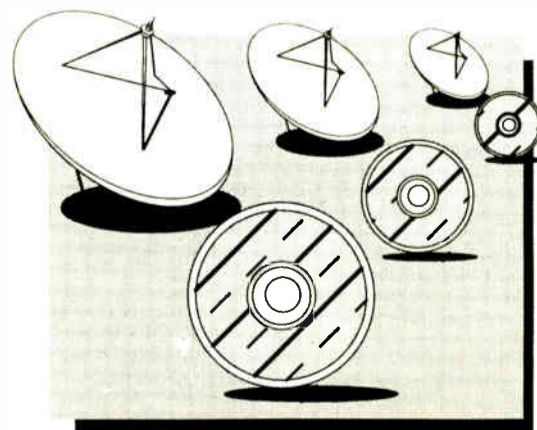
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SONY

Compact Sony HR-MP5 Effects Processor Incorporates Twin-Effect Block Design

MONTVALE, N.J. Sony's latest contribution to digital radio production and playback technology is leading a subtle revolution in convenient digital effects processing.

The compact HR-MP5 digital audio processor incorporates twin effect block construction. There are two equalizer

found in its DPS Series devices, added a faster 48-bit processing chip and an LCD display with a graphic user interface. Users can see an entire string of effects and edit the patch sequence for two separate channels from the front panel.

Each patch configuration can be called up as if it were an individual effect.



blocks that allow for simultaneous use with either serial or parallel connections for total flexibility in creating your own sounds.

The HR-MP5 uses high-speed 48-bit digital signal processing and twin 18-bit D/A converters to enhance digital effects on both right and left channels. All of this power is packed into a half-rack sized processor with an easy-to-read LCD graphic display.

Sony started with the sample audio signal processing algorithms and circuitry

There are 100 factory presets and 100 user-definable presets.

Designed for production environments where the talent demands high-quality sound and complete control, the HR-MP5 is available with an optional RC-5 footpedal. It provides quite a bit of functionality in a small space for typically tight-fit broadcast studios.

For information, contact Sony in New Jersey at 800-635-SONY, ext. DSP; or circle Reader Service 122.

MACKIE DESIGNS

MIDI Automation Package From Mackie Designs Affects Many Functions

WOODINVILLE, Wash. OTTO-1604, the new retrofit MIDI automation package from Mackie Designs for its CR-1604 mic/line mixer, brings full MIDI control to CR-1604 functions, including: all 16 fader inputs, master faders, ALT 3/4 bus levels, muting on individual inputs and main output, and AUX return level control of AUX 1 through 4.

The OTTO-1604 package consists of two hardware components: the internal gain cell and the external MIDI control module.

The internal portion of OTTO installs in about 20 minutes in the 1604 chassis and connects to the mixer's audio path via an internal ribbon cable system. It receives power from the internal power supply of the 1604.

The external control module contains all of the interface controls for OTTO. It connects to the internal portion via a MIDI din connector and is powered through the same interface

cable. Controls and ports of the external module include MIDI In, Out, Thru, Learn, Snapshot, Mute and Bypass.

OTTO does not affect the performance of the 1604 in terms of specs. The audio specification of the internal portion of the OTTO system offers the same high-performance audio specs as the CR-1604 mixer. The system can operate at many times the actual MIDI data rate: The faders, mutes and AUX returns respond as quickly as the user asks them to.

Up to 80 snapshot scenes can be sorted and later recalled with MIDI program change commands. A computer or fader package, however, is recommended to facilitate set up of the mixer before the snapshot is saved to OTTO's internal memory.

The system can be controlled by any sequencer that can send continuous controller messages. Included with the OTTO-1604 package is a copy of OTTOmix 1604, a dedicated automation sequencer program for Macintosh II, Centris and Quadra computers.

For information, contact James Fallow in Washington state at 800-898-3211; fax: 206-487-4337; or circle Reader Service 103.

DIGITECH

DigiTech Harmony Processor Transposes Voices In a Three Octave Range For Five-Part Harmonies

SANDY, Utah The DigiTech Vocalist is a harmony processor designed specifically for the human voice. It can transpose up to one octave above or two

octaves below the source signal. It also can create up to five-part harmony. Vocalist uses proprietary digital splicing to render very natural-sounding harmonies and shifted voices.



octaves below the source signal. It also can create up to five-part harmony. Vocalist uses proprietary digital splicing to render very natural-sounding harmonies and shifted voices.

Vocalist is relatively simple to use: There are four basic modes of operation, the easiest of which is the chromatic mode. In this mode, Vocalist shifts or harmonizes the input in a parallel interval specified by the user.

The second mode is scalar or diatonic harmony. The user simply tells Vocalist the key signature to use and the desired intervals. It then identifies the scale position of the input source and produces a harmony with the appropriate number of sharps or flats relevant to that key.

For example, if the key is C major and the intervals are 1-3-5, an input note of C renders a C major triad; D produces a D minor; E gives E minor; and so on, throughout the C major scale.

In the third mode, Vocalist produces notes that fit over the chord it is told to produce, regardless of the input note. Vocalist changes chords as the incoming MIDI chords or notes change. MIDI program change command or a foot switch can also be used to change chords.

ENERGETIC MUSIC

.WAV and MIDI Production Files Available On CD-ROM

SEATTLE The first in a series of products to help end users avoid copyright infringement and legal red tape, Energetic Music offers "SuperWAVE and MIDI," an MPC-compatible CD-ROM. It contains 500-plus .WAV files and 300-plus MIDI files.

The stereo .WAV files include complete songs, musical cues, sweeps, boings, riffs, drums and more. They are recorded at both eight and 16 bits.

The MIDI files are good for multimedia applications, presentations and sound card testing. Various lengths and tempos are included and the song styles include country, jazz, rock 'n' roll, industrial, romantic, new age, reggae, polka, comedy, traditional, dance, hip hop, funk, bluegrass and more.

All of the sounds and music are composed and recorded at Energetic Music's private recording studio to ensure usable, high-quality products.

For information, contact Sandy Klem in Washington state at 800-323-2972; fax: 206-467-6931; or circle Reader Service 18.

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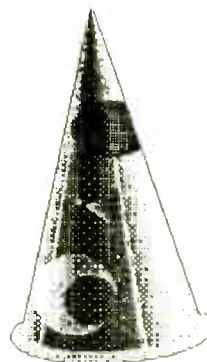
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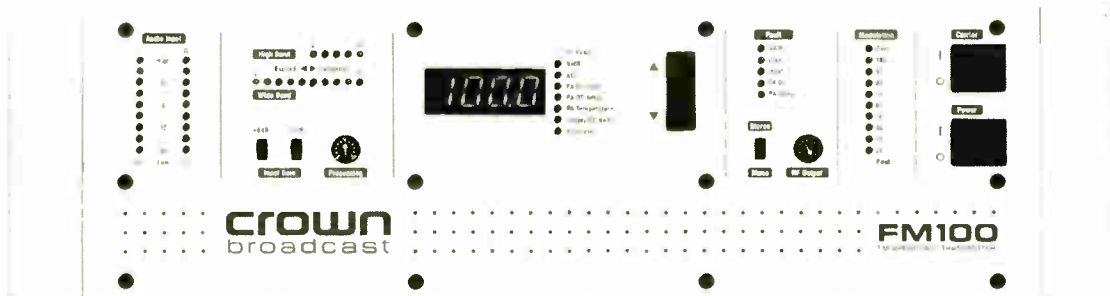


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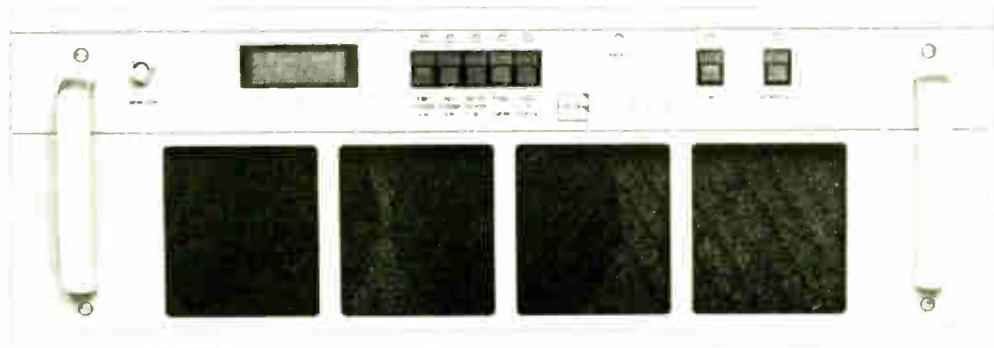
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The AC-12 rack-mounted coupler bay is the best way to eliminate a wall or cabinet full of yesterday's couplers. Our unique dual audio buss feature eliminates the tedious and messy wiring associated with networks and other mass feeds. Each card can also individually either send or receive telco audio. A fully loaded AC-12 lists for under \$185 per coupler.

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An interface for connecting a telephone line to a studio console. "Now with upgraded performance." It provides full duplex (simultaneous two way audio) for best results. The hybrid sends audio to a telephone line and receives audio from the line. To make up for a telephone line's inherent 15 DB send to receive level difference, it has a nulling circuit which is used to reduce the local send audio as heard back in its receive output.

Adjustable input and output gain controls are provided to accommodate almost any situation. Audio inputs and outputs are active balanced. The telephone line tip and ring connection is set up for a direct line hold configuration or capacitor isolated to prevent DC flow through the hybrid's telephone line transformer. The choice is user selectable on the rear terminals.

There are two null controls for reducing the audio input to output transfer. The hybrid also has an audio processor to reduce receive gain by 10 DB while audio is being sent to the caller. This reduced trans-hybrid leakage to a point where it is not normally audible to listeners.

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KURZWEIL

K2000 Series Combines Synthesis, Effects, Sampling and MIDI Sequencing in One Unit

CERRITOS, Calif. The K2000 Series from Kurzweil Music Systems is an innovative tool for a variety of radio broadcasting applications, as well as for use in recording studios and film and television production.

The K2000 is the only musical instrument on the market combining synthesis, effects processing, sampling/sample editing and full-function MIDI sequencing/editing into a completely integrated unit.

This makes it one of the most powerful all-in-one workstations available at any price. Both keyboard and rackmount models are available.

Radio broadcasters and production houses are exploring more and more practical applications of MIDI connectivity with this new breed of workstations.

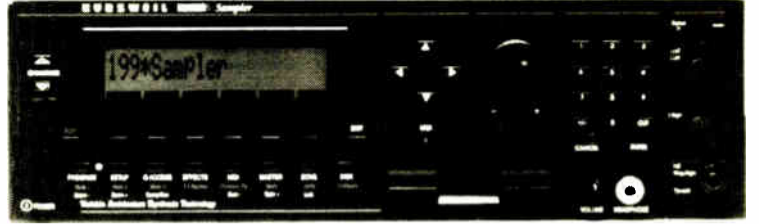
Some of the functions of the K2000 include sampling; digital audio editing; MIDI-automated or live performance of sound effects, cues, commercial spots, music sequences, etc. It can even use streams of MIDI data and MIDI clock to control other devices and to affect parameters like MIDI volume, panning, effect

processing, pitch, modulation, synchronization, etc.

Digital signal processing (DSP) algorithms in the sample editing functions include time compression and pitch shifting, truncating, cross-fade looping, sample rate conversion and more. On-screen visual waveform editing and audible cuing make sample manipulation a simple task.

The Kurzweil K2000 Series is also capable of reading sample files across many platforms, including Roland, Akai and Ensoniq formats, as well as reading and saving standard AIFF and .WAV

sample formats and Type O Standard MIDI file format using a standard DOS-based disk system on either floppy or



SCSI. K2000 samplers also offer standard AES/EBU and SPDIF digital audio I/O, plus Optical input, and can perform real time A-D conversion from any line level external source.

For information, contact Kurzweil in California at 310-926-3200; fax: 310-404-0748; or circle Reader Service 109.

TWELVE TONE

Cakewalk Software Packages Bring MIDI Production To Any Studio

WATERTOWN, Mass. Cakewalk Home Studio from Twelve Tone Systems is an entry-level MIDI sequencer for Windows that lets you create and play back music through a soundcard or external MIDI instrument. Cakewalk lets you "build" music layer by layer—record a drum track; add a bass line; lay down a melody; insert sound effects from .WAV files; enter, move or delete notes with the click of a mouse; and adjust volume levels with on-screen faders.

Cakewalk Home Studio offers a basic set of graphical tools for recording, editing and printing music, including: multitrack Staff view; Piano Roll view; Faders view; Controllers view; Markers view; Tempo and Meter/Key maps; and multitrack Event List view.

For more advanced users, Cakewalk Professional for Windows is a high-powered 256-track MIDI sequencer. With a MIDI instrument or soundcard connected to the computer, Cakewalk Professional can record, edit and print multiple tracks of music.

Its editing features include: multitrack Staff view, scrolling Lyrics view; Controllers view; Faders view with 96 assignable MIDI faders; multitrack Event List view; 256-bank System Exclusive librarian; Groove Quantize with DNA and MIDI machine control (MMC); Tempo and Meter/Key maps; CAL, a programming language for creating custom editing routines such as chord generators; built-in MIDI file player; a record filter; and support for MCI commands and Dynamic Data Exchange (DDE).

Both programs support digital audio wave files on .WAV-compatible soundcards.

Cakewalk Home Studio requires an IBM PC 80286/10 MHz or higher with 2MB of RAM, and Cakewalk Professional requires an IBM PC 80386 SX or higher with 4MB of RAM. Both programs require a hard disk, mouse, Windows 3.1 and a MIDI interface or soundcard with MME drivers.

For information, contact Twelve Tone in Massachusetts at 800-234-1171 or 617-926-2480; fax: 617-924-6657; or circle Reader Service 74.

Hard Disk Recording Doesn't Have To Be Hard On Your Wallet.

"...in a price/performance comparison, the DR4d would be hard to beat. Thumbs up on this one." George Petersen, MIX Magazine



"...great sound, useful features, and friendly operation... sure to set a new standard in affordable recording" David Frangioni, EQ Magazine

"If you're a broadcast engineer... the DR4d may seem like one of the greatest inventions in the history of audio." Gary Yelton, Electronic Musician Magazine

If you're involved in production for radio, then you're aware of the increasing demand for digital audio quality. So your next multitrack recorder should be digital, but which format: tape or hard disk? You've heard about the great editing tricks offered by disk-based systems, but there's a problem.... don't all hard disk systems require expensive add-in hardware and software, to already expensive computers? Not anymore!

The DR4d is the solution for those looking for an alternative to expensive, complex computer-based systems, or the limitations and mechanical uncertainty of tape recorders. It offers a perfect combination of hard disk recording benefits with an easy-to-use interface.

The DR4d can record up to four tracks simultaneously to standard SCSI hard disks, either internal or external drives. An optional 213MB internal disk offers 40 track minutes of recording (44.1kHz) right out of the box. To expand your recording time, simply connect external drives to the DR4d's supplied SCSI port.

With standard tape machine-style controls the DR4d is by far the easiest hard disk recorder to operate, which means that you can get to work immediately, rather than setting up and operating a computer system. Punch ins/outs can be performed manually or automatically from the front panel, or by footswitch, just like you'd expect.

Now you can start to take advantage of the power of random access editing. You can cut, copy, and paste sections of audio with ease. Our Jog/Shuttle wheel lets you scrub through the audio at various speeds, forwards or backwards. Try out different arrangements. Create perfect tracks by combining the best sections from multiple takes. Whatever. And you can edit with confidence, be-

cause if you change your mind you can instantly Undo your last edit - even after the power is turned off and on again! Imagine it. Do it. It's that simple.

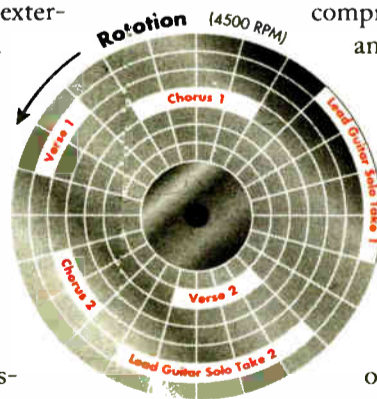
Another DR4d advantage is not having to wait for tape to shuttle back and forth. You can instantly move to 108 memorized locations at the touch of a button, and these locate points may be entered manually or on-the-fly. It's also simple to set up seamlessly looping repeat sections, so it's easy to jam over tracks. No more wasting time on rewinding tape!

Of course, how the DR4d sounds is as important as how it works. Advanced 18-bit oversampling A/D and D/A converters insure crystal clear sound, and with a full 96dB dynamic range, the DR4d offers no-compromise specs. The four balanced 1/4" input and output jacks are switchable between -10 and +4 operation, and 2-channel digital I/O is included (XLR and RCA).

Backups can be made to a standard DAT machine.

Need more than four tracks? Four DR4d's can be linked to create a 16-track system. And for synchronization to other gear, just add the optional MIDI or SMPTE interfaces.

And best of all, the DR4d is an affordable reality: suggested list is only \$2495.00 (or \$1995.00 w/o hard disk)! Multitrack disk recording is within your reach! Please call or write for further information.



On a spinning hard disk, the various sections of music can be accessed almost instantaneously by the moving heads of the drive mechanism. This allows you to seamlessly output different parts in any order, with no time spent rewinding. Audio can be moved and rearranged in ways not possible with tape!



P.O. Box 2344 Ft. Worth, TX 76102 (817) 336-5114 Fax 870-1271

EUPHONIX

Euphonix Digitally Controlled Analog Mixing System

NORTH HOLLYWOOD, Calif. The Euphonix CS2000 is a digitally controlled analog audio mixing system. The console features a sleek digital con-



rol surface with remotely located analog electronics and is available in a variety

of configurations from small 24-fader systems for use with digital audio workstations to large 104-fader systems suitable for high-end commercial music and audio post production.

A large number of the consoles have been installed in project studios and audio post suites. Systems also have been supplied to broadcasters for on-air applications.

The desk is ideal for use with MIDI setups where the system's SnapShot Recall system, which instantly resets all controls and switches, and its six inputs per channel allow it to speed up the process of recording and mixing.

New software due out later in 1994 will allow external MIDI devices to be con-

trolled from the console and for sequencers to control the console. The system includes automation of all controls to time code.

Options such as dynamics, additional aux sends (up to 48), and extra mix

busses, including multiformat mix busses and mix-minus feeds, are available for easy retrofit.

For information, contact Andy Wild in California at 818-766-1666; fax: 818-766-3401; or circle Reader Service 157.

EVENTIDE

Two New Broadcast Effects Processors from Eventide

LITTLE FERRY, N.J. Eventide offers two new versions of its H3000B Ultra-Harmonizer broadcast effects processor—the H3000BPlus and the H3000B/LT. Both MIDI-capable units include the dynamic effects of the Mod Factory algorithm, as well as the Multi-Shift pitch-shift algorithm.

Mod Factory is an algorithm construction kit that allows users to select and patch together a full set of independent processing modules. An LFO section allows for smooth autopanning, filter sweeps, etc., and dynamic

effects such as reverbs are easily created. Factory presets include ducked delays, touch sensitive choruses and flangers. The Multi-Shift algorithm offers superior deglitching and a broad six-octave range.

The H3000B/LT Ultra-Harmonizer is identical to the H3000BPlus, just without the Plus' Timesqueeze algorithm and internal hardware for controlling tape machine speed.

Both units are equipped with an optional internal sampling board, available in short or long versions. Playback time of samples can be changed on the fly without changing pitch.

For information, contact Gil Griffith in New Jersey at 201-641-1200; fax: 201-641-1640; or circle Reader Service 29.

MARKETPLACE

Recently Introduced Products for the Radio Broadcast Professional

Modular, Paperless, Cartless Air Studio

The Master Control from Radio Computing Services (RCS) is a completely modular, paperless, cartless and CD-less air studio. All of the information that traffic, programming, news and promotion work on is poured into the studio.

Master Control interfaces with most consoles to provide RCS Works control through the same faders and stop-start buttons with which your staff is familiar. The news, sports and weather scripts and live announcements scroll before their eyes at the right time.

It can be a completely digital audio system, playing music from a CD jukebox or directly from the computer hard disk. Because Master Control is part of RCS Works, it has immediate access to a sound library stored on the hard disk, to the ProSonix digital production room and to the Selector and MUSICBase libraries.

Master Controls features a "Voice Tracking" feature, which lets DJs pre-record the entire live content of their shows. All spots, voiceovers, etc. run just the way you would do them in real time.

When a DJ uses Voice Tracking, she or he actually hears the music segue as the voiceover is recorded. The computer plays the end of the previous element and the beginning of the next from the hard disk.

For information, contact Lee Facto in New York state at 914-723-8567; fax: 914-723-6651; or circle Reader Service 79.

Multifunction Voice Processor

Symetrix Inc. offers the 528E voice processor, a complete voice processor that simultaneously performs six functions: microphone pre-amplification, de-essing, compression/limiting, down-

ward expansion, parametric EQ and voice symmetry alignment.

Symetrix

The 528E works with any mic to enhance vocal intelligibility, increase perceived loudness and presence and reduce off-mic noise.

It features a mic preamp gain variable up to 60 dB, 48 V phantom power for condenser mics, switchable 15 dB pad to reduce gain in front of the mic preamp to prevent distortion, three-band parametric EQ with bandwidth variable from 0.3 to four octaves, 15 dB boost/cut and overlapping frequency ranges.

For information, contact Jon Bosaw in Washington state at 206-787-3222; fax: 206-787-3211; or circle Reader Service 172.

Shed Light on the Rack

The I15 Power Light Module from dbx is a rack-mounted utility light module and patch bay, designed to make audio work a little brighter and more organized.

Two rack lights are housed in retractable metal tubes and the rear panel has eight AC outlets with spike and surge protection. Front panel controls include switch and dimmer for lights and a separate power switch for rear panel outlets.

For information, contact J.X. Loeb in California at 510-351-0555; fax: 510-351-0500; or circle Reader Service 210.

Affordable Small Towers

Stainless Inc. and SG Communications Services provide design, fabrication, AISC-certified quality control and installation of all new small tower configurations and monopoles.

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initial consultation and proceed through civil and structural engineering, project management and tower installation. Also provided is complete systems integration: analog and digital systems, conventional and trunked two-way systems; cellular, radio and paging systems; and antenna systems.

Inspection services and complete maintenance programs, including 24-

Stainless, inc.

hour emergency service, are available.

For information, contact Peter Starke in Pennsylvania at 215-699-4871; fax: 215-699-9597; or circle Reader Service 32.

Lightning Protector

Andrew Corp. offers a one-piece connector/surge protector that protects personnel and equipment from the repeated and potentially damaging effects of current induced by lightning strikes.

The design of the Arrestor Plus incorporates the technology of a quarter-wave shorting stub into a connector body, which attaches directly to Helix coaxial cable.

Arrestor Plus is compatible with 1/2-inch Helix coaxial cables and is available for field attachment or as a prefabricated custom jumper assembly.



Andrew's universal version is designed for direct replacement of surge arrestors currently installed that have been compromised or have failed. All three versions are equipped with threaded mounting stub.

For information, contact Andrew customer support center in Illinois at 800-255-1479 and request bulletin 1982; fax: 708-349-5673; or circle Reader Service 50.

KLARK-TEKNIK

Digitally Controlled Klark-Teknik DN3600A Equalizer Offers Enhanced Software Features

BUCHANAN, Mich. The DN3600A programmable graphic equalizer from Klark-Teknik (K-T) offers enhanced software and other new features. It is a digitally controlled, two-channel, 1/3-octave, 30-band analog equalizer.

Version 2.0 software for the DN3600A is more than an upgrade. It is a complete rethink of the operation of the unit, with improved and expanded facilities, easier and more intuitive control, faster memory access and more readable information. DN3600 units are easily upgraded by the factory to the DN3600A model.

The EQ faders, as well as the notch, low- and high-pass filters, can also be adjusted in the curve display, which changes in real time. In addition, when interfaced to a K-T DN60 real-time analyzer, auto-equalization to a user curve is possible: The auto EQ simply adds the DN60 data to the fader positions.

Two special function keys on the DN3600A allow users to alternate between an EQ curve, relative fader position for channel A or B or a combination of both. In the stereo mode, the two channels can be linked together to provide identical curves to two signal paths from one set of fader controls. In dual mode, these can be adjusted independently.

Other features of the DN3600A include: user-adjustable gain within a 24 dB range; "auto make-up" gain function that compensates for any changes made without altering the overall output level; 66 memory locations for storing EQ curves; and two levels of password protection.

For MIDI operations, the DN3600A includes a MIDI Pro interface. Other I/O include an open architecture control port and a parallel port for interfacing with the DN60 for auto-EQ applications.

For information, contact Ivan Schwartz in Michigan at 800-695-1010; fax: 616-695-0470; or circle Reader Service 213.

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Phase Linear 4000 autocorrelation pre-amp, 2 front channel/2 rear channel outputs, 2 tape outputs, aux outputs, 2 tape/2phone/tuner & aux inputs, provides AC for 6 devices, rack mount, \$125/BO; BGW @%)B stereo power amp, 100 W/channel into 4 Ohm load, rack mount, \$125/BO; JVC FX-330 AM/FM computer controlled tuner with quartz lock, LCD multimode display, up to 16 preselects, \$100/BO, all 3 \$300/BO, all prices + ship. E Helvey, Summit Productions, 461 Layside Dr #100, Winchester VA 22602. 703-877-2717.

Sparta TPA-7, 25 W audio modules for MAS-50 monitor amps (3), \$40 ea or 3 for \$95. D Peluso, KJUL, 2880 E Flamingo Rd, Las Vegas NV 89121. 702-732-2200.

Yamaha P2350 like new, used 10 hrs, 350 W, \$600. J Michaels, WZZK, 530 Beacon Pkwy, Birmingham AL 35209. 205-942-7800.

Dynaco stereo 120 solid state, rack mt \$229, Dynaco stereo 70 tube amp all new tubes! Dynaco PAT 4 preamps \$59. W Gunn 619-320-0728.

Record Cutting Lathes, tube amplifiers, limiters, microphones. 612-869-4963.

Want To Buy

Marantz Model 1 audio console pre-amp, single or pair, and model 6 stereo adapter. P Chance, Imperial Analog, 925 Clinton St, Philadelphia PA 19107. 215-574-8147.

ANTENNAS/TOWERS/CABLES

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341' tower w/guy wires & lights, 10 ft sects, \$10,000/BO; 1 5/8" Cablewave line, approx 350', BO. G Condroy, WREC, 203 Beale St, Memphis TN 38103. 901-578-1103.

Andrew EW 63A waveguide w/ends, 2 rolls, new, 75' and 140' in boxes, BO/trade. M Kestler, KAWZ, 241 Main Ave, Twin Falls ID 83303. 208-733-3133

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Scala PR450 450 MHz (4), \$350 each or \$1200/all; Bogner UHF 14, UHF TV ant for channel 14, max input 1 kW, \$500. J Arzuaga, WOOZ-FM, POB 980, Quebradillas PR 00678. 809-895-2725.

Collins G5CPS-AE 5 bay broadband super power FM, 98.9 MHz, built by ERI on ground, excellent condition. D Martin, WSLM, Salem IN. 812-883-3797.

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Shively 3 bay CP on 94.3, \$4000; Scala FM, \$150. D Rose, KDUC, POB 250, Barstow CA 92312. 619-256-2121.

6 Bay CP low power, on 89.3, good condition, bolts & mounting, Best Offer. M York, WKPW, 11410 N State Rd 140, Knightstown IN 46148. 317-345-9070.

ERI 1 bay FM on 92.1, 115' of Cablewave 1 5/8" coax, B/O. S King, KGFL, Box 33, Clinton AR 72031. 501-745-4474.

Andrew HJ7-50A, 1-5/8" coax, several at 310', \$7.25/ft; Andrew LDF2-50, 3/8" coax, any length, \$0.85/ft; Andrew LDF7-50A, 1-5/8" coax (4) lengths of 245' & 3 lengths of 265', \$5.00/ft. Jim Mussell, 1421 Bay Ave, Santa Maria CA 93454. 805-922-7775.

Brand new, never out of shipping carton, DPDT, ITT Jennings vacuum contactor with 230 VFR solenoids, for half price. Galeco Electronics, Ph: 416-421-5631, FAX: 416-421-3880.

Cablewave FLC158-50J, 1-5/8", 500', new roll, accepting best offer. Call Thomas at 804-420-3643.

Want To Buy

Tower sections 24" or larger, to make 190' tower; 1 5/8" or 3" heliarc coax cable. J Powley, WNGS, 1512 Sherwood Dr #3, Reidsville NC 27320. 910-342-1843.

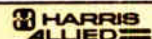
AUDIO PRODUCTION

Want To Sell

Channelmatic Spotmatic Jr (9) A/V switchers w/cables for Sony 5's, \$6000/all or \$700/each. Dave, WDTM, POB 388, Selmer TN 38375. 901-645-6165.

Looking for Audio Bargains?

We BUY ★ SELL ★ TRADE
QUALITY USED EQUIPMENT
317-962-8596



Collins 6P1, tube mic preamps (2), 50's vintage, \$95; Lexicon LXP-5, multi effects processor, \$275. D Miller, Airborne Audio Productions, 12209 W 88th St, Lenexa KS 66215. 913-492-8822.

dbx 700 digital audio proc (2), \$125 ea. L Lyman, TEC, POB 1743, Melbourne FL 32902. 407-676-6907.

Demeter 4 ch rack mount tube direct box NEW \$795. W Gunn 619-320-0728.

SAVE \$300 ON TT
96 & 144 POINT PATCH BAYS
brokers of fine and coarse used equipment
audio village 619/320-0728

ADC 96 & 144 Pr TT patchbays, excellent condition, 1 rack space, 3 rows of 48, top 2 rows normalled, \$149, 96 is 2 row normalled, \$129 (you remove old wiring) or we totally refurbish with new front panel, ready to install, \$199-229. TT cords up to 10 per bay at \$9 ea, reg \$13.95, also 1/4" bays. Audio Village, 619-320-0728, or Fax 619-320-2454.

Technics SH-9010 stereo parabolic EQ, rack mount, 2 channel, 5 bands/channel, adj freq/bandwidth each band +/- 12 dB/band, unbal in/out, \$225/Best Offer + ship. E Helvey, Summit Productions, 461 Layside Dr #100, Winchester VA 22602. 703-877-2717.

Want To Buy

QUAM AM stereo system for Harris SX-5. C Teacy, WKNE, Stanhope Ave, Keene NH 03431. 603-352-9230.

MERCENARY AUDIO

WANTS TO BUY YOUR:

NEVE-SSL-TRIDENT-AMEK
UREI-TELETRONIX-FAIRCHILD
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UNIVERSAL AUDIO-NEUMANN
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AUDIO QUALITY!

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(508)543-9670 FAX

AUTOMATION EQUIPMENT

Want To Sell

ESP-1 automation system, brain, PDC clock, 452 Carousels (4), encoder, decoder, video mon, power supply, no racks, Otari ARS-100 (5) R-R PB machines. R Statham, WSTU/WHLG, 100 Alice Ave, Stuart FL 34994. 407-692-1000.

Sono-Mag Mini-Pro brain with remote controller, RSC-100 random selector (2), RS 350 Carousels (3), PR99 Revox, you pick up, \$1500. S King, KGFL, Box 33, Clinton AR 72031. 501-745-4474.

SMC 350RSB 24 tray Carousels (3); excellent condition; \$850/BO for all. B Christie, Grande Radio Group, POB 907, La Grande OR 97850. 503-963-4121.

Henry Engineering net commander, \$400. C Tarkenton, WCOH, 154 Boone Dr, Newnan GA 30263. 404-253-4636.

CSI OTMF decoder, \$350; Conex 25 Hz generator, \$200; Conex 25 Hz decoder, \$100; SMC TS25 tone sensor, \$75. D Rose, KDUC, POB 250, Barstow CA 92312. 619-256-2121.

SMC DP2 brain, PD-5 clock, 352 Carousels (2), 452 Carousel, 20A switcher, time cart, stereo cart, spare parts kit, \$2000. D Rose, KDUC, POB 250, Barstow CA 92312. 619-256-2121.

SMC MSP-12 inc 2 monitors, keyboard, 452 Carousels (2), ITC mono SP carts (2), SMC 712 dual stereo play carts, equipment racks (2), excellent condition, \$6000. C Falvo, 110 Healy Ave, Clearfield PA 16830. 814-765-5541.

GM 42 tray Go-Carts (4), excellent condition, additional units for parts (2), \$1500/all 6. P Tinkle, WCMT, 901-587-9526.

CART MACHINES

Want To Sell

BE 5302B triple deck (3), mono, \$400/ea or BO; Audi-Cord S16 stereo (6), \$400/ea or BO; ITC PD-II R/P mono, \$200/BO. C Tarkenton, WCOH, 154 Boone Dr, Newnan GA 30263. 404-253-4636.

ITC stereo record, triple deck with sec tone, just rebuilt, stereo R/P with sec and ter tones, \$750. D Rogers, KXAX, Hwy 4, St James MN 56081. 507-375-3386.

ITC 3-D 3 deck player, stereo, 3 tone, excellent condition, manuals, some spare parts, 3 available individual or as pkg, \$1100 ea or \$3000 pkg. J King, WVXU, 3800 Victory Pkwy, Cincinnati OH 45207. 513-731-9898.

ITC R/P (2) excellent condition, stereo, 3 tones, all manuals, \$1750 ea/\$3000 pr. J King, WVXU, 3800 Victory Pkwy, Cincinnati OH 45207. 513-731-9898.

HALL Electronics

1305-F Seminole Trail Charlottesville VA 22901

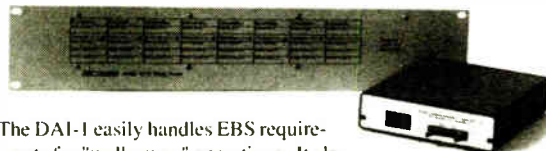
Here are just some of the bargains we have in stock:

- Otari MX-5050BII Reel -
- CRI FM-2 Basic FM Processing Package -
- Gentner VRC-2000 Dial Remote w/ accessories -
- LPB Citation C-85 8-Pot Stereo Constole -
- Belar ANM-2A AM Modulation Monitor -
- ITC Delta Stereo RP -
- BE 5300B Stereo 3D w/tones -
- Marti MW-500 STL Booster/Repeater -
- Orban 622B Stereo Parametric EQ -
- Valley 400 Mic Processor -
- Valley 'DYNAMITE' Stereo Studio Limiter -
- Quantum QM-168 8 Track Console -
- Bird 3" 25KW Wattmeter -
- Andrew 96.7 MHz FM Isocoupler -
- Tektronix 7704A 200 MHz Scope -
- TFT 8100/8101 TSL System -

- | | |
|---------|----------|
| Rebuilt | \$ 1,895 |
| Rebuilt | \$ 1,195 |
| Rebuilt | \$ 1,995 |
| Rebuilt | \$ 2,195 |
| Rebuilt | \$ 795 |
| Rebuilt | \$ 1,295 |
| Rebuilt | \$ 1,595 |
| Rebuilt | \$ 1,295 |
| Rebuilt | \$ 395 |
| Rebuilt | \$ 359 |
| Rebuilt | \$ 225 |
| Rebuilt | \$ 395 |
| Used | \$ 495 |
| Used | \$ 395 |
| Rebuilt | \$ 495 |
| As Is | \$ 295 |

Announcing New Crisp Voice

The RFC-1/BHV3 provides transmitter power control, has alarm dial out for 6 numbers, and provides up to 64 channels of control and metering.



The DAI-1 easily handles EBS requirements for "walk away" operations. It also allows direct access to the air chain in addition to providing remote broadcasts. The best & lowest cost "dial-up" remote control available.



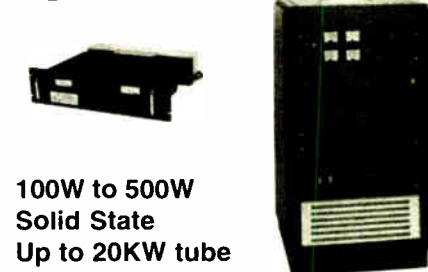
WE'RE MOVING!

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Charlottesville, VA 22901

Phone: 804-984-HALL Fax: 804-984-FAXX
(804-984-4255) (804-984-3299)

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100W to 500W
Solid State
Up to 20KW tube

Call for new 2KW!

Call us for the Best New & Completely Rebuilt Equipment! (804) 974-6466

Fax: (804) 974-6450

CART MACHINES...WTS

ITC 3D Premium condx stereo for all 3 tones, \$900. T McGinley, WPGC, Box 10239, Washington DC 20018. 301-441-3500.

ITC 99-B full stereo with 3 tone ITC 99-B R/P, all manuals, some spare parts, (2), \$2800 ea/\$5000 pkg. J King, WVXU, 3800 Victory Pkwy, Cincinnati OH 45207. 513-731-9898.

ITC R/P machines (2), 1 stereo, 1 mono. R Statham, WSTU/WHLG, 100 Alice Ave, Stuart FL 34994. 407-692-1000.

ITC SP stereo players (3), excellent condition, \$550 each or 3 for \$1500 J King, WVXU, 3800 Victory Pkwy, Cincinnati OH 45207. 513-731-9898.

Ampro mono play, good condition, \$100; Spotmaster 1070P mono, good condition, \$100. G Kombuth, A&J Rec, 225 W 57th St, NY NY 10019. 212-247-4860.

Audi-Cord DL-PS stereo PB (2), \$600 ea; Audi-Cord DL-RS R/P, \$1000. B Dixon, WAWC FM, 10129 N 800 East, Syracuse IN 46567. 219-457-8181.

BE 2000 mono PB, need cord & motor fan, \$50 + COD. R Weaver, WBZB, 413 S Fuquay Ave, Fuquay-Varina NC 27526. 919-552-9357.

Great Prices on original equipment tape heads for ITC, BE, Fidelipac, Otari, Tascam & others!
(804) 984-4255



HE HALL Electronics

BE Spotmaster 3000 R/P, with sec & ter tones, excellent condition, \$100 + ship; BE 3000 R/P w/tones, needs adjustments, \$75 + ship; BE 4000 PB with fld, excellent condition, \$75 + ship; BE 4000 PB, with fld, needs adjustments, \$50 + ship, all machines mono. S Zubrick, Z-Tec, 214-475-0234.

ITC SP stereo PB only (3), \$450. R Statham, WSTU, 1000 Alice Ave, Stuart FL 34994. 407-692-1000.

Spotmaster 505 mono player, recently record, \$300; also R/P, \$450. R Franklin, Super Sound Stud, 1004 Dekalb St, Norristown PA 19401. 215-646-7788.

Tapcaster X-700 R/P mono with secondary cue tone generator/detector, like new, 6 hours running time, \$750. R Franklin, Super Sound Stud, 1004 Dekalb St, Norristown PA 19401. 215-646-7788.

AMPRO-SCULLY CONSOLES
CART RECORDER
PARTS AND SERVICE

SEQUOIA ELECTRONICS
(408) 363-1646
FAX (408) 363-0957

BE 5300C tripledeck, stereo, PB, mint less than 50 hours, BO. R Kaufman, Pams Productions, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

Want To Buy
IGM Insta-Cart, 1985 or newer. H Hoeflicker, KDNS-FM, Box 88, Glen Elder KS 67446. 913-545-3220.

ITC, BE, Fidelipac cart machines: single, triple, mono, stereo, play & record/play. Call M O'Drobak @ 619-758-0888.

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Want To Sell

AmpeX ATR-102 1/4" half-track master rec, gd cond, exc sound, low wear incl meter bridge & rolling stand, \$2500. T Carroll, Manhattan Bch, 12 W 37th, New York NY 10018. 212-967-3300.

Recordex CS-2500 1 master 5 slave cassette duplicators, 15:1 dup speed, \$1000 + freight. W Feinberg, Totalltape Publishing, 9417 Princess Palm Ave #400, Tampa FL 33619. 813-621-6200 ext 337.

Revox PR99 with wired remote, excellent condition (4), \$2700/ea. W Feinberg, Totalltape Publishing, 9417 Princess Palm Ave #400, Tampa FL 33619. 813-621-6200 ext 337.

Sony TCD-D7 portable DAT rec, \$600. R Surraci, Fire Art Productions, 67 Maple St, Newburgh NY 12550 914-561-5866.

REVOX PARTS/SERVICE

Cassette-CD-Open reel
Rebuilt A77s, \$850.00
Capstan resurfacing, ALL BRANDS.
JM TECHNICAL ARTS
30 Music Sq. W. #156
Nashville, TN 37203 (615) 244-6892

Sony/MCI JH-24 24 track recorder with additional 16 track head stack, AL-III locator, excellent condition, new, all manuals, \$15,500 FOB. J Block, Production Block Studios, 906 E 5th St, Austin TX 78702. 512-472-8975.

Tandberg 310 3 head 3 motor, all steel const, excellent condition, \$200. W Feinberg, Totalltape Publishing, 9417 Princess Palm Ave #400, Tampa FL 33619. 813-621-6200 ext 337.

Tascam 38 1/2" 8 trk open reel rcd, \$1000. P Cibley, Studio C Music, POB 751 Murray Hill Stn, New York NY 10156. 212-532-2980.

Dolby 372 Nagra NR unit, Dolby type A. G Warren, POB 138337, Chicago IL 60613. 312-862-2320.

Otari ARS 1000 R-R, PB only (4); \$500 ea. R Statham, WSTU/WHLG, 100 Alice Ave, Stuart FL 34994. 407-692-1000.

AmpeX MM-1200 24 track with spare capstan and reel motors, spare play, record, bias, logic, servo cards and spare parts kit, 16 track head assembly with synchronizer w/remote, manuals, \$8000; Scully 280B-2, 260 xport with 280-B electronics, in new Russ Lang cabinets, new heads, mono to 8 track, \$1500/BO. R David, Audio Oasis, POB 4181, Falls Church VA 22044.800-966-2717.

AmpeX 3200 high speed R-R all tub duplicator, 1 master 4 slaves, new mono heads, new pinch rollers and guides, vgc, \$1200/BO. R David, Audio Oasis, POB 4181, Falls Church VA 22044.800-966-2717.

AmpeX AG-350 with 2 track R/P heads, Inovonics 3 speed elect, 3 speed reversible Beau motor, mdt in AG-440 console, \$700/BO + ship. E Helvey, Summit Productions, 461 Layside Dr #100, Winchester VA 22602. 703-877-1717.

AmpeX/Schafer AF440 2 track reproduce decks (2) rack mount, \$200 ea. D Bailey, Rock Shoppe Productions, 3422 Beech St, Rowlett TX 75088. 214-475-9796.

Nortonics sensor head (8), \$10 ea/\$75 all. D Peluso, KJUL, 2880 E Flamingo Rd, Las Vegas NV 89121. 702-732-2200.

Otari SX70 8 trk, 1", like new, used 50 hrs, incl 6 1" reels, new maintenance tape, remote control on custom stand 2/25 ft interface cables, BO. B Giordano, WODS, 30 Winter St, Boston MA 02108. 617-426-2200.

Otari ARS1000 (3), PB only w/25 Hz sensor, \$350. R Statham, WSTU, 1000 Alice Ave, Stuart FL 34994. 407-692-1000.

Scully 280A (5), 1/4" 2 track, 7.5-15, with or without Russ Lang console cab, vgc, \$500/ea; Recordex 250 R/R or cass master 5 slave high speed duplicator, \$1000. G Kombuth, A&J Rec, 225 W 57th St, NY NY 10019. 212-247-4860.

HEAD RELAPPING/REPLACEMENT
All tape and film formats
30 years experience



350 N. Eric Drive
Palatine, IL 60067
708-358-4622

Technics RS-1520 2 track stereo, 3 speed, bal & unbal in/out, rack mount adapters, remote control, extra full track plug in head assembly inc, \$500/BO + ship. E Helvey, Summit Productions, 461 Layside Dr #100, Winchester VA 22602. 703-877-2717.

VSC C-4 Soundpacer cassette rec with variable speech control, AC/DC, can feed R-R deck through for editing R-R tapes at high speed, ED, \$50 + ship. E Helvey, Summit Productions, 461 Layside Dr #100, Winchester VA 22602. 703-877-2717.

Wollensak 1520-AV mono w/built in compressor, fair cond, portable, \$50. R Franklin, Super Sound Stud, 1004 Dekalb St, Norristown PA 19401. 215-646-7788.

Otari 5050 MK III-8 track, heads excellent, \$2450. Wayne Gunn 619-320-0728.

No matter how you stack it...



Nobody reconditions tape heads like JRF.

- Heads restored to new performance spec at a fraction of new cost
- Cart machines and all open reel formats
- Full line of replacement heads for all manufacturers

Experience the difference experience makes. Ask around. Nobody treats you or your heads better than JRF.



MAGNETIC SCIENCES
249 Kennedy Rd., Greendell, NJ 07839
(201) 579-5773 Fax (201) 579-6021

ITC SP mono PB, BO C Springer, KLMR, POB 890, Hamar CO 81052. 719-336-2206.

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: _____

HELP WANTED

WANTED: BROADCAST ENGINEER - hands on Chief for Midwest satellite network. Must know RF, automation and studios. Send resume AND references to: M. Jaye - 5501 Excelsior Blvd., Minneapolis, MN 55416 - EOE.

Winston-Salem North Carolina radio station is seeking a full-time assistant engineer. Must be experienced and knowledgeable with Harris, RCA, and Continental transmitters. AM directional arrays and computers. Minimum 5 years hands-on experience. Qualified applicants only. Health insurance and 401K. Send resume with references and salary requirements to:
T. Levin, WSJS/WTQR Radio
875 W. 5th St.
Winston-Salem N.C. 27101
Fax: 910-777-3930
Equal opportunity employer

TELECOMMUNICATIONS TECHNICAL ASSOCIATE

Consulting firm seeks person with superior technical & computer skills to help design broadcast telecommunications software & provide customer service to clients. Applicants should be fluent in WINDOWS, DOS, VISUAL BASIC, C & FORTRAN. Assists in preparing FCC applications, BA/BS or BSEE or an Associates degree in computer science or electronic communications with a minimum of three years experience. Salary commensurate with experience.

Send letter of application, resume, salary requirements & at least three references to:
DOUG VERNIER
Telecomm Consultants
1600 Picturesque Dr.
Cedar Falls, IA 50613

Savannah Valley Broadcasting, Augusta GA is seeking a Hands-On Chief Engineer. Responsible for maintenance, repair & installation of all technical facilities of 2 Class C FM's and a Class C AM. Send Resumes & References to Savannah Valley Broadcasting, POB 2066, Augusta GA 30903. EOE.

Chief Engineer needed for Miami FM-FM duop. Must be aggressive self-starter with experience in transmitter, antenna, studio, construction, maintenance and digital recording. Come live in the sunshine and work with progressive thinkers. Women and minorities encouraged to apply. E.O.E. Send resume and references Fed Ex to:
Russ Oasis-WXDJ
3191 Coral Way, Suite 1000
Miami, Florida 33145

Customer Service Rep: Major bdet equip mfg is looking for an individual w/good tech knowledge, good written/verbal language skills. Will administer the in-house customer repairs & interface with customers by phone. Full employment benefits.
Resume to:
1044 Camino Real #5, Ste 367
Sunnyvale, CA 94087

Assistant Engineer needed for growing group in midwest major market. Minimum 5 years experience with AM Directional Antenna Systems, AM & FM high power transmitters, digital audio studio equipment, and have the ability to troubleshoot audio and RF equipment to the component level. Our company is an Equal Opportunity Employer & encourages minority & female applicants. Please send your resume & salary requirements to: Radio World, POB 1214, Falls Church, 22041. Attn: 94-09-09 RW

Make a young eager, willing to travel, air talent happy, seeks AOR/CHR/Classic Rock. Brad, 405-722-2846.

12 yr major mkt, degreed bdcdr seeks PT/weekend on-air pos, Detroit, Flint, Lansing or Saginaw MI markets preferred. Mike, 810-750-8380.

Recent bdcdr grad w/stn exp, dependable, humorous, seeks on-air pos, great news, copywriting and prod, will relocate. Mark, 405-748-5905.

CE exp in new const, upgrades, multi-facilities, sks employment, will consider all responses. GB, 805-473-0871.

Mature, exp anncr w/progam exper sks pos w/progressive, promo'l stn, exc voice & prod skills. B McNeal, 2445 Detroit Ave, Kingman AZ 86401. 602-753-6848.

HELP WANTED

Broadcast Technical Associate KUN/KHKE
University of Northern Iowa
Performs engineering tasks; installs and repairs RF & digital audio equipment for eight station system; maintains DOS/network computer systems, automation, and satellite downlinks, & produces & announces as needed. Bachelor's degree plus one year of experience or Associates degree in Electronics/Technology plus 5 yrs of related experience required. Knowledge of modern broadcast technology & digital application plus FCC license or comparable certification required. Minimum salary of \$21,240 plus liberal fringe benefits. Review of applications will begin August 22, 1994 & will continue until appointment is made. Additional information provided upon request (319-273-6400). Send resume & cassette tape air check to:
Wayne Jarvis, KUN/KHKE, UNI,
Cedar Falls, Iowa 50614-0359.
AA/EOO

POSITIONS WANTED

Call and hire Janet, FT announcing, programming, computer literate, in radio since 1980, PT announcing, marketing exp, metros, bedroom communities preferred. Janet, 502-895-5888.

Broadcasting school graduate, academic credentials seeks on-air talk show, cutting commentary, incisive research, will relocate. Joe, 918-627-5611.

20 yrs exp asst eng AM/FM, any format, FCC 1st class/Gen/Radar, Marine, rest, ham, SBE cert. C Hamlin, 509 W 4th St, Corbin KY 40701. 606-528-5460.

Combo Manager, sales, PD, CE, Announcer, production, Tampa Bay, coastal FL or powerful signal in gd area, 30 years exper. Bill, 813-844-3823.

Diligent, dedicated on-air/prod talent, recent bdcdr school grad, will travel, have intern experience and mobile DJ equipment. George, 405-721-7871.

Bilingual newscstr anncr, radio/TV, spanish neutr accent, 20+ yrs exp in US, Cntrl Amer and Europe. 305-717-6811.

15 yr pro Christian bdcdr seeks anncr/PD pos w/committed religious stn in AK or SE region. Carlos, 305-754-9437.

Unique asst GM at NCE stn seeks to relocate to San Jose, CA, 2 yrs mgmt/on-air/prod exper. Kris, 314-962-6966.

GM with 8 years exper, can do most everything incl some engr, will relocate, awesome resume. Clint, 302-477-0265.

Director of Operations, 9 years exper, willing to relocate, hardworking, quick learner. P Schoolcraft, POB 291, Springerville AZ 85938. 602-333-2814.

GM/GSM with news, weather, sports play by play and all around exp, seeks oppor in TX. R Muirhead. 405-335-2343.

Nat'l Rock Promo Mgr has left his label, pursuing other opportunities in AOR radio or records, experienced AOR jock, bloodtype FM. Blake, 914-635-8285.

CE with big production voice, over 15 years hands-on engineering experience seeks CE position with production, strong troubleshooting, RF & computer networking skills. G Morgan, 704-563-8676.

Combo Manager, sales, PD, CE, anncr, prod, Tampa Bay area, coastal FL or pwful sig in gd area, 30 yrs exp. Bill, 813-844-3823.

Call and hire Janet, FT announcing, progmg aspirations, computer literate, in radio since 1980; PT announcing, mktg experience, metros, bedroom communities preferred. Janet, 502-895-5888.

ABOUT OUR EMPLOYMENT SECTION

HELP WANTED

Any company or station can run "Help Wanted" ads for \$1.50/word or buy a display box for \$60/column inch. Payment must accompany insert, use your MasterCard or VISA; there will be no invoicing. Blind box numbers will be provided at an extra charge of \$10. Responses will be forwarded to listee, unopened, upon receipt. Call 800-336-3045 for details.

POSITIONS WANTED

Any individual can run a "Position Wanted" ad, FREE of charge (25 words max), and it will appear in the following 2 issues of Radio World. Contact information will be provided, but if a blind box number is required, there is a \$10 fee which must be paid with the listing (there will be no invoicing). Responses will be forwarded to the listee, unopened.

Mail to: **BROADCAST EQUIPMENT EXCHANGE**
PO Box 1214, Falls Church, VA 22041 Attn: Simone Mullins

CASSETTE/R-R...WTS

16 track 2" \$3450, MCI JH110C-8 \$2800. 110C-8 play only \$500, ATR800 mono or Tascam 7300 or 2502 \$600 ea, MCI Locator III \$1195, Tascam 52 2 Trk \$1200, Ampex AG350 electr \$50/ch. W Gunn 619-320-0728.

Otari Mark II-IV 1/2" 4-track, multi-track, mint, less than 50 hours, Best Offer. R Kaufman, Pams Productions, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

Recordex 6 cassette rewriter \$100; Tascam 40-4 4 track 10" in flight case with free dbx \$750; MRL new short test tapes \$39 for 1/4" to \$199 for 2". W Gunn 619-320-0728.

Scully '100' recorders, record/play amplifiers, 8, 16, 24 trk heads. Sequoia Electronics, 4646 Hounds-haven Way, San Jose CA 95111. 408-363-1646.

Want To Buy

Lang LRP-1C, manual, schematic, or any tech data; electronics for Ampex 350/351. B Glenn, KGDN, POB 3258, Tri-Cities WA 99302. 509-946-3258.

Ampex tube recorders and mixers. W Gunn, 619-320-0728.

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

Tascam 58 1/2" 8 trk wanted to buy or trade for Otari 5050 MK III-8 or...? Wayne Gunn 619-320-0728.

CD PLAYERS

Want To Sell

Denon 950FA like new, \$550. K Thomas, Rebel Rcding, 5555 Radio Lane, Jacksonville FL 32205. 904-388-7711.

Studer A7s7 (2), exc cond, w/spec book, BO. B Giordano, WODS, 30 Winter St, Boston MA 02108. 617-426-2200.

COMPUTERS

Want To Sell

Wang LVP2000 CPU and terminals (2); TI 810 printer (2); 286 mother boards (2); Anderson AJ1256 modem; TEC F10 Daisy wheel printer; 8" Dysan floppy disks; Heathkit H89 computer; TI 700 printer; Topaz 73550 3 phase 208 volt reg 45 KVA; Topaz 93445021 isolation transformers. T Wortman, WJAG, 309 Braasch Ave, Norfolk NE 68702. 402-371-0780.

Samsung Syncmaster SVGA 14", \$360 + s/h. R Surraci, Fine Art Prod, 67 Maple St, Newburgh NY 12550 914-561-5866.

Want To Buy

Tandy 6000HD w/at least 1 floppy drive. Mel Crosby, 408-363-1646, FAX 408-363-0957.

CONSOLES

Want To Sell

BE 85150A 8 chnl st, w/mono matrix and audition, BO. C Springer, KLMR, POB 890, Hamar CO 81052. 719-336-2206.

Tascam M-35 8 channel mixing console (3); TEAC 35-2B 2 track R/P reco machines (2); TR patch bays (2); dbx 150 NR; Tascam DX-FD dbx NR; MW Persons 25 Hz tone generator; Burwen transient noise elimination; Delta 99 stereo cart system, 1 R/P unit, 1 PB only, 1 amp; pair JVC SP54 WD studio monitors and much more, call for details. Toby Arnold, 214-661-8201.

Auditronics 501 46 I/O modules, 52" main frame w/32 outputs, 400 point patchbay, gd cond w/all upgrades, \$6000/BO; Auditronics 110-8 w/12 I/O mono modules, stereo module and spare i/o module, all upgrades, Jensen transformers excel cond, \$1200/BO. R David, Audio Oasis, POB 4181, Falls Church VA 22044. 800-966-2747.

Gotham long throw faders (10), \$50 ea. G Kornbluth, A&J Rec, 225 W 57th St, NY NY 10019. 212-247-4860.

MCI JH416 18x4x2 recording console with patch bays & producers desk, updated w/5534 chips, clean with spare faders, parts and manual. \$3000. D Bailey, Rock Shoppe Prods, 3422 Beech St, Rowlett TX 75088. 214-475-9796.

Shure M-67, rack mount for mixer. D Peluso, KJUL, 2880 E Flamingo Rd, Las Vegas NV 89121. 702-732-2200.

Sphere Eclipse C 40x24 plasma meter, Allison 65k automation w/super graphic, parametric and quasi parametric EQ's, 440 point patchbay w/prod desk, vgc, \$20,000/BO. R David, Audio Oasis, POB 4181, Falls Church VA 22044.800-966-2747.

Ampro AC-8 mono, gd cond, \$800 or trade for stereo console. E Smith, WDFX, POB 1855, Cleveland MS 38732. 601-846-7060.

Ramko DC5AR 5 channel mixers, vgc, \$175 each. 916-725-2434.

Spotmaster 5M11 mono, 5 channel, 15 input, \$175; Spotmaster 4M50 mono, 4 chnl, 8 input, mint condition with doc, \$190 + ship. S Zubrick, Z-Tec, 214-475-0234.

Russco 505, \$350. J Arzuaga, WOOZ-FM, POB 980, Quebradillas PR 00678. 809-895-2725.

Want To Buy

Altec 9470 amplifier modules (6). L Williams, WFIC, Box 475, Collinsville VA 24078. 703-647-1530.

Harris-Gates need transisterized duolux stereo board that can drive AM-FM mono combo. A Wilkerson, WLIL AM, POB 340, Lenoir City TN 37771. 615-986-7536.

McMartin any, need for parts, will pay shipping & handling E Smith, WDFX, POB 1855, Cleveland MS 38732. 601-846-7060.

DISCO-PRO SOUND EQUIPMENT

Want To Sell

Alesis 3630 compressor, Scott 340 tube amp, Packburn noise suppressor, McIntosh cabinet. K Gutzke, Custom Rec, 7134 15th Ave S, Minneapolis MN 55423. 612-866-6183.

UREI 530 graphic EQ, 9 band stereo, 18 band mono EQ, barium strip, input/output, excel cond, \$200; Sequestrial Circuits drum machine, 9 keyboard style, programmable, MIDI compatible, \$200. W Feinberg, Totallape Publishing, 9417 Princess Palm Ave #400, Tampa FL 33619. 813-621-6200 ext 337.

Akai S1000 sampler; Akai S900 sampler (2); Otari MTR-12 (2); Otari MX-70; Soundcraft 6000, 44 channel, 88 inputs, 16 track out with patch bay, BO. J Burdick, DJ Int'l Records, 727 W Randolph, Chicago IL 60606. 312-559-1845.

Ensoniq EPS sampling keyboard w/4X memory & 8 output expander, in box w/manuals, software available, \$900. D Bailey, Rock Shoppe Prod, 3422 Beech St, Rowlett TX 75088. 214-475-9796.

dbx 155 4 chnl encode/decode type I NR (2), \$200 ea or \$350/both. P Cibley, Studio C Music, POB 751 Murray Hill Stn, New York NY 10156. 212-532-2980.

Teac 8 chnl mixer; Fostex A-8 8 trk rec; Techniques SL1200MK2 turntable. D Rose, KDUC, POB 250, Barstow CA 92312. 619-256-2121.

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dbx 140A new, dbx Type II NR, \$350. W Feinberg, Totallape Publishing, 9417 Princess Palm Ave #400, Tampa FL 33619 813-621-6200 ext 337.

Inovonics 230 mono 8 band compressor limiter in excellent condition, \$1000. A Anello, ATS, 1915 W Waters Ave, Tampa FL 33604. 813-933-6009.

Optimod 8000A excel cond, 3 yrs since factory rebuild, \$1800; Moseley 505-C, 950 MHz, SN41201T not type certified, \$3000. Ron, KPIC, 1206 N Main, Beebe AR 72012. 501-882-3331.

Teletronix LA-2A tube type leveling amp, BO. W Bos, KGM, 229 Yew St Rd, Bellingham, WA 98226. 206-734-9790.

CBS Labs Volumax 441 stereo peak cntlr, \$100 + ship. D Kennedy, 800-377-0022.

Want To Buy

Fairchild 670 or 660 tube compressor/limiter, Teletronix LA-2A tube compressor/limiter or UREI LA-3A solid state compressor/limiter, call after 3PM CST. 214-271-7625.

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Shure SM-7 mint cond, in box, \$190. S Zubrick, Z-Tec, 214-475-0234.

Audio Technica C87, \$125. R Surraci, Fine Art Prod, 67 Maple St, Newburgh NY 12550 914-561-5866.

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Shure SM-7. D Miller, WINA, POB 498, Charlottesville VA 22902. 804-977-3030.

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TDS CS Weisel Technologies controller for Vic 20 to switch audio equip. WDTM, POB 388, Selmer TN 38375. 901-645-6165.

ACD/UTC audio transformers, lg quan, \$12 ea. For list: G Kornbluth, A&J Rec, 225 W 57th St, NY NY 10019. 212-247-4860.

Astron power supply RS-35A, 13.8 VDC 10 amps, great condition, \$50 + ship. S Zubrick, Z-Tec, 214-475-0234.

Alertlite 3-V on-air warning light, verticle, visible on 3 sides, new, \$40. R Franklin, Super Sound Stud, 1004 Dekalb St, Norristown PA 19401. 215-646-7788.

Audio transformers, for list: D Peluso, KJUL, 2880 E Flamingo Rd, Las Vegas NV 89121. 702-732-2200.

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

Circuit brkrs, remote resetable, 30 A, 60 A, 135 A, 220 A, all adjustable. B Wolf, 2212 NW 119 St, Oklahoma City OK. 405-755-6603.

Onan 6.5 kW gas, pull start, 15 hp Briggs & Stratton engine, low hrs. R David, Audio Oasis, POB 4181, Falls Church VA 22044.800-966-2747.

Orban 9100B new complete manual w/prints, \$20. R Weaver, WBZB, 413 S Fuquay Ave, Fuquay-Varina NC 27526. 919-552-9357.

Sparta Electronics audio/RF tech manuals. D Peluso, KJUL, 2880 E Flamingo Rd, Las Vegas NV 89121. 702-732-2200.

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RCA TM-21 need flyback and pwr xfmr. Jay, NBC, 30 Rock Pl, New York NY, 212-664-3033.

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Want To Sell

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Want To Buy

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Telos T-10 control heads for Telos-10 hybrid. T McGinley, WPGC, Box 10239, Washington DC 20018, 301-441-3500.

Gates RDC-10AC remote w/manual, all parts working A Wilkerson, WLIL AM, POB 340, Lenoir City TN 37771, 615-986-7536.

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Scotch 3M, hundreds of used, some old, some new, plus cart rack, BO. D Rogers, KXAX, Hwy 4, St James MN 56081. 507-375-3386.

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Pams Jingles ref tapes, 1951-1976, BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625.

Maxell LNE-25-1 low noise pro rec tape, 2400', on 7" reels, w/leaders, new, sealed in plastic, \$80. R Franklin, Super Sound Stud, 1004 Dekalb St, Norristown PA 19401. 215-646-7788.

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19A IO8B Potomac Instruments FM 41 field intensity monitor. C Scott, WKYO, W KY Univ, Bowling Green KY 42101. 502-745-3834.

Assortment of older test equip manuals/other equip manuals. S Daitch, Box 182, Louisville GA 30434.

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Bauer 5000 W, \$5000. Bill, KCNO, POB 570, Alturas CA 96101. 916-233-3570.

Gates Harris FM 5C w/manuals, gd cond, less exciter, \$3800/BO. M Kestler, KAWZ, 241 Main Ave, Twin Falls ID 83303. 208-733-3133.

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BE FX-50 still in box, \$5800. D Magnum, Magnum Radio, 1021 N Superior Ave, Tomah WI 54660. 800-736-WBOG.

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Tepeco J318 10W KM booster with TX broadband ant, \$1800. 20W FM exciter, solid state, synthesized freq to any channel, \$1500. J Arzuaga, WOOZ-FM, POB 980, Quebradillas, PR 00678, 809-895-2725.

ITA 1000-A gd cond. J Martinez, WUPR, POB 868, Utado PR 00641. 809-894-2460.

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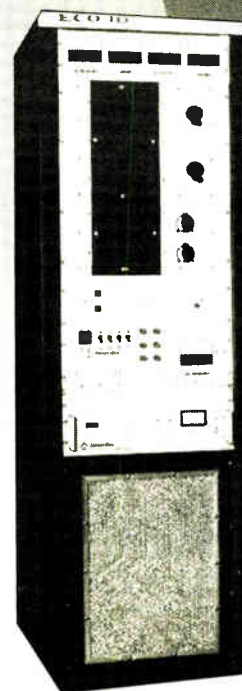
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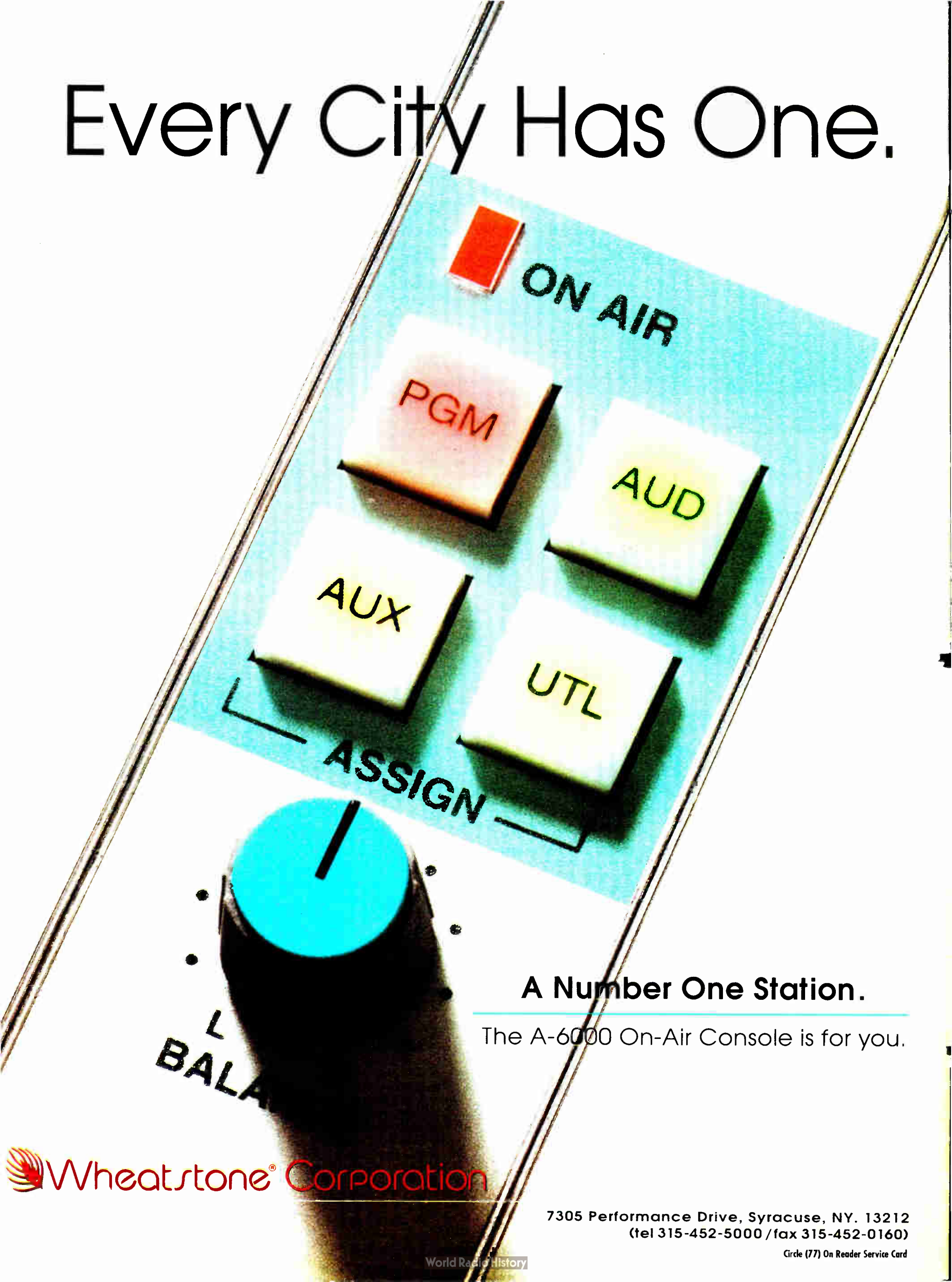
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