

Harman on Harman

by Alan Carter

WASHINGTON Sidney Harman is a man who wants to have an influence. What he's doing is making quite an impact, especially in the world of audio.

Harman, 75, is chairman, chief executive officer and director of Harman International Industries Inc., a corporation he formed in 1980 that is approaching \$1 billion in annual sales.



Sidney Harman

Tremendous growth recorded in the second and third quarters of fiscal 1994—25.6 percent and 33 percent, respectively, over the same periods a year ago—is attributed partly to sales from newly acquired companies. Two key additions are AKG, which became part of Harman International in September 1993, and Studer ReVox pro, the latest acquisition for the Harman Professional Group finalized in March.

Today, Harman International covers all facets of audio from consumer and automotive to professional.

The professional line accounted for 27 percent of net sales in fiscal 1993, a figure expected to be more than 30 percent in fiscal 1994. The Professional Group also was recognized as making a substantial contribution to newly released 1994 third quarter sales of \$222.9 million, compared to \$222.7 million in the second quarter and up 33 percent

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License Renewal Cycle Starts

by Randy Sukow

First in a series

WASHINGTON Equal Employment Opportunity (EEO) regulations lead a long list of complicated federal regulations radio broadcasters must thoroughly familiarize themselves with before the next round of radio station license renewal proceedings begins in June 1995.

In a little less than a year, the FCC will begin reviewing renewal applications from stations in a few Eastern states (Maryland, Virginia, West Virginia, as well as the District of Columbia) and slowly work its way through the rest of the country over the following three years.

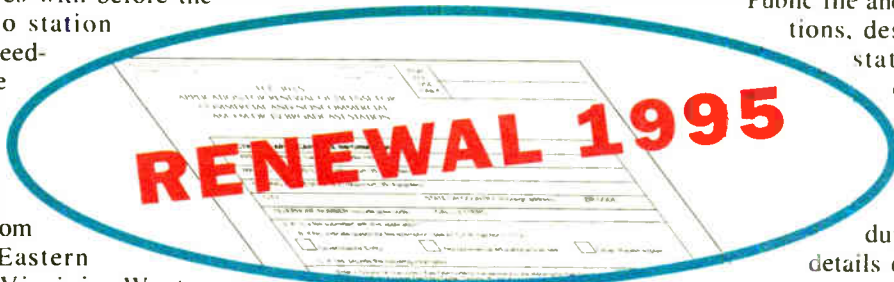
Unprepared licensees are vulnerable to license challenges from several directions, possibly leading to costly legal proceedings and even loss of license.

Challengers

A citizen or citizens' group may use almost any grounds to file a challenge to a license renewal. But the National Association of Broadcasters (NAB), working with several communications

attorneys, has identified the issues that are most likely to draw competitors.

It is not too early—in fact, it may be a bit late for some stations—to review minority hiring histories in the years since the last license renewals, attorneys say. The rules have changed significantly in recent years.



It is also a good time to review compliance with technical rules, the lawyers say, especially the regulations limiting public exposure to radio frequency (RF) radiation.

The RF radiation issue is especially complicated because the FCC is currently in the process of changing the exposure standards for the public and station workers. The new rules are not expected to be approved until late 1994 or early 1995, and their impact on the coming license renewal proceedings is unknown.

Radio industry consolidation, another

phenomenon that has ascended since the late 1980s, also presents possible complications during the renewal process. Licensees that have brokered their facilities in local marketing agreements (LMAs) must be especially careful to see that all commission regulations are followed.

Public file and program content regulations, designed to demonstrate a station's commitment to community service, have long been a target for groups seeking grounds to challenge a renewal. Diligent filing procedures may seem like minor details during day-to-day operations, but could be license savers when the commission comes to call.

The license renewal procedure of the mid-1970s, recalls Jeff Baumann, NAB executive vice president and general counsel, is significantly different from today's.

The renewal cycle was three years rather than the current seven, and the commission maintained a separate "renewal branch" of the Broadcast Bureau, which was staffed by 12 attorneys, said Baumann, who was one of the FCC attorneys during that era.

A decade and a half of deregulation, beginning in the late 1970s under FCC Chairman Charles Ferris and continuing through the Republican-led FCCs of the 1980s, streamlined much of the process, while budget cuts reduced the FCC staff by hundreds.

The FCC staff that remains is not only overworked, but less familiar with the renewal process than their counterparts in the 1970s, who did not have four-year breaks between renewal periods.

New experience

License renewal will be a new experience for many broadcasters who entered the radio business within the last seven years; it will be just as new for some of the regulators as well.

"Even with all the years of deregulation, there are still many obligations today and many things are more complicated," Baumann said.

The number of complicated rules still on the books escalates broadcasters' necessity to follow commission rules and renewal filing procedures to the letter.

"The greatest concern to me, historically and today, is the temptation to check a box (on the renewal form) and fudge an answer," said attorney Mark J. Prak of Tharrington, Smith and Hargrove, Raleigh, N.C., during a recent NAB-sponsored renewal seminar

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NEWSWATCH

Court Scheduled Indecency Hearing

WASHINGTON The U.S. Court of Appeals in Washington has scheduled oral arguments for Sept. 13, to hear a challenge to the FCC's indecency regulations.

Among the plaintiffs are National Public Radio, the National Association of Broadcasters and radio ownership groups, including Infinity Broadcasting Corp., which has amassed over \$1 million in FCC fines from indecency complaints against its national morning personality, Howard Stern.

The plaintiffs claim judicial review of

indecency findings against stations tend to be unreasonably delayed, sometimes for years, due to flaws in the FCC rules, and that the delays amount to "an unconstitutional system of informal censorship."

Legislative Action Benefits Broadcasters

WASHINGTON Broadcasters are still reeling from the recent Clinton Administration push to levy billions of dollars in "user" and "spectrum royalty" fees on FCC licensees (RW, May 18), but they received a few pieces of good news from the Congress on other issues last month.

A scheduled May 14 markup of Sen. Strom Thurmond's (R-S.C.) bill to require five-second warning announcements after broadcast beer and wine commercials was canceled after Thurmond withdrew the bill.

NAB President Eddie Fritts praised grassroots efforts by broadcasters to block the bill in committee, but said the effort must continue without rest. "We expect similar legislation to be introduced in the next Congress," he said.

Also last month, House Copyright Subcommittee markup of a proposal to charge broadcasters "performance royalty" fees to air prerecorded music, on top of current ASCAP and BMI fees, was postponed.

Subcommittee Chairman Bill Hughes (D-N.J.), who is retiring from Congress at the end of this session, is continuing to push for

the bill, but faces increasingly tough odds as the scheduled October adjournment approaches.

FCC Nominees Get Committee Nod

WASHINGTON New FCC nominees Rachele Chong and Susan Ness were approved by the Senate Commerce Committee late last month and, at press time, were expected to be confirmed by the full Senate.

Chong will fill the vacant Republican slot while Ness will take the open Democrat position on the five-member Commission.

PCS Auctions Scheduled

WASHINGTON The FCC will hold initial auctions for narrow band Personal Communications Service (PCS) and Interactive Video Data Service (IVDS) July 24-29.

Narrow band PCS will include advanced voice paging, two-way acknowledgement paging, data messaging, and one-way and two-way messaging and facsimile.

According to the FCC, spectrum will be continued on page 12 ▶

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

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Radio Station Newrooms Decline

by Alan Haber

WASHINGTON The lifeline for local radio news programming is getting shorter year after year, according to the results of a survey published in the April issue of the Radio Television News Directors Association (RTNDA) Communicator.

An estimated 230 radio newsrooms closed in 1993, according to the survey, which was compiled from a sample of 830 "of an estimated 6,640 commercial radio stations with working addresses," according to the Communicator (apparently joint AM/FM news departments were counted only once).

Returns were received from 307, or 37 percent, of the sample. Of the radio stations responding, 254, or 83 percent, said they had news departments. News directors were asked to count sports, weather and technical "specialists" as part of their staffs, if they were essentially part of the news departments.

A downward spiral

The survey found radio news departments caught in a downward spiral: no news programming was created locally by one of every six, or 16.9 percent, of the stations surveyed, leaving approximately 5,520 radio newsrooms active.

This was an increase from the 1992 survey results, which found one in seven, or 13.4 percent, originating no news programming locally. An estimated 1,100-plus radio news operations have closed since 1981's deregulation freed stations from carrying non-entertainment programming, according to the Communicator.

Usually, the survey found, radio news staffs consisted of one full-time and one part-time employee in 1993, a situation which has been true since the 1981 deregulation. Median radio news staff size did not seem to be affected by market size, although the Communicator stated that "the means get larger with markets. The larger the market, the more often you'll find newsrooms with

two or more full-time staff."

The estimated size of the radio news worker pool in 1993 was 15,000, a loss of 500 full-time and 100 part-time workers from 1992, according to the survey. In the last six years, the survey said, the part-time pool remained basically stable, but full time staff fell 38 percent. The trend points to a strong increase in part-time staff: the survey predicts that somewhere in the neighborhood of 5,500 full time news people will be employed by radio stations by the year 2,000, versus 7,200 working part-time.

Dave Bartlett, RTNDA president, laments the loss of individual radio news departments. "But at the same time, I recognize the economic realities that have forced us into that position," he said. "There are simply too many radio stations doing news than the marketplace could support."

Dr. Vernon A. Stone, journalism professor emeritus at the University of Missouri, who conducted and compiled the survey, agrees that radio is having a difficult time supporting its local news operations. "Radio doesn't have the share of the media market that it once did, and it is extremely competitive," he noted.

Irreversible?

Charging that radio has lost ground to the influence of television, Stone isn't sure if the downward trend can be changed. "TV has proved too strong a competitor for radio," he said. "Radio is one-dimensional; you just get sound. TV is two-dimensional; you get sound and video. So audiences choose the two-dimensional (medium), the greater reality, the greater actuality, where you have the visual as well as the audio actuality."

One of the reasons for the trend of radio newsrooms closing down, according to Doug Wills, director of media relations for the National Association of Broadcasters (NAB), is duopolies.

"The fact that these consolidations take place...ends up hurting the working news

people in those stations," he said. "It is not a cheap undertaking to support two newsroom operations under a duopoly arrangement, and producing local news is one of the more expensive things that a radio station does."

The view from the radio station trenches seems to support the survey results. For example, WSIP-AM and FM, in Paintsville, Kentucky, has one news director and one sports director. Jason Blanton, the stations' program director, also handles the sports duties.

More of a luxury

"Out of our area, we're probably one of the few stations that really has a full-time news and sports director...you have to look at it nowadays, with the tough economic times of a lot of radio stations, as a kind of luxury," he said.

Regardless of the number of newsrooms closing each year, Chris Berry, news director of Chicago's all-news WBBM-AM, said that "Whether it's in Jackson, Mississippi or Jackson, Michigan, there will be a radio station that's committed to supplying its listeners with news and information."

Even though the survey shows the number of news departments shrinking, RTNDA's Bartlett said that this "doesn't

suggest for a minute that there's less news on the radio; it suggests there is a consolidation in the production of radio news."

And Mark Fratrik, NAB's vice president/economist, offered a ray of hope, noting that the survey results show medium and small markets having higher percentages of stations that have news operations versus stations in large and major markets.

Some optimism

"The greater percentage of stations having news operations in medium and small markets shows that the public is well served by radio stations covering news," he said.

Taken from the radio network news perspective, the survey might appear at first to be good news, said Jim Farley, general manager, news programming, for ABC Radio News, "because radio stations are putting more network news product on the air. However, the trend is bad for the whole radio industry."

The blame for the flux of radio newsroom closings in 1993 may indeed lie with the industry itself. "Radio personalities are the offense that will gain new audience, but news and information (are) the defense that holds your audience," Farley said. "As an industry, we haven't assured our listeners that if they stay with us, they'll be kept up on the latest developments that affect the audience. So more than ever, radio listeners are feeling a need to tune into television or cable news."

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Radio Future Takes a Page from Past

WASHINGTON The history of broadcasting is a fascinating read, and reviewing the inception of this industry often serves as a reminder that change has indeed been the determinant factor in defining radio's personality.

Every issue of **Radio World** that goes out is packed full of news about changing technologies and new and competing media (digital cable radio, for instance). News in **RW** also includes stories like the one about diminishing newsrooms in the radio station universe. Every facet of the business is as important as the other, and one's effect on the other can sometimes go unnoticed.

Back in the days of Sarnoff and Armstrong and de Forest, radio networks

move that resulted in the creation of the American Broadcasting Co. (ABC) two years later.

At the time, FM was an enigma, and Sarnoff already had fixed RCA's eye on television.

Today, ABC Radio is group owner, network, program syndicator, news provider and satellite distributor, all under the umbrella of Capital Cities/ABC Inc., and co-owned with the television group, the television network and cable channels, both audio and video.

NBC (formerly RCA) and CBS have undergone similar metamorphoses. And there are more choices today than these three entities, yet consumers still turn to the Big Three for reliable news, information and service. They have to—less and less of the thousands of radio outlets are programming their own news anymore (see story page 3).

In light of tough times and diminishing news returns, I was concerned when rumors of change began to swirl around ABC Radio. Relax, ABC affiliates. I recently spoke to Marty Raab in the Dallas office of ABC Radio Networks. Marty reassured me that all is well at the networks. The

company is shifting several of the New York-based jobs to Dallas. The advertising and affiliate marketing offices in New York will move to a new location in midtown Manhattan.

Dallas will expand to encompass all programming and operations jobs, as well as MIS and research. ABC News remains in New York, of course. Marty stressed that no jobs are being eliminat-

ed, and the network is planning a move to bigger, state-of-the-art facilities in Dallas in early 1995. Many of you will recall that ABC is now occupying the Dallas facility of Satellite Music Networks, which the company purchased



a few years ago.

So here we are, 50 years after its inception, and ABC Radio is still out front, one of the largest players in the game, moving to new facilities. Change can be a good thing.

★ ★ ★

Speaking of change and long-time industry names, Associated Press (AP) is happy to report that 30 stations have signed on to its new, AP All News Radio format. The network launched June 1, and provides live, turnkey, news and information programming all day (see **RW**, May 18). The three affiliates that launched the network are: WKIN(AM) Kingsport, Tenn. (Tri-Cities), KESQ(AM) Palm Springs, Calif., and KNUU(AM) Las Vegas.

AP All News Radio airs national and international news, business, sports and feature programming produced and delivered at the AP Broadcast News Center in Washington. The service uses digital audio compression technology to transmit the programming via GTE Spacenet III and Satcom C-5.

★ ★ ★

Not as old as ABC or AP perhaps, but certainly on the forefront of change

stands Telos Systems. Formed in the mid 1980s, Telos Systems is the brainchild of Steve Church. Steve invented the Telos 10 in 1984, the first digital telephone-to-broadcast interface system, a piece of gear that allows stations to improve the technical quality of their call-in segments.

The Telos 10 marked the introduction of the first digital signal processor- (DSP) based professional broadcast product. Introduced at the 1985 NAB convention, the Telos 10 is celebrating 10 successful years. Neil Glassman (pictured with the Telos 10 and its birthday cake) invited us to help with the celebration. Also present but not pictured were my colleagues, **RW** International Editor Alan Carter, The Radio World Magazine Editor Charles Taylor, and Kate Cowan.

Telos, however, wants to include everyone in the anniversary. If you are a Telos 10 user, photograph your unit in action and send Telos Systems the picture for a \$200 gift certificate toward your next Telos product purchase (read the fine print on the certificate). Photos should be sent to Telos Systems' Cleveland address. Camera-shy Telos 10 users can fax their unit's serial numbers to the company at 216-241-4103 and get a coveted Telos T-shirt.

★ ★ ★

The best place to learn about change, of course, is the fall radio show, now known as World Media Expo. All of us will be there, ready to absorb and disseminate news as quickly as we can. The good news is we will have more than one way to share the wealth of information, as our company will be publishing the trade show daily for NAB. You read it right. You not only have our pre- and post-NAB issues to look forward to, you can now also look forward to an informative, well-executed news daily while you are attending the show.

And, you can look forward to The Radio World Magazine. Eagle-eyed readers may have noticed I referred to Chuck Taylor as the Editor of Radio World Magazine previously in this column. It is official. We will be launching a monthly magazine, and Chuck is the editor. More on that later.



Telos' Neil Glassman and the Telos 10

were the ultimate ties that bound the nation—be it through President Roosevelt's fireside chats or that day in 1943 when General Dwight D. Eisenhower himself broadcast the news of Italy's surrender in World War II by the radio.

1942 marked the year that NBC separated the Red and Blue Radio Networks, a

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Herbert Kaplow is retiring from ABC News. Kaplow is a 43-year veteran of network news, starting out at NBC News in 1951 and moving to ABC in 1972. Kaplow's many accomplishments include accompanying the late President Nixon during his historic 1972 trip to China, and reporting from Cuba in 1959 when Fidel Castro assumed power.

Gary Nunn was named ABC Radio News financial correspondent in New York.

READERS FORUM

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

Wind power

Dear RW,
The story about solar/wind powered KFMU-FM Steamboat Springs, Colo. (RW, April 6), brought to mind WIBU Poynette, Wis., which went on the air in July 1925 on 1350 kc with a power of 20 watts.

There was no electric power in this rural area at the time, so the station ran off banks of batteries which were kept charged by a windmill electric generator. When there was little or no wind, an old Ford car engine ran another generator to keep the batteries charged.

The station moved to 1210 kc with a power of 100 watts in 1931. It retained the call letters WIBU, which stood for the slogan: "Wind Is Being Used." I would guess they stopped using wind power some time in the mid-1930s. WIBU(AM) is still on the air today, now at 1240 kHz.

In the mid-1960s, I worked with Arthur F. Schroeder, who was employed at WIBU during the wind-powered era, and he told me about the wind-powered setup. Mr. Schroeder died in 1991, so I have been unable to obtain further information.

I thought your readers might find it interesting that there was wind-powered radio some 50 years prior to KFMU-FM's 1975 start.

Don Sieb, Harvest Productions, Cross Plains, Wis.

Well said

Dear RW,
Having started to work in radio in 1931, and spending 52 years in the field, I wish to offer the following comment on the Guest Editorial by Mr. William R. (Bill) Bish, of KVOS-TV Bellingham, Wash. (RW, April 6): This is probably the most important, thoughtful and meaningful letter ever submitted to RW.



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Next Issue of
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June 29, 1994

Mr. Bish is to be saluted and the editor congratulated.

Palmer A. Greer, Greenville, S.C.

Sound advice

Dear RW,
James T. Wold is right about one thing: the work of great sound effects men (and women) is what made the golden age of radio golden (RW, April 6). I feel, however, that today's radio sound effects men and women deserve a little credit.

Take heart, all you f/x fans. There are still people keeping this craft alive today, most notably Tom Keith every Saturday on American Public Radio's "A Prairie Home Companion." Mr. Keith is often featured as a centerpiece in many of the program's segments, and never ceases to amaze and entertain the audience at home and in the theater.

I have discovered some other fine examples since moving from the East Coast a few years ago and tuning into Oregon Public Broadcasting's "The Neil Gladstone & Friends Radio Show" and "Rider's Radio Theater" (a modern "classic" Western-style radio show).

If you do not have tapes of those old "Shadow," "Lights Out" and "Inner Sanctum" shows, but want to find out just how creative those radio sound effects people are, try turning on your radio. You will find someone, somewhere keeping it alive.

Eric J. Gleske, Walla Walla, Wash.

Dear RW,
For your edification, most sound effects were from the famous sound effect record libraries of Gennett Records, Speedy-Q, Standard, E.M.I. and Major Records. This company (Charles Michaelson Inc.) distributed the first four of those libraries, which included thousands of effects, all taken from life.

For example, during World War II, I remember the Navy invited us to the Naval Proving Grounds in Dahlgren, Va., to record the sound of their battleship guns screaming overhead, both for training purposes and posterity. I was stationed half way down the range, with microphone in hand, as the shells plunged into the Chesapeake Bay.

Charles Michaelson, Charles Michaelson Inc., Beverly Hills, Calif.

Sins of omission

Dear RW,
I just read the article, "Processing Boxes Unveiled at NAB" by Ed Bukont (RW, May 4) with great interest. I am, however, disappointed by two omissions.

The first is the AM Amigo, an AGC/processor and C-QUAM Matrix limiter all rolled into one, made by Circuit Research Labs (CRL). The flexibility and price of this unit would have made a fine addition to Mr. Bukont's story.

Also, in the announcement that Orban and Cutting Edge have both introduced remote control software for their on-air processors, where was no mention of the fact that CRL has had available remote

News Trends Worrisome

Dr. Vernon Stone's invaluable survey of employment trends at broadcast news departments, conducted annually for the Radio-Television News Directors Association (see page 3), has been tracking a disturbing trend for well over a decade. The latest survey estimates one in six radio stations no longer airs any news,

and many others provide very limited coverage using part-time reporters. As a practical matter, regular news programming is worth airing because it helps prove to the FCC that a station serves the public interest, which, as the start of RW's "Renewal 1995" series notes (see page 1), will be a difficult point for some music-only stations to prove. Even though the commission no longer requires regular news programming at all stations, maintaining a news staff does much to block potential license challenges.

It may seem idealistic to say during an age of tight budgets, shrinking revenues and increased competition from alternative media, but news is also important because it actually does serve the public.

One of RW's editors happened to be in Milwaukee the morning after the local CBS-TV affiliate announced plans to switch to Fox. The upbeat and likable morning team on one of the local music stations, apparently drawing its information from a Milwaukee Sentinel clip, began questioning why other media were making such a big deal of the story. After all, what difference would it make if Milwaukee viewers had to adjust to finding Bart Simpson and Dan Rather on different channels?

The radio team seemed to miss the part of the Sentinel story reporting that Milwaukee's CBS affiliate was one of 12 network affiliates nationwide defecting to Fox, a development that could potentially change the balance of power among the broadcast networks and have ramifications for cable subscribers as well.

This is admittedly anecdotal evidence, but how many other RW readers could tell similar stories of times when music radio stations could have improved their product if a full-time reporter were on hand to double-check other's facts and perhaps break a few stories?

Hopefully, Milwaukee listeners interested in the Fox coup were able to find other news sources.

—RW

control software for their Audio Signature ever since that unit was introduced.

This software is free and is included with every Audio Signature shipped. It works on IBM-compatible computers and will talk to the Audio Signature either through a direct connection to the computer or via a modem.

Kevin Clayborn, Customer Service Manager, CRL, Tempe, Ariz.

Dear RW,
I just received my May 4 issue of RW, read the "Integration" article by Dennis Martin and the "DAWS" article by Ty Ford, and was disappointed to see that Dalet Digital Media Systems was not covered in either article.

I know there was a plethora of systems on the exhibit floor, but Dalet was prominently visible in its 20-foot exhibit located in the central part of the radio hall. They showed one of the more advanced systems on the floor, and are closer than most companies to the "integrated" computer system concept.

Dalet is certainly a name that should be familiar to RW. I have copies of three Dalet user reports you have published. I hope you will be able to give their system better coverage in the future.

John F. Schneider, president, RF Specialties, Seattle

Good attitude

Dear RW,
Concerning Bob Harris's article in the April 6 RW ("Learn to Market Radio's Strengths"), I just wanted to say, "Bravo."

A new attitude is what radio needs to prosper. Too many times I am faced with account executives that try to sell against other radio stations rather than sell the strengths of radio. By doing this,

we ruin our credibility with our clients, as well as our individual reputation in the industry.

We must learn to market radio's strengths and not be afraid of our own local competition. I, too, am proud of radio and love working in the industry, and you are right, radio works.

Professionalism starts with management. Without proper guidance and reinforced sales training, I am afraid you might be receiving more correspondence addressed to Bill at Professional Spots. A strong manager is the key to having a professional sales staff.

The management staff your XYZ station is at fault for the lack of professionalism in its account representatives. The sales staff only follows examples.

The context of your article was the subject of my weekly sales meeting. This is proof positive that lack of professional bearing not only hurts radio's image locally, but when published can tarnish our reputation on a much broader scale.

I hope other managers read your article and look deep inside themselves and their staff so that we may start to change the attitude of radio in general. It begins at the top.

Jerry L. Feal, General Sales Manager, KQLA(FM) Manhattan, Kan.

Dear RW,
Towing the line? I don't think so...and in the same issue that Bill Bish tells us that broadcasters have a responsibility to use correct English. (He's right, of course.)

Robert E. Richer, Farmington, Conn.

Editor's note: Mr. Richer is quite right. RW pulled out the wrong word in a sub-head on page 22 of the April 6 issue, by "towing the line" instead of "toeing" it.

NRSC Has Full Agenda at Summer CES

by John Gatski

WASHINGTON Although the full National Radio Systems Committee (NRSC) has not convened since January, members will have a full schedule at its scheduled meeting (June 20) during the upcoming Summer Consumer Electronics Show in Chicago.

The NRSC group's subcommittees have been busy working on new standards and updating existing ones, including digital audio radio, Radio Data System (RDS), and high speed data. These issues will be among the topics

discussed by the full committee.

According to John Marino, the NAB's manager of technical regulatory affairs, the digital audio radio subcommittee is still setting up procedures for the field tests of the in-band, on-channel digital audio radio systems. The lab tests, which began in January at the NASA Lewis Research Center in Cleveland, are scheduled to conclude this fall. The field tests are expected to start shortly after—and carry into 1995.

Although there are non-IBOC systems being evaluated, the NRSC is only concerned with IBOC, which

would minimize station conversion costs if found to be workable.

Marino said the field test parameters have taken longer to work out because of the time consuming process that went into the lab test guidelines.

Another area still being addressed by the NRSC is RDS. Although the standard was approved in 1993, the RDS subcommittee is still refining the standard—including the continual search for a subcarrier system that works with AM, and adding Digital Global Positioning System (DGPS) guidelines into the overall standard.

AM RBDS proposals are not as bit-robust as the FM standard (1,200 bits per second) Marino said that two AM RDS systems have been discussed including the European-developed Rohde and Schwarz system (200 bits per second) and a system that Motorola is supposedly developing. The Rohde and Schwarz system, Marino explained, is not compatible with C-QUAM AM stereo.

The NRSC also plans to have a high speed data subcarrier standard in place—perhaps by the end of 1994 or early 1995. "The actual goal is to announce it at the spring NAB conference," Marino said.

High speed subcarriers have as high as 20 times the data rate of RDS and can provide more complex types of information. Currently, there are three systems being discussed in the standard deliberations: the Japanese NHK system, the Seiko systems and the Mitre system, Marino said.

Any high speed subcarrier standard would have to be compatible with RDS, according to Marino. About 120 stations are on the air with RDS and more are expected this year and into 1995.

License Renewal

► continued from page 1

For example, on the second page of the renewal form (303-S) the FCC asks licensees whether they have filed all of their annual ownership reports since the last renewal period. If a licensee knowingly or inadvertently answers incorrectly, the commission will consider the answer a "misrepresentation" of the facts. Misrepresentations, no matter how minor they may seem, weigh heavily against licensees should their renewals be challenged.

The currently understaffed FCC is



NAB's first renewal seminar, held in Charlottesville, Va.

unable to double-check all the facts on license renewal forms, said Barry Umansky, NAB deputy general counsel. Misrepresentations uncovered by license challengers are, therefore, considered very seriously.

Editor's note: In coming issues, RW will review the procedures and deadlines stations can expect to face during the three-year renewal period. It will also publish stories on EEO, compliance with RF radiation rules and other major issues that are sure to draw challengers.

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Harman Is Now Major Force in Pro Audio

► continued from page 1

from \$167.58 million a year earlier.

International business accounted for 34 percent of total net sales, while 44 percent was in the U.S. and 22 percent was U.S. export, according to the 1993 Annual Report. This figure, too, should increase in 1994 with new contributions from AKG, formerly Austrian owned, and Studer ReVox, formerly Swiss owned.

In addition to AKG and Studer ReVox, the Professional Group includes JBL Professional, UREI, Soundcraft, Allen & Heath, DOD, Lexicon, BSS, Orban, dbx, Quedsted and Turbosound.

The name Harman, in the audio business, dates back to 1953 when he co-founded Harman Kardon with his colleague Bernard Kardon. The two met in the engineering department at the David Bogen company, where they adapted Bogen public address systems gear to accommodate their interests in music.

Talking about those early days while sitting in his 10th-floor offices in Washington on Pennsylvania Avenue, Harman admits that engineering was not his forte even though he graduated from college in 1940 trained in the field. That was best left to Kardon, so Harman moved over to the business side.

"I remember well that Mr. Kardon's view was—remember 1940 was the time of World War II—if Mr. Bogen insisted on keeping me in the engineering department, I would single-handedly lose the war," Harman said. "Though, what I tend to suggest these days," he said in jest, "is that what happened is I was trained as an engineer, but then somebody invented AC and everything was obsolete."

Starting over

Harman took a brief break from the audio business, selling his holdings in what was then Harman International, when he served as under secretary of commerce in 1977-1978 during the administration of President Carter.

His wife Jane was recently elected to the U.S. House of Representatives representing the South Bay area of Los Angeles as a Democrat, but Harman expresses no interest in returning to the government. "I'm often asked whether I'd do it again," Harman said, "and I always reply: I would do it over again, but I sure wouldn't do it again."

Harman's biography includes such notations as president for three years of Friends World College, a worldwide experimental Quaker College; founder and active member of the Program on Technology, Public Policy and Human Development at the John F. Kennedy School of Government at Harvard; and senior advisor to the Aspen Institute for Humanistic Studies.

His doctoral thesis, written in 1973 at The Union Institute, was titled "Business and Education—New Experiments, New Hope."

Harman started rebuilding the current Harman International in January 1980 by reacquiring the JBL loudspeaker business and the international distribution companies that together represented approximately 60 percent of his original business. Held privately by Harman until 1986, the Fortune 500 company is traded publicly on the New York Stock Exchange.

For the broadcast industry, the acquisition of Studer ReVox and AKG, whose subsidiaries included Orban and dbx, brings additional attention to Harman International. These product lines, combined with the radio console line of MBI, which Harman took over in 1991 and incorporated under Soundcraft, makes the company a turnkey provider.

The influence of Harman International on the latest acquisitions is taking hold, with recent announcements relating to manufacturing, distribution and service in the U.S. of products from dbx, AKG, BSS, Orban, Studer Editech and Studer.

"We will rationalize, in the case of each of these companies," Harman said, "much to us that seems to have been irrational in manufacturing, distribution and marketing. We've already begun to do that."

dbx, a division of AKG, moved manufacturing and marketing to Salt Lake City from AKG-U.S. and Orban operations in San Leandro, California, operations outside San Francisco.

Distribution of AKG microphones and headphones,

along with BSS products, is managed by the JBL organization in Northridge, California.

Lexicon assumes management oversight of Orban in San Leandro and of Studer Editech in Menlo Park, California. Lexicon also is responsible for all Studer distribution in the U.S.

Reorganizations in place

From Europe, Soundcraft Managing Director Philip Hart was appointed president of the Harman Professional Group and will direct all U.S. and international Harman professional business units.

Hart said no announcements were forthcoming about distribution changes in Europe, such as those in the U.S. One move taking place in Europe, however, is the move of AKG into new facilities in Vienna.

"Perhaps the most important thing you will see is a significant commitment to the enlargement of engineering facilities and engineering capabilities," Harman said. "And for that matter, a similar address to appropriate capital facilities."

Harman said he considers his corporation a builder.

"We don't think of companies as currencies to be traded," he said. "We think of them as organizations of human beings to be constructively developed."

In the cases of AKG and Studer ReVox, Harman acquired them from holding companies with no background in broadcasting. He said he believes it takes the perspective of someone in the industry to understand the twists and turns of the business.

"As technology takes dramatic turns, it tends to generate excitement among people like me, but perhaps less excitement among potential users who don't quite know where it is going," Harman said. "So I think in many of the fields

of activities of these two companies, we see caution—a backing off by potential customers. One might even think of it as a state of junior paralysis.

"But for many, including, I think, those firms who sold these companies to us, that was a pretty horrifying situation to contemplate," Harman said. "For some, including us, it represents opportunity. There is going to emerge out of this chaos, a delineation and clarification and some number of companies are going to demonstrate that they know what they are doing.

"It is our intention and my expectation that we'll be among those who demonstrate they know what they are doing."

Other acquisitions

Asked if he is eyeing other companies to add to his growing organization, Harman seemed comfortable with his current holdings. "With the exception of cable or a similar commodity, we're pretty well formed. We have been interested in Studer for the longest time," he said. "What happened here is that it became available."

This sounds like a cliché—not wanting to grow a company for the sake of size or scale—but listening to Harman explain his reasoning gives the statement more credibility.

"I am interested in business as a fascinating social invention. Certainly, within this country, the role of business is the center of life, liberty and the pursuit of happiness," Harman said.

"I care about the way business functions, I care about how they nourish their communities and their people. I care about building principled companies," he said. "I really don't care much about building a principled company that nobody's heard of. A business like that doesn't have much influence."

CBS Sets the Pace with P.A.C.E.

WASHINGTON Newsrooms, deadlines, live reports—the very words associated with broadcast journalism conjure up images of a fast-paced, frenzied daily existence. But step into the calm and serenity of CBS Radio's state-of-the-art news facility in Washington, and you can feel the tension leave your body.

The news bureau is designed around Corporate Computer Systems' (CCS) P.A.C.E. (Parallel Audio Computerized Editing). Each PACE is contained in a modular room, dubbed "snowflake," that can be dismantled and rebuilt in two-and-a-half days. All the rooms are interconnected, and total cost of each room is \$10,000.

"The beauty of the design," said Jerome Navies, director of CBS Radio Station News Services, "is that now, there is no need for a control room—although you can have one if you want."

Each snowflake, built in conjunction with Northeast Communications, features acoustically treated walls, ergonomically designed workstation furniture and chairs (with eight-hour shifts in mind) and of course, the PACE.

CCS designed the system specifically for CBS Radio. Tony Masiello, CBS Radio vice president of technical operations, worked closely with Tim Chase, vice president, CCS, who developed the software for PACE. Each unit is equipped with a large color display, a keyboard and control devices including a fader and scrub wheel. The system is icon-driven and emulates a typical radio production studio. The icons represent familiar and traditional tools of the trade: tape recorders, a mixer, tape duplicator, master tapes

and carts, and even a television screen.

Navies points out that the system is evolutionary. "The system is never finished," he said. When CBS thinks of another feature it would like, the call goes to CCS, and they write the software.

"For example, the PACE features 'Jerome's button,'" explained Navies. "I wanted to be able to audition the end portion of an audio cue. Jerome's button will allow you to audition the last four seconds of any cut."

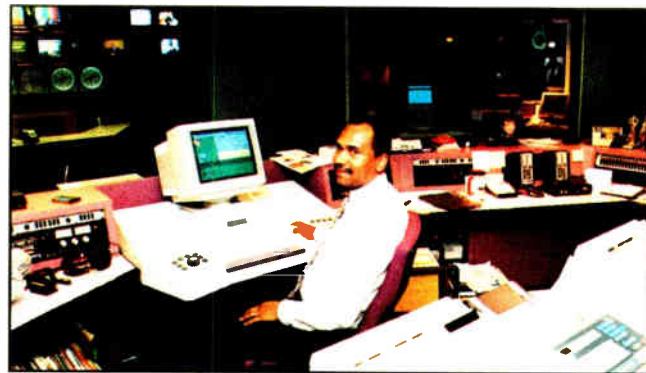
Navies, Masiello and Chase spent long hours planning the screen, so that "...everything you can possibly need is on the screen," Navies said. A reporter sitting at a

PACE inside a snowflake can perform functions such as group-ins, group-outs, duplicate, store information, access 20 recording devices and conference locations through the unit for broadcast. He or she could stack show segments, autocheck, share information or keep information stored in just that one unit.

The bureau's current setup includes seven

snowflakes and an assignment desk area. Each PACE can store up to three hours. The average unit will eventually store up to six, in addition to the community file server.

The PACE system features include a mono, dual mono (bilingual), joint stereo and stereo operation mode; ISO 11172-3 LAYER II (MUSICAM) PCM with an option for future formats; data rates of 128 kilobits per second (kbps) mono, 256 kbps stereo; XLR analog input and output connections; 18-bit Sigma Delta analog input and output A/D converters; 48 kHz analog input sampling frequency with a future option for 32 and 44.1 kHz, and will feature the AES/EBU SPDIF digital input and output format as a future option.



Jerome Navies overlooks the entire newsroom from the assignment-desk PACE.

Transmitter Maintenance Still Important

by Ed Bukont

LAS VEGAS Although much of the new gear steals the limelight when it comes to digital radio equipment, transmitter maintenance still is paramount to engineers.

At a workshop during the NAB spring show, John Bisset of Multiphase Consulting moderated a panel of technical support managers from several transmitter manufacturers. The speakers included Tim Bealor of Broadcast Electronics, Gerry Meier of CCA, David Chenoweth from Continental, David May of Harris Corp. and Kevin Rodgers from Nautel.

While each company represented offers a different way to tickle the ether, they all agreed on several points about what it takes to keep a transmitter on-the-air. Beginning with Bealor, these points were mentioned, detailed, reiterated and stressed several times by each representative.

Heat is the enemy

First—Keep cool. This refers to both the transmitter and to how you handle troubleshooting a poorly or non functioning transmitter. Keep a positive pressure of cool, clean air into the room and the transmitter. Then give the hot air a place to

exhaust. This is perhaps the most overlooked factor in transmitter plant design.

While tube transmitters are somewhat forgiving, heat is the number one enemy of solid state power devices. When working under pressure, don't aggravate the situation with bad engineering practice. If you are handling FET or CMOS devices, use proper grounding strap, avoid carpeted areas and be especially careful when working in dry air that is conducive to static buildup.

Second—Keep it clean. Meier noted with some disgust that there is quite a difference between the scant attention paid to trans-

mitter cleanliness in the U.S. versus Canadian transmitter sites. Meier noted that the station must do maintenance, even if it means occasional downtime.

The problem is worsened, he said, by "transmitters being in places we don't want them to be...top of mountains, cornfields, dust, dirt...it's a work of art for the engineer to keep it on the air."

Each manufacturer discussed its transmitters, cleaning needs at length, particularly Rodgers who noted that routine cleaning of the Nautel line can be performed during daytime hours with a vacuum, by simply opening the rear door. Because solid state systems operate at low voltages, the doors are not interlocked.

It was noted by all that one should vacuum, rather than blowing air or using solvents inside the transmitter. If you must blow air through a device, take the device outside if possible, rather than simply

Heat is the number one enemy of solid state power devices.

redistributing the dust back into the building and eventually the transmitter.

Tube socket cleanliness

Tom McGinley, chief engineer for WPGC-AM and FM in Washington, D.C., noted during the question and answer period that, in cleaning hard to access areas, such as the underside of the tube socket, one may have to use both air to dislodge debris and a vacuum to immediately remove the flying particles from the area. Solvents may drip and damage components, they should be avoided, he said.

Third—Give electrical power a proper way in, and out, of the transmitter. Good AC power is a must. In some instances, this may require the addition of voltage regulation at the AC power source or within the transmitter. May reiterated that open delta three phase power should be avoided and replaced when possible.

Proper grounding is equally important especially with solid state power devices which are more sensitive to transient energy. Almost 80 percent of lightning energy enters through the power line, not the coax. Tower, coax, transmitter, audio and AC power systems should all be grounded through a "star type" configuration which shares a common ground point.

However, this point should not be at, nor routed through, a piece of equipment. A better place would be where the coax enters the building. Maintain ground throughout the facility, don't interrupt or defeat a good two inch or four-inch ground strap by using a piece of #4 wire to jump the strap to the tower.

Be aware

Fourth—Know your transmitter. Learn the history including installation, previous owners, upgrades and field bulletins, history of operating parameters and repairs. Keep a running log of the transmitter's parameters during normal, proper operation and use this data to track changes in performance that may signal a developing problem. If changes are caught as part of routine maintenance, corrective action can

continued on page 13 ►

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COLE'S LAW

People at FCC Not to Be Forgotten

by Harry Cole

WASHINGTON This column is a personal one. I want to say a few words in memory of a couple of FCC staffers who died recently—Peter Rubenstein and Norman Blumenthal.

You may not have heard of them. They were not commissioners, bureau chiefs or the guys who got on panels at all the conventions. But they were both hard-working, dedicated staffers who consistently demonstrated a clear understanding of their importance in the great FCC bureaucratic machine and of the effect that bureaucratic machine has on broadcasters and our society as a whole.

Public servants

Peter, assistant chief of the AM Branch when he died, was 38. An attorney by trade, he was the one to call about any AM-related problem. He returned phone calls quickly, and he gave straight answers.

To the extent that a particular problem could be resolved without a lot of muss and fuss, he would work with you to do just that. If no fast and easy fixes existed, he would tell you. He would also give you an honest estimate of how long it would take to get a final answer, and those estimates tended to be pretty reliable.

The AM Branch, in the eyes of many, is

far from the sexy, cutting-edge regulatory issues raging elsewhere at the commission, but you could not tell from Peter's attitude. He was consistently upbeat, and he treated every question with respect and diligence. He was precisely the kind of guy you would want to help you through the administrative maze of the commission.

Norman Blumenthal, 51, a 26-year FCC staffer, spent the last 13 years as a member of the Review Board. Many broadcasters may never even have heard of the Review Board, which serves as a kind of lower court of appeals within the commission that reviews decisions made by the FCC's administrative law judges. If you won your license by going through a comparative proceeding within recent memory, you probably know of Norman.

Before joining the board in 1981, he served as a legal assistant to Commissioner Benjamin Hooks in the 1970s, and did a stint as Associate General Counsel for a few years.

Norman's job on the Review Board was to make decisions and write opinions, tasks at which he excelled. Unlike other FCC offices, which seem to pride themselves on their ability to make unique "purple cows" out of every case, Norman struggled, case after case, year after year, to craft coherent, consistent precedents

that could be applied to all similar cases. He was largely successful.

Fairness and consistency

Consistency was important to Norman. He recognized the importance of the rule of law in our society and knew a governmental agency like the FCC had to adopt reasonable rules and apply them evenly to all affected parties. He wrestled over and over again with crazy-quilt FCC rules and policies to get a consistent sense of them, which the Commission itself often did not seem inclined to do. When he saw the commission, the Mass Media Bureau or some other office acting inconsistently, he was not shy about issuing his own separate opinions, and sometimes scream bloody murder when policies made no sense.

He often gave lawyers appearing before him a hard time during oral arguments, and sure, he could be insufferably opinionated. Some people thought he had an ego

big enough to qualify for its own zip code.

But these were minor matters when measured against his tireless efforts to make sense of the commission's policies and to communicate that sense clearly.

The FCC seems to have lost considerable credibility and prestige in recent years. Even as the importance of its role in today's increasingly interconnected, interactive society expands, the quality of FCC decision-making has been in decline.

But the decline in some areas of the FCC cannot and should not be read as an indication of an overall decline in the quality or dedication of all FCC personnel. To the contrary, many staffers, like Peter and Norman, remain, laboring to do right as public servants.

Unfortunately, two of the best, most dedicated commission staffers are now gone. We should all remember Peter and Norman and hope the spirit that made them what they were lives on at the FCC.

□□□

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

NEWSWATCH

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licensed on a nationwide Major Trading Area and Basic Trading Area basis. Only 10 available narrow band PCS licenses will be included in the July Auctions.

Denon Offers Text RDS Receiver to Pros

PARISIPPANY, N.J. Denon is now selling its TU-380RD RDS AM mono/FM stereo tuner to radio stations through its professional audio division.

The \$300 list price tuner is Denon's first RDS scrolling text home/studio tuner. It features 64 character text, station selection by format, call letter display, and traffic message display. The unit is rackmountable. For more information, contact Denon at 201-575-7810.

EEPA Changes Name to EEA

WASHINGTON The Electromagnetic Energy Policy Alliance (EEPA) has changed its name to Electromagnetic

Energy Alliance (EEA), reflecting a change in goals and purpose of the organization.

The EEPA was mainly an advisory and educational body dedicated to providing "rational information about electromagnetic energy including radio frequency radiation.

According to EEA, the name was changed "to complement EEA's agenda to support responsible and rational public policy regarding electromagnetic energy... establishment of ANSI accredited product and industry standards for EMF use and providing an extensive public education effort in support of EMF safety."

According to EEA Chairman Jesse Russell of AT&T's Bell Laboratories, "EEA is positioning itself to provide expanded services to companies in the EMF area."

The radio industry is interested in EMF issues because of environmental concerns by local communities that may make it harder for towers to be built, moved or modified. Such prohibitions are often not substantiated by scientific research, according to the NAB.

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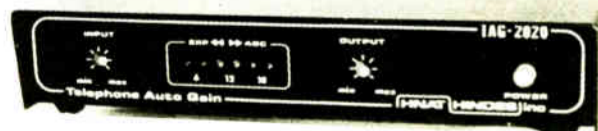


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Transmitter Maintenance Stressed

► continued from page 10

be taken before catastrophic failure occurs.

Chenoweth noted that modern high power transmitters are not subject to the drift problems of older technology. If the system is running properly, and the readings haven't changed since the last regular maintenance visit, then leave the controls alone. It would be a good idea however, as part of more in-depth maintenance to check the operation of sliding contact controls.

Become familiar with the subsystems (power supply, control, intermediate and power amplifiers) found in all transmitters and know how to service them. Efficiency data derived by monitoring the temperature difference between the air entering and leaving a transmitter is desirable. An increase in the difference indicates a change in efficiency.

When weighed against the PA voltage and current values, one can see where changes may cause some portion of the generated power to be lost somewhere, as heat, rather than being coupled into the antenna.

Manufacturer info

It was also noted that all manufacturers keep a database of their product line history. May described the rather extensive on-line system at Harris Corp. which keeps track of each station's individual history including who worked on the transmitter, any telephone or site visit contact, related service bulletins and station personnel who may need to be contacted.

Fifth—Make a thorough visual inspection of the transmitter. If you see poorly executed modifications, clip leads, or other questionable engineering, consult the documentation (if there is any), or call the factory to discuss the mod. In any event, poorly done modifications should be cleaned up, removed or replaced as appropriate before they lead to failure.

Review the record of field modifications that should, or have been done to the transmitter. It is important to perform such mods when the kit is available to prevent voiding a warranty, causing damage to the transmitter or risking the future unavailability of modification parts.

Take your time

When approaching a non-functioning transmitter, spend 30-60 minutes in a visual inspection. You may find a problem, correct it and be back up in no time. An all too common problem is poorly seated components, including the tube. Poor seating of the tube can lead to socket failure and considerable down time.

Sixth—Safety. You already have a first aid kit at the site—right? When was the last time it was checked?. Follow an OSHA approved (and required) equipment lockout plan when working on any piece of electrical and mechanical machinery. The front of the 8th edition of the NAB handbook details many OSHA workplace requirements including proper lockout procedure.

Pay attention to your surroundings and basic good engineering practices such as using a shorting stick to discharge power amplifier components, double checking that power supply voltages are turned off and replacing covers when done. Many transmitters have two sources of AC power, one to the HV supply and another for control or LV systems. Verify the absence of stray

voltages before proceeding.

An excellent item for filling one's pocket protector is the Texas Association of Broadcaster's (TAB) safety pen.

This inductive device, about the size of a penlight, will glow red when held near a conductor carrying 10-600 volts. It is probably the least expensive test device you will ever own, yet is one of the most necessary.

Post card

May suggested posting a card at the site with emergency phone numbers and clearly written directions to the site so that you can direct someone there in an emergency. The note might also have your

account number and shipping address for ordering parts.

Education—Invest in both your own future and in the station's. All manufacturers offer factory and/or field training. Harris offers both product specific and general knowledge courses which may be attended by anyone.

Continental has had a program of excellent field classes for several years. Broadcast Electronics also offers a series of well researched and written technical papers that can guide an engineer in designing and maintaining the transmitter plant.

The educational process is a team effort

and the information flows both ways. Never hesitate to call a manufacturer with a question, concern, comment or observation. Provision of field support is already built into the cost of the product.

Support programs

Manufacturers maintain technical and field support programs for the specific purpose of working with the engineering community. To make the most out of your call however, be prepared. Know what part or designator number you are asking about, where it is, the model or sub-system number and its serial number or approximate age.

Meier decried the state of the industry in which engineers are underpaid, forced to work several jobs and may not be able to respond immediately to an off-air situation.

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PRODUCT EVALUATION

Aphex Goes for 'Big Bottom' with 104

by Ty Ford

BALTIMORE Of the many schools of thought concerning the use of audio processing, and perhaps the most disturbing to most manufacturers, is the idea that, if recorded and mixed correctly, no processing is needed. Fortunately for the industry, most engineers and producers are enamored with the possibilities that these processing boxes offer.

Since its introduction in 1975, the Aural Exciter has continued to evolve. One of its latest configurations is the Aural Exciter with "Big Bottom," Model 104 (\$349.00). While earlier designs worked only on the generation of upper harmonics, the "Big Bottom" circuitry also processes the lower frequencies, primarily in the 20 Hz to 120 Hz range.

The key factor in the operation of "Big Bottom" and the Aural Exciter is that they increase the apparent of both low and high frequencies, without causing a proportional increase in the level of the signal. In other words, if you tried to get the same amount of boost with equalization, the added energy would result in a noticeable increase in signal level. At some point, that extra energy would push the amp stage following the equalizer into distortion, requiring you to rebalance your gain stages.

The Model 104, also known as the C2 is a two-channel device, without any stereo linking circuitry. Back panel I/Os are quarter-inch and are rigged for both balanced and unbalanced, +4 and -10 dB operation. Aphex has included an easy to understand piece called "The Care and Feeding of Balanced Lines" as a fool-proof hook up guide. Power is supplied by a 120/240 volt "wall wart."

Controls

Front panel controls include "Overhang" and "Girth" controls for low frequency processing of each of the channels. "Overhang" increases the sustain of low frequency sounds. A red LED indicates the relative amount of added sustain. The "Girth" control is used to increase the amount of the bass effect.

The Aural Exciter section includes "Tune" and "Harmonics" controls for each channel. The "Tune" control adjusts the corner frequency of the upper harmonics circuit from 800 Hz to 6 kHz. The "Mix" knob determines how much of the upper harmonics are added back into the "dry" signal.

The process in/out button on the front panel lights an LED when the circuit is engaged, but does not provide a hardwire bypass—a consideration which may make engineers think twice before putting it in the air chain of a remotely located transmitter processing rack.

Circuit changes

After trying a few basic maneuvers with the Model 104, I called Donn Werrbach,

head of engineering at Aphex to see if I could get him to reveal some of the device's internal workings. According to Donn: "The 'Big Bottom' doesn't rely on sub-harmonic synthesizing, but instead on frequency-dependent and phase shift amplitude-dependent control in the 'Big-Bottom' side-chain. When the direct bass

were too expensive for the C 2's projected list price. Aphex did more R&D to find a circuit that didn't need the more expensive frequency multipliers, but would still generate even harmonics. "The odds sound good on some things," Werrbach said, "but the evens sound good on everything."



Aphex Model 104 Aural Exciter

signal is full, there's less effect. When the signal drops, the effect fills in the low end, automatically bringing up the level of lower bass parts. It's not pure bass compression, because that would remove the attack and make it sound choked." The enhanced signal is then added to the "dry" output.

Over the years, the Aural Exciter circuitry has undergone a lot of modification. Werrbach explained, "The earlier design was amplitude dependent — the more input, the more harmonics. Drive controls controlled the amount of harmonics. In 1985, with the Type C, we used a circuit that differentiated between steady-state and transients. We were then able to use just the transients to generate harmonics."

Because parts of the Type III circuit

He also found that most people used either a little or a lot of processing, hence, the simplified "normal" and "high" modes. "Ninety percent of the time you should use the normal position. The added harmonics are relatively small, low in level." He also recommends that the Model 104 be used in-line, rather than as an effects loop device.

Practical applications

Depending on your source material, the Model 104 can do some remarkable things. However, it does have limitations. If there is noise in the source, like turntable rumble or tape and circuit hiss, these noises will also be "enhanced" and made more apparent.

The "Big Bottom" circuitry added a nice


warmth to a track of solo, finger-picked, steel-stringed acoustic guitar from my CD production music library. Sort of what you'd expect to get by moving a good condenser mic away from the bridge and more to the sound hole. Adding the Aural Exciter section brightened the top end, making it sound as if the player was picking closer to the bridge.

Next I combined the channels to mono and adjusted the controls so that the left channel was only boosting the bottom and the right channel was only boosting the top. While the spread and sense of space was not as great as the original multitrack recording, pushing the different frequencies to different channels did create a spatial effect. When I panned the source stereo pair back out to their extremes, the processing made the image even wider than the original.

Music recorded on analog cassette with a good level, proper tape EQ and bias and very little noise also responded well. Without the processing, the bass was a little thin, and the highs a bit soft. With minimum effort, I filled in the bass and added a bit of definition to the top.

Using a Sennheiser 421 microphone for some voice tracks, I found that the "Big Bottom" and Aural Exciter circuits easily added both chest and edge. Phase rotators, including those in the "Big Bottom" always give me that hollow "head cold" effect when I'm listening to my own voice with headphones while it's being recorded. It's a by-product of having the feedback loop to your ears messed with. If this bothers you too, try recording your voice track without the "Big Bottom" and using it when you mix.

continued on page 29 ▶



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PRODUCT EVALUATION

Advanced Hard Disk Audio Editing from MTU

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

ELKHART, Ind. The latest tool for producing spots, news stories and other radio programming is a multitrack hard-disk, digital audio workstation editing system. One of the best that I have come across is MicroSound by Micro Technology Unlimited (MTU). It's fast and sophisticated, yet costs as little as \$2,995 (excluding computer and hard drive). Complete workstations, including a 486DX-D2-50 MB drive, start at \$7,660.

MicroSound makes it easy to create

elaborate productions. You can record thousands of program parts, edit them, overlap them up to 50 stereo tracks deep, slide them in time, and digitally mix them to mono, stereo, or four channels.

MicroSound works on 386 and 486 PCs running Windows 3.1. For full performance recording and playback at the same time, and sampling rates above 32 kHz, you need at least a 386 with 33 MHz performance and a large SCSI hard drive.

The sound quality exceeds CD standards, thanks to the 16-18 bit A/D converters running up to 48 kHz. Fifteen sampling rates from eight to 48 kHz are available.

The noise floor is claimed to be -110 dB. During my evaluation, the MicroSound's audio quality was superb—clean, easy on the ears, and free of glitches. Fades are ultra-smooth because they are done at the sampling rate, rather than in steps.

Features

MicroSound comes in three parts: a 32 MHz DSP card which you plug into a slot in your computer, an external I/O module with connectors, and MicroEditor 2.2 software. I was able to install the system in just 15 minutes—both hardware and software.

Suppose you need to synchronize a live

singer with a music segment. You can play the music while you overdub the singer—even on a one-disk system. You can also punch in/out non-destructively to record replacement audio.

Other features abound. MicroSound can import Wave files and drive an 8/16-bit Multimedia Sound Device. It will network with other systems. Although the current version lacks effects or EQ, there are effects sends to outboard analog or digital equipment.

MicroSound can greatly speed up your production of "donuts." A donut is a single spot used by several affiliate stations. The spot has a space to drop in each station's ID or promo in order to individualize the spot. With MicroSound, you record a string of IDs to be dropped in later. This way, you can crank out hundreds of donuts in a few hours. It also works for repeat customers who want to change parts often.

Another application well-suited to MicroSound is an Awards program. Since you can re-sequence cues so quickly, last-minute changes in the program are no problem.

Product Capsule: MicroSound Digital Audio Workstation



Thumbs Up

- ✓ fast
- ✓ sophisticated
- ✓ excellent sound quality



Thumbs Down

- ✓ long learning curve (see text)
- ✓ lacks specific application notes
- ✓ requires windows

For more information, circle **Reader Service 8**; or call Micro Technology Unlimited at 919-870-0344.

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Many options are available: rack or table-top I/O modules, time compression/expansion, pitch shifting (without changing the duration), noise removal, unbalanced or balanced connectors, AES/EBU and SPDIF digital inputs and outputs, four channels in and out, filtering, and sample-rate conversion.

With the optional MicroSync board, the system can sync to SMPTE or video. This operation works smoothly; chase lock takes only one to two seconds to lock, resolving to incoming time code

How to use it

In the MicroEditor program are three main screens: Record, Segment, and Project. You record program material in the Record screen, edit it into segments in the Segment screen, and mix the segments and adjust their timing and levels in the Project screen. All these screens are uncluttered. Commands are easy to use once you've read the manual.

Many commands can be done in several ways. While this adds complexity, it lets you use the method that works best for you.

Up to 2900 stereo segments can be used in a mix, and up to 50 of these can overlap or play at the same time—without bouncing. In that sense, there are 50 stereo tracks available. But you don't assign segments to tracks, you just place them as needed.

Here's how it works: First, record program material onto your hard disk. You can use up to 40 soundfiles in a project. Each soundfile can be a separate recording of, say, a music bed, narration, or a string of sound effects. You can also

continued on page 32 ►

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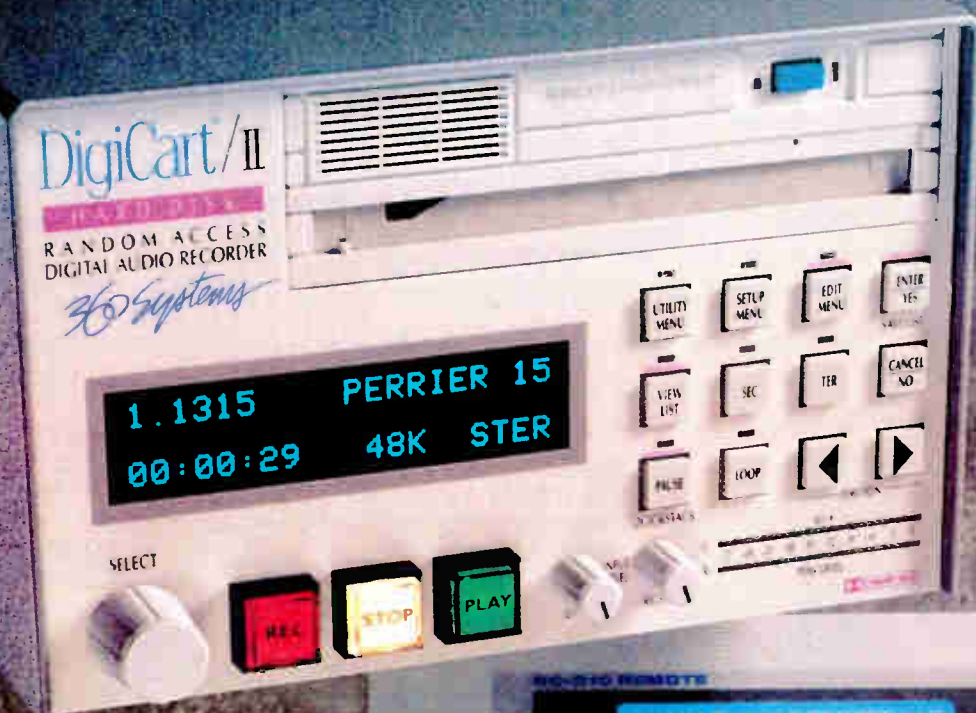
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Circle (49) On Reader Service Card

USER REPORT

Spectral Synthesis in the Studio

by Chris Crump
Creative Services Dir.
Paxson Communications

MAITLAND, Fla. When the director of technical operations for our station group, WJRR-FM, WMGF-FM, WWNZ(AM) and WWZN(AM), informed us that we were breaking into the digital age, it felt as though the ceiling of possibilities had been raised. The tame production that we had been doing on the ancient reel-to-reels soon was destined to become a thing of the past.

Like all good DTOs, our guy David Murray buckled down and did some intensive research on the vast array of digital workstations on the market. His decision was to go with the Spectral Synthesis Digital Studio System; the purchase was made in 1993.

Hardware

Throughout David's selection process he found that nearly every system he encountered was good, but the proprietary platforms drove the costs up. Spectral is unique in that it uses a standard PC/AT compatible computer combined with an ISA compatible expansion board set, a SCSI hard drive system and a totally user friendly software interface that is Microsoft Windows based.

With a dedicated hardware system, expandability usually entails selling the old machine and getting the latest model. Because the Spectral is PC-based, upgrades and expansion are as simple as installing new software or plugging in an expansion board. (And besides, if a couple of years down-the-road, the business office needs a great PC for accounting with lots of disk space...)

Our system consists of a 80486/33 MHz PC with 8MB of RAM, a 100MB hard drive, a 17-inch VGA monitor with an Orchid Fahrenheit Video Card and a Cooper Electronics CS10 User Interface. With software, our group paid about \$30,000 for the entire systems—minus the MO drive.

What really makes the system work is a group of components that Spectral refers to as its AudioEngine Hardware. At the heart of Spectral is the Digital Studio Board which provides a single SCSI bus that permits up to four hard drives to record and playback simultaneously. The FlyBy Board is an audio network controller that routes all of the audio connections between all of the hardware components by means of the FlyBy Bus.

By the way, Spectral outlines everything you need to know about your system in its documentation so there's no way you can be left in the dark.

At any rate, our system has two 316MB SCSI drives each having about one hour of audio storage. Each disk is capable of simultaneous playback and record of eight tracks. However, due to the current limits of digital-to-analog transfer, only 12 tracks of audio can be squeezed through Spectral's hardware without any signal degradation. Still, with a little planning, I still have an enormously versatile 16-track system.

For I/O, Spectral uses its AD/DA (analog to digital, digi-

tal to analog) converter. It employs 18 bit sampling at 32, 44.1 and 48 kHz. It will also lock to SMPTE and scads of other time locking devices. It is fully compatible with MIDI sequencing software and other third party time boxes.

Our system also has the SynthEngine board which, combined with Spectral's Audio-Scape software, allows us to take advantage of real-time digital signal processing, sampling and much more. With the recent addition of Spectral's new Q-

Card to the SynthEngine, I've got real-time EQ which gives me two parametric filters per channel as well as two audio sends per channels.

Since I do production for four different stations, I'm constantly eating up disk space. So instead of blasting my promos off the disk never to be heard again, I simply blast the audio onto Data DAT. Spectral also offers a magneto optical drive that is much less time consuming but much more budget consuming.

Software

Whenever our vice president/general manager is giving a tour through our facility, she

always saves the visit to the digital production room for last. Our guests stare wide-eyed with mouths agape as I manipulate audio in front of their eyes. Spectral's Studio Tracks is amazing in that it graphically allows you to see and hear audio as it is being manipulated.

The Windows interface allows a number of ways to accomplish this. The most familiar for those of us coming out of the analog world is the MultiTrack Screen. Here we are given up to 256 linear tracks where we can record, split, splice, duplicate, automate, invert, mute and edit audio, just to name a few possibilities.

The Studio Tracks set up gives continued on page 20 ▶

CM86

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You really only have to remember two things about the CM 86 mixer.....

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It's much simpler than trying to remember even half the unique features that the CM 86 has, like:

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- Independent mono switches on Master and Tape/CD
- Two Master output pairs: one XLR, one terminal strip, with independent level controls
- UL listing
- Flex bus in and out
- Individual phantom power switches
- Both terminal strip and XLR mic input connectors (with 1/4" line inputs)

.....plus a whole bunch of other functions you'd expect from any well-designed mixer. We would have added Rane's well-earned reputation for reliability and factory support to the list...but you already knew that.

RANE CORPORATION 10802-47th Ave. W., Mukilteo, WA 98275. (206) 355-6000

Production a Breeze on Spectral Synthesis DAW

► continued from page 19

you a 16-track mixer with an input metering bridge, a meters window, "transport" controls with a real-time digital clock (accurate to the thousandth of a second) a stereo Master control fader, a Playlist editor window and a Graphic Waveform editor. As you can imagine you have, at the very least, four ways to quickly edit audio at the click of a mouse—and even more ways to amaze anyone who may be watching you work.

As with all Windows-based programs, Studio Tracks uses EDLs (Edit Decision Lists) in the form of pull-down menus to offer the user a veritable plethora of editing options.

To give you an example, here's a quick rundown of what I might do in a typical project: 1—Select "Project" menu. 2—Select "740day.PJT." 3—Select "MultiTrack," "Mixer," and "Meters." At this point, the entire studio (16 channel mixer, multitrack and plasma meters) is set up on screen along with the WZNZ promo and all of its segments.

This is a daily promo with three variations. The intro tag is different to accommodate play on three of our stations. So, to make the quick change, I delete the current intro tag "THIS AM" on Track 1, select "Directory," select the "740day" library, highlight "MISS A DAY," select "Grab,"

and it will magically appear on my current 740day project screen. I just grab it with my mouse and drop it where it belongs. The whole process takes less than two minutes. You have got to believe that it sure beats the hell out of re-cutting the promo every day and remixing it for three stations.

Having started out with Spectral's Studio Tracks 1.5 version, I was delighted by the recent arrival of 2.0. The software upgrade offered many improvements in the EDLs, an incredibly transparent pitch shift/time compression/expansion feature and full automation for mixdown that scripts fader movement, pans, EQ settings and more.

With Studio Tracks you can program fades on individual audio events, crossfade events, mute, solo. The possibilities are endless.

One of the other products that Spectral offers for use with Studio Tracks is AudioScape Digital Effects software. I don't have too much to say about it other than I've never really been impressed with it. The concept is great—integrate a complete array of digital effects with you

digital workstation and plug them in just by clicking your mouse. I have not used them that much for two reasons: the sound quality is a bit lacking, and the Patch Bay is difficult.

Given complexity of algorithmic dimensions for audio processing, I've got to give the Spectral guys credit. The effects work—just not that well in my opinion. However, AudioScape is complex software that is constantly being upgraded. Considering what they've done with Studio Tracks, getting AudioScape right is really just a matter of time.



Paxson Communications uses its Spectral workstation for all production.

Speaking of software, the nice thing about the Spectral Synthesis software is that it's easily upgradable. All you need is a modem and a decent communications package. By offering users an electronic bulletin board, Spectral can post weekly upgrades of Studio Tracks 2.0, AudioScape and there many other products that are easy to download and

install. Spectral is constantly upgrading their software's features, performance and on-line documentation, and they rely on input from users to affect significant changes. The BBS offers roundtable discussions with other users all over the world. E-mail, equipment exchange, new release information and many other useful features for the Spectral user.

Performance

The Spectral system really is quite amazing, and it allows for relatively instant access to any project that you may be working on or need to change. I've gotten great results from the machine but I'd be lying if I said that I'd never sat there in front of it and uttered numerous harsh expletives. From time to time, if my disk drives are getting too full, anomalies will occur when I attempt to record something. Occasionally, the system will lock up for no reason apparent to me. And sometimes when, in the midst of a very complex promo, I've stacked too many audio events simultaneously; strange things will happen and signal degradation occurs.

Yet, despite its relatively few shortcomings, Spectral's system is exciting, versatile and a very impressive digital audio workstation.

For more information, contact Spectral Synthesis at 206-487-2931 or circle Reader Service 147.

□ □ □

Chris Crump is creative services director for Paxson Communications, WJRR-FM, WGMF-FM, WWZN-AM and WWNZ-AM in Maitland, Fla., and a contributing writer to Studio Sessions.

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SIGNAL-TO-NOISE

Sound Effects the Old Fashioned Way

by Frank Beacham

NEW YORK Because it engages the imagination, radio is unequalled as a storytelling medium. The best radio storytellers use sound effects to help create



Sound effects specialist Tom Keith reaches for a prop during "A Prairie Home Companion."

imaginary "worlds" for their listeners. In the hands of a master, sound effects assume the role of living, breathing characters in a story.

In another era, when great storytelling was widely available on radio, the creator of sound effects was considered an actor. Most effects were generated live in the studio, just as was the music that would set the mood for the narrative. The great radio directors orchestrated the live actors, music and sound effects into a seamless symphony of story.

Garrison Keillor, this era's most compelling radio storyteller, uses live sound effects created by Tom Keith in many of his skits on "A Prairie Home Companion." In choosing Keith, Keillor has rejected computer-controlled samplers and synthesizers in favor of real materials manipulated to often comic acoustic effect before a live audience.

No computers here

Keith, a unique breed in the age of computers, works at a set-up that's decidedly old fashioned. He stands behind a modest wooden table cluttered with worn leather shoes, thin wine glasses, a telephone and hodgepodge of cheap noise making gadgets. Behind him stands a wooden door in a movable frame and to his side is a wire basket for catching fragments of flying glass.

A self-taught sound effects artist, Keith approaches his job—like in the old days—as an actor. For example, he said, the sound effects creator can say a lot about a character's state of mind in portraying how he or she walks, in the way they answer and hang up a telephone or even how they open a door.

"You might think there's only one way to open a door, but I think you can manipulate it enough to give it a sort of mood as to whether or not (the character) is tentative about it or is bursting through," Keith said. "There is a lot involved as far as timing and picturing what is going on in a script."

In the dozen years he has been doing live sound effects for Keillor's show, Keith said he has learned that in writing

for radio an effect needs to be properly set-up so the audience clearly comprehends it.

"If someone is going to open a window," Keith said, "you don't just have a sound of an open window. You'd first

Although Keith has studied books on how sound effects were made in the early days of radio, he's found that many of the materials of that era are no longer available. "For example, the sound of crunching wood," he recalled. "We used to use peach crates and raspberry cartons. But now they are plastic...so we lost that effect. Now I've found some picnic plates by Hefty made out of styrofoam that have a nice crisp sound, and I use them for cracking wood."

A weekend job

Keith, who during weekdays hosts a morning radio show on Minnesota Public Radio in St. Paul and then joins up with Keillor's company on weekends, gets little time to create new sounds for a performance. He receives the script for a new show on Friday evening, less than 24 hours before the live broadcast, and gets a chance for only one complete rehearsal the following day.

When on the road, Keith always checks with local stage hands about area hardware stores. "If you go to a town, you want to find out where the best hardware store is because they have the best noisy contraptions," he said.

continued on page 40 ►

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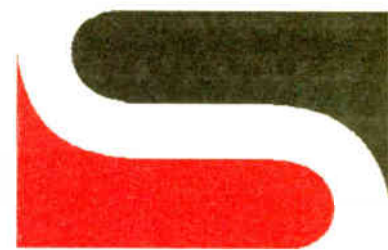
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PRODUCT GUIDE

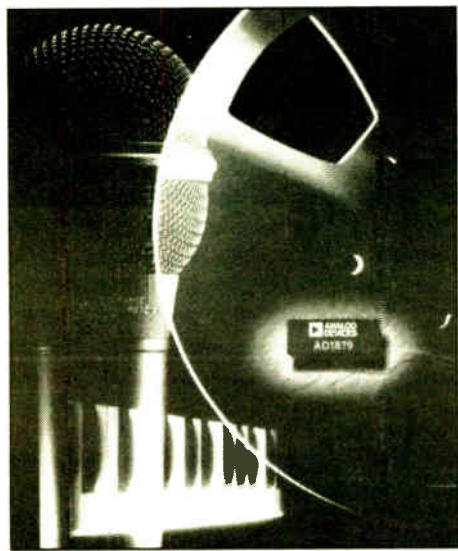
Companies with new product announcements for Studio Sessions Product Guide should send them to Radio World, c/o Studio Sessions Editor, 5827 Columbia Pike, Suite 310, Falls Church, Va. 22041

Analog Devices 16-/18-bit AD Converters

Analog Devices AD1878 (16-bit) and AD1879 (18-bit) analog-to-digital converters are professional quality chips that use switched capacitor circuitry said to eliminate external sample-and-hold amplifiers and reduce antialias input filtering.

Recommended applications include digital recording equipment, digital effects and digital audio switchers and routers.

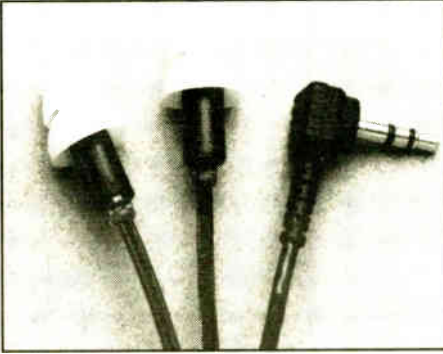
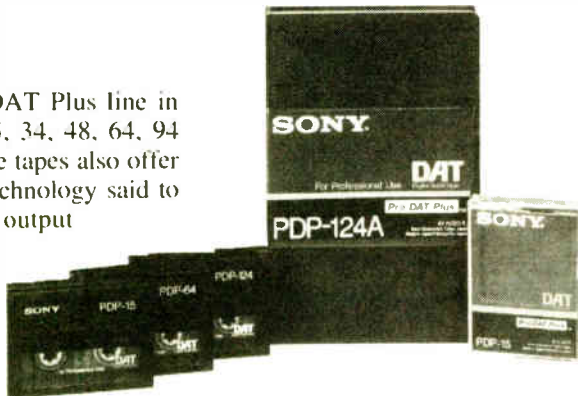
For more information, contact Analog Devices at 617-937-1428; or circle Reader Service 145.



Sony Pro DAT Plus

Sony now offers its Pro DAT Plus line in several lengths including 15, 34, 48, 64, 94 and 124-minute versions. The tapes also offer the latest in metal particle technology said to provide improved playback output and signal-to-noise.

For more information, contact Sony at 201-476-8000 or circle Reader Service 211.



Etymotic Research ER-4 Canal Phone

The ER-4 Canal Phone is a lightweight ear phone set that inserts into the ear canal, providing 20 to 25 dB of external cancellation and full fidelity listening. Bass is said to be down to 20 Hz.

The ER-4 lists for \$330. For more information, contact Etymotic Research at 708-228-0006; or circle Reader Service 200.

OSC 8-Track Tool

OSC has introduced the 8-Track Tool for Deck II enabling Digidesign Protools users to playback eight simultaneous tracks of digital audio on a single Pro Tools system.

According to the company, OSC engineers have programmed around limitations of Digidesign's hardware, enabling users the capability to squeeze eight tracks out of a single Pro Tools card. The price is \$129.

For more information, contact OSC at 415-252-0460; or circle Reader Service 79.

Stedman N90 Microphone

Radio production is just one of the suggested

uses for the Stedman N90 microphone, dynamic microphone that retails for \$399.

The unidirectional microphone features integrated hum-bucking coil, internal shock mount, stainless wind screen and 3-pin XLR connector. Optional external shock mount also is available. Specifications include 20 Hz to 20 kHz useable frequency response and 155 dB maximum SPL.

For more information, contact Stedman Corp. at 616-629-5930; or circle Reader Service 34.



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We understand why broadcast engineers have a wait-and-see attitude about new products. Your station (and your job) depend on rock-solid reliability and sonic performance you can count on.

We'd like to introduce you to Mackie... even if we do probably seem like a wet-behind-the-ears newcomer compared to some manufacturers. We've been around six years now. During that time we've gained a serious reputation for building high-value, trouble-free mic/line mixers.

Mixers with legendary headroom, ultra-low noise and unique features that make using them easier.

Mixers so good that they're regularly used to create major label compact discs, feature movie soundtracks, and more commercial production work than you can shake an RE20 at. For example, our CR-1604 16-channel mic/line mixers are used nightly on the Tonight Show, Arsenio Hall, Conan O'Brian and David Letterman Shows¹.

Our mixers have also covered hundreds of thousands of miles with acts like Peter Gabriel, Madonna, Whitney Houston, Paula Abdul, Bruce Springsteen, Reba McEntyre, Alabama and Michael Jackson¹. Compared to the relative security of a station production room, a six-month world tour is about the most brutal test that any electronic component can go through. Our mixers have a reputation for being bullet-proof on the road — even when loading dock mishaps and power surges have taken out everything else in the same rack.

As for use at broadcast facilities, well, we're not total newcomers. A quick scan of our warranty database shows that over 70 U.S. radio stations already have Mackie mic/line mixers in place.

Does that mean you folks aren't as conservative as everybody says? If so, call your favorite broadcast supply house, or dial us toll-free for complete information on Mackie's line of mixers.

If you are conservative, keep an eye on us, anyway. We want your business even if we have to wait five years.

¹ Mention in this ad denotes documented usage only. Mention is not intended to infer endorsement by any of the television shows listed.

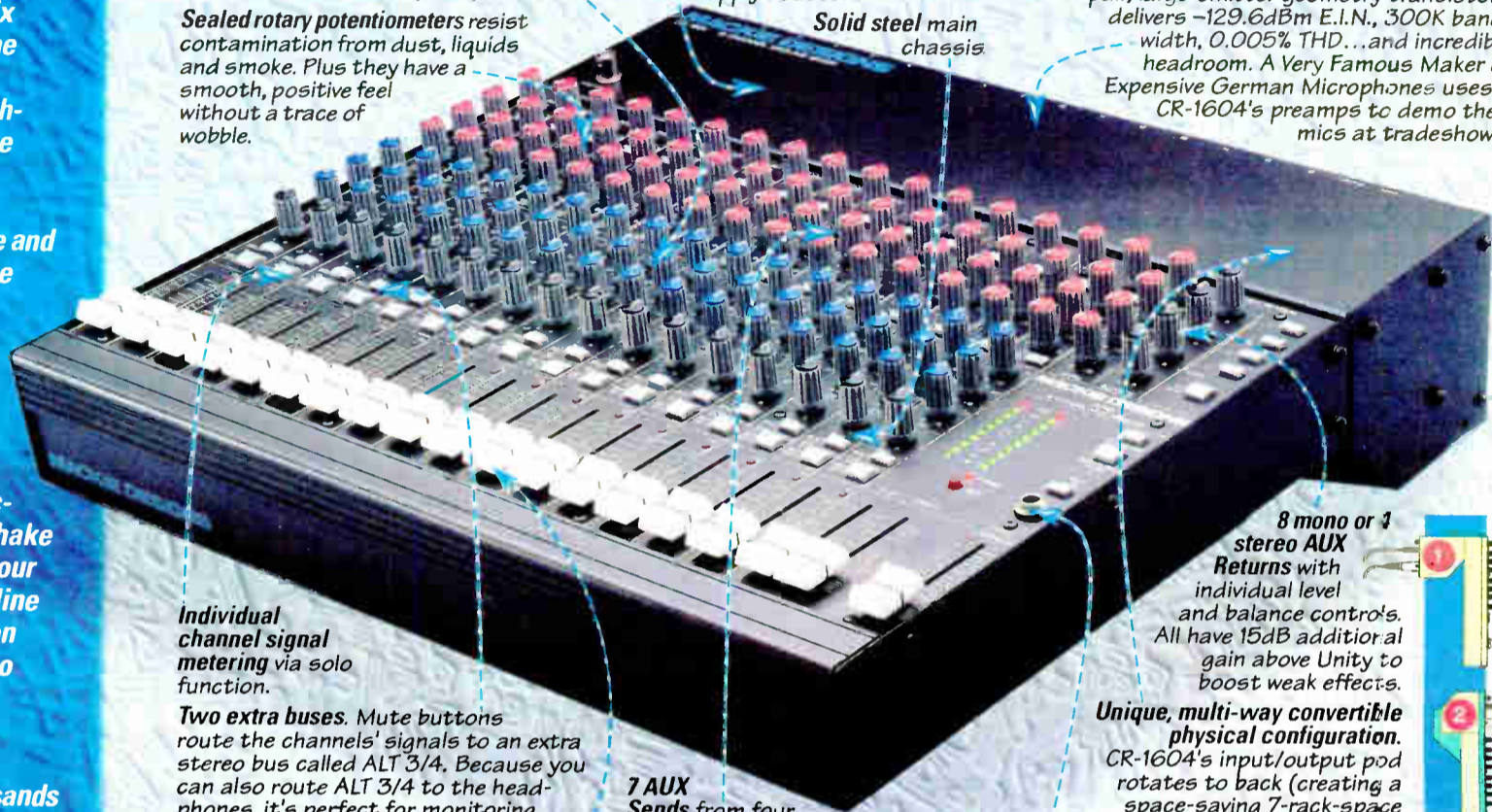
² Price is slightly higher in Canada.

3-band equalization done right: $\pm 15\text{dB}$ at 80Hz, $\pm 12\text{dB}$ at 2.5kHz (perfect for voices), $\pm 15\text{dB}$ at 12kHz. Far more useful than traditional 100Hz, 1kHz, 10kHz EQ.

Sealed rotary potentiometers resist contamination from dust, liquids and smoke. Plus they have a smooth, positive feel without a trace of wobble.

The Mackie Designs 16x2 CR-1604 Mic/Line Mixer. Suggested retail price, \$1095². Available at America's top broadcast supply houses.

Six recording studio-grade microphone preamps with +48VDC phantom power. Discrete circuitry with four conjugate-pair, large-emitter geometry transistors delivers -129.6dBm E.I.N., 300K bandwidth, 0.005% THD... and incredible headroom. A Very Famous Maker of Expensive German Microphones uses a CR-1604's preamps to demo their mics at tradeshow.



Solid steel main chassis

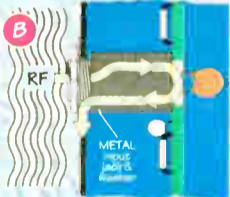
Individual channel signal metering via solo function.

Two extra buses. Mute buttons route the channels' signals to an extra stereo bus called ALT 3/4. Because you can also route ALT 3/4 to the headphones, it's perfect for monitoring advance audio cues: Preview a signal that hasn't been brought up in the mix yet... then add it by unmuting the channel.

UnityPlus gain structure gives high headroom and low noise at the same time. Set the fader to center-detent Unity Gain, press channel solo to monitor the channel via the CR-1604's LED meters, adjust the input trim ONCE, and you're ready. Because there's 20dB MORE gain available on the fader, you

won't need to constantly re-adjust the trim.

Maximum RF protection. Most compact mixers use plastic jacks that transmit RF to the main circuit board where it's re-radiated and picked up by anything that rectifies (A). The CR-1604 uses metal jacks and washers plus a shunting

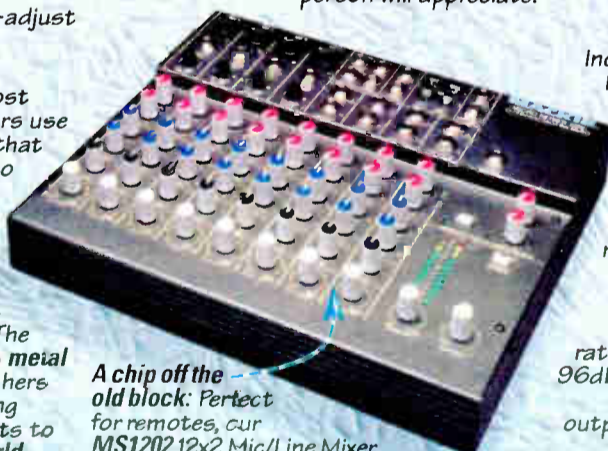


capacitor to de-rail RF before it gets to any circuit traces (B). A Radio World reviewer tested a CR-1604 on a transmitter hill with 3 VHF TV and 1 FM sticks plus several microwave repeaters and shortwave transmitters. When he plugged in a notoriously RF-prone microphone, he detected NO RF.

Not shown: Inserts on Chs. 1 thru 8, main left/right bus inserts, phantom power switch, balanced/unbalanced main stereo outputs and separate mono output. XLR10 Mic Preamp Expander connects to the CR-1604 pod to provide 10 more preamps complete with trims and phantom power.

7 AUX Sends from four knobs. AUX 1 can be used as an effects send or headphone monitor cue via the MON. Sends 3 & 4 become AUXs 5 & 6 when the SHIFT button is pressed. All sends give you 15dB more gain above Unity so that you can get tons of effect even when the channel fader is pulled down.

Powerful headphone amp (with volume control) drives any phones to head-banging levels even an AOR production person will appreciate.



A chip off the old block: Perfect for remotes, our MS1202 12x2 Mic/Line Mixer has 4 of the same superb mic preamps that distinguish our larger CR-1604, plus phantom power, 2 AUX sends/ch, 2 stereo AUX returns, channel patching, 2-band EQ, 3-way 12-LED peak metering, headphone monitor amp with level control, built-in power supply. Suggested retail is just \$399!

8 mono or 4 stereo AUX Returns with individual level and balance controls. All have 15dB additional gain above Unity to boost weak effects.

Unique, multi-way convertible physical configuration. CR-1604's input/output pod rotates to back (creating a space-saving 7-rack-space mixer shown in Fig. 1), or to front (10 rack spaces, shown in Fig. 2) with our optional RotoPod bracket. Use the CR-1604 on a tabletop with jacks on the same plane as the controls via the RotoPod bracket (Fig. 3 below), or jacks to top (Fig. 4 below). Our XLR10 Mic Preamp Expander can also be added in any of these configurations.

Rugged design and construction. Including mil-spec, double-sided, thru-hole-plated fiberglass circuit boards (horizontally-mounted on brass stand-offs for impact-resistance), double-parallel-wired faders for 2-times redundancy, and electronic protection against power surges, impedance mis-matches and static discharges.

Better-than-digital specs and headroom. The CR-1604 has a dynamic range of 108dB and an internal S/N ratio of -116dB (versus compact discs' 96dB dynamic range.) This means you're getting a mixer that can handle the output of digital workstations, CDs and DAT tapes without overload.

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The DA-88 is built for production. The integrity of TASCAM's design is evident in every facet of the deck. From its look and feel — to its exceptional sound, unsurpassed features and expansion capability.

GOES FASTER, LASTS LONGER AND TAKES A BEATING

While we admit that it's an elegant looking machine, it's tough to see its finest asset. The tape transport. Designed and manufactured by TASCAM specifically for the DA-88, it's fast, accurate and solid. And that's what counts in production — in personal studios, project studios or in those demanding high-end facilities.

You'll notice it uses superior Hi 8mm tape, giving you a full 108 minutes of record time. What's more,

the transport is lightning fast and yet so quiet you'll barely hear it blaze through a tape.

We didn't stop there. Because production environments are notorious for constant, if not abusive, shuttling, punching, 24-hour operation — you get the idea — the transport was designed and built to take a beating.

TASCAM DA-88

POWER



CASSET



Even more impressive is the transport's responsiveness. Take a look at the front panel. Notice the shuttle wheel? Turn it just a bit and the tape moves at one fourth the normal play speed. Turn it all the way and it flies at 8 times faster. Do it all night if you want. It's quick, smooth and it's precise. Need to get to a location quickly? Accurately? Shuttle a bit and you're there. The location is easily viewed on the DA-88's 8-digit absolute time display — in hours, minutes, seconds and frames. With the optional SY-88 sync card it displays timecode and offset, too.

YOU ALREADY KNOW HOW TO OPERATE IT

Unlike other digital multitrack decks, the DA-88 works logically and is simple to operate. Like your analog deck. All functions are familiar and easily operated from the front of the deck.



Adding the optional SY-88 synchronizer card is as easy as changing a Nintendo® cartridge. With it you're SMPTE and MIDI compatible. And no matter how many DA-88s you have locked up, you need only one sync card. Other optional accessories include AES/EBU and SDIF2 digital interfaces allowing the digital audio signal to be converted for direct-digital interfacing with digital consoles, signal processors and recording equipment.

s Machine



Take punching-in and out, for example. You have three easy ways to do it. You can punch-in and out of single tracks on the fly. Just hit the track button at the punch-in point. Hit it again to punch-out. You can use the optional foot switch, if you like.

Or, for multiple tracks, simply select the track numbers you want to punch, push play, and when you're ready, hit record to punch-in, play to punch-out.

Finally, for those frame accurate punch-ins, you've got auto punch-in and out. In this mode you can rehearse your part prior to committing it to tape.

No matter which way you choose, your punch-in and out is seamless and glitch free due to TASCAM's sophisticated variable digital crossfade technology.

That's not all, you also can set your pitch ($\pm 6\%$), sample rates (44.1 or 48K), as well as crossfade and track delay times. All from the front of the DA-88.

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There's more. Add the optional SY-88 synchronizer card to just one of your DA-88s and you've got full SMPTE/EBU chase synchronization. The best part is, you can record time-code without sacrificing one of your audio tracks. You also get video sync input, an RS-422 port to allow control of the DA-88 from a video editor, and MIDI ports for MIDI machine control.

A DIGITAL RECORDING SYSTEM THAT GROWS WITH YOU

The DA-88 is truly part of a digital recording system. Start with 8 tracks today — add more tomorrow.



Adding tracks is as simple as adding machines — up to 16 for a total of 128 tracks. They interconnect with one simple cable, and no matter how many DA-88s you have, they'll all lock up in less than 2 seconds.

Controlling multiple machines is made simple with the optional RC-848 remote. With it you can auto locate and catch 99 cue points on the fly. It comes complete with shuttle wheel, jog dial, RS-422 and parallel ports, and it controls other digital and analog machines, too.

LISTEN TO THE REST

Of course, the sound quality is stunning. With a flat frequency response from 20Hz to 20kHz and dynamic range greater than 92dB, it delivers the performance you expect in digital recording.

So get to your authorized TASCAM dealer now. Check it out. Touch it. And listen to it. Once you do you'll know why the TASCAM DA-88 is the serious machine for digital production. The TASCAM DA-88 is the choice of studios worldwide. And at only \$4,499, it should be your choice.



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BOOK REVIEW

Book Makes MIDI Accessible to Radio

by Ty Ford

BALTIMORE In the eight years or so I've been writing for **RW**, I have been urged many times to write about MIDI. The reason I have not devoted more space to the subject is that trying to explain MIDI in 1,200 words is like trying to take a picture of the Grand Canyon with an 110 Instamatic camera. In both cases, because the subjects are too wide and deep, they defy description.

Proof of that premise was made even more evident when "MIDI For The

Professional" (\$19.95), by Paul Lehrman and Tim Tully appeared on my doorstep. I had received a call from Paul in March 1993 in which he asked me how radio people use MIDI.

Studio domain

With few exceptions, MIDI has remained in the Music Keyboard and Project Studio quadrant. The return on your investment did not justify the amount of time you had to spend learning how to make the technology useful.

Don't get me wrong, I have a modest

MIDI setup: Roland U-20 synth/controller, Alpha Juno 1 and MT32 sound module. I recently retired my Alesis MMT-8 sequencer and disk drive and began running Opcode's Vision sequencing software. I use the rig to create music pads and to fire the samplers in my Eventide H3000 Ultra-Harmonizer. (The aforementioned are not recommendations. In fact, I'm thinking about putting out my own book, "Stories From MIDI Hell.")

Along the way

But along the way I have looked at many books on MIDI. None have been as accessible or as useful as "MIDI For The Professional." In the 239 pages, and these are physically big pages, authors Lehrman and Tully convey the history, technological basis of MIDI. They also provide numerous

charts, graphs, diagrams and practical applications.

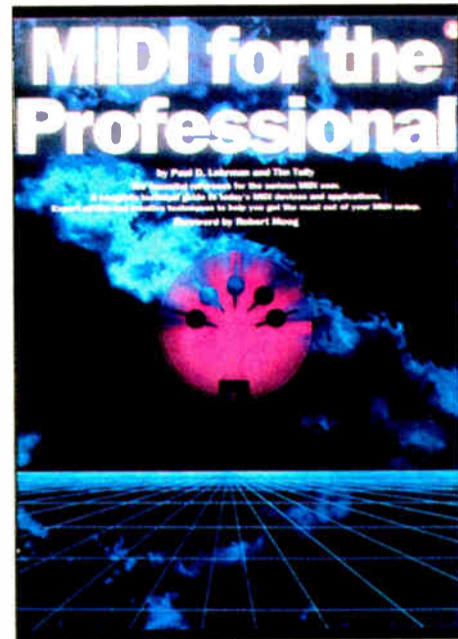
This is a book you will read more than once. The discussions of the art and science of MIDI are equally balanced. This is a book you will use as a reference manual.

Chapter and verse

The first chapter, "An Overview of MIDI," is exactly that. In twenty pages you get a history of MIDI and MIDI 101 combined in a relatively easy to digest text. The second chapter, "MIDI Equipment," covers the hardware. "Composing Tools," chapter three, explains MIDI sequencers, MIDI file types, challenges of printing sheet music based on your MIDI composition and how, with algorithmic composers, you can apply artificial intelligence to the music-making process.

The fourth chapter, "Composing Techniques" explains how to further refine your performances. Chapter five, "Live Performances," addresses typical

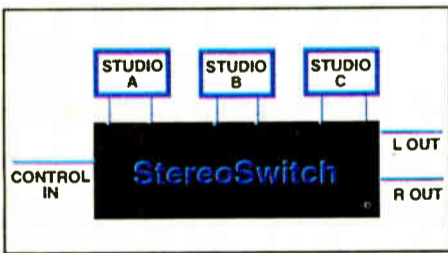
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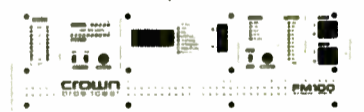
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Circle (146) On Reader Service Card

Refurbishing the Teletronix LA-2A

by John Diamantis

Part I of II

WASHINGTON Several fellow "tube-aholics" have suggested that I do an article on refurbishing an older piece of equipment. Almost unanimously, they suggested the Teletronix LA-2A leveling amplifier.

The Teletronix LA-2A is the quintessential 1960's vacuum tube compressor/limiter.

Find its compression "sweet spot" and you can make that average vocal track larger than life. Used in the final mix, or even in the air chain, and you transform flat, bland audio into powerful and punchy "walls of sound."

Simple, but effective

The audio path is not complex, but it's not simple, either. The input is transformer coupled through a UTC-A-10; a decent hunk of iron. The signal then passes through a series/shunt, variable attenuator, with a fixed resistor as the series element, and light dependent resistors as the variable shunt element. (Light, emitted from an electro-luminescent source in intimate contact with the light dependent resistors, varies with intensity in relation to the audio signal sent through it. As the light gets brighter, the light dependent resistors' LDRs, resistance decreases, causing attenuation in the audio path, and compression).

A variable pot labeled "Output" is connected at the output of the variable attenuator. The center tap of the pot feeds a three stage vacuum tube feedback amplifier, with two gain stages, and a totem pole, or "White" cathode follower, providing low impedance drive for the output transformer, a UTC-24-A—a whole big hunk of iron!

The side chain is all tube, with an amplifier stage driven with audio from the variable attenuator through the "Peak Reduction Control." (Mainly it is a "feedback" type compressor. When switched to "limit," some pre-attenuator audio is mixed with post-attenuator audio, creating a unique hybrid feed-forward/feedback limiter, with dynamically variable elements of each.)

The next stage drives the electro-luminescent light source. Although other compressors of this era used the LDR as a gain controlling element, The LA-2, and later the LA-2A, were the only type that drove the light source directly. All other designs required rectifying and filtering the audio to create a DC control voltage, operating a lamp circuit, and controlling the gain.

The power supply, is full-wave rectified, through silicon rectifiers, and filtered with electrolytic capacitors and resistors in an RC network. A neon bulb is used as a shunt voltage regulator to provide a constant 65 volts as a bias against the VU meter, when switched to "gain reduction." In this instance, the meter is calibrated to let the "0 VU" point signify "0" gain

reduction, and scale to the left (-3dB, -5dB, -7dB, etc.) indicating the amount of gain reduction, in "dB's."

In demand

If you are lucky enough to locate someone who wants to sell an LA-2A, or even luckier to locate someone who wants to sell two, you'll find going rate to be between \$1500-3000 each, depending upon condition and vintage. Surprisingly, Urei Corporation, owned by JBL, which is owned by Harman International, has made a couple of semi-secret production runs of brand new LA-2A's in the last few years! (Only the well connected got their hands on any.) They

appear identical to original, vintage LA-2A's, and sound about 95% identical.

If you're truly interested in finding one of these newer units, get "connected," and be patient. I waited nearly two years, (and it was worth it).

If you can't wait, or want a vintage LA-2A, check the want ads in *RW*, or other pro audio publications, and before long, you'll likely find what you want.

Before we get into the actual refurbishing, or discussions about replacing parts, let me emphasize again: Vacuum tube equipment contains hazardous voltages! Even if you routinely repair and/or build equipment, remember, there are voltage potentials inside this

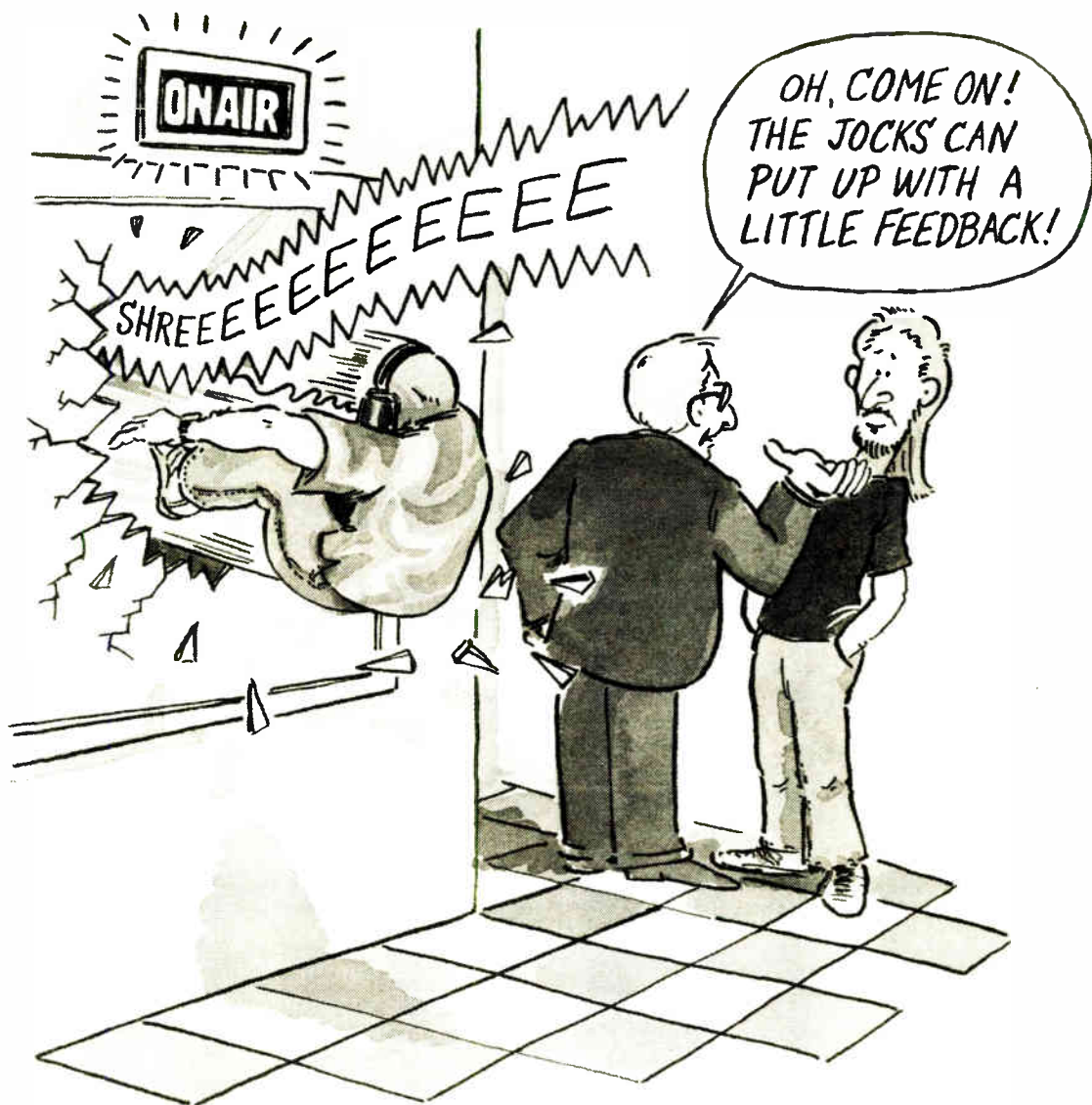
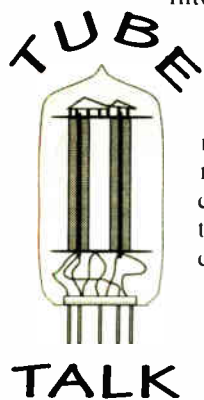
chassis in excess of 350 volts DC.

Internal construction is typical for units of this era. The front cover hinges down to allow servicing while the unit is rack mounted. The wiring is point to point, utilizing tag strip and the tube sockets. The tubes are mounted on the back, and are exposed. Audio connections are made via barrier strip screw down terminals on the back.

There's a chance the tubes (two 12AX7As, one 12BH7A and one 6AQ5A) in your unit are originals, and are still providing good service. However, if you want long, reliable service, I recommend replacing the four tubes (save the old ones, if they are still working).

Apply a very light amount Caig DeOxit to the ends of the tube pins, and work the new tubes in and out of the sockets a few

continued on page 37 ▶

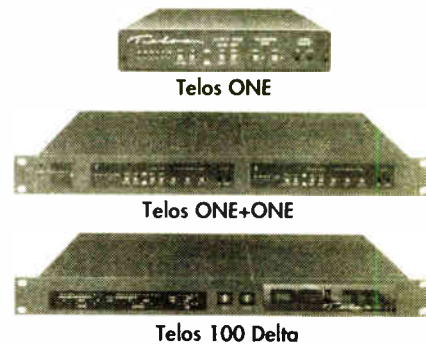


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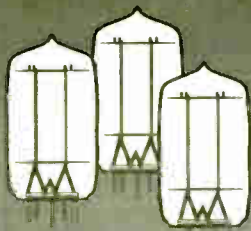
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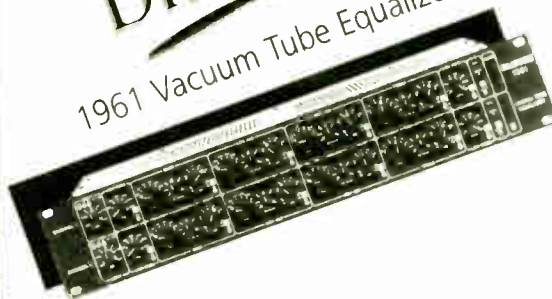
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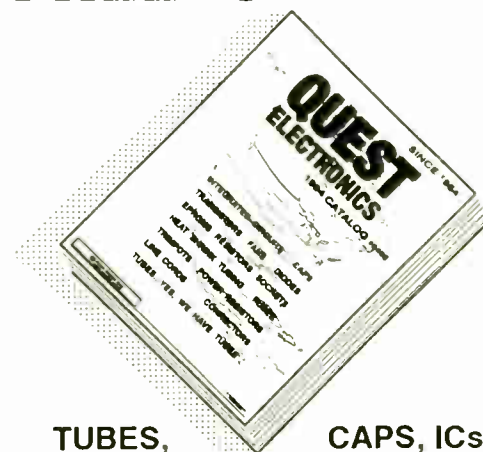
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The Aphex Model 104

► continued from page 15

The Model 104 also works well in re-defining the instrument sounds from synthesizers. The Model 104 is a lot easier and quicker to use than diddling around with the timbre and ASDR settings on my Roland U-220. And yes, if you like to push the envelope a bit, you can make some very strange sounds.

By the way, it's not a good idea to trust any mix you make after long-term exposure to moderately high monitor levels or short-term exposure to very high monitor levels—especially if you're using an

Aural Exciter. Until you get a few hours of mixing under your belt, do yourself a favor and always check your mixes the next morning. Usually the best approach is to add enough processing so that you can't really hear it when you kick it in, but so that you'll miss it when you've been listening to it for a few minutes and take it out.

The real power of the Model 104 is in its ability to change the frequency content of audio that already sounds good. It works on individual tracks and can also be used on submixes (like drums) or on

the whole mix. To be sure, the effects of the new Aural Exciter portion of the Model 104 are more subtle than in the

Product Capsule: **Aphex Model 104 Processor**

 Thumbs Up	 Thumbs Down
<ul style="list-style-type: none"> ✓ easy to use ✓ inexpensive 	<ul style="list-style-type: none"> ✓ no exciter level indicators ✓ wall wart power supply

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earlier Type C. This could keep you out of trouble if you have a heavy hand.

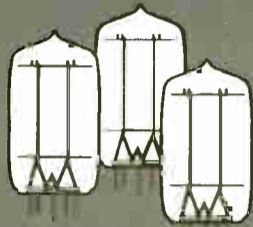
I would like to see some sort of visual indication for determining acceptable

Aural Exciter drive levels. It's a nutty world out there and outputs that claim to be -10 and +4 aren't always correct. And I'd also like to see Aphex come up with a different design element to express "Big Bottom." There's got to be a more clever way than implications of pink-pantied body parts with a butterfly tattoo. Maybe a \$10,000 Aphex contest for a de-anthropomorphized design would work.

□□□

Ty Ford is a regular contributor to Studio Sessions and is a principle in T/S/F Productions in Baltimore. He can be reached at 410-889-6201. His book, "Advanced Audio Production Techniques," is available by calling 800-366-2665.

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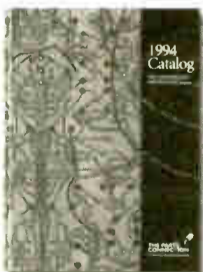
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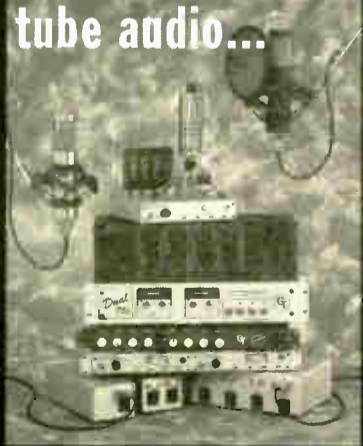
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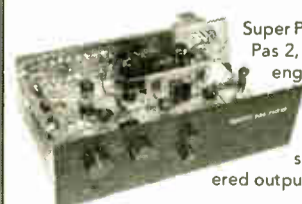
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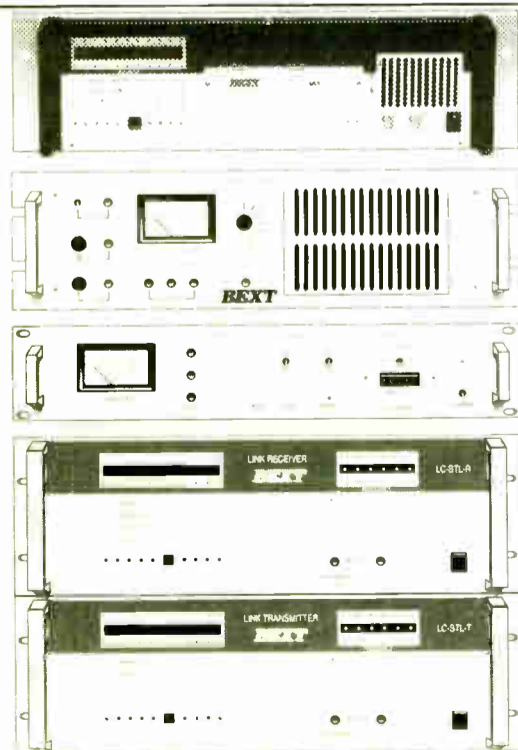
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DIGITAL DOMAIN

Examining the Cable Connector Issue

by Mel Lambert

LOS ANGELES Without a doubt, the AES/EBU interface represented a major advancement in the state of digital audio. The original AES3-1985 and revised AES3-1992 Recommended Practices were developed in the spirit of mutual agreement between representatives from a number of leading hardware companies, broadcasters and pro-audio organizations. It is here; it is being used; it works!

The one fly in the ointment, so to speak, has been the choice of connector. For reasons that are now lost in the annals of time, the final vote went to a conventional 3-pin XLR. Which, in an audio-based facility, is probably an entirely bad choice. Why? Not because there is anything inherently wrong with the connector; just that its analog use is fundamentally different in philosophy and practice than its intended digital one.

Consider the paradox. Conventional analog mic/line connections usually don't worry that the capacitive and resistive impedance is of the order of several hundred ohms (or more), particularly at high frequencies—after all, it's only being asked to pass a 10 Hz to, maybe, 30 kHz signal.

A tough task

Contrast that requirement with the same cable being asked to carry a much higher frequency square-wave—up to 6 MHz—over distances up to 300 feet. To give the output a fighting chance of making it across a reasonable length of 110-ohm, low-capacitance cable, AES3 specified a balanced TTL-compatible output level.

In many broadcast facilities around the world, AES/EBU signals are being passed routinely between production and on-air requirement, separated by long distances, with no problems whatsoever. Just so long as the engineering staff realize that AES3-format digital signals are fundamentally different from their analog equivalent and, as a result, have specified the use of appropriate cable types, life in the digital fast lane can be trouble-free.

But in response to practical experience from broadcast users that operate more complex facilities—where equipment might be separated by distances greater than 300 feet, or in situations where audio and video signals need to be integrated in a coax-based environment—the Audio Engineering Society has been considering possible alternatives to our familiar XLR-type connectors and balanced, 110-ohm interfaces.

A soon-to-be-released AES Information Document discusses the use of low-capacitance, 75-ohm coaxial cable and BNC-type connectors. AES-3ID, as the document is known, provides details of not only the minimum and maximum input signals that a receiving port should be capable of accommodating, but two particularly useful appendices.

New AES discussion

Appendix A provides a detailed discussion of cable and equalizer characteristics; for those of us unfamiliar with the impedance losses of typical lengths

of coaxial cable, the analysis provided here will be especially handy. As with the balanced, TTL-compatible implementation of AES3 interfaces, no equalization is allowed at the transmitter; all signal correction must be performed using active or passive circuits at the receiver.

Given the variations in capacitance losses that could be encountered while using different types of coax cable—from very "lossy" cable such as 3C2V, to low-loss cable such as 7C2V—we might assume that a cable-dependent equalization circuit is necessary. As AES-3ID points out, however, this is not the case; it should be pretty easy to fabricate a receiver circuit that can accommodate a variety of cable types, and cable lengths. (All of this information is not purely theoretical. I understand that a number of hardware manufacturers have donated a great deal of time and effort to fabricating and evaluating typical receiver circuits, and that their practical results bear out the AES document's conclusions.)

Of equal interest is AES-3ID's Appendix B, which provides illustrative circuits that could be used to provide suitable output connections from existing hardware. The most elegant approach would be to convert a TTL-compatible signal within the recorder, mixer, workstation, or whatever, into an unbalanced, 75-ohm signal for passing via coax to the receiving unit. Such a circuit is provided in the Appendix, designed to be powered from a single +5V rail. (It even includes a pair of trimmers for adjusting output level and rise time.)

Circuit designs

For stations that would like to convert existing devices to offer coax interfaces, AES-3ID provides a passive 110-to-75 ohm circuit that also lowers that output voltage from a TTL-compatible signal

(between 2 and 10 volts) to 1V, peak-to-peak. (A selection of resistor values are provided for the suggested attenuator circuit, to accommodate situations where the range of output voltages is more closely defined.)

And for users of equipment that features output transformers—recall that European broadcasters often specify systems designed to EBU Technical Document 3250-E, which is identical in wording to AES3-1992, aside from the mandated use of transformers—a circuit is provided that contains a 1.211:1

impedance-matching transformer and attenuator.

Since outputs are only half the connection, AES-3ID also provides details of receiver circuits, in both active and passive flavors (the latter with and without transformers).

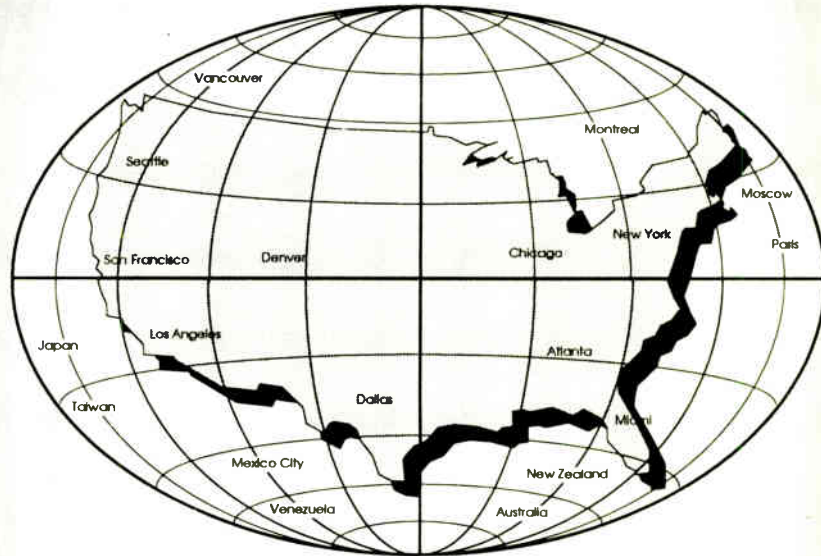
The new AES-3ID information documents make an invaluable adjunct to the current AES3-1992 Recommended Practice. I would advise chief engineers to secure a copy, when it is published, from the Audio Engineering Society: 212-661-8528.

□ □ □

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

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Micro Technology's DAW Editor

► continued from page 16

record several sounds into one file, pausing between each recording. As you record, you can mark the approximate start and stop points of each segment (program element) by pressing letters A through Z.

The next step defines segments within the soundfiles. Each segment might be a sound effect, a section of music, or several seconds of dialogue. Using a mouse, adjust the start and end points of each segment. Or simply click-on

the Record Segment icon in the Project screen. It lets you record new audio directly into a "default" soundfile. As each length of audio is recorded, a segment can be created from it and automatically placed into the Project. This saves many steps for the casual user, such as a deejay needing to make a few spots.

When editing a segment, you can zoom-in to sample precision for tight editing. Edits can be quickly undone at any time, in any order. You can extend or

shorten segment lengths in the Project screen by clicking and dragging the start or end marker.

To make certain all the cues start at the right point, you position the segments in time—by ear, by SMPTE time, or by elapsed time in the mix. As an example, suppose you've recorded a door-slam sound effect. If it comes in too soon, just slide it later in time with your mouse. MTU calls this feature "Floating Tracks."

Up to 50 stereo or mono segments can play back at the same

time. MTU calls this "disk layering." Segments remain independent and can be moved or edited at any stage in a project, even after mixing (unlike bouncing). You can easily change each segment's volume and fades, or add "zone edits" to duck music under dialogue. These gain changes calculate in real time as the audio plays.



MicroSound Digital Audio Workstation

Unlike a multitrack tape recorder and mixer, the computer might take some time to calculate the mix before it will play. The more tracks you are mixing, and the longer the program, the longer the calculation. It usually takes a few seconds to a few minutes. Version 2.2 of MicroEditor, however, allows instant mixing of four to eight stereo tracks. The computation required to do this is impressive, to say the least. MicroEditor is one superb, efficient piece of software coding.

The computer will automatically do the fades and level changes you asked for. (This is not exactly the same as an automated mix. In an automated mix, a computer remembers your mix moves, which are real-time adjustments to faders on-screen.)

Suppose you've completed a mix, but you want to edit certain portions. Only the areas you edit require remixing.

When you're happy with the mix, record it onto your two-track recorder, DAT, cart, or send it over a network. You can backup your soundfiles, edits and mixes to an audio DAT, load them later and re-do them if necessary.

All this editing capability requires a deep read of the manual, which was recently updated to make for easier comprehension of the system. Learning the program will take some patience. However, the manual clearly explains concepts and features. MTU wants you to fully understand the basics before you try a specific application.

Many radio producers, however, just want to know, "How do I create a spot or news story with music, talk, and sound effects?" For those types of users, I'd like to see a quick-start section in the manual on this application, and on several others.

On the other hand, many users stop with the quick-start, and don't explore the rest of the manual. MTU's philosophy is to help the user in the long haul, not just to offer instant gratification.

All in all, despite the learning curve, the MicroSound system offers sophisticated editing at a reasonable price. It is fast, reliable, and sounds great.

□ □ □

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

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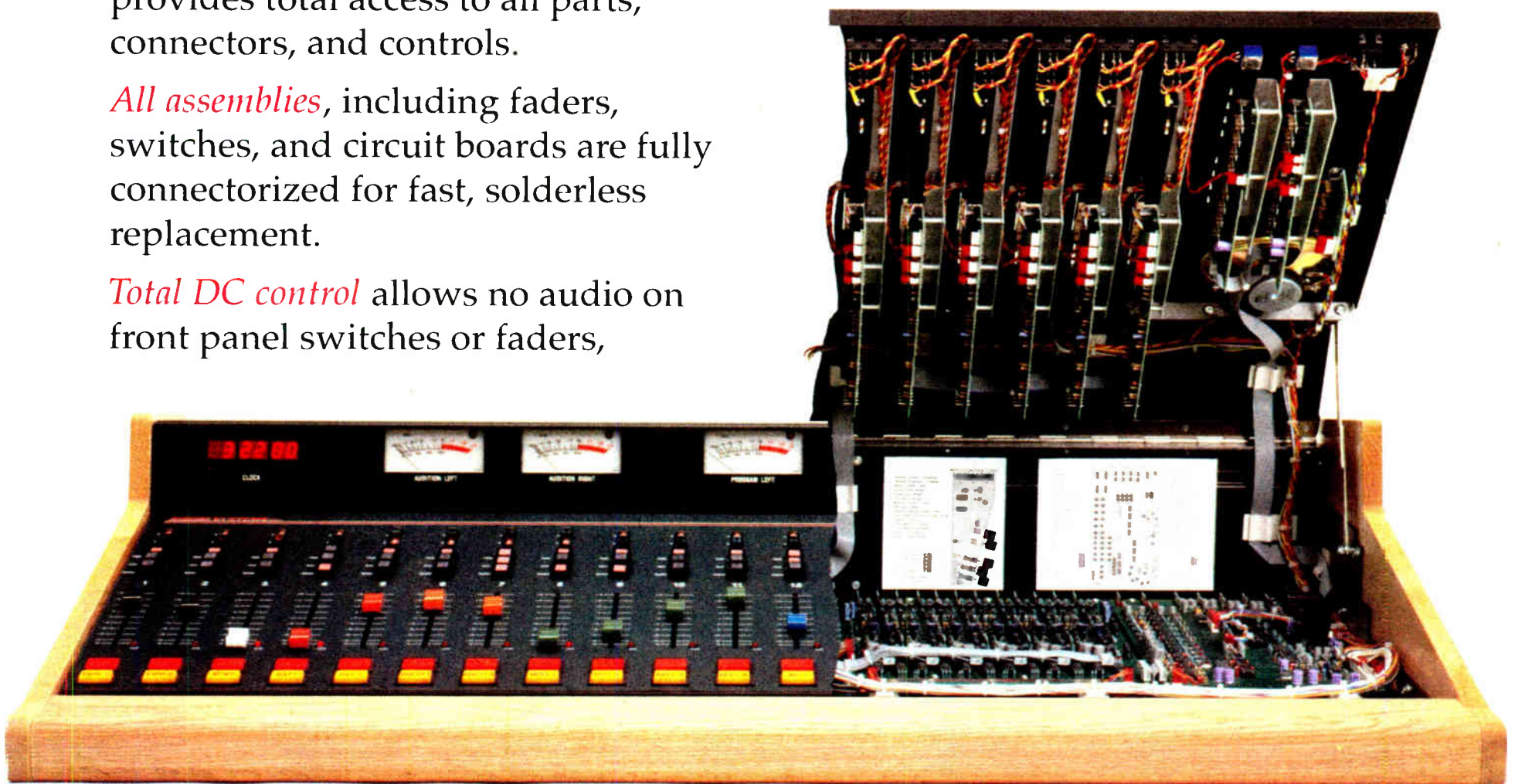
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Documentation of connector pin-outs, and internal control locations are screened inside the console for quick reference.



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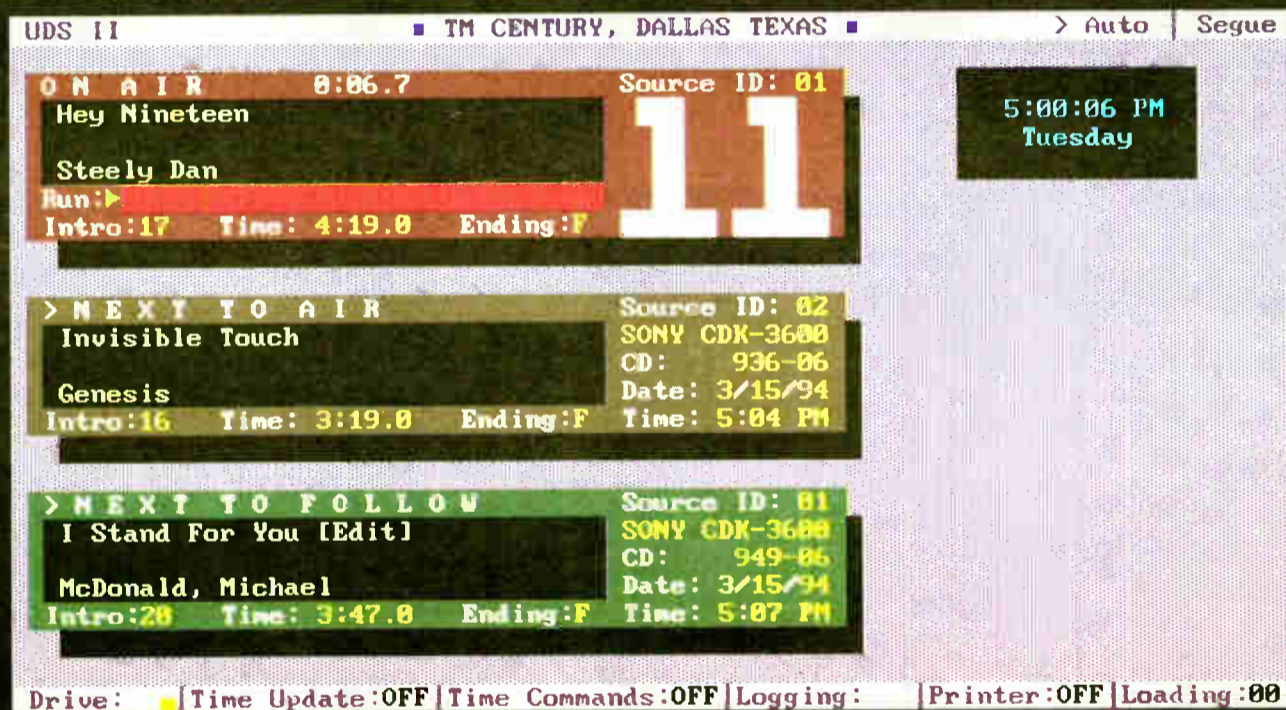
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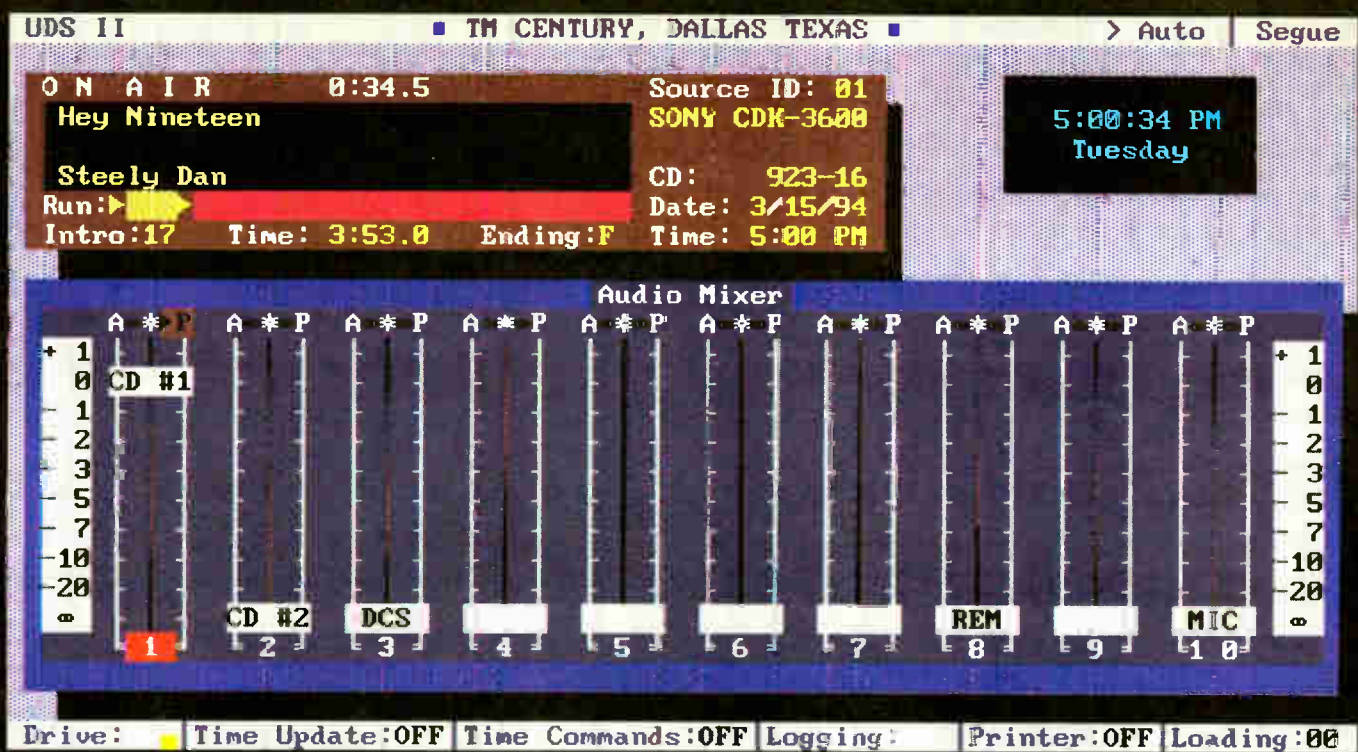
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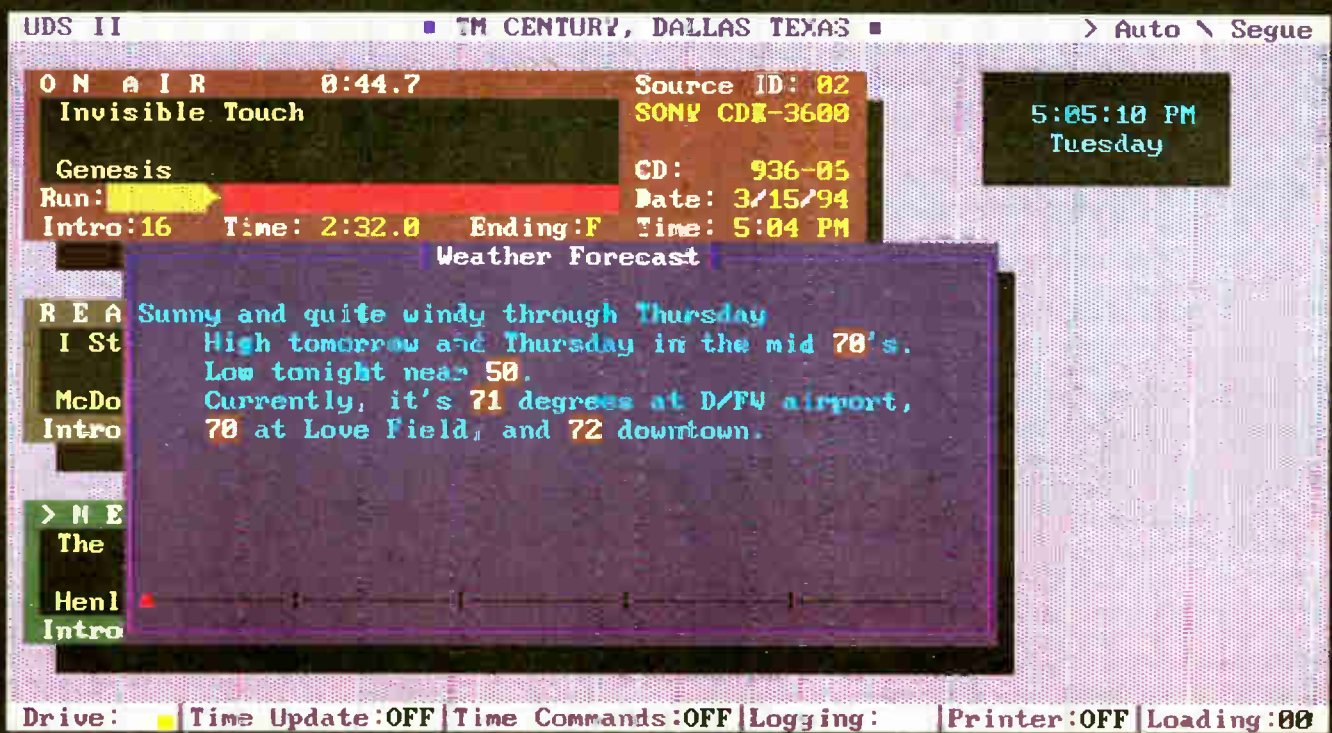


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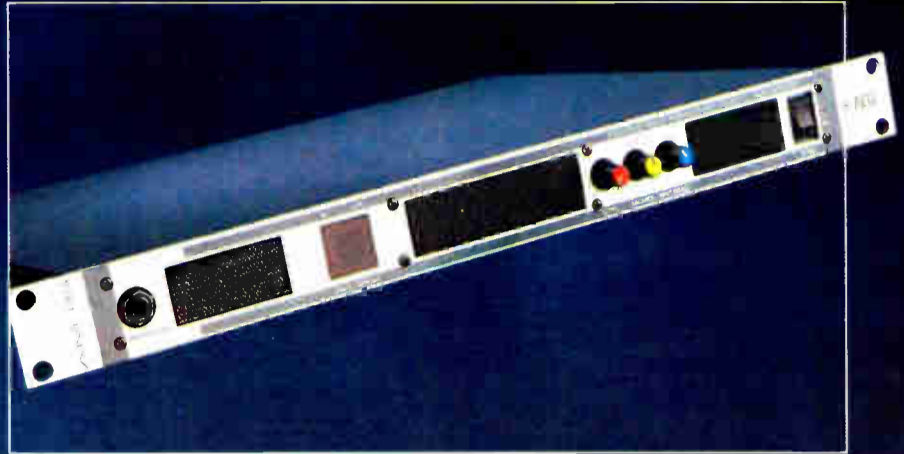
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A Look at Professional MIDI Uses

► continued from page 26

applications for keyboard players in bands, MIDI in the theater, MIDI mapping, orchestral optimization and mid to high-level equipment connection diagrams.

"Sound Editing," chapter six, explains different ways to create and edit sounds, the use of samplers (including cut, paste and crossfade operations at the sample level) and librarian software, CD, CD-ROM sound and datafile library.

Chapter seven, "Synchronization and Audio Production," addresses one of the trickiest areas of the MIDI kingdom; MIDI, FSK (Frequency Shift Key), MTC (MIDI time code), SMPTE, LTC (linear time code) and VITC (vertical interval time code). The logical next step, chapter eight, is "Automation and Post-Production." With more and more audio effects and audio transport devices being manufactured with MIDI controllable parameters, this chapter is a welcome tutorial.

Altering effects programs and performing mix automation, while being the two most obvious uses of MIDI, are two of a much greater number of possibilities. The authors take time to provide examples of how to put the technology to work.

Includes multimedia

"Multimedia," the ninth chapter, explains the rules for General MIDI. General MIDI is an attempt to provide an improved sense of order for, among other things, what instrument sounds are available at the 128 standard MIDI program numbers. This means that, regardless of the make or model of the MIDI synthesizer or sound module, the Acoustic Grand Piano sound will always be program No. 1, the Acoustic Bass sound will always be program No. 33, and so on. The intent here is to make life as simple as possible for non-"techno wizards" and to create a safe environment for the development of multimedia technology.

This chapter also delves into the dark realm of other intertwining softwares from Windows, Multimedia Presentations Manager/2, QuickTime, Apple MIDI Manager, Hypercard, HyperMIDI, Macromedia's Director and others.

In chapter ten, "MIDI's Limitations and Inconsistencies," the authors bare all and point out the truths and myths of MIDI. Gear-heads like myself will appreciate the historical perspectives and the anecdotal information.

Upon seeing the chapter, "MIDI In Music Education," I was immediately thrown back to the sixth grade when the music teacher rolled the piano into the room, hit two keys that sounded obviously different to me, and tried to convince the class that they were the same note. (Although now I'm sure they were octaves, at the time I was convinced that she was deaf, crazy or both and tuned her out.)

With a little music theory, ear training and compositional software tutorials discussed in this chapter, you will be

making music before you know it.

The next chapter, "Programming With MIDI," will appeal to the analytical side of your brain. You'll find discussions of the use of different computer languages (C, Pascal and others) that can be put to work and on which computer platforms.

Future look

The last chapter, "MIDI Into The Future," consists of information about the role of the MIDI Manufacturer's Association (MMA) and the Japan MIDI Standards Committee (JMISC) function. It also

Making the LA-2A Like New Again

► continued from page 27

times. If any of the tubes slip in and out too easily, you'll have to replace the socket (or find someone that will show you how to retension them).

Slightly more difficult, but not impossible to locate is the quad can electrolytic capacitor used for power supply filtering and bypassing. Odds are, after 30 years of use, original units are pretty well spent, and need replacing. The closest unit I've found is a 40-40-20-20 uf 475 volt unit. The original is a 40-40-30-30 uf 450 volt unit.

There are two discrete electrolytics: C5 couples the tube output stage to the output transformer—replace it; C10 decouples V4's cathode resistor—replace it as well. C1, C2, C3 are coupling caps in the audio path and should be replaced with modern polypropylene equivalent values. Make sure the voltage rating is at least 400 Volts for this type. Blocking caps C9, and C11 need to be replaced only if they don't measure correctly. The same goes for the rest of the caps.

Depending on how hard your LA-2A was used, your T4A or B, electro-luminescent light source module may need immediate replacing, or will soon. I recommend investing in these now while they are still available through local suppliers. I paid \$85 apiece for

includes information that was just emerging as the book went to print.

My only problem with the book is that it lacks an index. The authors wanted it, but the publisher obviously didn't think it was necessary. No highly technical book should be without one. Lehman mentioned that the publisher may spring for one in the next printing.

Other than a few typos, like the radical on the bottom of page 18 should be (1x15), not (1x51), this book covers MIDI better than any I have read. Remember, to get the most out of MIDI and this book, you'll have to commit yourself to regular use of a MIDI system, or you may not retain the information long enough to use it.

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mine almost a year ago. I've also heard that there is a company repairing worn out units, but I've yet to find anyone with details on address, pricing, etc.

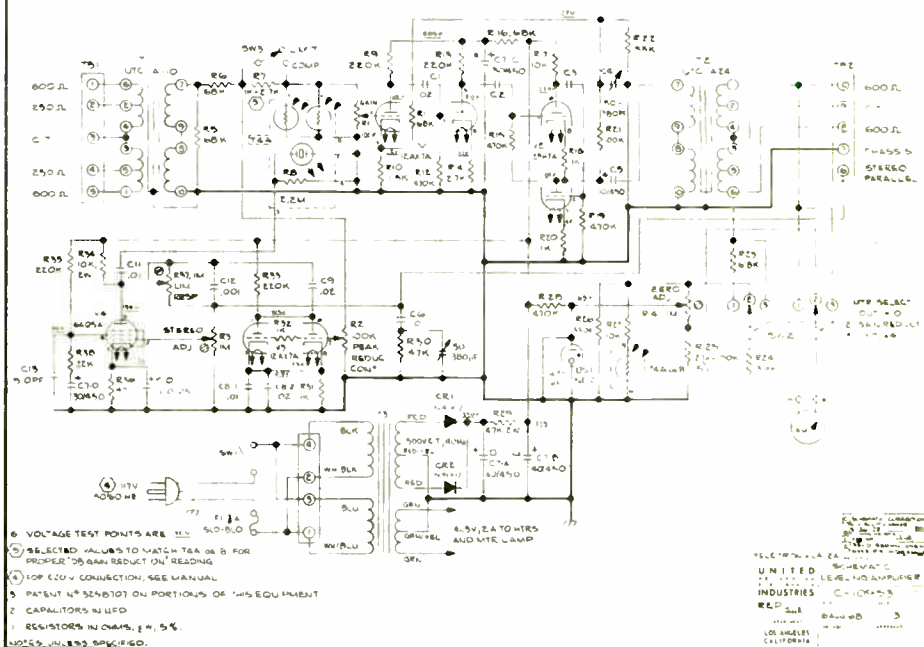
Now is as good a time as ever to check over your work. Make sure polarities are correct on your electrolytic capacitors. Make sure the proper tubes are in their proper sockets, and all are firmly seated in place.

There's still more work to be done, plus, we'll be testing some original, and recent vintage LA-2As in part two in the August issue.

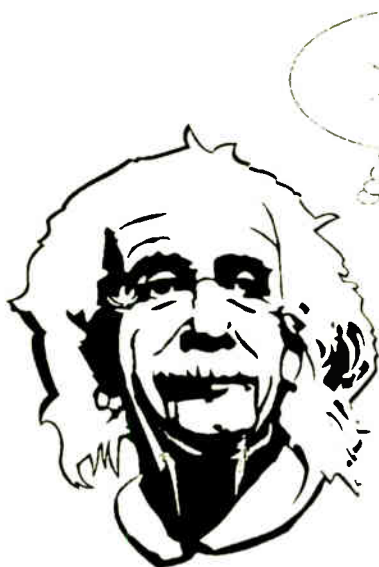
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John Diamantis is engineering manager for WBIG-FM, WGMS-FM and WTEM (AM) in Washington, D.C.

Figure 1. — Teletronix LA-2A Schematic



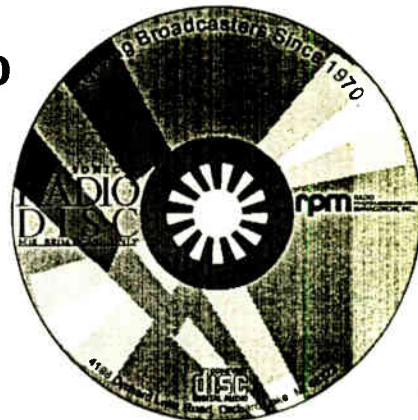
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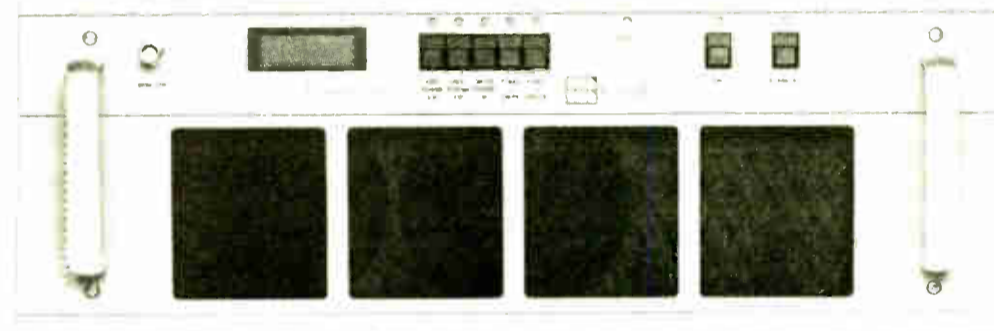
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READER SERVICE NO. 78

KEYBOARD CONNECTION

Scale the Heights to Computer Programming

by Barry Mishkind

TUCSON, Ariz. It often seems as if there is a computer program out there to fill every need, but occasionally a task calls for writing a custom utility on the spot.

Most broadcast engineers are neither computerphobes nor gurus. We can boot up and run our normal programs, but tend to get a bit perplexed when trying to do something out of the ordinary.

The practical engineer attaches a chart to the transmitter log clipboard. In the deep,

dark pre-computer days, a desk calculator was used to make the chart (some of you may remember slide rules), but the job took up a great deal of time.

If the high voltage changed enough, the chart might no longer cover all possible parameters, chasing you back to the calculator for another joyless afternoon.

Computers automate the process.

BASIC training

Many do not know how to write programs, so stations often adapt one of the popular spreadsheet programs to build a

table of possible values. The problem is that you have to remember where the program is and then reload the basic parameters. There has to be a better way.

If you have some sort of BASIC interpreter in your computer, a short series of commands will print the calculations desired on the screen. It is not hard.

For example, here's the essential core for most versions of BASIC:

```
100 INPUT "Efficiency factor = ";EF
110 INPUT "Plate Voltage = ";EP
120 INPUT "Plate Current = ";IP
130 TPO = EP * IP * EF
140 PRINT TPO; "watts"
```

For Plate Voltage of 2,700 volts, current of .605 amps and an efficiency factor of 88 percent (input .88), the program will print something like "1437.48 watts." That is a bit more precise than necessary. It can be easily adjusted by adding two lines:

```
125 IP = INT((IP + .0005)*1000)/1000
135 TPO = INT((TPO + .05)*10)/10
```

That sequence will then return "1437.5 watts." Your numbers will depend on your licensed power level.

However, this is nearly as cumbersome as using a calculator. Only one answer appears at a time.

The program can also be enhanced by changing the "PRINT" command to "LPRINT," which sends the output to the printer. It can be improved again by adding a "loop" calculation over a range of voltages and currents. Suppose you wanted to cover situations where plate voltage could range from 2400 to 3100 volts, and the current from 0.58 to 0.62 amps. Replace lines 110, 120 and 140 with:

```
110 FOR EP = 2400 TO 3100 STEP 100
120 FOR IP = .580 TO .620 STEP .005
140 LPRINT EP; "Volts", IP; "Amps",
```

```
PO; "watts"
```

```
Then add:
```

```
150 NEXT IP:160 NEXT EP
```

Now you get a whole series of numbers on your printer. You can transcribe them to a chart or into tabular form.

You may notice these commands are not in strict numerical order. This is not important in BASIC because the computer puts things in order automatically. Those of you who have the newer versions of MS-DOS™, however, have QBASIC™ I instead of the older GWBASIC™. While numbers are optional in QBASIC, you must be careful to enter the lines in the proper order.

Other ideas

If you want more "features," just a few more lines of programming to calculate transmission line loss and antenna gain, resulting in your ERP (effective radiated power), or make the efficiency factor a constant so you do not have to enter it each time.

These little features are nice, but each time you want to use them, you have to reload BASIC or QBASIC, then the program and then fiddle with the numbers you want. How about a program that comes up with your normal operating numbers, lets you select any range and then prints out the results? That is easy to do in BASIC.

Having written your first program, perhaps you would like to share it with someone. The easiest way is to print out the listing, and give it to them. That way it will run on most any computer, even if your

friend has a Macintosh™ or Amiga™ instead of a PC.

Longer programs can be tedious to input, but if your friend has the same type of computer and the same generation of BASIC, you are using, you can copy the program to a diskette.

If you don't know what your friend has, it may be best to use a compiler. Microsoft QuickBasic™ or a similar program, PowerBasic™ allows you to turn your code easily into an .EXE file that can be run on any PC.

There are many uses for little utility programs. Maybe sports remotes would be easier with a program to do statistical averages on the fly.

Perhaps the sales department could use a program similar to the power output calculator. A salesman could quickly compare different rate structures for spot packages.

Another little utility could help the bookkeeper analyze phone bills. Look around, the possibilities are endless.

□ □ □

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

Radio Sound Effects Use

► continued from page 21

Often he experiments with sound—the results sometimes a hilarious failure. When Keillor wanted the sound of a mermaid's tail hitting water, Keith tried slapping a wet towel in a tub of water. It didn't work and the effect was eventually abandoned. Elephants are another difficulty.

"Garrison knows I can't do elephants but he still writes them in anyway." And belching on cue. "I ask people and they say 'Oh, all you have to do is swallow air.' But I've never been able to do that."

Then there was the time Keillor threw away Keith's favorite shoes. "Once you find a good pair of shoes with hard heels for a walking sound, you want to hang onto them forever. They are very hard to find these days," Keith said. "At the end of the final show of one season, Garrison picked up my pair of shoes on the table and threw them into the audience. I had to go to Goodwill again and find another pair."

To some Tom Keith seems like an anachronism in the age of samplers and other computerized effects. But, so far, no machine has yet been designed that can come close to bringing Keith's aesthetics of sound to story. The art of Tom Keith is a strong reminder of the limitations of technology and the strength of human creative imagination when it comes to radio storytelling.

A Prairie Home Companion airs live each Saturday at 6 p.m. on public radio stations. It is produced by Minnesota Public Radio.

□ □ □

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



Splatter Control.

The Delta Model SM-1 AM Splatter Monitor provides AM broadcast engineers with a means of accurately and easily measuring off-channel emissions to ensure compliance with the FCC regulations or the more stringent recommendations of the NRSC.

Manufactured in response to the NRSC (National Radio Systems Committee) for AM improvement, the SM-1 gives you the features you need to ensure compliance without buying an expensive spectrum analyzer.

The AM Splatter Monitor measures the level of splatter or any other spurious emissions which fall between 11 kHz and 100 kHz away from both sides of the carrier.

The AM Splatter Monitor is designed to be installed in an equipment rack and fed with an RF sample from the transmitter or common point. But, it's also portable so you can operate it from a twelve volt DC source, such as the cigarette lighter in your automobile. An RF sample is provided via an optional active antenna. This feature makes the Splatter Monitor ideal for investigating interference complaints.

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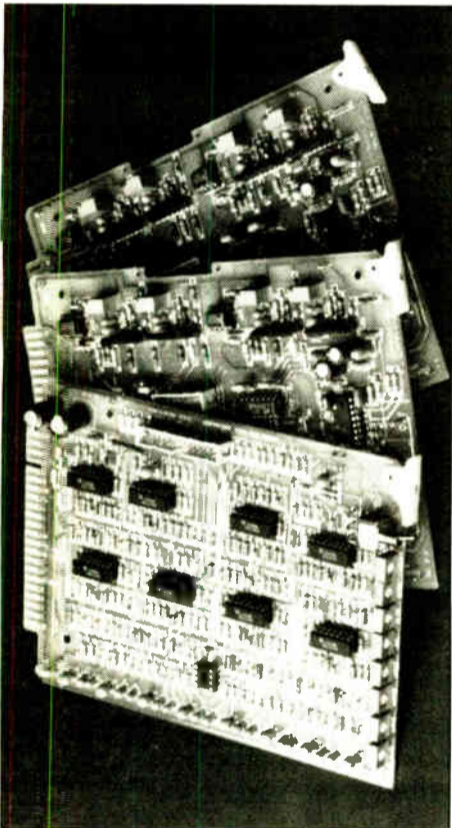
WORKBENCH

The Lightning Sounds of Summer

by John Bisset

SPRINGFIELD, Va. Ken Zuercher at WGLE(FM) Lima/WGTE-FM Toledo, Ohio, recently installed a digital STL and was very impressed with the audio improvement compared to his previous STL. Around the first of the year, however, he noticed a bizarre phenomena. The STL emitted a strange "water dripping" sound that could be heard over the air whenever it snowed or got windy.

The STL manufacturer claimed the sound occurred because the bit error rate of the data reduction system was too high. The normal bit error rate is 10-9, but it was 10-4 when the dripping sound appeared.



The Purple Processor reduces processing artifacts while providing a competitive signal.

The STL path is 5.5 miles, passing between two relatively tall buildings with a scant 10-foot slot for RF to pass. Although there is no proper fresnel zone clearance at 950 MHz, the short path gives sufficient signal (around 200 microvolts) at the receive sight.

The RF signal does not change during problem periods. There is no disruption of the RF envelope when looking at the 70 MHz IF port with a spectrum analyzer. The problem does not appear to be multipath or interference. At one point during the dripping, the STL transmitter was turned off and the receiver IF showed no carriers when observed with a spectrum analyzer.

Ken attacked the problem from the hardware side, changing feed on the six-foot Mark Products dish with a spare that was known to be good. The pigtail was changed, all of the connectors were weatherproofed and a wind brace was added, all with no effect.

He tested the antenna system on the

receive end with a TDR and an admittance bridge. There were still no problems found.

The manufacturer sent a complete new transmitter and a replacement demod

The STL emitted a strange "water dripping" sound that could be heard over the air whenever it snowed or got windy.

card, but the problem continues.

There is no reliable way to predict when the problem will reoccur, other than the presence of wind or snow. If you've had a similar digital STL experience, or care to suggest a diagnosis or cure, fax it to my attention at RW.

★ ★ ★

After Bob Orban introduced the Optimod, the concept of a unified audio processor/stereo generator led to a new standard, by which most audio chains are measured even today.

As time went by, engineers started adding "building blocks" to the audio chain to improve consistency and increase loudness. The predictable result was a step backward as the processors interacted and took their toll on the audio.

Three broadcast engineers, two of them from the Washington area, have spent several years researching this problem and developing a solution: the Purple

Processor, which combines the best of both worlds.

It is designed to function as a stand-alone processor, restoring the unified system approach to audio processing by incorporating an AGC and four-band compressor inside the Optimod 8100 framework. Custom-tailored complementary time constants eliminate processor infighting, creating a single

audio control block with a highly efficient gain control that leaves the audio clean and open while competing well in the ever present loudness war.

The processor replaces cards three, four and five in the Optimod 8100, and without soldering or chassis modification.

Demonstrations can be arranged, and dealer inquiries are welcome. For a data sheet and more information, circle Reader Service 10.

If you are not ready for the rash of continued on page 45 ►

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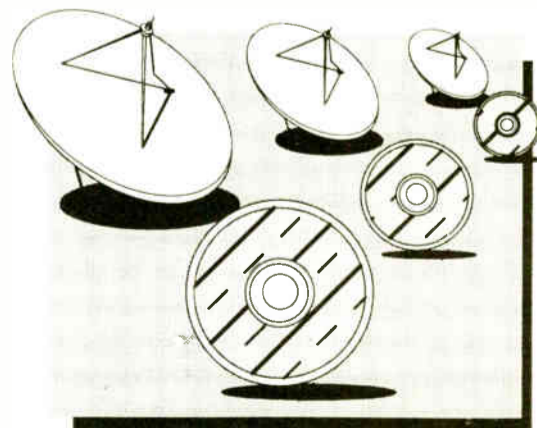
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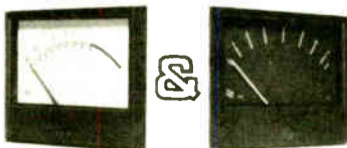
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Use of Schematics Aids Troubleshooting

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

Continuing Education Units will be offered to all who register with Northern Virginia Community College. You will be required to read all of the articles and participate in an exam that will be mailed to you at the completion of the course.

To register, contact the Community Education Office, Annandale Campus, 8333 Little River Turnpike, Annandale, VA 22003. The fee for the course is \$30.

by Ed Montgomery

Part XII of XII

ANNANDALE, Va. All active and passive devices eventually fail. Component failure often seems to happen at critical times when demand for the equipment is high. You can never prepare too much for this possibility.

Keep all documentation on all equipment purchased or fabricated on file. Schematics identifying transistors, diodes and passive devices are important troubleshooting aids.

The first step is to visually investigate circuits. Look for areas of discoloration on the circuit board, which may indicate areas of extreme heat caused by a failed device. If the device is hot to the touch, it may be bad, drawing too much current.

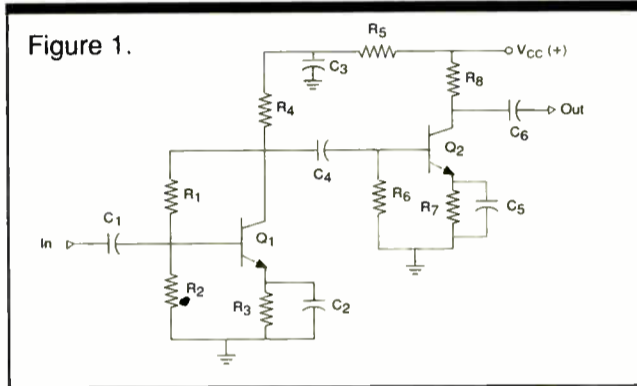
Schematic diagrams usually give nominal voltage levels at transistor and opamp locations. You will need to make sure a prescribed operating level is achieved before taking any readings. For instance, does the manufacturer require a certain level of input signal? Are the readings related to any external adjustments that must be set? This information is in the component's maintenance manual.

Check the power source. This may sound foolish, but over the years, time and tempers have often been lost because of unplugged electronic devices.

I remember rebuilding a radio station's studios with another engineer and finding a plug that went through a hole in the wall to who knows where. I pulled it out, and nothing happened for about 30 seconds. Then the audio from the main studio began to fade into oblivion. I had unplugged the on-air console, but its very large electrolytic capacitors kept the board operating until charge drained off.

If you have utility power, the next step is to check the regulated power supply. Is there an output at the secondary winding of the power transformer? Is the power transformer unusually hot? If it is, it may indicate a short circuit. The high current demand will create the heat.

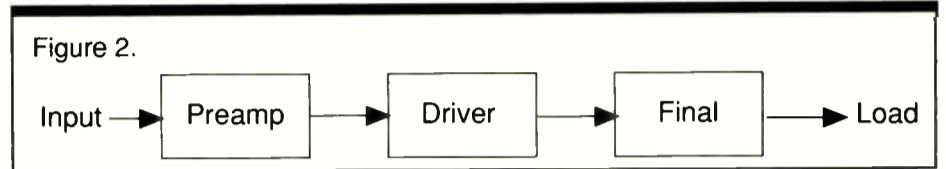
If it is possible to break the power supply away from the circuit it feeds, you may be able to determine where the prob-



lem is. Often a power transformer will have several secondary windings with individual power supplies operating out of it at different voltages.

All outputs should be checked against the manufacturers' specs. If a constant hum is present, a filter capacitor has opened. If there is no regulation, the regulator has failed.

Figure 1 illustrates a typical common-emitter, two-stage transistor amplifier. All stages in this circuit are "isolated" through capacitive coupling. If transistor Q_1 's junction opens, it will have little effect on DC voltages surrounding



Q_2 . However, if Q_1 shorts, the voltage from V_{CC} will drop causing the voltages surrounding Q_2 to be incorrect.

A situation like this can also cause a voltage regulator to heat up. If all the voltages at the emitter, base and collector of a transistor are the same, the device is probably bad. If the total V_{CC} voltage shows up on the collector, it is probably indicating that the transistor junction is open and not operating.

Another test way to evaluate an amplifier chain is the "click" test. Using a resistor of several thousand ohms, carefully connect the resistor leads between the base and collector. An output pulse or click will sound if the amplifier stage is working. The resistor actually changes the transistor bias momentarily, creating a pulse.

C_2 and C_5 are emitter-bias capacitors to stabilize DC voltages while the AC signal is being amplified. If an emitter bias capacitor shorts, the bias on the transistor will be radically changed, causing distortion or possibly cutting off the transistor.

Opamps are very reliable devices. They actually have longer life expectancies than

discrete-device amplifiers. Troubleshooting is the same procedure as with transistors, only it is easier to replace the entire opamp rather than individual components.

Opamps occasionally appear to be inoperative when they "latch-up" to their maximum positive or negative operating level. This could be due to an unusually high input signal. The opamp may snap back to

normal after it is turned off and back on.

If the latch-up problem continues, either the input signal should be reduced or an opamp with a higher signal capacity should be considered.

Figure 2 is a block diagram of a typical amplifier chain. Start troubleshooting by injecting a signal at the load and work backwards to the preamp. The component will fail wherever the signal in the load is lost.

Troubleshooting takes time and logic. It gets easier when the same component fails a second time. Familiarity also does much to speed up finding exactly where the problem may be. The best training for troubleshooting is working beside a skilled technician.

This concludes the Active Devices course offered through RW and Northern Virginia Community College. If you have registered for the course, your exam and an answer sheet will be mailed to you before July 15. Please take the test and return the answer sheet to the college no later than August 1.

Certificates will be mailed between August 15 and 22 to those who have successfully completed the course.

□ □ □

Ed Montgomery is a communications teacher at Thomas Jefferson High School for Science and Technology. He can be reached at 703-750-5090.

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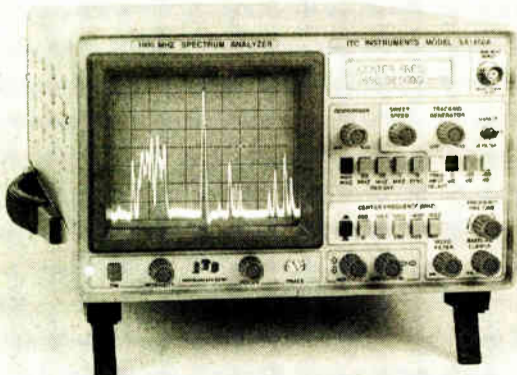
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DESIGNS THAT MAKE THE DIFFERENCE

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STATION SKETCHES

Test Both Digital and Analog Audio

by Tom Vernon

Part II of III

HARRISBURG, Pa. Two of the leading multitone audio measurement systems are manufactured by Audio Precision and Tektronix.

Multitone audio testing systems, as introduced in Part I (RW, May 18), inject a burst of a second or less of sine waves on several carefully selected frequencies into a device. The multitone process drastically reduces the time needed to evaluate equipment, and is almost completely

unobtrusive during on-air testing.

Both the Audio Precision and Tektronix systems can handle a wide range of tests for analog and digital devices. The two systems use sophisticated software to increase the speed of filtering, analysis and calculation.

AM 700

The Tektronix AM 700 Audio Measurement Set is a new entry in the audio testing market. It is an outgrowth of the popular VM 700 system used by television engineers for a variety of video tests. For dual site testing, the AM 700 may be

employed in conjunction with the Tektronix ASG 100 audio signal generator.

The ASG 100 is a two-channel device offering traditional tone generation, sweep tones, CCITT 0.33 (short interval testing) and multitone capability. The generator may be operated via front-panel controls or remotely via the rear panel RS-232 port.

A front-panel display shows status and particulars. User-defined test schemes may be entered and stored. Output impedance is programmable, permitting the generator to be used in both power-matched and voltage-driven environments.

Four different multitone signals are available in the ASG 100's menu. MTone 1 and 3 are intended for analog equipment where the upper frequency response is limited to 15 kHz. MTone 2 and 4 extend the response to 20 kHz and are intended for digital systems. L MTone and R



The new AM 700 from Tektronix

MTone produce a signal on one channel only and facilitate crosstalk measurements.

The AM 700 contains a dictionary of the multitone signals used in the ASG 100. Additional signals may be created by the user and added to the recognition dictionary by feeding a brief sample, so that the analyzer can "learn" the new sequence. One useful example would be a user-designed multitone sequence with a 75-microsecond deemphasis curve for testing FM transmitters.

The analyzer can control remote devices through user-defined functions with an RS-232 port, with the ASG 100 and AM 700 working together in split-site testing. The AM 700 in the multitone mode typically dials up the ASG 100; sets it to Multitone 1 and puts it online; waits a second for the AM 700 to acquire the signal; switches the ASG 100 offline, and prints out the data.

FASTtest

Audio Precision offers multitone testing in its FASTtest program for the System One+DSP and System One Dual Domain.

FASTtest measures noise in the presence of a multitone signal by measuring in areas where there are no fundamental signals or distortion products. This is particularly important when evaluating multi-band processors, which are known to behave differently with and without a signal present.

Users may also regulate the time delay from start of burst to signal acquisition, to



Audio Precision's System One

provide adequate time for companders to settle.

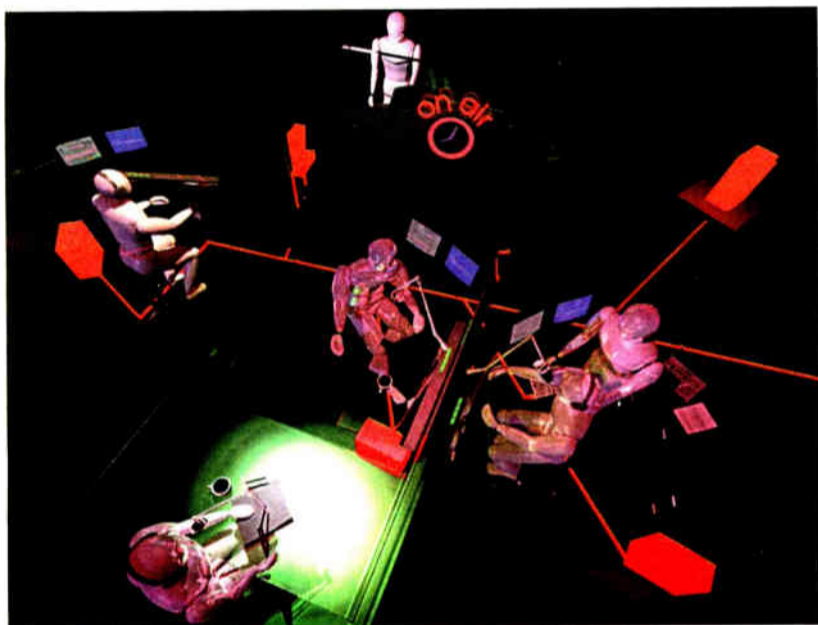
Audio Precision recently added FASTtrig capability to its multitone tests. Multitone split-site testing and evaluation of recorded media was impossible before because there was no way to trigger the analyzer on short bursts. System One with FASTtrig can continuously monitor a broadcast channel, ignore program material, and trigger on the multitone signal.

Short bursts yield a surprising wealth of information. A 31-tone burst is typically used to evaluate a stereo system, with tones spaced at roughly one-third octave intervals. Twenty-six of the tones are identical, left to right, and five are offset

continued on next page ►

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WORKBENCH

► continued from page 41

remotes that the good weather brings, the Thomas Tone Baton may solve some problems. This battery-powered (one AA penlight cell) audio power oscillator fits in your pocket, but is big enough to ring out distributed speaker lines. It produces a steady 1 kHz tone that can drive speaker loads from 1 ohm to 70 volt line impedance.

The Thomas Tone Wand generates 1 kHz at -50 dBm for checking mic inputs and remote amps. The built-in male XLR allows direct connection to commonly used input receptacles.

The Tone Wand and Tone Baton list for under \$30, and are available from Kathleen Karas of Crouse-Kimzey, Annapolis, Md. Call Kathleen at 1-800-955-6800, or circle Reader Service 177.

★ ★ ★

WJTN(AM) Pearl, Miss., broadcasts a news/talk format, so its Fairchild DART-384 satellite receiver gets plenty of use. The receiver is located some distance from the operator position, so Chief Engineer Stan Carter devised the circuit shown in Figure 1, which has been in operation for over six months now

The transponder switcher uses normally open momentary switches to make the selection, and a Radio Shack 12 VDC wall plug supply powers the relays. Note that the nine-pin "D" connector pinout for the Fairchild Dart 384.

Stan Carter can be reached at 601-366-1150.

□ □ □

John Bisset is a principal in Multiphase Consulting, a contract engineering and projects company. He can be reached at 703-323-7180. Faxed submissions can be sent to 703-998-2966 and qualify for SBE recertification credit when published.

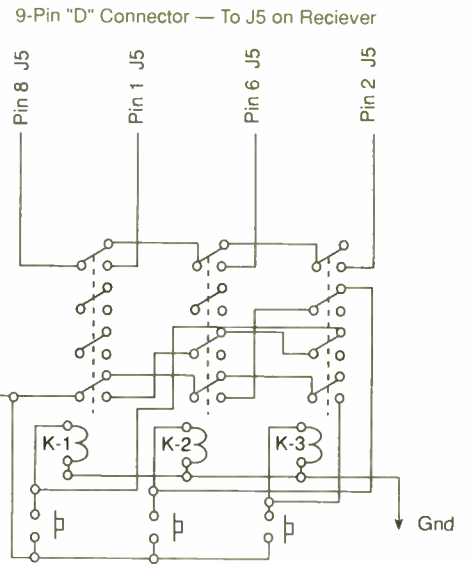
Figure 1.
Remote Transponder Switching for Fairchild Dart 384

Relays—Potter & Brumfield KHAU-17A11-12 or equivalent

Switches—N/O momentary

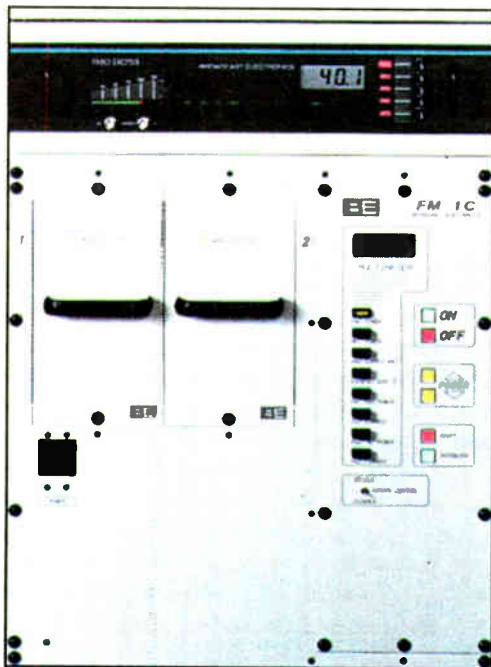
Power Supply—Radio Shack +VDC 12VDC Plug-in

This simple transponder switcher simplifies transponder selection



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New Gear to Test Audio

► continued from previous page

slightly to facilitate crosstalk measurements.

Several forms of data are stored in the computer following this test: 31 point frequency and phase response graphs for both channels; total distortion at one-third octave intervals for each channel; noise spectrum at one-third octave intervals; interchannel separation at five frequencies, and even noise at power line frequencies and harmonics.

Automatic features

Two System Ones can be used in split-site tests. Otherwise, the multitone signal can be recorded on a linear digital medium such as DAT or recordable CD. The recording may then be played back manually, or loaded into the station's automation system.

Does all of this sound too good to be true? Is there a darker side to multitone?

This sophisticated level of audio testing is expensive. Both companies' products are priced at well over \$10,000. Industry experts expect prices to drop over time, but how much is an open question.

From a manufacturer's perspective, the radio broadcast market is a narrow niche, and many companies believe there are not enough radio-industry customers to break even. Television broadcasting remains a safer market.

Both companies' analyzers have many additional features that space does not allow to be mentioned here. For additional information, call Audio Precision at 800-231-7350, and Tektronix at 800-426-2200.

□ □ □

Tom Vernon divides his time between consulting and completion of a Ph.D. He is occasionally sighted at WXPN(FM) Philadelphia. Call him at 717-367-5595.

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World Radio History

USER REPORT

Aphex Air Chain Increases Coverage Area

by John Caracciolo
Vice President of Engineering
WDRE(FM)

GARDEN CITY, N.Y. WDRE(FM) is a grandfathered short-spaced Class A FM whose target audience includes Nassau and parts of Suffolk counties in Long Island, as well as Queens, Brooklyn and parts of Manhattan and the Bronx in the greater New York City metropolitan area. Our 1 mV contour is completely encompassed by two powerful FMs—one broadcasting from the Empire State Building and the other from the World Trade Center. So far, WDRE's petition for a power upgrade has not been approved by the FCC, so we remain at 1 kW broadcasting at 522 feet HAAT.

WDRE has a lot of positive things going for it. Our owner, Jarad Broadcasting, is committed to excellence and to breaking new ground in format and coverage. We have added stations in Westhampton, N.Y., and Philadelphia, both of which simulcast our Garden City signal.

Loyal listeners

Our modern rock format is unique to the New York metro area: although some other New York stations play some of the same songs, WDRE is the only commercial station playing solely modern rock. We have a history of appealing to listeners in search of the most cutting edge, alternative rock sounds. And while we have a loyal listenership, we have always been somewhat frustrated by our signal limitations.

In March, WDRE moved to brand new studios, about a block away from our old home. To make the relatively short STL hop, I added a new Moseley analog STL.

Then I had the problem of how to handle processing once we made the switch over to the new building. I was going to use an old processor, just until I could transfer our processing equipment over, but around that time I began some informal discussions with Marvin Caesar, president of Aphex. I was impressed by Aphex's commitment to helping radio stations improve the quality of their on-air sound. He suggested I install the Aphex Audiophile Air Chain to make the switch.

The Air Chain is a combination of Aphex equipment all working together, and includes the Aural Exciter Type C² with Big Bottom, the Compeller compressor-leveler, the Dominator multiband peak limiter and the Digicoder stereo generator.

I had heard of the Audiophile Air Chain, but the word "Audiophile" has always turned me off. To me, an audiophile is the annoying person who calls at odd hours complaining about some minuscule nuance in my signal. An audiophile is most definitely not what most dedicated WDRE listeners—who enjoy Lemonheads, the Cranberries, Squeeze, Depeche Mode, Pearl Jam and Midnight Oil, to name just a few of the artists we feature—would call themselves.

Personal attention

But the personal attention Caesar paid to providing processing tailored to our station's sound convinced me to give the

Aphex Air Chain a try. He spent some time at our station, showing me how to fine tune the equipment.

I heard some other stations claim that their interference-free coverage improved after installing Aphex equipment, but I would only believe it if I saw it. The switch over to the new studios was set for March 20, and I decided to really put the Aphex gear to the test: I told very few people at the station about the new processing.



John Caracciolo shows off WDRE's Aphex.

better separation, less interference, more dial presence."

More dial presence

Listeners from Manhattan call and write to tell us they can pull WDRE's signal in better, including people in the record industry and in music management, which is an added plus for us. The Aphex Air Chain has generated such positive comments that we have ordered a second Air Chain for our Philadelphia station.

To me, the quiet passages in the music sound quieter. I have also noticed greater dial presence in many areas, meaning there has been no sacrifice in loudness. Our on-air staff, who are the first to notice changes in the sound—and to let me know about it—are pleased with the results. And Calderone, who insists that our music sound just like the CD from which it originates—full stereo separation and all—is extremely satisfied with the quality of the sound. Needless to say, our owner is happy with the extended coverage.

We have stayed with the Aphex Air Chain. Letters and phone calls documenting our extended interference-free coverage continue to come in, and I have driven around and pinpointed previous problem areas that are now free from multipath. One additional benefit has been an extension of interference-free signal to the east, toward our Westhampton station, eliminating a coverage gap in Suffolk county. We now cover almost the entire length of Long Island.

□□□

For information from Aphex, contact Chrissie McDaniel in California at 818-767-2929; fax: 818-767-2641; or circle Reader Service 152.

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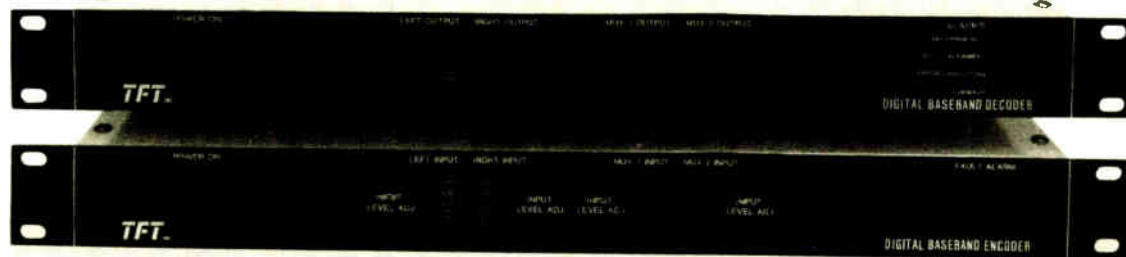
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READER SERVICE NO. 162

USER REPORT

Sound Unified with Cutting Edge

by Tom Sittner
Chief Engineer
KSJL-FM

SAN ANTONIO, Texas Audio processing both is and is not subjective. Frequency response, distortion, noise and the amount of gain reduction or the amount of clipping can all be measured to the nearest hundredth of a decibel.

But if you ask 100 people to listen to the same thing at the same time, you will get 100 different descriptions of what they just heard. For that reason, I won't try to tell you how the Unity 2000i from Cutting Edge sounds. We think it sounds great. But the genius of the Unity 2000i is that you can make it sound however you want it to sound.

Single chassis

Frank Foti and the Cutting Edge crew put everything a good audio processing chain needs into a single chassis and made it user friendly. The Unity 2000i has nine basic functions:

- A wideband AGC that maintains a consistent level that the rest of the chain wants to see. This provides plus or minus 10 dB of range and is selectable on or off.
- A selectable phase rotator operating between 300 and 2,000 Hz.
- A selectable and adjustable bass enhancer, which provides up to 10 dB of bass boost in the sub bass region up to about 105 Hz. It sounds rich, but not boomy.
- A phase linear four band crossover network with adjustable crossover points.
- A four band processor/leveler with adjustable mix levels.
- A four band limiter. Each band corresponds with the bands in the leveler and attack time, release time, threshold levels and mix levels are adjustable.
- A clipper/low pass filter. There is 10 dB of range in the clipper drive control, which is plenty of room to find that loudness-verses-quality tradeoff point. The

15.2 kHz low pass filter is phase linear and knocks the audio signal down by at least 80 dB at 19 kHz.

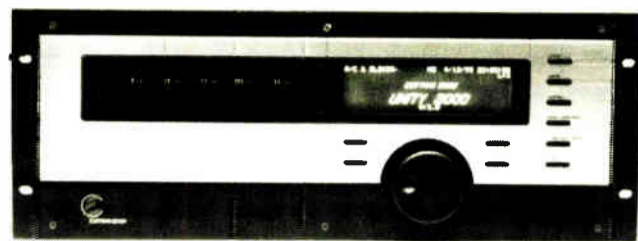
- Stereo generator section with two low

impedance outputs, individually adjustable in level.

Every function is accessed at the front panel through a few buttons and a shuttle wheel. This includes output level and pilot injection. A backlit LCD display displays information.

If you store all of your settings in memory and back that up on paper every thing is totally repeatable. There is also a serial port on the back of the unit for connecting to an IBM-compatible PC directly or through a modem.

Both the front panel controls and remote software are intuitive and easy to learn. One thing I have noticed, however, is



Cutting Edge Unity 2000i lets KSJL-FM customize its sound.

software are intuitive and easy to learn.

- A composite clipper that can be turned on or off and provides up to 6 dB of clipping. The clipping function is performed before pilot is added in and does not appear to effect pilot level or phase at all.

Presets

The Unity 2000i comes with nine factory presets for formats such as AC and oldies, CHR (both friendly and hostile), classical, jazz/new age and talk. Cutting Edge suggests using these as starting points for your station and then tweak to suit your tastes. We found it hard to improve on these presets, but everyone hears things differently.

In addition to the nine factory presets, The Unity 2000i can store up to 50 custom processing presets. This allows us to program different processing for different dayparts. If we want to sound a little more aggressive during drive time and then mellow out during middays—or if there is a one-time event like a live via satellite concert that we want to make sound better by adding a little bass or by backing off of the processing because of what the network does to the audio before they transmit it—we can set the Unity 2000i to fit the needs of our program. These events can be used just once or everyday.

that the front panel controls appear to lock up when the serial port is turned on and connected to a modem or computer. What happens is the control bus waits to see if there is a command coming from the remote software, and after about 30 or 40 seconds it releases the front panel controls and everything returns to normal.

This is a minor distraction and can be eliminated by simply turning the serial port off when you want to operate the front panel controls. The glitch does not effect the remote software control.

The Unity 2000i sounds clean and open, delivers a powerful signal and is easy to learn and operate. A subjective statement, yes, so the next time you're in San Antonio tune us in and see what you think.

□ □ □

For information from Cutting Edge, contact Danielle Cline in Ohio at 216-241-3343; fax: 216-241-4103; or circle Reader Service 115.

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USER REPORT

With Orban, Station Is Smooth, Clean and Loud

by Chuck Lawson
Chief Engineer
WXBQ-FM

BRISTOL, Va. This electronic age we live in is changing fast. The FM band is crowded by too many signals, and every station wants to sound better than the rest. WXBQ-FM has always had a unique sound, but with the addition of an Orban Optimod 8200, our audio is cleaner and louder than ever.

WXBQ-FM installed the 8200 and a Mosely digital STL about 18 months ago. Before we decided on the Optimod,

we tried several other processing boxes. They all have their advantages, but we feel the 8200 best handles our country format. It gives us a loud signal, while at the same time keeping the audio open and smooth with no fatigue.

Installation

Setup of the 8200 is not difficult, but it is different from analog processors. There are several factory preset programs, but these programs are just the starting point. We have set the program parameters differently from any of the factory presets.

The analog input adjustments are critical. If they are set too high, the distortion is terrible. If set too low, the noise becomes very apparent. Since the initial installation, we purchased Orban's digital I/O card. This allows us to go directly from the STL's AES/EBU output to the digital input of the Optimod, and it eliminated the problem we encountered with the analog I/O.

One of the most noticeable differences between the 8200 and other processors is the bottom end. The bass is not mushy like some other processors. It is solid and low: In fact, we have seen 20 Hz peaks on a real time analyzer. Similarly, the highs are clear and bright. The presence makes all types of program material come alive. Almost any type of spectral balance can be achieved.

The 8200 also makes the audio sound amazingly clear. When there is dead quiet, you hear no noise at all.

Working with the Optimod is also very clear. The front panel display screens are easy to understand and tell you everything you need to know about what the 8200 is doing. The technical manual is helpful.

Different dayparts

The Optimod offers the ability to change processing setups for different dayparts with its internal real time clock. This is a nice feature, but one we don't use.

Another helpful feature of the 8200 is its passcode system. This system keeps unauthorized hands from changing the processing, and can prove to be a valuable feature. You can install the new processing, lock it up and never worry about non-technical staff changing the processing parameters

once your back is turned.

We have had a few problems with the first 8200 WXBQ-FM bought. The front-panel back light went out and we lost a DSP board and a stereo generator card. All of these problems were corrected within one day with a phone call to Orban. They were very helpful and got the parts to us quickly.

The Optimod 8200 is the cleanest, smoothest and loudest processor we have ever tried. It does the job it is supposed to do and with lots of flexibility.

WXBQ-FM uses some other processing equipment in addition to the 8200. These other units are a big part of our on-air sound, but the Optimod is the final step in the air chain, and it keeps our audio consistent from song to song.

Like many engineers, one of my biggest concerns about up-and-coming digital technology is unwanted artifacts caused by mixing sampling rates. The 8200 and our digital STL are compatible at 32 kHz. I do not believe that 32 kHz is a high enough sampling rate, although that seems to be what the industry is going to adopt as a standard.

I would caution anyone buying an Optimod 8200: allow yourself enough time to learn how the unit works. If you want a processor you can plug in, tweak a little and then forget about, this is not the box for you. It takes hours of listening to get the sound just the way you want it, but once it's set right, you will love it. And your competition will hate it.

□ □ □

For information from Orban, contact Amy Herndon in California at 510-351-3500; fax: 510-351-0500; or circle Reader Service 68.

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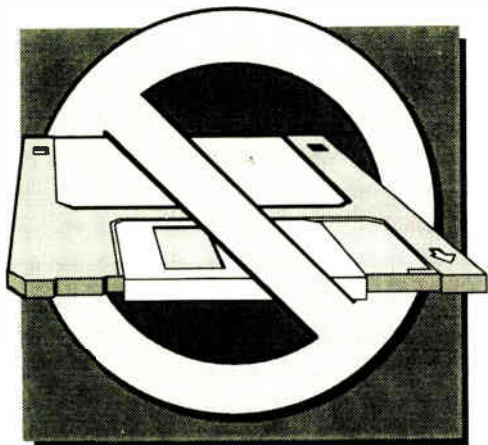
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USER REPORT

Dolby Tweaks Audio with Precision

by Jim Stagnitto
Director of Engineering
WMXV(FM)

NEW YORK When my equipment supplier tried to explain the Dolby Model 740 Spectral Processor to me, he was at a loss for words. The only way to convey how this unit works is to demo it, and then try to match the sound it produces.

The Spectral Processor works by boosting only low-level information by as much as 20 dB. A total of eight processors split the incoming audio in terms of both frequency and level. The audio is treated as a sidechain signal that is eventually mixed with the unaltered input audio.

Selective boost

The boosted low-level signal then passes on to a three-band EQ section, which allows you to selectively boost portions of the spectrum up to 20 dB. The output of the EQ section is then added to the original unprocessed signal.

Depending on how you set the controls, your station can achieve a sound that emphasizes a sparkling high end, without bringing up noise or crashing against the high frequency limiters; a full deep low end, without sounding boomy; or any combination in between.

It's kind of like putting an intelligent loudness button on your station's sound signature.

The effect is not achieved by generating harmonics or through phase manipulation. It is done by boosting low level signals already present in the audio passing through the unit.

What is a "low-level" signal? As far as the Spectral Processor is concerned, it works on signals in the area of -40 dB and below. There is a lot of subtle musical detail in this area that can improve a station's sound. But to make sure that these details, and not noise, are processed, Dolby incorporated a two-pole high pass filter that limits the amount of low-frequency boost below 100 or 200 Hz, and a two-pole low pass filter that controls the amount of boost above 4 or 8 kHz. These filters are ahead of any processing stage, and can be switched out of the circuit, if desired.

After setting the box for either +4 or -10 dBm operation (via a rear panel switch), you can set the level at which the processing level begins to take effect with the Threshold control. The threshold of the processing can be set from -60 dB to -40 dB below a reference level.

If, for example, you set the control at -50 dB, any signal below -50 dB is boosted by 20 dB, and signals above -50 dB pass through with progressively less boost until unity gain is reached.

Highlights

Setting the control is simple. Just put in normal audio and adjust the Threshold control until the center LED of a five-LED meter is lit most often.

If, after boosting all of these signals, you decide to only highlight certain sections of the spectrum, then the EQ section comes into play. It allows you to control the low, mid and high band of frequencies up to the full 20 dB that the signal has been boosted.

Two Crossover controls allow you to adjust the spectrum that each control covers. With the controls in their center,

After the EQ controls comes one final chance to reduce any source input noise that might have been magnified by the



Dolby Spectral Processor boosts audio quality without sacrificing loudness.

detent positions, the crossover point between the low and mid controls is 300 Hz and between the mid and high controls is 2 kHz.

boosting process with a sliding-band Source Noise Reduction control. It reduces noise present in the input signal by as much as 12 dB. It also can be

switched out of the circuit entirely.

After processing the low level signals, the audio is remixed with the original input signal, and passed on to the output section. The 740 is a stereo unit, and the sidechains can be linked for true stereo tracking or, by means of a toggle switch, separated for dual mono use.

After all of that, you may wonder why you might want one of these units in your air chain. Well, the Dolby 740 is not meant to make you the loudest thing on the dial. It is not going to turn a poorly set-up AGC/limiter/stereo generator into a flame thrower.

Clearer sound

One of the first things I noticed after installing the 740 in my airchain is that I

continued on page 52 ►

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Their high end sounds artificial. Female voices sound harsh and some harmonics from the original source seem to disappear.



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World Radio History

Precise Audio Control with Dolby

► continued from page 51

was able to back off the amount and release time of the multiband processing I use. This translated into a much less fatiguing sound without any loss in loudness. The radio station just seemed clearer than before.

I was also able to slow down the AGC release time a bit, and totally disengage the equalizers that are integral to the processor we use in our main airchain. The Dolby 740, when properly adjusted, still allowed me to achieve a present and "up-front" air sound.

That begs the question: why not just put a standard EQ in the chain instead? The problem is that once you set up a

curve, a standard equalizer consistently affects the chosen frequencies, whether they need to be adjusted or not. For example, if you set up a curve that emphasizes the upper midrange, it might sound just fine on the majority of your programming, but when you play a song with kicked-up screaming high end, the EQ faithfully boosts those frequencies that do not need to be boosted further.

The Dolby unit looks at the audio spectrum, sees that no further boost is needed and passes the audio through unaltered. It does this automatically as it only boosts low-level signals; the high-level

signals receive progressively less and less boost above the threshold you set.

A multiband compressor or limiter has its own deficiencies if you attempt to use it for a form of automatic equalization. Some multiband limiters force you to drive them a bit harder than you would like to in order for an "auto-EQ" effect to work. Subsequently, the audio sounds more squashed than you desire.

Goes a long way

As with any other sort of processing, however, please realize that a touch of the Spectral Processing goes a long way. Just the right amount serves to

enhance audio and make things pleasurable. Too much makes things totally unpalatable.

For example, if you set the Threshold controls too low, both low and high level signals are boosted, and the unit is just like a standard, fixed-gain equalizer. Set it too high, and it is just a very nice (and expensive) line amplifier. Dial in too much high end boost, and all of the dogs in your neighborhood will be wincing. Too much Source Noise Reduction seems to throw a blanket over your speakers.

One thing you must do for best performance is to install the 740 as the first device in your airchain—ahead of any other gain-changing processors.

The Dolby Spectral Processor is a high quality, well-built box designed to process audio only when needed. At our adult contemporary station, it allows us to create a very listenable, yet competitive, sound with less aggressive processing. Our station has more punch, precision and clarity.

□ □ □

For information from Dolby, contact Kevinn Tam in California at 415-558-0200; fax: 415-863-1373; or circle Reader Service 75.

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World Radio History

Audio's Catch-22

by T. Carter Ross

WASHINGTON No longer are radio stations torn between processing audio either to pump up the volume or to improve signal quality.

Manufacturers are eliminating the hard choice by developing processors that both strengthen the signal and boost loudness.

"A large segment of the broadcast market is still confused about loudness-management, not engineering," said Marvin Caesar of Aphex Systems. "They think it's best to cram as much density into the signal as possible."

There is a need to deliver loud audio, Caesar conceded. But developments must ensure a quality signal, he added.

"Distortion may enhance certain types of music, but it also may be very destructive to voices. What people need to judge is the naturalness of the human voice," he said.

Kevinn Tam at Dolby Laboratories agrees the search for a happy medium between loudness and sound quality causes some stations to reassess processing needs.

"It would seem that people are looking for apparent loudness," said Tam. "But they also are willing to give up some loudness in return for improved sound quality."

Broadcasters are stuck in a Catch-22: There is a real need to deliver a loud signal to stay competitive; however, too much processing creates a sound too dense to listen to comfortably. But as the technology advances, manufacturers look to suit broadcasters' needs.

USER REPORT

CRL Amigo Friendly to Alabama Station

by **Byron E. Fincher**
Owner-Chief Engineer
WGMZ(FM)

GADSDEN, Ala. My wife, Barbara, and I own WGMZ(FM), a station operating on 93.1 MHz in Gadsden. I also double as the chief engineer, so in planning the station, I looked for an audio processor that was easy to both install and operate.

I didn't want a repeat of problems I had experienced with audio processing units in the past. There were times when it took several days (or nights) to install and adjust a processor, and then you still could not be sure it was right.

The automatic gain control insures precise level control over a wide variety of program material.

I had heard that the Circuit Research Labs (CRL) Amigo FM fit my criteria for ease of installation and operation, so I called them. They offered to ship me a unit on a trial basis, and I have used the Amigo FM ever since.

Complete system

The Amigo is compact, easy to install and does an excellent job. The one-rack-high unit contains a complete audio processing system that is both flexible and powerful. It combines a dual-based automatic gain control (AGC) with a variable pre-emphasis multiband limiter, a low-pass filter section and a digitally synthesized stereo generator.

The first section of the Amigo is a wide-range dual-band AGC. With more than 25 dB of range, the AGC insures precise level control over a wide variety

of program material. The Amigo's limiter/audio low-pass configuration provides exact peak modulation control while maintaining outstanding program clarity.



WGMZ finds CRL Systems' Amigo FM easy both to use and install.

The multiplex (stereo) generator is also located after the limiter. Its digitally synthesized approach provides a flawless, drift-free signal. Independent left and right audio outputs are provided in addition to a multiplex output. After selecting either pre-emphasized or flat audio, the level is controlled from panel pots.

The Amigo FM is designed for quick and easy setup. When we installed our unit, we first adjusted the input level to match our source—the front

panel 10-segment LED display allows quick calibration. We then aligned the multiplex level to match our exciter. The AGC, limiter and multiplex generator sections are internally matched to each other.

If your transmission system is not stereo-ready, the Amigo may be operated in mono simply by turning the pilot control off. We had our unit up and running in less than two hours, and it sounds great.

Control options

The Amigo FM has several control options, allowing us to further customize station sound. An internal three-position AGC jumper selects up to 12 dB of gain reduction.

The Amigo also includes stereo sound field enhancement circuitry.

This circuitry provides additional separation to stereo program material without affecting mono programs or voice. Two internal jumpers facilitate augmentation of the stereo image.

Front panel low-frequency equalizer (bass boost) and limiter drive controls allow easy control of overall density and base enhancement of the signal.

A few weeks after we went on air, the Amigo FM developed an unbalanced condition between the left and right channels that could not be corrected locally. I called Kevin Clayborn in CRL's customer service department, and he arranged to overnight us a replacement unit. The new unit was installed and we have been trouble-free ever since.

□ □ □

For information from Circuit Research Labs, contact Bill Ammons in Arizona at 800-535-748 or 602-438-0888; fax: 602-438-8227; or circle Reader Service 18.

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People, Promotions and Appointments

AudioTechniques named David Schecterson and Ed Knieriem as co-managers of its parts department.

Bill Rose joined the eastern division of Arbitron's radio station services. He is a senior account executive and his territory covers Philadelphia, parts of New Jersey and upstate New York.

Symetrix Inc. named Joe Blacker and Pat Coney of Audio Associates its 1993 National Rep of the Year. Audio Associates represents Symetrix products in the mid-Atlantic region.

TFT Inc. appointed Paul Black to

the position of radio products manager. He is responsible for TFT's line of STL and radio monitoring equipment.

Producer and session keyboardist David Lebolt joined Digi-design as professional products manager.

Jack Shewman was promoted to vice president of sales at Panduit Corp.

Steve Gordoni joined 360 Systems as a sales engineer, and John Longawa joined the company as a senior software engineer.

Sabine added Michael Rennie to its sales and marketing department.

Company News

Lukens Inc. and Jackson Products Inc. signed an agreement under which Jackson will purchase Lukens' Safety Products Group, including the Flex-O-Lite Inc. unit.

Best Power Technology Inc. was selected as a supplier of power protection systems for the 1994 World Cup soccer tournament.

Group W is installing an ENCO Systems DAD486x digital audio delivery system at its newest acquisition, KPIX-AM-FM in San Francisco.

ENCO Systems also recently completed the installation of 23 DAD486x workstations at KSL-AM-TV in Salt Lake City. KSL(AM) is a 50 kW clear channel news/talk station owned by Bonneville International Corp. and is one of the groups' two flagship stations.

International Telcell Inc. and DSC Communications Corp. entered an equipment sales agreement under which Telcell will incorporate DSC's wireless access product Airspan into its wireless telephony installations in Eastern Europe and the Commonwealth of Independent States.

Belden Wire & Cable Co. received ISO 9000 registration for all of its U.S. facilities. The ISO 9000 series is a set of generic standards that provide quality management guidance as well as quality assurance requirements.

Otari Corp. and Creation Technologies reached an agreement giving Otari worldwide exclusive rights to market and distribute the RADAR random access digital audio recorder.

At the Third Annual Professionals' Choice

Awards Ceremony, held at NAB '94, Solid State Logic's G Plus console system was named audio console of the year.

360 Systems doubled its facility size by moving to new headquarters. The new address is 5321 Sterling Center Drive, Westlake Village, CA 91361; telephone: 818-991-0360; fax: 818-991-1360.

Varian Associates Inc. is celebrating the 60th anniversary of its Eimac line of power tubes this year, and to celebrate this milestone the company is running a contest to find the Eimac tube with the longest history.

For information on the contest contact Varian's customer service department at 800-414-TUBE; fax: 415-592-9988.

Digidesign Intelligent Noise Reduction (DINR) was named "best new music software" in the 18th annual Keyboard Magazine reader poll.

Also, Digidesign Pro Tools 2.03 won the Professionals' Choice Award for digital audio workstations at NAB '94.

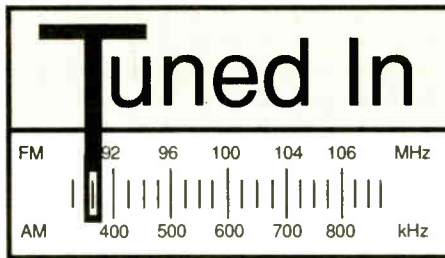
Cartwright added an engineering services department to help provide better service to its customers. For information, call 800-543-8614 and ask for engineering.

Gaylord Entertainment Co. purchased a Harrison AP-100 on-air console to be installed in the Wildhorse Saloon in Nashville, Tenn. The console will be used for interviews and live broadcasts on WSM-FM.

The 1994 Cutting Edge Music Business Conference is scheduled for October 13-16 at the New Orleans Sheraton Hotel. The Conference will feature seminars, workshops, showcases and a trade show and "Music Mart."

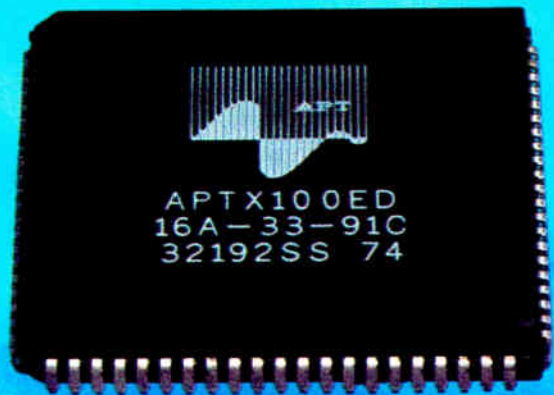
For information or registration call 504-565-7591; fax: 504-565-7876; or leave a message at the Cutting Edge Message Center at 800-945-5447.

Spectral Synthesis appointed AudioTechniques as its representative in the New York metro area.



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MARKETPLACE

Recently Introduced Products for the Radio Broadcast Professional

Green Fire Extinguisher

Ansul Fire Protection received Underwriters Laboratories listing (UL EX-4510) for its Inergen fire extinguishing agent. Known as "the environment-friendly halon alternative," Inergen agent extinguishes fire while continuing to support human life.

Inergen agent is a mixture of three inert gases: nitrogen, argon and carbon dioxide. As a "clean" gaseous extinguishing agent, it is well suited to protecting sensitive electronic equipment.

Although Halon 1301 was often specified for similar applications, its ozone-depleting characteristics resulted in a complete production phase-out as of December 1993. In contrast, Inergen agent contains only naturally occurring gases that have no impact on the ozone or the environment in general.

For information, contact Ansul Fire Protection in Wisconsin at 715-735-7411; or circle **Reader Service 119**.

Radio Weather Radar

Accu-Weather Inc. has 17 different NEXRAD Doppler radar products available in real time for each of 45 radar sites. NEXRAD Doppler radar allows stations to receive up-to-the-minute, detailed graphics with a PC and modem or over a fax line.

More than 35,000 products and services are available from Accu-Weather, including official forecasts, warnings, current conditions, lightning strike data and maps. Accu-Weather's 75 meteorologists also prepare custom forecasts for radio stations and other clients.

For information, contact Don Heaton or Phil Gelenberg in Pennsylvania at 814-237-0309; fax: 814-238-1339; or circle **Reader Service 109**.

Digital Audio Satellite Receiver

The MP-72000 professional grade digital audio SCPC satellite receiver from Micro Phase Communications is designed to meet the needs of radio broadcasters.

It includes a 70 MHz input allowing the MP-7200 to be used directly with existing analog downconverters. The MP-7200 uses the MPEG Layer II MUSICAM compression algorithm for standards conformity.

A fully featured front panel includes a bright LED-type display and keypad entry of parameters. To simplify diagnostics, the front panel also allows access to vital operating parameters such as signal strength, carrier to noise ratio and bit error rate. A real-time clock is included for advanced control features.

For information, contact Micro Phase in California at 415-368-8379; fax: 415-368-3869; or circle **Reader Service 179**.

Third Generation DAW

Fairlight offers a new series of products based on its MFX digital audio workstation (DAW). The third generation MFX3 provides a full range of multitrack recorder/editors for post and general multitrack recording.

These packages allow virtually any audio recording/playback facility to be configured into a four- to 24-track system. Multiple systems can be configured to allow hundreds of tracks for post-mixdown and music production.

The MFX3 provides 24 tracks of simultaneous playback from a single hard disk, 24 digital and analog I/O and DSP functions such as real time, clip-based EQ. The MFX editing console remains the basis of the user interface. MFX2 systems can be upgraded easily to MFX3.

For information, contact Michael Callen in California at 213-460-4884; fax: 213-460-6120; or circle **Reader Service 214**.

Digital Time and Temperature

DC Productions offers a cost-effective digital time, temperature and weather service designed to help increase station revenue. Callers are greeted and then hear a one of your sponsor's commercials. Time, temperature and forecast follow the commercial.

Additional spots could be sold for fishing reports or lottery numbers as well. The spots can be rotated and/or dayparted. Programming is easy and everything is digital.

For a demonstration of a working system, call 912-246-1100 or 912-872-8111.

For information, contact David Cunningham in Georgia at 800-789-3472; fax: 800-789-3472; or circle **Reader Service 204**.

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VHF narrow band:

The industry standard VHF plug-on version works with the CR185 receiver for day to day ENG use.

This system has been the basic workhorse companion of ENG crews since 1988. With over 12,000 of these systems in the field, it's no wonder you see them everywhere. The ruggedness and reliability of this system speak for themselves.



UHF narrow band:

The UCR190 receiver is an updated UHF version aimed at broadcast ENG applications.

Increased operating range, improved signal to noise ratio and lower distortion are the most obvious differences in the 190 Series over its VHF counterpart. The 190 Series UHF systems typically exhibit 2 to 3 times the operating range of the VHF systems, due mostly to antenna efficiency. The addition of the Lectrosonics exclusive dual-band compandor provides the noticeable improvement in audio quality.



UHF wide band:

The 195 Series UHF systems set the new standard for the state of the art in wireless systems, with high definition audio quality and full function metering.

Using +/- 75 KHz deviation, dual-band companding, a digital pulse counting detector, full RF and audio metering, and balanced XLR output from -50dBm to +8dBm, the UCR195 receiver clearly sets the standard at the high end of the market. The compact size is convenient for camera mounted applications, yet the performance is well suited to the most demanding studio environments.



All 3 models operate on a single 9 Volt alkaline battery and provide a wide range level control which adjusts from mic to line levels.

Since 1988, Lectrosonics has led the broadcast market by introducing innovative wireless products to solve day to day problems. The plug-on transmitter is only one example of these innovative efforts.

All broadcast and professional wireless products are constructed of machined aluminum, designed and manufactured in the Lectrosonics facility. The latest computerized machining equipment is utilized to maintain the highest standards for precision.

The newest fully automatic surface mount equipment is used to assemble circuit boards, providing a final product that is as rugged and dependable as it is attractive.

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World Radio History

MARKETPLACE

Recently Introduced Products for the Radio Broadcast Professional

Highly Accurate Real-Time Analyzer

The latest version of the AudioControl Industrial SA-3050A real-time analyzer makes measurement of SPL levels even more accurate—down to one tenth decibel.

The SA-3050A is a real-time, third octave spectrum analyzer, microprocessor controlled with six memories, built-in pink noise generator and calibrated microphone. In addition, a complete line of accessories, including a rechargeable battery pack and a parallel printer interface, are available.



Most existing SA-3050A units can be upgraded easily at the factory.

For information, contact AudioControl Industrial in Washington state at 206-775-8461; fax: 206-448-3166; or circle **Reader Service 52**.

New Electret Mic Line

Sennheiser offers the K6 series of electret microphones. The K6 series takes a modular approach, building upon the K6 and K6P powering modules for AA battery or phantom power operation respectively.

The ME62 and ME64 are omnidirectional and cardioid capsules ideal for interview situations, the ME66 and ME67 are short and long shotgun mics for directional pickup and the MKE2-60 and MKE102-60 are omnidirectional lavalier microphones.

The line's ability to take extremely high sound pressure levels and its low self noise and high SNR make these microphones ideal for any type of situation.

For information, contact Joe Ciaudelli in Connecticut at 203-434-9190; fax: 203-434-1759; or circle **Reader Service 112**.

Telephone Autocoupler Bay

The AC-12 coupler bay from Circuit Werkes enables you to fit up to 12 full-featured telephone autocouplers in 5.25 inches of rackspace. Its dual audio buss feature eliminates the wiring associated with networks and other mass feeds.

Each card can individually either send or receive telco audio.

The coupler cards can be removed or installed while powered without affecting the operation of other couplers. Each card has an individual 600 ohm bidirectional audio connection with level trim for specific feeds.

Features of the AC-12 include auto-answer/auto-disconnect; two bridging, balanced input, switchable busses for audio distribution; LED indicators for incoming ring, on-line, clipping and power; automatic signal limiting; remote pick-up and hang-up control; included power supply; and a strappable input attenuator that accepts a wide range of input signals.

For information, contact Mike Hagans in Florida at 904-331-5999; fax: 904-331-6999; or circle **Reader Service 81**.

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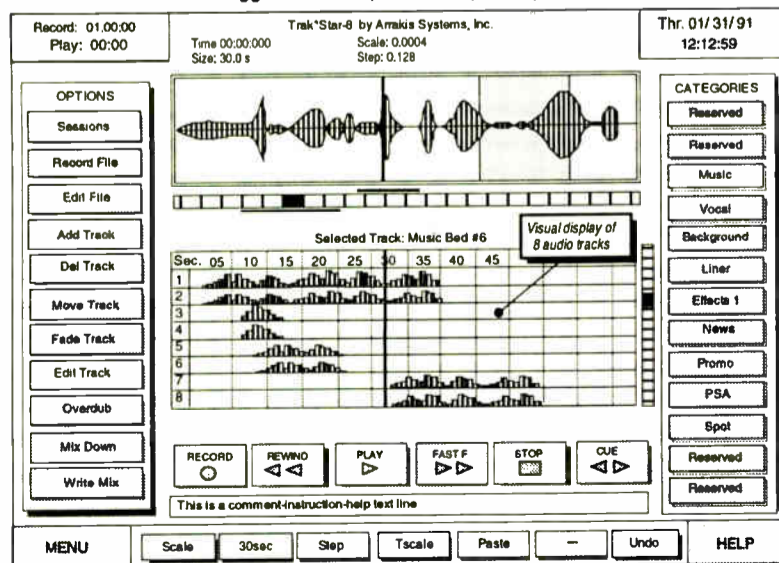
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Modulink

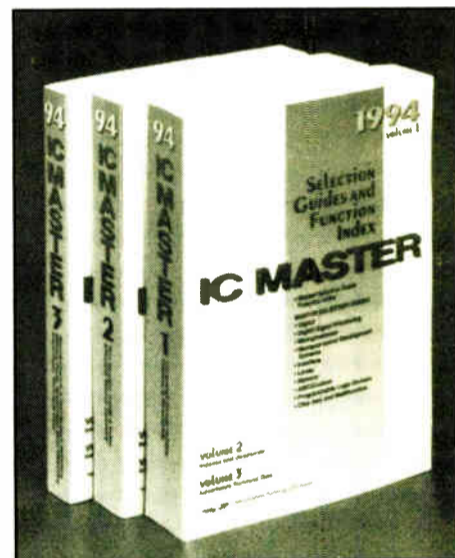
Integrated Circuit Catalog

Hearst Business Publishing offers the 1994 *IC Master* catalog, which provides technical information on all commercially available integrated circuits (IC).

It is designed for engineers who specify ICs or who design, repair, service or reverse engineer equipment using ICs. More than 100,000 commercially available ICs are included in the three-volume, 3,000 page set.

Hearst also offers the 1994 *Directory of IC Manufacturers' Data Pages*, a quick reference guide for identifying the most current data books and data sheets on specific ICs.

For information, contact Marie Botta in New York at 516-227-1314; fax: 516-227-1453; or circle **Reader Service 168**.



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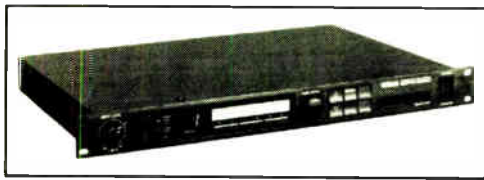
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TECHNOLOGY UPDATES

YAMAHA

Multi-Effects Processor from Yamaha Thinks Like a Musician

BUENA PARK, Calif. The SPX990 professional multi-effect processor from **Yamaha Corp. of America** features 20-bit A/D and D/A conversion to ensure professional-quality sound.



It features a true stereo, two-in/two-out configuration. All I/O are electronically balanced, with XLR or TRS phone jack connectors. The SPX990 is MIDI equipped. The SPX990 comes with 80 preset effect programs ready to

use, or the presets can be edited to suit individual needs and tastes and stored in any of 100 internal memory locations. The SPX990 also accepts external memory cards that can store an additional 100 programs each.

The SPX990's three-stage effect configuration allows a user to add pre and post effects to polish the sound of a signal. The SPX990 is designed to think like a musician. Delay time programming is either in terms of tempo or note length or in milliseconds. Delay time can also be entered via MIDI clock data or a footswitch. The pitch change program uses a dynamic waveform analysis technique to insure that a pitch change creates an appropriate harmony.

Available effects on the SPX990 include: reverb, early reflections, delay and echo, modulation, pitch change, pan and freeze.

For information, contact **Yamaha Corp. of America in California at 714-522-9011; fax: 714-739-2680; or circle Reader Service 140.**

The SPX990's three-stage effect configuration allows a user to add pre and post effects to polish the sound of a signal.

Available effects on the SPX990 include: reverb, early reflections, delay and echo, modulation, pitch change, pan and freeze.

BURK

Burk Technology LX-1 Eliminates Patching

PEPPERELL, Mass. The LX-1 stereo selector from **Burk Technology** is designed to improve control room operation by reducing demands on the air console and eliminating the need to patch for alternate program sources.

If programming originates from more than one studio, the announcer simply presses the appropriate "Take" button, putting his or her console on air. The transition is smooth and quiet, the levels are consistent and the master control console is off-line. Tallies in each studio make it clear as to which studio is on air.

The LX-1 allows on-line switching of up to six stereo sources, and it transitions softly, without pops or clicks.

There are two-left, two-right isolated outputs. Distortion is less than 0.005 percent at +28 dBm, 20 Hz to 20 kHz. Frequency response is ± 0.1 dB, 20 Hz to 20 kHz.

A "Loop" function allows users to bypass an audio processor which may be connected to the output of the switcher.

For information, contact **Phil Halter in Massachusetts at 508-433-8877; fax: 508-433-8981; or circle Reader Service 105.**

AEV

Exclusive FM Offers Full Programmability And Brilliant Sound

BOLOGNA, Italy The Exclusive FM audio processor from **AEV** provides complete control of the output signal of radio transmissions.

The Exclusive FM features: 10 bands of stereo processing per channel; independent control of variables, such as clipping, threshold limiting, gain and attack; AGC drive and release adjustment; active balanced I/O; and an internal pink noise generator.

A user can program more than 40 process parameters to customize sound, and 246 different personalized equalization curves can be stored by a user. Another 10 are pre-programmed in the Exclusive FM's memory to suit most common music formats.

Options include a digital stereo encoder; transformer balanced I/O; and AES/EBU and fiber optic digital audio I/O.

For information, contact **Luca Bergonzini in Italy at 39-51-950-350; fax: 39-51-950-201; or circle Reader Service 127.**

AUDIOARTS

Digital Distribution Amplifier from Audioarts Engineering Adapts to a Range of Applications

SYRACUSE, N.Y. The SDA-8400 distribution amp from **Audioarts Engineering**

provides digital audio performance in a single rack unit of space. It can be user-configured for one stereo in by eight stereo out; one mono in by 16 mono out; two stereo in by four stereo out; one stereo in by four stereo out; or one mono in by eight mono out. Output is controlled by front-panel 15-turn trims with a 21 dB range.

The SDA-8400 features heavy duty, rear-panel Moldex three-pin connectors for each I/O channel. All I/Os are electronically balanced.

Audio quality of the unit exceeds the requirements for 16-bit digital in the analog domain. Distortion is 0.002 percent (20 Hz to 20 kHz, +4 dBu). Noise is -95 dBu. The sound is exceptionally clean and its specifications are reflected in the



end sound.

For information, contact **Rick Strage in New York state at 315-452-5000; fax: 315-452-0160; or circle Reader Service 137.**

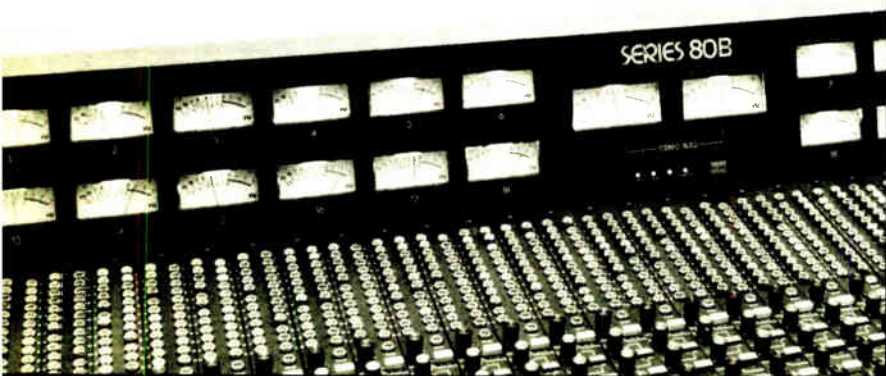
In fact, with over 60% of our line new in the last few years, we can probably offer you same day delivery on products the competition hasn't even heard of. All developed in cooperation with leading equipment manufacturers to guarantee compatibility, and assure you of Belden's renown reliability and signal integrity.

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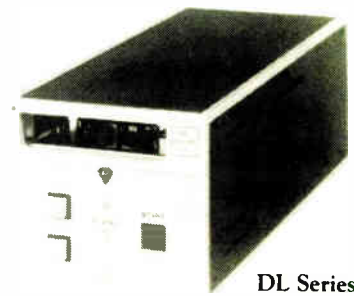
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QEI

QEI Stereo Generator Uses Digital Signal Composite Technology for Stability

WILLIAMSTOWN, N.J. After introducing the CAT-LINK digital STL system, **QEI Corp.** received requests from engineers for a stand-alone stereo generator that incorporated the CAT-LINK's digital composite signal technology.

quality audio performance. Noise measures at -90 dB, distortion is less than 0.008 percent and separation is greater than 75 dB.

Behind the 710's specifications is a true numeric digital processing system. From its 64-times oversampled FIR filters to proprietary firmware and an 18-bit D/A converter, the 710 generates and controls the signal entirely in the digital domain.

The front panel offers recessed input and output level controls, stereo/mono switching, pilot and pre-emphasis on/off and a test select rotary switch. LED bar graphs provide instantaneous display of the left and right channel input level and output level. The output metering is selectable by means of a composite/main and sub-channel rotary switch.

The rear panel provides composite output, audio input, remote control connections and the Q-Chain connector, which provides a direct digital audio interface to the CAT-LINK.

QEI plans to introduce later this year the option of an AES/EBU digital audio interface for the 710.

For information, contact Jeff Detweiler in New Jersey at 800-334-9154; fax: 609-629-1751; or circle Reader Service 186.



The QEI 710 digital stereo generator offers several advantages over analog designs, including increased apparent loudness, long term stability and CD-



LMA/DUOPOLY CONTOUR MAPS

The **DATAWORLD** LMA/DUOPOLY Market Survey Contour maps present a precise electronic verification of overlapping and intersecting contours.

AM 5 mV/m and FM 3.16 mV/m City Grade contours are shown in full color, including transmitter site indicator. The map is supported with a printout showing all of the stations which appear on the map.

Daily updating of **DATAWORLD'S** AM and FM databases protects against errors and omissions.

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KLARK-TEKNIK

Klark-Teknik DN3601 Offers Programmable Equalization And Digital Control

BUCHANAN, Mich. The new DN3601 from Klark Teknik (K-T) is a "slave" derivative of the K-T DN3600 programmable equalizer, introduced last year.

Like the DN3600, the DN3601 is a digitally controlled, two-channel, third-octave, 30-band graphic equalizer. It can be controlled by a master DN3600, suitable computer or other MIDI control devices, allowing creation of an extensive equalization system offering central, user-friendly control.

With instant recall, it is ideal for a host of post production applications. Other primary applications include permanent installation and live sound.

Up to 64 DN3601 units may be linked

in a single MIDI loop via the Pro MIDI Interface on the unit's rear panel. Slave units may be addressed individually or as a group by a master DN3600, and they too will respond to standard MIDI program change messages.

Being a slave version of the DN3600, the DN3601's front panel requires only twin LED meters, clip LEDs, an LED numerical display and a power switch. For further graphic equalization flexibility, it incorporates variable frequency low- and high-pass filters, in addition to two one-twelfth octave, variable frequen-



cy notch filters. Each DN3601 also offers storage of up to 66 equalizer settings in its own internal memory.

For information, contact Ivan Schwartz in Michigan at 800-695-1010; fax: 616-695-0470; or circle Reader Service 37.

RADIO DESIGN LABS

Stick-On Series from Radio Design Labs Puts Audio Processing Wherever It Is Needed

PRESCOTT, Ariz. The Stick-On series from Radio Design Labs (RDL) includes several audio processing modules, including the ST-CL1, an advanced line-level, low noise audio compressor

with many in-studio uses.

Operation of the ST-CL1 is virtually transparent to the ear, allowing it to be used in front of any input that might overload.

Inputs to cart or reel-to-reel tape recorders are protected against input circuit clipping or tape saturation on peak material.

The ST-CL1 protects digital equipment—including computer-based recording equipment, digital satellite uplinks and digital processing equipment—which may generate audible errors when peak material exceeds sampling input levels.



In the studio, the ST-CL1 compresses preamplified microphone signals to provide constant mic levels or to yield a "beefier" mic sound for announcers.

A pair of ST-CL1s installed between the output of a console and the input of audio distribution equipment can protect all inputs fed by the distribution amp. Feeds from a satellite receiver, which may vary greatly, are substantially levelled by the unit.

Peak levels from audio power amplifiers are effectively controlled when the ST-CL1 is installed at the amplifier input.

Soft knee compression and automatically adjusting compression ratios afford unyielding protection without any of the audible effects typically associated with tight audio peak control.

The unit measures only 2.9 inches by 1.5 inches by 0.5 inches, allowing for easy mounting where compression is needed.

For information, contact Jerry Clements in California at 805-684-5415; fax: 805-684-9316; or circle Reader Service 195.

What is this man doing?

... he is optimizing his audio processing!

You no longer have to compromise your station's sound. Format changes, audience profile variations and cut-to-cut music inconsistencies present challenges that no ordinary processor can hope to deal with. That's why Inovonics pioneered the *Programmable Processor*.

Our Model 250 behaves just like five independent audio processing chains. The AGC action, Compression, Equalization and Limiting of each of these chains can be custom-tailored to any specific audio feed or to any station format. This gives precisely the proper processing to make any program source or format sound its very best. No compromise.

Controlled by station automation, a time clock, or simple manual selection, the 250 provides processing which can change with your programming throughout the broadcast day. What's more, our RS-232 Interface Option can put the 250 under continuous computer control with almost endless processing possibilities.

Has the Inovonics 250 proved to be ahead of its time, or haven't you been keeping up?

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HENRY ENGINEERING

**StereoSwitch from Henry
Distributes Audio
With Passive Switching**

SIERRA MADRE, Calif. The StereoSwitch from Henry Engineering is a three-input audio switcher/router. It accepts up to three stereo balanced audio sources, and selects one source which is sent to the output. It can be used as a studio switcher, remote line selector, or for any situation where audio feeds need to be switched.

StereoSwitch can also be used "in reverse" as a router, sending a single audio source to one of three destinations. This is because StereoSwitch uses passive audio switching: There is no circuitry in the audio path. Gold-plated relays are used for switching, making the unit totally transparent to the source.

StereoSwitch is controlled with any external contact closure or DC voltage. Any push-button switch, relay, logic gate or "open collector" circuit can be used to control the unit. StereoSwitch has LED indicators showing which input is active.



Crosstalk between audio sources is typically 90 dB at 1 kHz; over 80 dB at 10 kHz.

For information, contact Hank Landsberg in California at 818-355-3656; fax: 818-355-0077; fax-on-demand: 818-355-4210, request document No. 118; or circle Reader Service 26.

FM SYSTEMS

**FM Systems Provides
Consistent Audio Level**

SANTA ANA, Calif. The ALM771 Audio Level Master from FM Systems regulates audio program level so that the sound volume—as perceived by the human ear—is consistent even when the source program material differs in amplitude by as much as 25 dB. The input power variation is corrected to within 0.5 dB of the desired audio level.

Each ALM771 regulates the audio power level of one monaural channel. Two units can be connected together with a control jumper wire to enable them to operate together to control the level of a stereo signal.

The ALM771 incorporates a program dependent gating system to insure that a background sound remains at a constant level—even during pauses in foreground speech. Program-Dependent Loudness Control Time Constants ensure that sudden short-term sound effects, e.g., a gun shot or door slam, do not affect background sound levels.

The dual frequency band control systems also insure that pulses of low frequency sound do not cause pumping of higher frequency program material.

All of this is done without noise pumping, program pumping, ducking or any other artifacts resulting from level control being exerted by the ALM771.

For information, contact Frank McClatchie in California at 714-979-3355; fax: 714-979-0913; or circle Reader Service 124.

DRAWMER

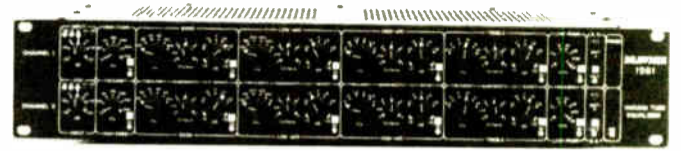
**Two-Channel Drawmer Vacuum Tube Equalizer
Provides Spectral Control with 'Warm' Sound**

WAKEFIELD, England The Drawmer 1961 Vacuum Tube Equalizer is a two-channel equalizer that combines spectral control with the warmth and sweetness commonly associated with vacuum tubes.

Each channel has an input level control and level meter, allowing a user to optimize the signal and drive the tubes hard or gently as required. Each of the four main equalizer bands uses a separate tube section for increased harmonic clarity, providing "soft clipping," which may easily be controlled using the input level adjustment and LED indicators.

The four main equalizer sections have six switchable, overlapping frequencies and bandwidth variable from 0.3 octaves to 3 octaves with ± 18 dB

boost or cut. This fully balanced system includes a variable high pass section allowing a 12 dB/octave roll-off from 20 to 500 Hz, and a variable low pass section providing 12 dB/octave attenuation from 5 kHz to 35 kHz.



For information contact Barry Fox at QM1 in Massachusetts at 508-435-4243; fax: 508-435-3666; or circle Reader Service 43.

Weirdo on line one. Bitter psycho on two. Irritated mom on three. Religious zealot on four. Talk radio seems so simple. At least your phone system is, if it's the new TS612 from Gentner.

The TS612 is a six-line (expandable to 12) Telephone System. It features Gentner's Direct Connect Technology™, which allows you to hook it into a regular phone line. Plus, its built-in handset and keypad eliminate the need for another screening phone. With the TS612, you can talk to callers (even the Pizza Guy) off-air, while other callers are on-air.

Technologically, the TS612 features built-in mix minus, to complement Gentner's digital audio enhancement. It has two DCT Superhybrids, automatic level control, dual air control surfaces, optional screener control surface, and dual audio bus operation. You also have DCT connection to your hard disk or studio PC, for screening and controlling calls. But what would you expect—the TS612 was designed specifically for talk shows

See your Gentner rep today, or call 1-800-945-7730 and make your life easier with the TS612. After all, that psycho's still on line two.



Gentner

1-800-945-7730



TECHNOLOGY UPDATES

EVENTIDE

**Eventide Ultra-Harmonizer
Creates Custom Effects**

LITTLE FERRY, N.J. The DSP 4000 Ultra-Harmonizer effects processor from Eventide is not just a sophisticated digital effects processor and an elegant production tool, it is a whole new way to create customized effects.

With its unique Algorithm Construction Kit, the DSP 4000 lets users build totally new effects algorithms of their own by linking modular effects "building blocks" selected from a graphics-based, user-friendly LCD screen. Users choose from 90 effects modules and use up to 40 in one preset, in whatever combination and configuration they desire.

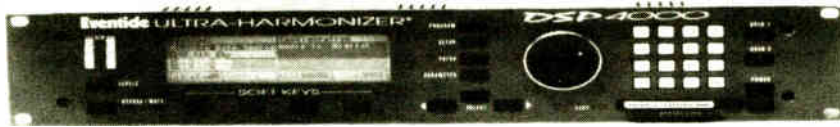
The Patch Editor on the DSP 4000's front panel, which effectively constructs effects programs from modules, simplifies the algorithm building/editing process. Factory effects can be edited this way, and the new programs created can be saved to use

over again or entirely new programs can be created.

The DSP 4000's front-panel removable memory storage card lets a user create a new preset, save it, then store it on a memory card to use in other DSP 4000s.

It includes more than 215 programs, including a six octave pitch shift range, delays up to 10 seconds, reverbs, EQ, dynamics processing, envelope generators and more.

The DSP 4000 features 18-bit A/D and D/A converters and 24-bit internal processing for 97 dB dynamic range and 0.005



percent THD. It uses 32, 44.056, 44.1 and 48 kHz sampling rates, and flexible remote control interfaces include MIDI In/Out/Thru jacks and PA422 serial port data.

For information, contact Gil Griffith in New Jersey at 201-641-1200; fax: 201-641-1640; or circle Reader Service 71.

EMT

**Natural-Sounding, Full
Bandwidth Effects with
EMT Model 248 Processor**

KIPPENHEIM, Germany New from EMT is the model 248 Digital Audio Processor. The two rack space unit offers a wide range of natural-sounding, full bandwidth reverb effects: from cathedrals and concert halls to small rooms and stairwells. The 248 also provides echo, delay, stereo synthesis, M/S decoding and stereo channel balance (in the digital domain).

The clean, uncluttered control panel and LCD display make this unit fast and easy to use. Up to 120 user programs can easily be named and stored.

In addition to the standard programs, optional ones can be loaded in via plug-in cartridges, for which a front panel slot has been provided. Currently available are the EQ program module and the real time adaptive dynamic noise filter program module, the latter being very effective in restoring old, noisy recordings. Other cartridges to follow include dynamics processing and de-clicking.

The 248 features a true stereo-in, stereo-out signal path. It is equipped with both AES/EBU 24 bit digital and balanced XLR analog I/O. Input and output of external word clock is through two BNC connectors.

For information, contact Jerry Graham at G Prime Ltd. in New York City at 212-765-3415; fax: 212-581-8938; or circle Reader Service 77.

SYMETRIX

**Symetrix 602 Unit Links
Three Processing Blocks**

LYNNWOOD, Wash. In response to a strong demand from engineers in need of a programmable processor for stereo sources, Symetrix developed the 602 Stereo Digital Processor.

The 602 is a digital domain audio toolbox that integrates three essential processing blocks into one user friendly package: parametric EQ, multidynamics processing and time domain effects—all simultaneously. It includes a compressor/limiter, expander/gate, de-esser, dynamic filter noise reduction, automatic gain control, EQ/notch filter and digital delay with chorus and flanging.

Designed as an in-line device, the 602 provides all the tools needed to enhance and control on-air voices, music programs and transmitter feeds. It is equally at home in production studios where its digital and analog I/O and ultra-clean sound quality make any recording task a breeze. The user interface offers instant access to all the processing controls. A single button push moves one from EQ adjustments to the compressor threshold control.

Eighteen-bit, 64-times oversampling A/D converters and a 24-bit internal data stream provide mastering quality performance. Eight-bit delta-sigma D/A converters insure high-frequency linearity and zero-phase error between channels with over 100 dB dynamic range.

There are 256 presets, 128 factory and 128 user-defined. Two levels of front panel security protect all parameter settings, and the entire contents can easily be copied via MIDI to floppy or hard disk.

For information, contact Jon Bosaw in Washington state at 206-787-3222; fax: 206-787-3211; or circle Reader Service 85.

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Robert Reymont, KVRV, Phoenix, AZ

"It's truly amazing to drive 120 miles from the studio, hear an FM broadcasting with a totally quiet signal, and know it originated five hops back."

Jim Travis, Family Life Network, Bath NY

"The DSP 6000 allowed us to run both our FM's from one studio over one STL. We got cost savings and digital fidelity."

Chris Reid Murray, KMGE & KKNV, Eugene, OR

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Robert Lear, KTWW, Hollywood, CA

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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.

New 10 kW FM amp under \$24,000. Call for details. Bill Hoffman, 518-743-1601.

Want To Buy

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

ANTENNAS/TOWERS/CABLES

Want To Sell

Pirot 160' Self-Supporting tower, new in 1987 w/original prints, \$18,000. Andrew 7Ghz waveguide, 295' & 13' w/24" flex section, \$1900. Stephen Buzzy, WKJG-TV, Fort Wayne IN 219-422-7474.

Radiation Systems P9A120G (3), grid 940-960 MHz STL xmit/rec, \$3300; Radiation Systems P9A72G (2), grid 940-960 MHz STL xmit/rec, \$1950. J Stanley, Colfax Communications, 60 S 6th St, Minneapolis MN 55402. 612-373-0104.

Harris FMXL 3 bay CP FM, on 99.3, \$1500. KLBQ, 1904 W Hillsboro, El Dorado AR 71730. 501-863-5121.

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Want To Buy

6 bay CP med power, or 4 Bay horiz/low power on 100.1. D Crepps, Big Tree Comm, 29673 Silver St, Val Verde CA 91384. 805-294-9441.

AUDIO PRODUCTION

Want To Sell

Orban 245 E, stereo synthesizer, mint cond, will trade for click & pop filter for records. \$200. C Jennings, CJ Recording, 1300 Robeson St, Reading PA 19604.

Valley 400, mic processor, \$340. J Stanley, Colfax Communications, 60 S 6th St, Minneapolis MN 55402. 612-373-0104.

Orban 536A, sibilance controller, \$550. J Stanley, Colfax Communications, 60 S 6th St, Minneapolis MN 55402. 612-373-0104.

Orban 111B reverb unit, \$480; Orban 245F stereo synthesizer, \$250; Orban 222A, stereo spatial enhancer, \$550; Orban 290RX, \$1000. J Stanley, Colfax Communications, 60 S 6th St, Minneapolis MN 55402. 612-373-0104.

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

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Dolby NR Type A-301, matched pair, \$1100/BO; EMT 420 gold foil reverb, vgc, \$2500/BO; MXR Digital Delay 113, BO; Orban reverb 105-C/BO; Soundcraft EQ 2012/BO. R. Smith, 318-227-1200 CT.

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Gentner GT300 teleconference unit, new in box, \$750; Shure AMS 4000 new, no manual, \$900; Dyaxis I, system sync, DSP card, 320 HD, Mac Portrait display & Mac II driver card, very good condition, \$2750, plus shipping. Klay, 801-272-1814.

Want To Buy

MERCENARY AUDIO

WANTS TO BUY YOUR:

NEVE-SSL-TRIDENT-AMEK
UREI-TELETRONIX-FAIRCHILD
PULTEC-LANG-LEXICON
UNIVERSAL AUDIO-NEUMANN
AKG-TELEFUNKEN-AMS

ANYTHING THAT IS
OF EXCEPTIONAL
AUDIO QUALITY!

TOP DOLLAR PAID

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(508)543-0069 TEL
(508)543-9670 FAX

AUTOMATION EQUIPMENT

Want To Sell

Schaffer 903 comp automation system, victim of simulcasting, 60" racks (5), ITC-750 (4), SMC Carousels (6), printers, battery backup, 25 Hz generator, TTY for encoding, all works, will sell parts, \$2000 FOB Portland OR. M Everhart, KXYQ, 111 SW 5th, Portland OR 97204.

BE Control 16 brains with audio switchers (2); Otari ARS 1000 R-R in excellent condition (5); working SMC Sonomag Carousels (2); SMC Sonomag Carousels good for parts (3); ITC triple stacker cart machine with R/P/B; ITC triple stacker with PB only, cabinets included. M Jones, WZKB, POB 520, Wallace NC 28466. 910-285-4900.

Harris 9000 perf for sat operations, ITC 750, Carousels (3), triple deck, CRT & cables, \$2000. T Beschta, WAQE, POB 703, Rice Lake WI 54868. 715-234-9059.

CART MACHINES

Want To Sell

Digicart w/one gigabyte, \$5950. J Hepler, WOLV-FM, 234 Union St, Millersburg PA 17061. 717-362-1099.

Great Prices on original equipment tape heads for ITC, BI, Fidelipac, Otari, Tascam & others!

HE HALL Electronics
(804) 974-6466 • FAX 6450

ITC 99B PBs (3), mono PB (6), Audi-Cord stereo PB (2). J Phillips, 414 Washington Ave, Defiance OH 43512. 419-782-8591.

AMPRO-SCULLY CONSOLES
CART RECORDER
PARTS AND SERVICE
SEQUOIA ELECTRONICS
(408) 363-1646

ITC Delta R/P, excellent condition, less than 1 year old, stereo, \$1500/BO. C Scherer, WZAK, 2510 St Claire, Cleveland OH 44114. 216-621-9300.

3 deck mono all tone, \$750/BO. Jim, 419-782-8591,

BE tape delay R/P, like new; Gates/ATC mono cart w/1 record amp (6), lots of spare modules. J Kuenzie, KFYE, 511 W 5th St, Washington MO 63090. 314-239-0209.

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.



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

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.

Sony MDS-B2P pro MiniDisc player, new, does not power up, slight ding on bezel, \$750. Klay, 801-272-1814.

Want To Buy

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

HE HALL Electronics
1305-F Seminole Trail Charlottesville VA 22901

WHY is HALL Electronics for YOU?

You'll like our GREAT PRICES on NEW & REBUILT EQUIPMENT. WE CARRY MOST BRANDS.

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LPB SALSALSA - \$ 8995

386DX33 PC System with 1 Gigabyte Hard Drive
Open-ended architecture, always upgradeable
Simultaneous Record and Play of audio
Stereo and Mono audio
User-controlled variable audio overlap for live-sounding segues
Accepts downloads from all traffic and music scheduling systems
Provides a 31-Day historical log of everything that aired and when
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7000 Series Consoles

12-Channel and 18-Channel Stereo Consoles



- Front panel switches rated for 5,000,000 operations
- Gold contacts throughout
- Modular electronics behind unitary front panel
- Penny & Giles 3000 Series linear faders
- It cost less to own quality LPB equipment than you might think!

Fax: (804) 974-6450

EMPLOYMENT

To place ads in this section, use the ActionGram form. To respond to box numbers write Radio World, PO Box 1214, Falls Church, VA 22041. Attn: _____

POSITIONS WANTED

Mama's Dead radio talk host, David F Diamond is ready for new, Major market. 901-761-5577.

High energy, positive personality, perfectionist, reliable, team player, fun and common sense, attitude is everything, innovative, desire announcing, programming, production position. Gee, 405-722-8720.

Straight out of school and ready to go to work, sales, on-air, promo, prod, reporting. Jason, 405-733-2511.

Broadcaster with 16 years experience, sales training by J Jennings, degree, concert promoter, will relocate. 908-671-6491.

Broadcasting graduate, AM/FM/TV, 19 years experience, Gen/Radar, SBE certification, assistant engineering experience, prod, CD. 606-523-0901.

#1 Market Jock w/CHR, AC & PD exp, seeking new challenge. 201-728-3730.

Sportscaster, 8 yrs local level, ready for larger mkt, can paint the picture, Costas-like humor. JT, 417-673-1111.

Husband/Wife broadcast professionals w/25+ yrs exper, wishing to relocate to small market. Interested in FM only, or AM/FM combo, in NW Ohio, Michigan, Wisconsin, Minnesota, or N. Dakota only. We will locally own and operate station. We have good track record for sales, operation, and community service. Send rate card, description of assets and property, year end statement, and terms. All replies will be kept very confidential. Serious replies only! Send replies to: Radio World, POB 1214, Falls Church VA 22041. Attn: Box #94-06-01-1RW.

HELP WANTED

Leading jingle company looking to fill professional sales positions throughout the U.S.. Send resume, references and salary history to: Radio World, POB 1214, Falls Church, VA 22041. Attn: Box #94-06-15-1RW.

Advertise in
Radio World
For Details, Call
1-800-336-3045
TODAY!

ACTION-GRAM

EQUIPMENT LISTINGS

Radio World's Broadcast Equipment Exchange provides a FREE listing service for radio stations and recording studios only. All other end users will be charged. Simply send your listings to us, following the example below. Please indicate in which category you would like your listing to appear. Mail your listings to the address below. Thank you.

Please print and include all information:

Contact Name _____
Title _____
Company/Station _____
Address _____
City/State _____
Zip Code _____
Telephone _____

Brokers, dealers, manufacturers and other organizations who are not legitimate end users can participate in the Broadcast Equipment Exchange on a paid basis. Line ad listings & display advertising are available on a per word or per inch basis.

I would like to receive or continue receiving **Radio World** FREE each month.

Yes No

Signature _____ Date _____

Please Circle only one entry for each category:

I. Type of Firm

- | | |
|------------------------------|---------------------------------|
| D. Combination AM/FM station | F. Recording Studio |
| A. Commercial AM station | K. Radio Station Services |
| B. Commercial FM station | G. TV station/teleprod facility |
| C. Educational FM station | H. Consultant/ind engineer |
| E. Network/group owner | I. Mfg, distributor or dealer |
| | J. Other _____ |

II. Job Function

- | | |
|---------------------------|--------------------------|
| A. Ownership | G. Sales Manager |
| B. General management | E. News operations |
| C. Engineering | F. Other (specify) _____ |
| D. Programming/production | |

WTS WTB Category: _____
Make: _____ Model: _____
Brief Description: _____
Price: _____

WTS WTB Category: _____
Make: _____ Model: _____
Brief Description: _____
Price: _____

WTS WTB Category: _____
Make: _____ Model: _____
Brief Description: _____
Price: _____

*Closing for listings is every other Friday. Please be aware that it does take approximately 1 month for your listings to appear. They will then appear for only 2 issues. If more time is needed, please re-submit your listings.

BROADCAST EQUIPMENT EXCHANGE

Phone: 703-998-7600 PO Box 1214, Falls Church, VA USA 22041 FAX: 703-998-2966

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STUDER SERVICE SPECIALIST

Thousands Served • Unbeatable Rates
Precision Capstan Resurfacing
Audio Advantage
Tel (615)742-3834
PRICE-QUALITY-SERVICE
Let Us Prove It

Want To Sell

Ampex 350 7.5 & 15 full trk unmounted, gd cond, \$250; Scully 280 7.5 & 15 speed, unmounted 2 track stereo, needs refinishing, heads & electronics vgc, w/manual, \$350; Telex 6120, deck & electronics mounted in cabinet, needs heads, 16:1 ratio, \$750. C Jennings, CJ Recording, 1300 Robeson St, Reading PA 19604.

Sony TC-399 R-R, stereo, gd cond, \$35. J Cunningham, KEOR/KHKC, Rt 2 Box 113 B, Stonewall OK 74871. 405-265-4496.

Otari MX5050, Mark III-8 8 trk, mint cond, w/8 chnlis or dbx 150 noise reduction, dust cover, remote, very low hrs, \$2500. Larry, 212-463-9426.

Tascam 32 7.5 & 15 ips, gd cond, ltd use, \$500. F Reagan, Special Bdcet Svc, 203 Westville Ave, Danbury CT 06811. 203-743-7433.

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

Otari ARS-1000 (6), w/spare parts/cards, exc cond; Scully 280, 14" w/stereo R/P electronics; Ampex 351 (2) R/P, new heads; Spotmaster 505 PB. J Kuenzie, KFXE, 511 W 5th St, Washington MO 63090. 314-239-0209.

Otari MX5050 III BRC, MX5050 4 track, Tascam 25-2, Teac 40-4, Technics 1520 & MX5050 parts only. Jim, 419-782-8591.

Radio Systems RS-1000 DAT machines, automation ready, rack mounted, almost new, \$1500/BO. S Hill, KCAM, POB 249, Glenallen AK 99588.

Recordex Stereo X, 5 copies from cass master, heads need alignment, gd cond, \$1000 or trade for reel recorder. C Jennings, CJ Recording, 1300 Robeson St, Reading PA 19604.

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

Otari 5050B MK III-2, 1/2 track, professional broadcasting tape deck, console model, brand new, less than 30 hrs use, must sell, \$2500/BO. P Accardi, 717-586-4469.

Tascam ES-51 controller, ES-50 synchronizers (2), reads 1/20-100 x play speed, 29.97,30.24 & 25 fps, autopunch, 20 scratchpad memories, sub-frame accurate (1/100) off-set trimming, allow multitrack analog sync to video for editing, cables, manual, \$2100/BO + shipping. D Crepps, Big Tree Comm, 29673 Silver St, Val Verde CA 91384. 805-294-9441.

Ampex ATR-800 4 trk, 1/2" R-R, needs repair or use for parts, BO. T Rusk, KSSN, Little Rock AR. 501-227-9696.

STUDER/REVOX

Factory Authorized Service
"Superlative Service"
Over 14,000 units serviced! Fast turnaround w/War. Huge parts inventory. New/Used Equip., Capstan shaft resurfacing.

STUDIO-SONICS

450 W. Rand Road
Mt. Prospect, IL 60056
708-670-0025

Sony PCM-F1 digital recording system modified w/Apogee input filters and external sync input, system capable of locking to external video house sync, incl 2 SL-2000 portable Beta recorders, AC power supplies, NiCad batteries, tuner-timer module, cables, road case, complete system \$1500; F1 processor only \$1000. R Streicher, Pacific Audio-Visual Enterprises, 545 Cloverleaf Way, Monrovia, CA 91016. 818-359-8012.

Scully '100' recorders, record/play amplifiers, 8, 16, 24 track heads. Sequoia Electronics, 4646 Houndshaven Way, San Jose CA 95111. 408-363-1646.

HEAD RELAPPING/REPLACEMENT

All tape and film formats
30 years experience

iem

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

Otari Mark II-IV 1/2" 4-track, multi-track, mint, less than 50 hours, BOR. R Kaufman, Pams Productions, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

Recordex 6 cassette rewinder \$100; Tascam 40-4 4 trk 10" in flight case w/tree dbx \$750; MRL new short test tapes \$39 for 1/4" to \$199 for 2". W Gunn 619-320-0728.

MCI-110C/VP (3), two in vgc, \$750 ea, one gd for parts, \$500. No remotes/manuals; Ampex AG350/351 FT mono, 2-trk, in orig cabinets, \$500 ea/BO; Several Ampex 350-351 electronics & parts avail; Otari MX5050 2-trk, vgc, \$750; Teac 7300 2 trk w/rack mounts, very clean, needs power transformer/BO; Revox A77, gd for parts/BO. R. Smith, 318-227-1200 CT.

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.

Want To Buy

Otari MX5050BII (2) at DIRT CHEAP prices for P/T at NCE-FM station. Robert 214-226-2949.

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.

COMPUTERS

Want To Sell

Exabyte 8205 2.5 gig DAT tape backup, full height internal, SCSI interface, \$595; external unit w/power supply, \$650. G Wachter, KFYI, 631 N 1st Ave, Phoenix AZ 85003. 602-252-6161.

Want To Buy

Tandy 6000HD w/at least 1 floppy drive. Mel Crosby, 408-363-1646, FAX 408-363-0957.

CONSOLES

Want To Sell

Shure M67, mic mixers (2), exc cond, \$300 for both or \$160 ea. 818-785-2324.

UREI Mod One, 5 pot, slide faders, \$400. M Everhart, KXYQ, 111 SW 5th, Portland OR 97204.

Pacific Recorders Radio Mixer 20, \$12,000. J Stanley, Colfax Communications, 60 S 6th St, Minneapolis MN 55402. 612-373-0104.

BE Omega 10, 10 chnl, 40 input stereo w/slide faders, removed from service 4/94, extra preamp cards, \$2000/ BO. C Guglielmetti, Edgewater Co, 232 C St, San Francisco CA 94080. 415-589-3313.

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

CONSOLES...WTS

Auditronics 110 Grandson, 8 mono, 10 stereo input modules, Penny & Giles faders, foldback mix, tone generator, slate w/manual & power supply, \$2200. D Small, KNDD, 1100 Olive Way #1550, Seattle WA 98101. 206-622-3251.

Soundcraft Spirit 163 mixing console, 16 inputs, sep assignable stereo and mono outputs plus 4 aux busses, mods incl pre/post fader switches for Aux-2, tape return to monitor, line level monitor outputs, mono-sum to monitor, exc cond, \$1550. R Streicher, Pacific Audio-Visual Enterprises, 545 Cloverleaf Way, Monrovia, CA 91016. 818-359-8012.

Soundcraft series 200, 8 chnl mixer, nice cond, \$700. M Berg, 612-670-0364.

Fostex 2050 line mixer, 10 (8+2) line level inputs, stereo outputs, includes rack mount adaptors, \$100. R Streicher, Pacific Audio-Visual Enterprises, 545 Cloverleaf Way, Monrovia, CA 91016. 818-359-8012.

Yamaha PM-1800, 32 x 8, one owner, SN1032 w/fader & noise upgrade kit in excellent cond. Used in private prod studio, \$10,500, will negotiate. R. Smith, 318-227-1200 CT.

Ramko DC5AR 5 channel mixers, vgc, \$175 each. 916-725-2434.

DISCO-PRO SOUND EQUIPMENT

Want To Sell

Solar Black speaker grill cloth, 50 yds by 72" wide, \$225/BO + shipping. F Stadler, 3912 Liberty Blvd, Westmont IL 60559. 708-852-6654.

Electrovoice EV100 monitor speakers (2), \$540. J Stanley, Colfax Communications, 60 S 6th St, Minneapolis MN 55402. 612-373-0104.

Yamaha R1000 digital reverb, good condition, \$100/BO + shipping; Biamp SM23, crossover 3-way mono, 2-way stereo, good condition, \$99/BO + shipping. F Stadler, 3912 Liberty Blvd, Westmont IL 60559. 708-852-6654.

FINANCIAL SERVICES

EQUIPMENT FINANCING ON ALL RADIO EQUIPMENT

- Easy to qualify
- Fixed-rate, long-term leases
- Any new or used equipment
- 100% financing, no down payment
- No financials required under \$50,000
- Refinancing existing equipment



Call Mark Wilson (800) 275-0185

FURNITURE

Want To Sell

Revox PR-99 roll around cabinet accessory, used 3 mos, \$250. F Reagan, Special Bdct Svc, 203 Westville Ave, Danbury CT 06811. 203-743-7433.

LIMITERS

Want To Sell

CRL SMP-850, \$1175. J Stanley, Colfax Communications, 60 S 6th St, Minneapolis MN 55402. 612-373-0104.

Valley People Gain Brain II, new modules (2), no boxes, \$90 ea/ or BO + shipping. M Shea, Precision, POB 723, New York NY 10276. 212-989-3684.

CRL SEC-800 multiband processor, \$1175; **CRL SGC-800**, multiband AGC, \$1125. J Stanley, Colfax Communications, 60 S 6th St, Minneapolis MN 55402. 612-373-0104.

Texar Audio Prisms multi band, pair w/manuals, \$1500. M Berg, 612-870-0364.

CBS Labs Volumax limiter, \$50. M Everhart, KXYQ, 111 SW 5th, Portland OR 97204.

Orban XT-2 6 band limiter for 8100A, DAP 310 (2), CRL SEP 800, CRL PMC-300, CRL Dynafex DX-2. Jim, 419-782-8591.

Modulation Sciences Stereo Maxx, \$1400, Aphex Compellor, \$1000. J Stanley, Colfax Communications, 60 S 6th St, Minneapolis MN 55402. 612-373-0104.

Aphex 104 Aural Exciter w/Big Bottom, like new, \$200. K Thomas, Rebel Recording, 5555 Radio Lane, Jacksonville FL 32205. 904-388-7711.

Want To Buy

Gregg Labs 2530 tri band AGC processor, need urgently, J Mauk, KMJ/KSKS, POB 70002, Fresno CA 93744. 209-266-5800.

Orban Optimod 8100. S Garner, KCJH, 9019 West Lane, Stockton CA 95208. 209-477-3690.

903 (looking for 4) and 905 (looking for 2), just the modules, not the frame. R Streicher, Pacific Audio-Visual Enterprises, 545 Cloverleaf Way, Monrovia, CA 91016. 818-359-8012.

Fairchild 670 or 660 tube compressor/limiter, Teletronics LA-2A tube compressor/limiter or UREI LA-3A solid state compressor/limiter, call after 3PM CST. 214-271-7625.

MICROPHONES

Want To Sell

EV RE-20, Sennheiser 421, in boxes. Jim, 419-782-8591.

AKG C422EB large diaphragm stereo mic, incl remote pattern selector, operates on phantom power, 20 meter cable, windscreen and shockmount, excellent condition, \$1850; **AKG D-140** dynamic cardioid mics, \$225/pair. R Streicher, Pacific Audio-Visual Enterprises, 545 Cloverleaf Way, Monrovia, CA 91016. 818-359-8012.

RCA 77D, \$750. Gene Games, 908-850-3826.

Manley Labs CR3A, new, \$795 w/shockmount, windscreen & case, no risk trial in your studio. Also have used mics & everything else. Get our catalog! Liberal trade policy too. Audio Village, 619-320-0728.

Collins 212Y circa 1930, orig case, exc cond, BO. F Reagan, Special Bdct Svc, 203 Westville Ave, Danbury CT 06811. 203-743-7433.

Want To Buy

Neumann U87s, KM84s, AKG 451s, EV RE20s, Sennheiser 421s. W Gunn 619-320-0728.

RCA 77DXs/44BXs ribbon, chrome/TV grey, gd cond, BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

77-DX's, 44-BX's, WE KU-3A's On-Air lights, recording lights & audition lights. Top price paid. Fast response. Bill Bryant Mgmt, 2601 Hillsboro Rd, G12, Nashville TN 37212. 615-269-6131, FAX: 615-292-3434.

MISCELLANEOUS

Want To Sell

Novatel HS-3300, cellular phone w/12V battery pac, carry case, full 3W, gd cond w/antenna, \$100. J Cunningham, KEOR/KHCC, Rt 2 Box 113 B, Stonewall OK 74871. 405-265-4496.

Electro-Impulse 10 kW, air cooled dummy load; **Omega** line 80 kW water cooled dummy load, 50 SL, 10 GPM; **Scala PR 450**, 940-960 MHz paraffector STL antenna. M Everhart, KXYQ, 111SW 5th, Portland OR 97204.

Bud equipment rack 70" of 19" rack space, 16 gauge steel w/black finish, detachable back door w/vents on both sides of cabinet, 17" deep, mint cond, \$300. B Cuson, Tape-Tracks, 2275 Yargerville Rd, Lasalle MI 48145. 313-241-6695.

Shure ST-3000 oak speaker-phone/teleconference system, w/mic/speaker wheel, control unit w/in/out jacks & dial pad, \$495; original AT&T speaker phone & mic unit, \$50. G Wachter, KFYI, 631 N 1st Ave, Phoenix AZ 85003. 602-252-6161.

JVC HR-S10U portable VHS recorder w/companion tuner/timer unit, \$300 complete. R Streicher, Pacific Audio-Visual Enterprises, 545 Cloverleaf Way, Monrovia, CA 91016. 818-359-8012.

Want To Buy

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

MONITORS

Want To Sell

Gates FM & SCA modulation monitor; TFT EBS receiver-encoder. Jim, 419-782-8591.

JBL 4333 matched pair, SN 11261, 11262, \$750 pr; **JBL 4315** walnut/BO; **Yamaha NS-10M**, matched, \$400. R. Smith, 318-227-1200 CT.

Want To Buy

McMartin (buy & sell) any model. C Goodrich, 11435 Manderson, Omaha NE 68164. 402-493-1886 or fax 402-493-6821.

RECEIVERS & TRANSCEIVERS

Want To Sell

SCA RECEIVERS—ALL TYPES

Reading Service / Ethnic / Data Professional / Table Will work to meet your receiver needs

DAYTON INDUSTRIAL CORP. (Manufacturer)
2237 Industrial Boulevard
Sarasota, FL 34234
Tel: 813 351 4454 FAX: 6081

Muzak SCA rcvr for 104.5, Realistic stereo AM tuner. J Kuenzie, KFXE, 511 W 5th St, Washington MO 63090. 314-239-0209.

AM STEREO RECEIVERS
From \$34.95 Portable, Home, Auto
RRADCO
Phone/FAX 708-513-1386

GE Superadio III, custom modified w/noise free SCA w/improved selectivity & sensitivity, \$95. Other modifications avail. Performance guaranteed. **800-944-0630**.

REMOTE & MICROWAVE EQUIP

Want To Sell

Marti tube receiver 450 MHz, antennas, 200 ft 1/2 feedline, mobile sound systems, 12 VDC, complete. Jim, 419-782-8591.

RENT IT HERE! Call Steve Kirsch for Details

COMREX 1, 2, & 3-Line Extenders Switched 56/ISDN Systems

TELOS Zenaph Digital Phone Hybrids

GENTNER EFT-3100 3-Line Extenders

SHURE FP-410 Automatic Mixers

REMOTE AUDIO PACKAGES

SILVER LAKE AUDIO • 516-623-6114 • FAX: 516-377-4423

Moseley STL 303 mono xmtrs & rcvrs; **Marti SC68H** 38 kHz generator & rcvr. J Kuenzie, KFXE, 511 W 5th St, Washington MO 63090. 314-239-0209.

Burk ARC-16 w/IP-8 relay panel & voice card, 1 yr old, \$2200; **Moseley MRC-1600**, exc cond, \$1200; **Gates RDC-10**, BO. B Spitzer, KKLS, Box 460, Rapid City SD 57709. 605-343-6161.

Lanier 7200, ltd use, remote PU & rec activator, \$200. F Reagan, Special Broadcast Svc, 203 Westville Ave, Danbury CT 06811. 203-743-7433.

Burk TC-8 exc cond, orig purchased in 1987, w/manual, \$1100 shipping prepaid. J Murphy, WMXO, Olean NY, 716-223-3951.

RENTALS
RENTALS
RENTALS

COMREX
3-line extender

Frank Grundstein 610-642-0978
Audio/Video Consultants

INC switched 56 4-wire DSU, v35 interface, \$695. G Wachter, KFYI, 631 N 1st Ave, Phoenix AZ 85003. 602-252-6161.

Intraplex/Intralink 4801-1/4801-2, T-1 link system w/spares, \$16,400; **Aphex**, aural exciter, \$1000. J Stanley, Colfax Communications, 60 S 6th St, Minneapolis MN 55402. 612-373-0104.

Tellabs, STL phone EQS 4008 module, 4425 repeat coil, 248RF dual amp, 1012 housing, \$250/all. M Berg, 612-870-0364.

Symetrix 104 multiline phone hybrid, \$2000. J Stanley, Colfax Communications, 60 S 6th St, Minneapolis MN 55402. 612-373-0104.

Moseley 303C composite STL xmtr & rcvr w/manuals, \$400/BO or trade for low band FE Delta-S 2-way. D Small, KNDD, 1100 Olive Way #1550, Seattle WA 98101. 206-622-3251.

Cetec Vega R42 DII w/D77 xmtr, diversity, one owner, \$1500; (2) **Cetec Vega Pro Mod 58/55**, gd working cond, \$600. R. Smith, 318-227-1200 CT.

Comrex 3XR 3-line decoder, with remote control. Perfect condition. \$2950. S Kirsch, Silver Lake Audio, 2590 Hillside Ct., Baldwin NY 11510. 516-623-6114.

PHONE: 703-998-7600 FAX: 703-998-2966



Call Simone Mullins, Classified Ad Manager, to reserve space in the next issue. Use your credit card to pay, we now accept VISA and MASTERCARD.

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REMOTE MICRO EQUIP...WTS

Hnat-Hindes SX-87 telephone hybrid and homebrew 1A2 type, 6 line switch with keypad, working, great shape, \$550. M Vanhooser, KSKY, 4144 N Central Expy #266, Dallas TX. 214-827-5759.

Symetrix TI-101, phone interface, never used, with manuals, \$275. M Berg. 612-870-0364.

Wegener 1866 FM-2 subcarrier receiver for audio & data, 6 mos old, BO. J Book, KMXG, 3535 E Kimberly Rd, Davenport IA 52807. 319-344-7000.

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SATELLITE
EQUIPMENT

Want To Sell

Scientific Atlanta DAT 32, 15 kHz audio cards (2), voice cue decoder cards (2), for parts or repair cheap. J Kuenzie, KFZE, 511 W 5th St, Washington MO 63090. 314-239-0209.

OuterSpace Experts!

We SELL * TRADE * BUY
SATELLITE EQUIPMENT
317-962-8596



15 kHz card for Dart 384 rcvr. P Baillon, KMCM/KMTA, 1218 Pioneer Bldg, St Paul MN 35101. 612-222-5555.

Wegener audio processing card 1694; low power FM stereo xmtr card 1691-SW tuned to 101.5, use with Wegener main frame for cable radio, excl cond, \$750, you pay shipping. T O'Brien, WTYS, POB 777, Mariana FL 32447. 904-482-2131.

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Want To Buy

LBA, CP or DARK, South and East of Ohio and Mississippi Rivers, Florida included. D Gibson, 214-684-4907.

STEREO
GENERATORS

Want To Sell

Collins stereo generator for 310 series. J Kuenzie, KFZE, 511 W 5th St, Washington MO 63090. 314-239-0209.

TAPES/CARTS/REELS
& CD's

Want To Sell

3M/ITC/Scotchcart II's, 2.5 to 5.5 min carts, like new, \$.50 ea; Mastercarts, w/Xmas music, 50's, 60's and oldies, exc cond, \$.60 ea, will sell all or part in bulk at reduced price. KFEZ Radio, 8615 W 72nd Terr, Overland Park KS 66204. 913-432-5072.

ABCO stainless steel, wire carousels (2), hold 500 carts, like new, \$100 ea/\$175 both. KFEZ Radio, 8615 W 72nd Terr, Overland Park KS 66204. 913-432-5072.

Format Forty-One; 52 reels digitally mastered with legends, \$500; Drake/Chenault Great Gold, 52 reels with legends + 7 reels of Xmas music, \$350; Scotchcarts, 1500 total, most 3-5 mins, availabl 6/1, \$1800. Dave, WCIT/WLSR, 1301 N Cable Rd, Lima OH 45804, 419-228-9248.

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Circle (88) On Reader Service Card

Fidelipac Mastercart II, new in boxes of 10, :20 and :40; Dynamax cobalt tape carts, 5.5 min, 250 carts avail, BO. B Gyorgy, El Dorado Communications, 163 Fail Lane, Placerville CA 95667. 916-622-3818.

10" music reels, various formats, BO. J Egloff, TKR Cable, 5582 Rapid Run Pike, Cincinnati OH 45238. 513-922-7049 after 5 est.

AC/MOR/EZ Christmas library on 24 10.5" reels, stereo, toned, excellent condition, with cue sheets, in boxes, \$600. T O'Brien, WTYS, POB 777, Mariana FL 32447. 904-482-2131.

Pams Jingles ref tapes, 1951-1976, BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625.

SERVICES

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TAPES/CARTS/REELS/CDs...WTS

Karsky's rewind loop carts. Also sell reconditioned carts. Service guaranteed. Call 605-348-9928.

Want To Buy

10" music reels from TM Programming, all formats, exp stereo rock; Rick Dees weekly top 40 records & CDs. J Egloff, TKR Cable, 5582 Rapid Run Pike, Cincinnati OH 45238. 513-922-7049 after 5 est.

18BPre-recorded open reel tapes, including master dubs, RCA, Mercury, Livingston, Westminster, etc, 2 trk, in-line or stacked heads, all categories, labels and artist. P Chance, Imperial Analog, 925 Clinton Street, Philadelphia PA 19107, 215-574-8147.

Fidelipac/Audiopak Mastercart II gold or AA-4 light blue in 2:30 through 4:00 lengths, must be in very good condition, call after 3PM CST. 214-271-7625.

TEST EQUIPMENT

Want To Sell

US Army TS 303/G, made by RCA, radio test set w/orig manual, \$50. J Cunningham, KEOR/KHKC, Rt 2 Box 113 B, Stonewall OK 74871. 405-265-4496.

HP5006A digital signature analyzer w/probes, like new, \$300; Fluke 8012 true RMS digital multimeter w/low ohms & AC/battery option, \$125; Heath/Zenith 500 MHz freq counter, \$95. G Wachter, KFYI, 631 N 1st Ave, Phoenix AZ 85003. 602-252-6161.

TRANSMITTERS

Want To Sell

DEMOED EQUIPMENT

BEHT Inc. has a few demoed exciters, amplifiers and STL's for sale. All demoed systems are sold first come first served and have the same 2 year warranty as BEHT's new equipment. For information: **619-239-8462**

CCA 1 kW, 1280 kHz, rebuilt, works excellent, used tube, \$7000 or \$8000 on your frequency with new tubes + ship. Fax: J Velazquez, 809-840-1588.

McMartin BF 3.5M with current exciter, can be modified to 5.5 kW, new in '82, selling due to power increase, \$15,000/BO; 1 kW Wilkinson in good condition, Gates FM1C for parts, McMartin 15K; Wilkinson 4K, Gates 1K. F Morton, KMGZ, POB 7953, Lawton OK 73506. 405-536-9530.

TRANSMITTERS - TV/FM/AM, new and used. Tubes, xmtr parts. 305-757-9207.

LPB 30 W, traveler info transmitter with antenna & tuning unit. J Kuenzie, KFXE, 511 W 5th St, Washington MO 63090. 314-239-0209.

For the ABSOLUTE LOWEST PRICES on any size transmitters made in the U.S.A.
Call Bill Hoffman for details at **518-743-1601**

Blonder Tongue MAM, FM on 88.5, 100 VAC, 19" rack mount, very good condition, BO. B Gyorgy, El Dorado Communications, 163 Fail Lane, Placerville CA 95667. 916-622-3818.

\$\$\$ TRANSMITTERS FOR LESS \$\$\$

1 KW AM	Gates BC-1G	1 KW FM	Collins 830D1
1 KW AM	Gates Vanguard	1 KW FM	Gates FM-1G
1 KW AM	Collins 820D1	2.5 KW FM	Collins 831D1
1 KW AM	Harris SX-1A	5 KW FM	Harris FM-5H
1 KW AM	Gates BC-1F	5 KW FM	RCA BTF-5D
1 KW AM	RCA BTA-1D	10 KW FM	Harris FM-10H2
5 KW AM	Gates BC-5P2	10 KW FM	RCA-BTF 10D
5 KW AM	Harris BC-5H	20 KW FM	RCA BTF-20E1
5 KW AM	RCA BTA-5H	20 KW FM	Harris FM-20H
10 KW AM	Continental 316F	25 KW FM	AEL 25-KG
10 KW AM	RCA BTA-10H		
50 KW AM	Continental 317C2		
50 KW AM	Harris MW-50A		
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***All transmitters are tuned and tested on your frequency
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Hablo Español

CSI 3kW 1981, single phase, excellent condition, \$10,500; 1989 QEI, 30,000 W, excellent condition, \$28,500. J Davis, SCB, POB 7762, Amarillo TX 79114. 806-355-1187.

QEI 675T300 FM transmitter, excellent condition, \$2900; QEI 675 FM exciter, excellent condition, \$1750. All tested and tuned on your frequency. B Brown at 609-232-1625.

FM - TRANSMITTERS

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RCA 10 kW FM BTF-10C, mint condition, re-worked IPA & PA with Harris MX-15 exciter, out of service 4-20-94, will sell transmitter with out exciter. E Stanford, WAFM, 521 Hwy 278, Amory MS 38821. 601-256-9726.

Harris MS-15, exciter, freq agile, manual & some spare parts, \$1500; CSI (QEI), FM-20-E, freq agile, 20 W exciter and opt meter panel, \$1500. M Berg, 612-870-0364.

Collins 831D-2FM (4), currently on air w/new tube. D Royer, WBBC, PO Drawer 192, Blackstone VA 23824. 804-292-4146.

Spare parts for CCA AM50,000D, including, HV transformer, mod. transformer, mod. reactor, HV filter choke, tube sockets and more. Call Transcom Corporation 800-441-8454 or 215-884-0888.

Want To Buy

Collins 310Z-2 exciter, RF amp module A5, dead or alive. D Voy, KMAQ, 129 N Main, Maquoketa, IA 52060. 319-652-2426.

Harris MW1-A, PA modules, dead or alive; D Voy, KMAQ, 129 N Main, Maquoketa IA 52060. 319-652-2426.

RCA BTF 3E1 or CSI 3 kW. Fax: Heriberto Velazquez, 809-840-1588. **5kW or 10kW** older FM xmtr, reasonable or will trade Unistar Country receiver w/downconverter for xmtr. Please reply to: Radio World, POB 1214, Falls Church VA 22041. Box # 94-06-15-2RW.

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

TUBES

Want To Sell

Penta premium output tubes, EL34HD/\$19, KT88/\$29, 12AX7B, 6072M/PR. R Katz, Allegro Sound, 15004 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

RE-CONDITIONED TRANSMITTERS

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AM Transmitters

50 kW 1978 MARCONI B6034	\$58,000
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10 kW 1980 PYE/TVT LDM 1235/02/01	\$24,000
1 kW MARCONI, Various units	\$6,000

FM Transmitters

10 kW 1986 PYE/TVT 1233/50/02	\$18,000
1 kW 1970 MARCONI	\$6,000
1 kW CTE, NEW	\$9,000

Shortwave Transmitters

50 kW 1970 MARCONI HF	\$52,000
-----------------------	----------



CONTACT:

Ray Anderson
East Anglian Productions
Studio House, 21-23 Walton Road,
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3CX2500A3	4CX250R
3CX2500H3	4X150A
YC130	5CX1500A
4CX15,000A	5CX1500B
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Circle (21) On Reader Service Card

4CX250B, 4-400, 833, 813, 5CX1500, 4-1000, all types, full warranty EIMAC, Amperex, RCA. Westgate 800-213-4563.

For details on advertising rates & deadlines, call Simone at **800-336-3045**

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1 kW FM 1978 Collins 831C2	5 kW AM 1968 CCA AM5000D
2.5 kW FM 1978 CCA 2500R	5 kW AM 1979 Continental 315F
3 kW FM 1975 CCA 3000D	5 kW AM 1977 RCA BTA 5L
3 kW FM 1980 CSI 3000E	10 kW AM 1983 Harris BC10H
3 kW FM 1974 Harris FM3H	
5 kW FM 1991 BE FM5B	

50kW AM 1986 Continental 317C-3 with spare parts
50kW AM 1982 Harris MW50B with spare parts

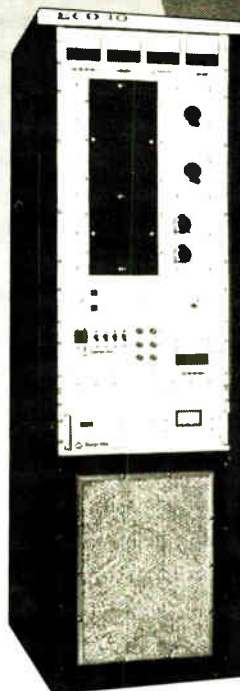
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Circle (57) On Reader Service Card

TURNABLES

Want To Sell

CB77 (3) w/arms & cartridges; Russco mono preamp, Russco stereo preamp; Gates mono preamp. J Kuenzie, KFYE, 511 W 5th St, Washington MO 63090. 314-239-0209.

Gates CB-77 w/stereo Gates preamps M6442, privately owned/used., one of a kind in excellent cond, complete, \$500/BO; (2) Gates Harris CB1201 w/tone arms, blue/white, vgc, \$400/pr; Russco/Stellar (one) w/APT-12T, never used, \$450/BO. R Smith, 318-227-1200 CT.

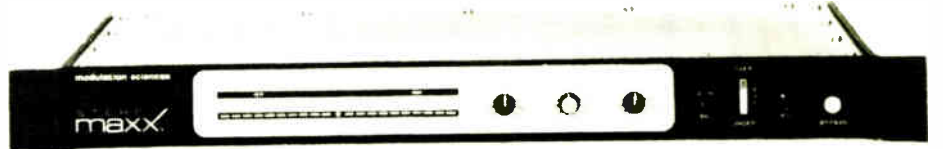
MODULATION SCIENCES

Modulation Sciences StereoMaxx Processes Audio In the Spatial Domain without Distorting Mono

SOMERSET, N.J. Aggressive processing is now the norm in most radio markets, but once a station has pushed its processing to the loudest legal limits, what is to be done? **Modulation Sciences Inc.** offers the StereoMaxx spatial image enlarger. Where other audio processors manipulate audio in the amplitude domain, StereoMaxx processes in the spatial domain. Unlike some studio effects boxes,

cated techniques to improve signals. First, the incoming stereo signal is examined for stereo content. If there is not enough stereo separation, StereoMaxx increases it to the desired level. If there is too much, StereoMaxx acts to limit stereo width.

If the input signal is mono, e.g., from a microphone, StereoMaxx silently and instantly switches off to avoid the creation of artifacts.



which upset the left/right phase relationship and cause on-air problems for mono listeners, StereoMaxx produces a 100 percent mono-compatible stereo output signal. Mono listeners cannot detect its presence in the air chain. Stereo listeners, on the other hand, will be amazed by your richer, fatter sound, as the StereoMaxx expands the stereo image.

StereoMaxx uses a variety of sophisti-

In addition to enhancing stereo content, StereoMaxx contains special circuitry to increase sonic density. This is accomplished by sampling the Left minus Right (difference) signal, feeding it through a digital delay, and mixing it back into the main chain.

For information, contact Art Constantine in New Jersey at 800-826-2603; fax: 908-826-2603; or circle Reader Service 11.

ADVERTISER INDEX

This listing is provided for the convenience of our readers. Radio World assumes no liability for inaccuracy.

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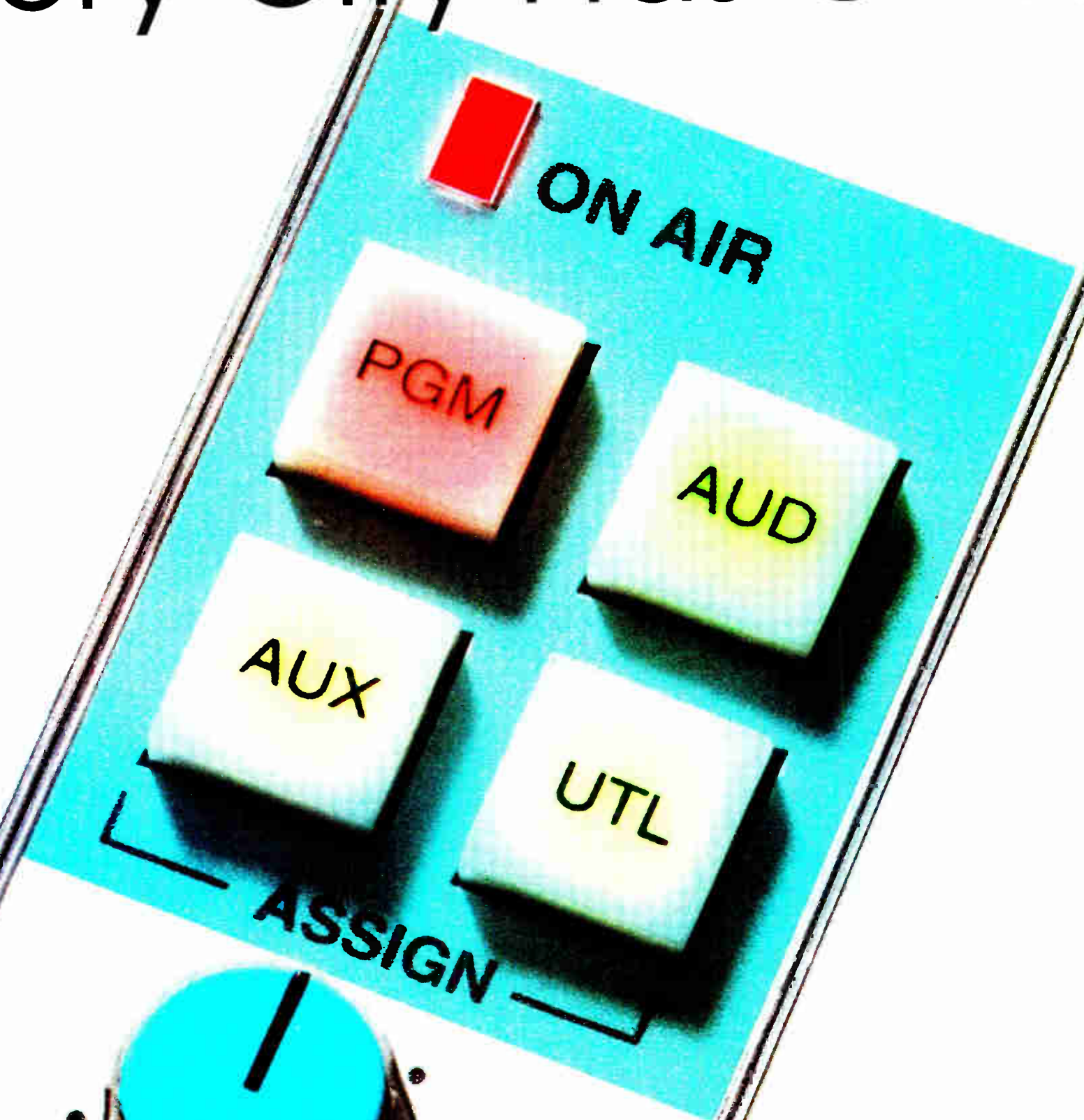
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