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# RadioWorld®

Vol 15, No 22

Radio's Best Read Newspaper

November 20, 1991

## Licensed Operator Law Eyed

**WASHINGTON** Buried within the FCC's 1992 fiscal year authorization bill, the House of Representatives has amended a section of the rules that would permit broadcasters to substitute automation technology for licensed operators.

If the Senate approves the authorization, Section 318 of the Communications Act would be amended to allow automated technology, such as dial-up remote and monitoring services.

The amendment will codify existing FCC policies that already allow the use of such technologies, according to FCC legislative spokesman Steve Klitzman.

The amendment would offer stations the flexibility to use computer technology rather than licensed operators to monitor station operations. According to the bill, use of computer technology will "make the operation of stations more cost effective and efficient." The provision also would save the FCC money by reducing the number of licensed operator permit applications.

The provision would not eliminate the licensed operator requirement, but gives stations the choice to use automated technology, Klitzman said.

The licensed operator has traditionally been required to be on duty 24 hours a day to ensure station compliance with technical provisions of its license, including transmitter power, modulation, etc., and in case any problems should occur. In recent years, specific FCC policies have allowed operators to monitor and control broadcast station functions via remote, but the policies had not been codified into the Communications Act.

FCC Assistant Mass Media Bureau Chief William Hassinger said the amendment would be a "move in the right direction" if approved.

He noted that stations still would not be able to have a station operating without personnel since someone—whether a designated disc jockey or a licensed operator—is required to be at the station to initiate EBS alerts.

The NAB, however, is exploring the possibility of seeking an FCC rule-making to allow EBS alerts via remote.

## LinCom DAB Debuts For NAB Task Force

by Judith Gross

**WASHINGTON** A second U.S.-developed in-band digital audio broadcasting (DAB) system, this one on the first adjacent FM channels, had its debut here in late October.

The NAB's DAB Task Force, the FCC, National Telecommunications and Information Agency (NTIA) and Electronic Industries Association (EIA) were witness to a dramatic demonstration of a DAB system developed by the Los Angeles-based firm LinCom in cooperation with Strother Communications Inc.

SCI had been looking for a U.S. in-band technology to back.

"We chose LinCom primarily because we felt they were so strong on intellectual and other resources," SCI President Ron Strother said.

The demonstration used a Broadcast Electronics FM stereo generator and exciter to produce a 1 mW analog FM signal at a frequency of 100.1. This was fed into a Delta compressor/expander and then to an FM tuner and out to speakers. The source material was a CD.

The same source was also fed into a Lin-

Com source encoder, a waveform monitor and then into the source decoder and into a breadboard receiver built by LinCom. The digital signal was then sent through the amp and speakers.

The digital signal was sent on 100.3 at 20 dB down (one-hundredth of the power of the FM) and was clearly distinguishable from the analog FM on the monitor.

For purposes of the demo, the Dolby AC-2 compression algorithm was used along with QPSK modulation, although LinCom engineer Steve Kuh said that other compression algorithms, such as MUSICAM, and other standard modu-

(continued on page 12)



**Reality Check:**  
This year's AES show reckoned with audio realities. For details, see our show coverage, p. 7.

## SBE Proposal Nixed

by John Gatski

**WASHINGTON** The FCC's recent decision not to adopt a Society of Broadcast Engineers (SBE)-proposed rulemaking that would have defined congested areas for TV STL users may affect any rulemaking pertaining to aural STLs as well.

The FCC turned down the SBE proposal just 10 days before the 10-year "grandfather" period that allowed TV stations until Oct. 1, 1991 to upgrade to broadcast standard auxiliary services antennas. The Oct. 1 deadline, however, has been extended again to April 1992.

The FCC decision to turn down the SBE's congested area definition proposal was based on the criteria used to designate a congested frequency area (Category A). The SBE sought to base the definition on the Department of Commerce's Standard Metropolitan Statistical Area (SMSA) designation. The proposal identified Category B areas as non-SMSA. Several exceptions also were written into the proposals.

"Although the SMSA approach initially showed some promise as a potentially simple way to predict microwave auxiliary service congestion, the record indicated that it would produce incorrect and inconsistent results and lead to unnecessary costs," according to an FCC press release.

FCC Assistant Mass Media Bureau Chief Bill Hassinger said the SBE proposal ended up being too cumbersome and riddled with burdensome exceptions.

"We'll continue to do it on a case-by-case basis," Hassinger said.

According to SBE Member Dane Erickson, who helped draft the TV and aural STL proposals to the FCC, the FCC decision will adversely impact the aural STL proposal, which uses a similar congested area definition. Both proposals were made by SBE in early 1990, but the FCC decided to act on the TV proposal first.

According to the FCC Mass Media En-

(continued on page 11)

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## NEWS BRIEFS

### NAB Asks FCC to Scrap New Fines

**WASHINGTON** The NAB has asked the FCC to terminate its recently adopted fine and forfeiture schedule and initiate a new rulemaking that would include public comment.

The NAB has charged that the FCC adopted the significantly increased fine schedule as a matter of policy and not through the "required rules

making" process.

"In taking this action, the Commission has deprived FCC licensees of their procedural and substantive rights," the NAB said.

### Energy-Onix and BE Get Russian Radio Nod

**GILLETTE, Wyo.** Energy-Onix and Broadcast Electronics have been selected to provide

transmitters and other broadcast equipment for the upcoming Radio 7 project in Russia. Radio 7 will be Moscow's first commercial FM station. Expected to operate with 60 kW of power, the station is the brainchild of American entrepreneur Ben Doud.

Project coordinator Video Communications and Radio, Inc. has announced that Energy-Onix will provide the transmitters while BE will provide the consoles, tape

machines and other miscellaneous equipment for Radio 7. Originally expected to go on the air Oct. 1, the station now is scheduled to begin broadcasting from Moscow in January.

### FCC to Conduct Workshop

**COLUMBIA, Md.** The FCC Office of Engineering and Technology's Equipment Authorization Branch will conduct a workshop Dec. 12, covering recent administrative changes in the equipment authorization process.

In light of the administrative changes in Parts 2 and 15 of the equipment rules, the FCC plans

to familiarize attendees with preparation and processing of Form 731.

The workshop will be held at the FCC's Laboratory Complex 7435, Oakland Mills Road, Columbia, Md.

### New Translator, Booster Form Available

**WASHINGTON** The FCC has revised Form 349, the application for authority to construct or make changes in an FM translator or FM booster.

Use of the new form will help reduce application processing time, according to the FCC. Forms can be obtained by calling 202-632 FORM, or writing to the FCC Form Distribution Center, 2803 52nd Ave., Hyattsville, Md. 207081.

### Colorado Man Accused of Interfering With Police Radios

**GRAND JUNCTION, Colo.** Local police recently arrested a man accused of purposely interfering with local law enforcement and emergency communications.

Ernest Robert Jones of Grand Junction was arrested following monitoring by the Denver FCC office. The interference included "noises, music, catcalls, rebroadcasts of official communications and inflammatory remarks."

Jones was charged with several violations of several state and local laws, and he may be charged with violating FCC regulations, punishable by fines up to \$100,000 and jail time.

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# The AM Game's New Rulebook

by Judith Gross

**FALLS CHURCH, Va.** Well, the world's longest homework assignment is finally done.

I'm talking about the **AM rules**, a.k.a. Docket 87-267. Now, considering the first two digits in a docket number tell you the year it was first proposed, you can see how long we've been sitting on the edge of our seats waiting for it.



What this does is **revamp** the **technical criteria** for AM stations. And at least at first blush, it doesn't look to be as bad as the **gloom-and-doomsayers** thought it might be.

'Course, it did land with a great big "thud" on my desk (actually on my hand, ouch!) . . . all 75 pages of it.

First off, those curious about that extra 100 kHz added to the **AM band** should not be too surprised to hear that the Commish wants to put AM stations **causing interference** up there. The word is "**migration**"—you know, as in what birds do this time of year.

The **Friendly Candy Company** wants to make sure nobody misconstrues this. Just because they've **limited the expansion** to AM licensees doesn't mean that they favor **existing licensees** over new entrants. Y'hear that, **DAB hopefuls**?

The FCC says don't take this as **future policy** or anything, but I'm sure the **lawyers will**, anyway, when it comes time to oppose entrants for **new services**.

Anyway, about all this **migrating**. They want the stations who **cause** the interference, not the stations who get **interfered with**, to make the move. They also want to help **daytimers**, so if no

fulltime station asks for an expanded channel a daytimer will get **preference**.

The whole idea is to create a **new AM band** that is designed to keep interference nil. And the number of letters from stations **interested in moving** was surprisingly high.

And since the radios with the **extra channels** are already out there, we shouldn't have the **chicken and egg "thing"** (as our esteemed President might say).

**Consolidation** covers **voluntary agreements** between AMs to give tax credits for marginal stations which **cease operations**. And the FCC also is relaxing the **multiple ownership** rules.

But sorry, **no limits** to **simulcasting** an FM's programming on your AM. At least not for now. The Commissioners said they'll look that one over about **three years** from now.

As for **AM stereo**, the bugaboo that refuses to be quiet . . . well, like the man said, there's **good news** and **bad news**. For stations migrating to the **new band**, yes, stereo operations will get a preference.

But for those of you who are staying put, it's still **voluntary**. So why don't more of you **raise your hand** and volunteer? I know, I know, it has something to do with **dollar signs**. And I sympathize. But geez.

Let's just say that if our **military** had to rely on the kind of **voluntary response** AM stereo has received, we'd be buying our oil from **Saddam** right now.

OK. On to the **technical** changes.

The Commish is **reclassifying** its AM stations to conform with **international rules**, and giving **Class Bs** (former IIs and IIIs) a boost to 50 kW.

It adopts a 2.0 mV/m protected contour for Class II and III at night, and does away with allowing the first local AM to get interference to the 1.0 mV/m contour.

Instead of a **16 dB adjacent channel** ratio for groundwave protection, the new rules make it **6 dB**, and also for first adjacent nighttime ratios. But forget any adjacent channel protection for **Class A's**

skywave.

So if you're in **Schenectady** and having trouble getting **Fort Wayne** when you drive to the **Tastee Freeze** at night, you have to **learn to live with it**.

As to the infamous "**ratchet clause**"—the one requiring a **10 percent reduction in power** for stations that want to **make modifications**, there's been a sort of **compromise**. Using RSS calculations for nighttime, with 50 percent and 25 percent exclusion values, stations are divided into **high, medium** and **low** interferers.

If you're high, **no go** on the changes unless you **lower the power**. For the guys in the **middle**, you have to keep the interference **no worse** than it is now if you make changes, and for the **low folks**, you can make **modest changes** without worrying too much.

And if you're a **new station**? You get to go **on the air** only if you qualify as "low." Now, there are a couple more **little things** here and there, but that's about the gist of it. Whew!

The question now is: Will all

this **help AM**? Well, we'll have to **wait and see**, I suppose, but it won't happen **overnight**. I guess the best we can say is that it's a step in the **right direction**, away from interference, and redefines a traditionally **passive** FCC as taking a few **aggressive stands** to battle interference.

And, oh yes. **The freeze**. It's lifted as of the **effective date** of 87-267, which is after it gets published in the Federal Reg-

ister. So we can stop **holding our breaths** now.

And, moving on to the "**D**" word: Now there are two.

I'm talking about **U.S.-developed DAB systems** for in-band which have been shown to **work very nicely**, thank you, at least in **demo form**.

**Ron Strother** demonstrated the **Lin-Com** system for first adjacent FM DAB

**. . . the world's longest homework assignment is finally done.**

for the **decision-makers** in Washington, including the **DAB Task Force**. Sounded good, as I tell you elsewhere in this issue.

So don't let 'em tell you it **can't be done**. The final battle will be between **IBOC** and **IBAC** (in-band on-channel and in-band adjacent channel), just you watch.

Expect demos at the **NAB spring show** that are more than just, "see, I got it working!"

And if all this tech talk has made you **thirsty**, you might want to put your feet up and relax with a **brewski**. How about a **DAB**? Imported from (where else?) **Germany**, of course.

Take a look at the bottle if you think I'm **kidding**. It's **empty** you say? Well I guess it **didn't survive** JG's visit to the local chapter of the **DAB Drinking Society**.

I just started that club but **anyone** can join. If you can't beat 'em, drink 'em.

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



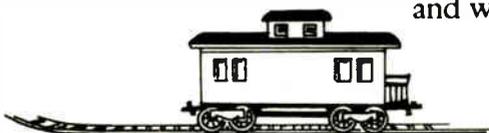
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# Multiplexing Problems

by Daniel B. Talbot  
President  
Talbot Technology (T-Tech) Corp.

**HUDSON, Mass.** The phenomenon of FM capture has been well-known for some time. The mathematics which describe it are mature and simple. Still there are "electronickers" in abundance who misunderstand its principles, and have fallen victim to false claims.

In the 1950s and '60s, the audiophile was briefed on the figures of merit of FM tuner "A" versus "B" by high-fidelity magazine testing laboratories. One favorite figure of merit for these laboratories was a term called "capture ratio." This term was used to distinguish the ability of one tuner's FM limiters compared to another to favor the stronger of two signals sharing the same channel.

If a tuner had a good capture ratio, the number would be near zero dB. Almost all the tuners reviewed had good capture ratios (1 or 2 dB). But what was the practical meaning of this number? The testing lab would proclaim that if the cap-

ture ratio was close to zero dB, then an imperceptibly larger amplitude FM signal transmitting on the same frequency as another would command complete control over the FM reception. This was based on another simplistic test.

If two unmodulated carriers near each other's frequency are summed, then fed to an FM limiter/discriminator, the average DC output voltage of the discriminator will be established by the larger of the two signals. Similarly, if the

## GUEST EDITORIAL

limiter/discriminator is ideal, if the smaller signal is now made the larger of the two, it alone will establish the average DC issuing out of the discriminator.

The actual test may have used a variation of this method, but it was essentially equivalent. And its result was indisputable. In an AM detector, for example, both signals would have influenced the DC output, regardless of their relative amplitudes.

The "capture ratio" test does not prove that the sufficiently weaker signal has no effect at all, only that it has no effect on the average DC coming out of the FM detector. In fact, it does not go unnoticed by the FM tuner; a whistle results. The frequency of this whistle is exactly the frequency difference between the two unmodulated carriers.

Furthermore, unlike envelope-detection AM, this whistle grows in amplitude as the two carriers are spaced farther apart in frequency. If the frequency difference is large enough, or the weaker signal is only slightly weaker than the stronger signal, this whistle is not even a sine wave. If one or both of the signals is now slowly frequency modulated, the whistle will be also, and the audible result will sound like a swarm of bees or distortion. The two signals cannot co-exist. If they could, we could build things like analog switches with infinite on-to-off ratios, simply by first making each signal frequency modulated, then tilting the amplitude ratio one way or the other. In short, we could get something for nothing—a contradiction of common sense, if not of the laws of physics.

Further, if the weaker interfering signal were made pseudo-noise-like, what would distinguish its effect upon the desired signal from ordinary front-end noise? And if FM capture were truly useful, why isn't the tuner's own front-end noise completely drowned out by the capture effect? Why is the stereo audio so hissy on a fringe area signal, even though the signal's RF amplitude is far above the tuner's front-end noise and atmospheric noise? Could it be that competing signals like noise, even though weaker than our desired signal, still get

At several of the fall conventions the beginnings of what may be a trend toward consolidation became apparent. Such a trend would have advantages not only for the associations hosting the events, but for manufacturers and attendees participating in them.

The most recent talk of consolidation came from the Audio Engineering Society (AES), which is considering combining its exhibition with that of the Society of Motion Picture and Television Engineers (SMPTE), possibly as early as 1994.

Also this fall, the Society of Broadcast Engineers (SBE) announced its plan to combine exhibitions with the Radio-Television News Directors Association (RTNDA). That will go into effect in 1993.

In both the potential AES-SMPTE and the actual SBE-RTNDA alliances, delays in implementation is because separate convention hall reservations have already been made into the near future. Manufacturers clearly benefit from show consolidation. Because of the recession and changes in the industry, these companies have been evaluating the effectiveness of all the trade shows.

Some have downsized their presence at certain gatherings; others are exhibiting at only the most prominent shows.

With fewer shows, manufacturers may opt for larger booths, heightening their profile on the floor. What's more, the larger audience of a combined show would offer greater sales leads than two smaller, more narrowly focused show.

Convention attendees also stand to benefit from the diversity offered by a combined show. Besides the economic benefit from reduced travel, the increased importance of audio in the TV and film industries makes the AES-SMPTE alliance particularly logical.

With SBE-RTNDA, the case is not so strong, but technology interests do overlap in certain areas. Plus, understanding advances in other segments of one's industry prepares attendees for future change. The wider range of equipment and opportunity to meet with crossover attendees offered by a combined show is valuable.

For their part, the associations can maintain their individual identity during combined shows by keeping sessions separate, while perhaps offering registration incentives to attendees interested in all the sessions.

Combining smaller shows into bigger shows serves the interests of everyone. The associations will get more attendance at their conventions, the attendees will have more to see and do, and the exhibitors will get more sales contacts. It's a win-win situation.

—RW

noticed by the FM detection process? The answer is emphatically yes.

A quick bench experiment will open one's eyes to the facts described above. In one such experiment, two unmodulated signals were applied to a Marconi 2305 modulation meter. The main signal was 10 dB larger than the secondary signal, spaced 4 kHz away. The absolute amplitudes are unimportant, since the FM limiters in the modulation meter were in hard limiting; only the ratio of the two signal amplitudes is important. A 4 kHz non-sinusoidal whistle resulted at the audio output of the modulation meter.

Next, the weaker signal was completely killed, and the stronger signal was frequency-modulated by a 1 kHz reference tone at 75 kHz peak deviation. The 4 kHz whistle was only on the order of 35 dB down from the 1 kHz reference tone at full modulation—hardly escaping notice.

Anyone wishing to study the mathematics describing this effect can read my engineering-oriented paper in the Journal of the Audio Engineering Society issue of June 1979, titled, "Improving TV Audio at the Broadcast Transmitter-Receiver Interface."

Mathematically, an FM discriminator (or a tachometer) can be modeled as a differentiator (a high pass filter of 6 dB per octave everywhere). Because of this, if the tuner front-end RF noise is white, it will no longer remain white noise after FM detection, but the high noise frequencies will be accentuated 6 dB per octave away from the center of the detector "S"-curve in either direction.

Whistles will obey the same 6 dB/octave climb in amplitude as they climb in frequency (although waveshape will change). This effect is often called the "Bow Tie" phenomenon in frequency modulation reception.

Power multiplexing as it has been described either cannot work without damage to the primary signal if co-channel located, or the description given for its operation is missing key items. This is not to say that the secondary signal cannot be retrieved, via calibrated subtraction of the primary instantaneous carrier voltage, but the main desired FM signal will be corrupted. The only issue is how much corruption can be still considered unimportant to the FM listener.

Perhaps if the main signal's audio is heavily compressed heavy-metal tub-thumping music, interfering whistles of considerably large amplitude or pseudo-noise data would not be noticed. But a true test of compatibility should include quiet classical music, or no music at all. The sound of silence is easily disturbed by interference.

Is a whistle or bee-swarm of -80 dB considered compatible? I do not presume to know the answer, since it is totally subjective, as is the word "compatible."

"FM capture" has been a severely misused term, becoming an unintelligible buzzword when used by laymen. In the hands of an engineer conversant with algebra, calculus and Bessel functions (essential to understanding FM), the FM capture effect's usefulness can be understood and properly evaluated. Proponents of in-band digital audio broadcasting on co-channels should consider non-ideal (non-straight-line "S" curve) FM detectors, since a mechanism for rectification and intermodulation exists between a main signal and a secondary signal, even though the two are widely spaced in frequency (in the ideal case, the whistle could be made ultrasonic, by separating the frequencies greatly—but then, who needs power-sharing?)

■ ■ ■

Daniel Talbot is president of T-Tech. He can be reached at 508-562-5820.

## Radio World

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Radio World  
December 11, 1991



# FAN MAIL

## RAVE REVIEWS ON THE NEW AudioMetrics CD 10



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

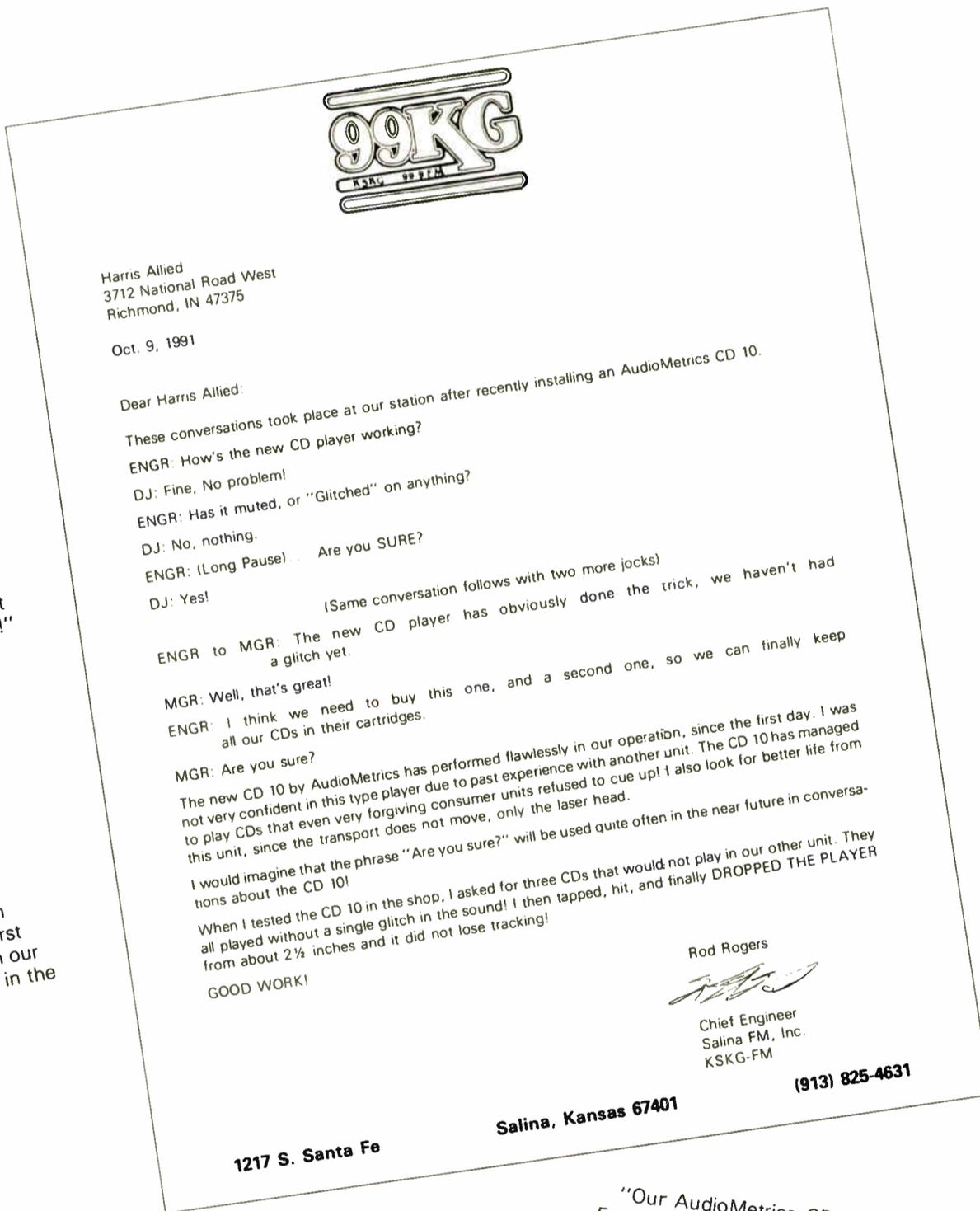
**Kevin Jenkins**  
Chief Engineer  
KHEY  
El Paso, TX

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

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

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

**Tohru Ohnuki**  
Engineer  
KROQ  
Burbank, CA



Harris Allied  
3712 National Road West  
Richmond, IN 47375

Oct. 9, 1991

Dear Harris Allied:

These conversations took place at our station after recently installing an AudioMetrics CD 10.

ENGR: How's the new CD player working?

DJ: Fine, No problem!

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

DJ: No, nothing.

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

DJ: Yes!

(Same conversation follows with two more jocks)

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

MGR: Well, that's great!

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

MGR: Are you sure?

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

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

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

GOOD WORK!

Rod Rogers

Chief Engineer  
Salina FM, Inc.  
KSKG-FM

(913) 825-4631

Salina, Kansas 67401

1217 S. Santa Fe

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

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



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# AES SHOW WRAP-UP

## Products on Parade

by Ty Ford

**NEW YORK** After three days of reconnoitering the exhibit booths and demonstration rooms of the 91st Audio Engineering Society (AES) convention, held October 4-8 at the New York Hilton, it's fair to say that the meeting was aptly subtitled, "Audio Facts and Fantasy: Reckoning with the Realities." The following is a selection of some of the more interesting products shown.

### Microphones

Three microphone products from be-



Sony's TCD-D10 PRO II reflects a trend toward more portable professional DAT recorders.

yerdynamic deserve mention. The TE 170 miniature VHF diversity wireless transmitter and receiver, combined with the DT-159 headset mic, provides wireless mic and headphone operation for "maximum freedom" for the on-air announcer. This system (at \$1,300) is perfect for the one-person "all-request" shows and fast-paced morning shows because it allows the talent to leave the board to search for music cuts or "bits."

The DT-159 comes with a high SPL version of the M-500 mic capsule. The headphones can be configured for stereo or dual mono, for broadcast and cue.

All batteries are removable.

Also new was beyer's MC 833 (\$2,500), an intermediate-size diaphragm stereo condenser mic for EFP and sampling. The MC 833 contains three separate diaphragms and can be adjusted to provide a variety of both MS and X-Y configurations.

Gotham Audio was showing a mic they call "The Perestroika Microphone." Based on the sound of the U47 Neumann, it is available in three configurations. The UM 70 (\$995) is three-pattern switchable; the UM 70S (\$1,150) is the same, but offers "unit construction and improved noise performance." The M 71 (\$795) is a cardioid-only version.

Sony introduced two new omni and cardioid tube mics, the C-800G (\$5,600) and the C-800 (\$4,400), which will be on the market in May 1992. Sony describes the C-800G as a cardioid/omni mic with "the world's first thermo-electric cooling system." It is patterned after Sony's C-48. The C-800, without cooling fins, is patterned after the C-37A.

### For your ears

AKG showed its K400 (\$189) and K500 (\$229) headphones with acoustically transparent diaphragms that reduce sound bounce between the ear and the driver. All materials used are biodegradable or recyclable. They have washable, replaceable, non-allergenic ear pads, oxygen-free copper cable and gold connectors. Their dual diaphragm K270s come with a switch in the headband that turns the phones off when you take them off.

Orban Associates, part of the AKG family, showed its digital Model 8200 Optimod FM processor. Still undergoing software tweaks at the Radio '91 show in

San Francisco, production units have at last been shipped. One of the first was installed last month at KVMY-FM in Mesa-Phoenix, Ariz.

### FadeMaster

JL Cooper Electronics has a great device called the FaderMaster (\$299). Through software and firmware, the FaderMaster control panel gives you eight channels of real-time control for MIDI devices, including volume and panning, pitch bend, aftertouch, program change, notes and more.

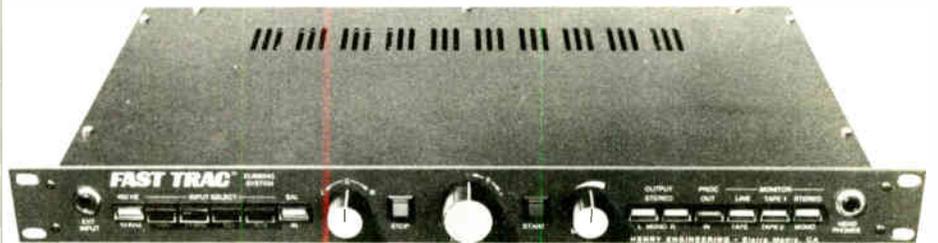
The FaderMaster also can be used as



an effects processor controller. You can jack a FaderMaster into most new effects boxes and have real-time control of up to eight parameters at once (no more (continued on page 10)



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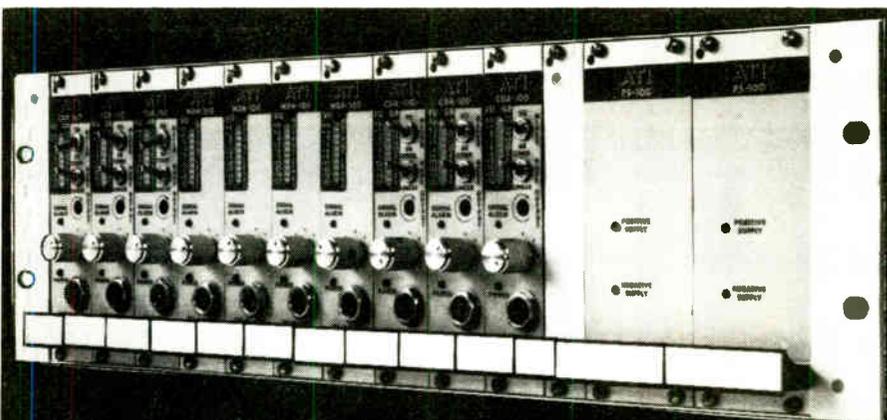
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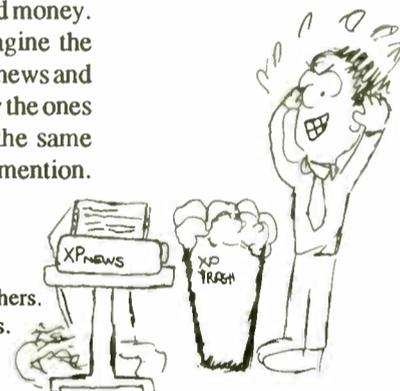
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# Convention Panel Tests Emperor's New Cables

by Ty Ford

**NEW YORK** Do expensive audio cables really make a difference?

That was the topic under discussion at an Audio Engineering Society (AES) workshop called "New Cable Designs: Innovations or Consumer Fraud" held at this year's convention in New York in early October.

A panel of experts and almost 200 interested observers participated in the workshop. What they found, however, was not exactly conclusive.

Chairman Dan Dugan, of Dan Dugan Sound Design, opened the workshop by showing a variety of questionable advertising claims. Following Dugan, Corey Greenberg of Stereophile magazine presented data to support claims that silver is the best conductor for cables, followed by copper and tinned copper. He also noted the importance of dielectrics, which protect signal-carrying conductors from oxidation, thereby allowing their surfaces to maintain higher conductivity over time.

Greenberg also spoke in favor of more expensive cable manufactured with two twisted pairs within an additional conductive shield, although his preferences seemed based on improved noise rejection rather than improved signal handling of such a cable.

Referring to the "skin effect," which theorizes that DC currents travel through the core of a conductor while AC components (like audio) normally travel on the outer surface (or skin) of a conductor, Greenberg saw merit in using varnish- or urethane-coated single-strand conductors to guard against surface corrosion.

He also noted that speaker cables should be considered in context with the system in which they are used. For example, the less stable the power amp output, the greater the possible variations in performance when coupled with different speaker cables.

Engineer Fred E. Davis from Hamden, Conn., who has studied the relative resistance, inductive reactance and capacitive reactance of a dozen different cables, agreed with Greenberg that amps can make more of a difference in performance than the cables.

Jeff Corey, of the New York Area Skeptics Society, produced evidence to support a claim that listeners may become predisposed by information that will alter their opinions. According to Corey, "Something as simple as being told that the cable you're testing is supposed to be better, or reading that 'respected professionals' believe it to be better, can skew the listeners' perceptions so that they really believe it's true."

David L. Clark, of DLC Designs in Farmington Hills, MI, reported on a recent "double-blind" experiment between Monster Cables and double conductor twisted-pair machine tool wire. Results were so inconclusive that one

report declared, "Differences in speaker cables may be noticed (only) if any cable is not long enough to reach the speaker."

The audience then participated in an A/B/X test. The A/B/X process allowed the listeners first to compare two different speaker cables (A and B). Then they were asked whether X was either A or B. Consecutive tests were performed. In each test, only the A/B/X computer knew whether X was A or B.

The first test—between a pair of 10 foot long speaker cables that cost \$2,600 and 30 AWG twisted pair wire—was done, showing an obvious difference.

**Some studies suggest that a listener's perception of audio is influenced by a manufacturer's or salesman's endorsement of a product.**

While that comparison proved easy, the next test between the \$2,600 cable and standard 12 AWG two-conductor twisted pair cable with standard insulation was not.

Some in attendance complained that tests may have been compromised by the 40 milliohm contact resistance of the switching relays in the A/B/X box, the use of 12 AWG two-conductor twisted-pair cable from the power amp to the switchbox and even by the large hall in which the tests were conducted.

While some left convinced that the test had been compromised, others left convinced that they had just heard the emperor's new speaker cables.

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# New Products Displayed At 1991 AES Convention

(continued from page 7)  
punching around from page to page and squinting at undersized LCD readouts).

FaderMaster comes with presets for the ART Multiverb II, Lexicon LXP-1 and

track for a spot into the H3000, time compress it and change the pitch up or down for extra character. There's even room to spare for recording a 30-second spot in stereo.

Also for the UltraHarmonizer, there's the third-party Zvonar software package for Mac II and above (\$250 includes the Run Time version of Opcode's MAX). Zvonar is an editor/librarian/front panel emulator that lets you graphically present all UltraHarmonizer parameters and locks the computer keyboard to the H3000 controls.



A Fostex DAT recorder was just one of several DAT products at the 1991 AES show.

### Workstations, DATs

Advances on the digital audio workstation (DAW) front include the "Otariza-

LXP-5. You can also program it to run the Alesis Quadraverb, all Digitech products, Lexicon 300, Yamaha SPX-1000, Eventide UltraHarmonizer or any other devices via SysEx, as long as they can receive MIDI controller data.

### Eventide advances

Speaking of the UltraHarmonizer, the four megabyte chip sample boards are ready, which means 95 seconds of mono sampling or 47.5 seconds of stereo sampling. It's a \$1,500 upgrade from the old sampler board and a \$2,299 upgrade for H3000s that don't already have a sampler board.

In effect, the sampler boards can turn the H3000 into a digital cart machine with time compression and pitch change. So now you can record a voice

tion" of the Pro-Disk 464, now available in 4- to 64-track versions starting at \$31,000.

My "Best New Player" award in the DAW category goes to SoundLink from Korg. For \$35,000 you get an 8-in/10-out controller and hard drive system that records and plays back up to eight channels of audio for a total of 100 minutes, expandable to over nine hours, at 48 kHz.

SoundLink has digital EQ, reverb, limiter, gate, a MIDI master fader and a Master fader. Automation includes read, write and update modes.

The parade of new DAT machines includes Sony's TCD-D10 PROII portable DAT (\$3,300) with absolute time and new display features, balanced mic/line inputs and RF end search. Earlier TCD-D10 PROII models can be upgraded for \$400.

Sony also showed the PCM-2300 DAT (\$1,590) with 1-bit delta sigma modulation, absolute time and 12-bit "LP" record/play 32 kHz sampling (in addition to 44.1 and 48 kHz).

The Fostex PD-2 timecode DAT portable (\$10,950), set for January 1992 delivery, takes an "if-it-doesn't-have-it-you-don't-need-it" design approach that makes this DAT recorder a formidable piece of EFP gear.

In addition to JVC's time code DS-DT900N DAT now in use, JVC also showed a hand-held portable DAT expected to be ready sometime in '92. Plan to pay between \$1,000 and \$2,000.

Teac's Model DA-P20 portable DAT (\$1,000) features absolute time, balanced mic/line analog I/Os, digital I/O, 16-bit A/D converters, two-hour battery operation and SCMS.

Eventide's VR240 digital logger has an entry-level price of \$9,995 for eight channels of low-bandwidth audio, expandable to twenty-four tracks.

Finally, Alesis showed its ADAT digital eight-track recorder (\$3,995) that uses S-VHS video cassettes. With the optional BRC remote control (\$1,995), ADAT can provide up to 128 channels on 16 time code locked machines.



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## SPL Effects Debated

by Ty Ford

**NEW YORK** Back-to-back papers given at this year's AES convention by W. Dixon Ward of the University of Minnesota, and Julia Doswell Royster of Environmental Noise Consultants, Raleigh, N.C., downplayed recent reports of hearing loss due to overly loud music.

While both agreed that sound levels above 85 dB could produce hearing loss, they also cautioned that the specifics of measurement were equally important. According to Ward, "Much of the data collected is inferential and flimsy. Research based on knowledge of the average and peak elements of acoustic input to the inner ear over a period of time, which creates a pressure/time history, provides much more conclusive evidence."

Although most testing has been done on humans, Ward referred to one experiment in which autopsies on chinchillas, which had been subjected to 90 dB-plus audio for eight hours at a time, showed no auditory damage.

Citing the individual nature of each person's hearing ability, Ward said experiments in microtrauma (the loss of hearing in small increments due to very short exposures to high decibel sound), have not been conclusive. Hearing loss may occur a bit at a time or as the result of a single exposure.

Royster noted that recent figures of 130 dB published in USA Today could be alarmist and misleading. "It's important," she noted, "to know exactly what that 130 dB figure means—whether it is a measurement of sustained level of an hour or more, or a peak measurement of less than a second within an hour's performance."

According to Royster, variance factors such as distance from the speakers, peak versus RMS values, and duration of exposure all must be considered to provide conclusive data.

In her field studies, Royster's dosimetry results showed that average sound levels at clubs and concert venues during performances could typically be expected to be between 85 dB and 92 dB, with peaks in excess of 130 dB. While she stated that exposures of an hour in such an environment on a once-a-week basis probably would not prove injurious, she cautioned against longer or more frequent exposures.

## A European Look at DAB

(continued from page 3)

balanced between incoming money and service areas and so on.

Things are so balanced between AM and FM that any change could throw things out of order. (U.S. broadcasters) are very worried that new technical systems could cause a lot of trouble, and therefore they are against all new systems. That is our feeling here; maybe it is not true.

I think what is necessary is to provide much more information on how a system such as Eureka 147 can be employed

to fulfill requirements for localism, and so on: how this can be done. But the information has not yet come to those who are angry and trying to defeat any new technical services. That is our feeling.

**RW:** Do you think that it is possible to reach an agreement, or—based on what you see happening the United States—that it might not be possible?

**Plenge:** Again, we'd like to turn that the other way around. Our feeling now is that introducing or promoting a special system for DAB is not only a task for the NAB, but for the radio owners and some other groups as well. I think the NAB should first be sure that the other groups I mentioned will support NAB in these negotiations. If this is done, I think the negotiations will come to a success.

## FCC Nixes SBE Proposal

(continued from page 1)

gineering Office, no action has yet been scheduled on the aural STL proposal, but Ericksen said it probably won't be approved either.

Without a clear congested area definition for aural and TV broadcast auxiliary services, Ericksen said broadcasters will continue to be confused about STL antenna upgrades.

"What the FCC is saying (by its decision) is that there are no congested areas . . . it boggles my mind," Ericksen said.

He said that if the Commission had

problems using the SMSA as the criteria for congested areas, it could have offered alternatives such as Consolidated SMSAs—of which there are fewer—on the top 25 broadcast markets.

Ericksen said the FCC's decision also leaves open to interpretation a variety of scenarios including when a station should upgrade to a Category A antenna and which station should upgrade when a new station's STL creates a congested situation with a grandfathered station.

That situation was addressed by the SBE proposal, Ericksen added.

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# A Hit.

# EIA's DAB Committee Holds First Meeting

## Internal Structure of Industry Group Is Set

by Judith Gross

**WASHINGTON** Some 40 attendees representing all major facets of the radio manufacturing and broadcast industry showed up for the first meeting of the Electronic Industries Association

(EIA) subcommittee on DAB.

Chairman Randall Brunts from Delco Electronics said he was pleased by the turnout, which included systems proponents, the FCC, the NTIA, equipment suppliers, semiconductor manufacturers and broadcasters.

The discussion focused on the internal structure of the committee, according to Brunts. Five working groups were established to cover sys-

tems, lab and field tests, costs, industry liaison and objectives and evaluations.

### Goals in writing

Two attendees were chosen to help define the goals of each of the three most immediate working groups and to draw up a list of suggested names to chair each one.

Consultant Robert Culver and CBS Radio VP of Engineering Tony Masiello, a proponent of Gannett's Acorn system, will outline the work of the systems working group. Culver and American Digital Radio proponent Ted Schober will do the same for the working group on testing.

Paul Donahue of Gannett (also an Acorn proponent) and David Birch-Jones of Marantz will do the outline work for the working group on objectives and evaluations, Brunts noted.

Brunts said that the general feeling towards EIA's taking the initiative in DAB standards setting was positive. He acknowledged that having individual systems proponents working on the committee was "a concern," but said their presence is necessary.

"They are part of the standards setting activity. They'll help provide the entrepreneurial drive," Brunts said. He added that committee members did feel that proponents should not necessarily hold chair positions on the working groups, and that their participation may be limited "when appropriate."

(continued on page 19)

# LinCom DAB Debuted for Task Force

(continued from page 1)

lination schemes can be used.

A-B listening showed that neither the digital nor the analog signal interfered with the other. The digital signal was full, loud and clear and sounded similar to the CD played on its own. There was, however, a discernible difference in the digital and analog signals.

### More than current licences

Kuh noted that while the system is designed to work in the first adjacent of an FM channel, it could work in other frequencies if more spectrum is allocated for DAB.

He said it can accommodate all existing AMs and FM's, but Kuh and Strother both conceded there would be room for additional allocations.

Kuh also said that the system can meet existing FM protection criteria and still work well even in crowded spectrum areas such as the Northeast and the West Coast.

The system uses only a single carrier, instead of the multiple carriers other DAB systems use to mitigate multipath, according to Kuh.

He said multipath reduction is accomplished by combining several techniques: waveform design, adaptive equalization and error detection and correction. Kuh also said that multipath can be eliminated even during "stoplight fades."

The breadboard receiver contained several VLSI chips which LinCom said will be reduced to a single chip at a cost of about five to ten dollars each. The chip, according to LinCom, will be able to switch easily between a digital and analog signal.

### Short timetable

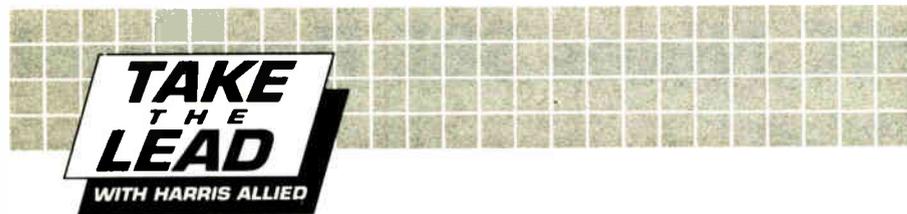
LinCom has done computer modeling and listening tests of the system, but has yet to do field tests and on-air listening tests. Strother noted that he has requested in-band test authority from the FCC in four cities.

He said that the LinCom system would be tested first on WPGC in Washington, WZLX in Boston and WZGC in Atlanta, according to an agreement with Cook Inlet Radio Partners. A station in the fourth city, Los Angeles, has yet to be selected.

Strother said he hoped to complete these tests by April of next year, with the construction of his D.C. test facility and before the start of the NAB spring convention.

Strother said both he and LinCom are planning a booth demonstration at that convention, and multipath reduction will be a part of that demo. Strother also said he planned a live, on-air, mobile demonstration of the system for the NAB's radio convention in September, 1992.

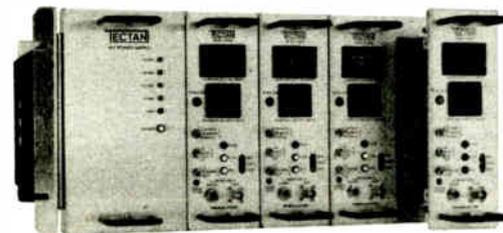
Both Strother and LinCom's chairman William Lindsey noted that, like other U.S.-developed DAB systems, the technology originally comes from work done for the military and defense industries.



## TOPS IN AUDIO PERFORMANCE TOPS IN QUALITY

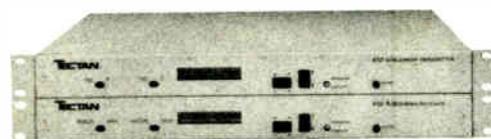
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### Model 412 Frequency Agile SCPC FM Terminal



Tectan's 412 is a frequency agile, single-channel-per-carrier (SCPC) wideband FM receiver for satellite transmission and reception of high quality audio, voice or data. The standard mainframe accepts up to four modulators or demodulators or any combination of either. The 412-basic is PROM driven for NPR network reception. The 412-360 is agile thru 360 standard channels. Both the mods and demods are available in wide (15 kHz) or narrow (7.5 kHz) or switchable.

### Model 450 Dual FM Subcarrier



The Tectan 450 is a frequency agile, synthesized FM subcarrier designed specifically for narrow band multi-channel applications. Each unit (1 rack unit high) contains two completely independent transmitters or receivers for stereo applications over terrestrial microwave, satellite or analog fiberoptic facilities.

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## 1991 Product Selection Guide

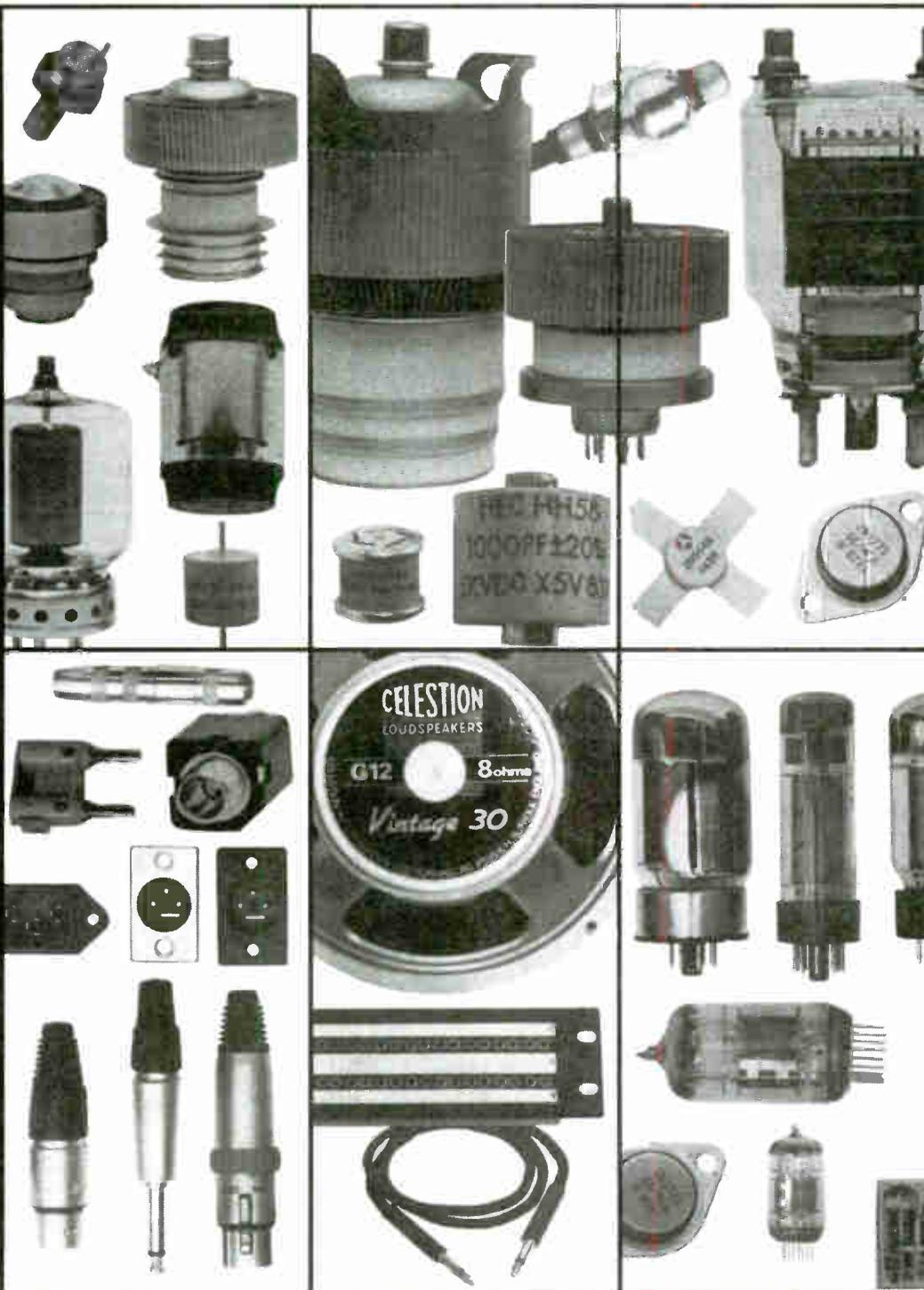
TV/RADIO STATION TRANSMITTER COMPONENTS  
plus ProMusic/ProAudio Components

### TV/RADIO STATION PRODUCTS

- ELECTRON TUBES
- VACUUM CAPACITORS
- DOOR KNOB CAPACITORS
- TUBE SOCKETS
- CAMERA TUBES

### PRO MUSIC AND PRO AUDIO PRODUCTS

- POWER AMP TUBES
- PRE AMP TUBES
- MATCHED POWER TUBES
- SPEAKERS
- PATCHBAYS
- PATCH CORDS
- MIC CONNECTORS
- GUITAR CONNECTORS
- TRANSISTORS
- INTEGRATED CIRCUITS
- CAPACITORS
- FUSES
- GUITAR/MIC CABLES
- MICROPHONES
- TUBE SOCKETS





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XLR Connectors  
AC Line Cords  
Celestion Speakers

### • TERMS AND CONDITIONS •

**MINIMUM ORDER: \$50.00**

#### PAYMENT TERMS:

First time orders are C.O.D. cash or money order; (Others C.O.D., company check only, **no personal checks**).  
Net terms available to rated companies upon proper reference submitted and verified. We also accept VISA & MASTERCARD.

#### PAYMENT TERMS INTERNATIONAL:



Prepaid by money order or Bank Draft drawn on a USA bank. We also accept VISA & MASTERCARD.



#### SHIPPING:

90% OF OUR SHIPMENTS ARE SHIPPED THE SAME DAY ORDERED. We ship UPS next day air, 2-day air, or ground service within their service area. All others are shipped Parcel Post (Air Mail) or Motor Freight. Other methods on request, freight pre-paid by customer.

#### WARRANTY:

All of our products carry the standard manufacturer's warranty.  
**Transmitter Tubes**—Most power tubes are warranted for 1000hrs from date of purchase. Some tubes carry a 3000hr or 5000hr warranty; contact ARS for more details. Power tubes are replaced for tube failures within the first 500hrs of operating life and prorated after 500hrs. Return authorization required. No transmitter tubes will be replaced without the return & inspection of the tube in question. If a tube is urgently needed the customer will be charged for a replacement tube, and adjustments or reimbursements will be made after the tube in question has been inspected by ARS.

**Speakers**—Celestion Speakers are warranted for 5 years; E/V Speakers are warranted for 5 years. *All returned speakers are repaired or replaced at the factory's discretion.*

#### RETURN PROCEDURE:

All returns must be approved. *No returns will be accepted without a customer invoice # and RETURN AUTHORIZATION #.*

## FUSES

1 1/4" x 1/4" 250V Standard Fuses



.125A	1.25A	4.0A	10.0A
.25A	1.5A	5.0A	15.0A
.50A	2.0A	6.0A	20.0A
.75A	2.5A	7.0A	
1.0A	3.0A	8.0A	

10-99: **10° ea.**

1 1/4" x 1/4" 250V Slow Blow Fuses



.25A	1.5A	5.0A	10.0A
.50A	2.0A	6.0A	15.0A
.75A	2.5A	6.25A	
1.0A	3.0A	7.0A	
1.25A	4.0A	8.0A	

10-99: **35° ea.**

1 1/4" Chassis Mount Fuse Holders



Chassis Mount Fuse Holder

1-9: **50° ea.**; 10-99: **45° ea.**

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## REBUILT POWER TUBES

3CX2500A3 . . . . . \$440.00	3CX15000A7 . . . . . \$1415.00	5CX1500A . . . . . 630.00
3CX2500F3 . . . . . 440.00	3CX20000A3 . . . . . 1700.00	5CX1500B . . . . . 630.00
3CX2500H3 . . . . . 465.00	3CX20000A7 . . . . . 1785.00	5762/7C24 . . . . . 775.00
3CX3000A1 . . . . . 445.00	3CX20000H3 . . . . . 1700.00	7894 . . . . . Call
3CX3000A7 . . . . . 525.00	4CX1500A . . . . . 568.00	8806 . . . . . Call
3CX3000F1 . . . . . 435.00	4CX3000A . . . . . 745.00	8807 . . . . . Call
3CX3000F7 . . . . . 555.00	4CX3500A . . . . . 730.00	8891 . . . . . Call
3CX5000H3 . . . . . 1240.00	4CX5000A . . . . . 848.00	8916 . . . . . Call
3CX10000A1 . . . . . 1415.00	4CX10000D . . . . . 1810.00	8976 . . . . . Call
3CX10000A3 . . . . . 1295.00	4CX15000A . . . . . 1165.00	8977 . . . . . Call
3CX10000A7 . . . . . 1290.00	4CX20000A . . . . . 1510.00	8984 . . . . . \$1370.00
3CX10000H3 . . . . . 1290.00	4CX20000B . . . . . 1510.00	8990/4CX20000A . . . . . Call
3CX15000A3 . . . . . 1415.00	4CX20000C . . . . . 1510.00	9011 . . . . . Call
3CX15000H3 . . . . . 1295.00	4CX35000C . . . . . 4270.00	

Prices assume the return of a rebuildable dud. if a dud must be supplied from ARS, an additional 20% of the rebuilding price will be added to the price of the tube.

## NEW POWER TUBES

2C39A	4-400C/6775	6BA6	813	5840	7558
2E26	4-1000A/8166	6BE6	872A	4876A	7580W
3-400Z	4CX250B/7203	6C4	4055	5886	7586
3-500Z	4CX250BC/8957	6CW4	4631S	5894	7587
3B28	4CX300A	6DJ8	4691	5902	7609
3CX1000A7	4CX350A/8321	6L6GC	4847	6005	7645
3CX1500A7/8877	4CX600J	6SN7GTB	5636	6012	7649
3CX2500A3/8161	4CX1000A/8168	6SL7GT	5639	6072A	7650
3CX2500F3/8251	4CX1500A	6V6GTA	5651	6080	7651
3CX2500H3	4CX1500B/8660	6X4	5654	6111	7801
3CX3000A1/8238	4CX3000A/8169	7C24/5762/7459	5670	6112	7895
3CX3000F1/8239	4CX5000A/8170	12AT7	5675	6136	7898
3CX3000A7	4CX10000D	12AU7A	5686	6146B	8106
3CX3000F7/8162	4CX1500A/8281	12AX7	5687	6201	8122
3CX5000A3	4CX20000A/8990	12AY7	5687WA	6205	8156
3CX5000H3	4CX35000C/8349	12BH7A	5702WA	6386	8791
3CX10000A1.8158	4X150A/7034	12BZ6	5702WB	6442	8792
3CX10000A3 8159	4X500A	25L6GT	5703WA	6688	8794
3CX10000H3	5CX1500A	25Z6GT	5703WB	6883B	8806
3CX10000A7 8160	5CX1500B	26C6	5718	6939	8807
3CX15000A3	5CX3000A	VA220 series	5719	7034	8890
3CX15000A7	5R4GB	VA221 series	5721	7059	8891
3CX15000H3	5U4GB	356/5771	5725	7060	8916
3CX20000A3	5Y3GT	Y572BAL	5726	7077	8976
3CX20000H3	6AK5	575A	5727	7167	8977
4-65A/8165	6AN5	673	5749	7289	8984
4-125A/4D21	6AQ5W/6005W	678	5750	7486	8986
4-250A/5D22	6AS7GA	810	5751	7543	8988
4-400A/8438	6AU6A	811A	5763	7551	9007
4-400B/7527	6AZ8	812A	5814A	7554	9011

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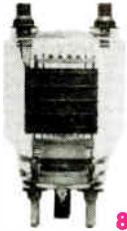


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833A

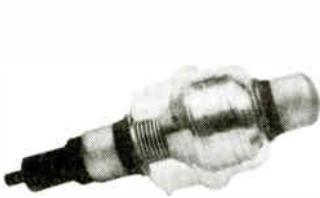


4-400A



3-400Z	4-125A	5-500A	872A
3-500Z	4-400A	575	6146
4CX250B	4-400C	807	7527A
4CX250BC	4-500A	810	8122
4-65A	4-1000A	833A	2E26

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HH58	5-7.5KVDC	500-2500pF	.6	.890	.813
HT53	5KVDC	7-45pF	7	31/64	9/16
HT54	5KVDC	1-40pF	5	27/64	7/16
HT55	5KVDC	1-15pF	3	25/64	5/16
HT57	10 + 15KVDC	10-1500pF	35	1.890	1.187
HT59	15 + 20 + 25KVDC	50-1500pF	50	3.000	2.000

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4380	4911	P8130	P8420	P8491	XQ1085
4837	BC4917	P8131	P8421	P8496	XQ1410
4389	BC4922B,G,R	P8132	P8436	P8497	XQ1413
BC4390B,G,R	BC4923B,G,R	P8133	P8438	P8498	XQ1415
BC4391B,G,R	BC4927B,G,R	P8135	P8452	P8499	XQ1427
BC4396	BC4937B,G,R	P8142	P8453	80XQZ	XQ2170
BC4532U	BC4992B,G,L,R	P8144	P8454	83XQ	XQ2175
BC4592B,G,R	BC4993R	P8146	P8455	XQ1020R,B,G,L	XQ2177
BC4593B,G,R	BC4994G,L,R	P8147	P8456	XQ1023	XQ3070
BC4594B,G,R,L	BC7735	P8148	P8457	XQ1025	XQ3075
BC4809B	BC8134B	P8160	P8460	XQ1070	XQ3077
BC4892B,G,R	BC8480	P8161	P8461	XQ1071	XQ3410
BC4893B,G,R	BC8507	P8199	P8462	XQ1073	XQ3415
BC4894B,G,R	BC8541	P8197	P8463	XQ1075	XQ3427
BC4908B,G,R	P8022	P8400	P8474	XQ1076	XQ3427
BC4909	P8024	P8401	P8490	XQ1080	XQ4500

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 Transmitters

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2N3375	BFR92	BLV20	BLX69A	F2009H	MRF1946A	MRF342	MRF641	SD1169	SD1520-1	TH2001
2N3375	BFR93	BLV21	BLX919A	F2012H	MRF2001	MRF344	MRF644	SD1219	SD1520-8	TH2003
2N3553	BFR96	BLV25	BLX92A	F2013H	MRF2001B	MRF401	MRF646	SD1219-5	SD1520-8	TH2005
2N3553	BFR99	BLV30	BLX93A	F2015	MRF2003	MRF402	MRF648	SD1220	SD1522	TH2302
2N3570	BFS22A	BLV31	BLX94A	F3001	MRF2003B	MRF406	MRF652	SD1222-5	SD1522-1	TH2304
2N3571	BFS23A	BLV32F	BLX94C	F3002	MRF2003M	MRF421	MRF652	SD1222-6	SD1522-2	TH2307
2N3572	BFT50	BLV33	BLX96	F3003	MRF2005	MRF422	MRF653	SD12229-1	SD1522-3	TH264
2N3632	BFW16A	BLV33F	BLX97	F3004	MRF2005B	MRF422A	MRF654	SD1224-10	SD1522-8	TH3000
2N3632	BFW92	BLV36	BLX98	F3005	MRF2005M	MRF426	MRF660	SD1224-2	SD1522-9	TH3001
2N3733	BFX89	BLV57	BLY87A	F3006	MRF2010	MRF426A	MRF750	SD1232	SD1524	TH3003
2N3866	BFY90	BLV59	BLY87C	F3007	MRF2010B	MRF427	MRF752	SD1234SD12	SD1524-1	TH3005
2N3866	BGY22	BLV75/12	BLY88A	F3008	MRF2010M	MRF427A	MRF754	SD1272-2	SD1526	TH415
2N3924	BGY22A	BLV80/28	BLY88C	F3009	MRF2016M	MRF428	MRF8003	SD1278	SD1526-1	TH416
2N3924	BGY23	BLV90	BLY89A	F3010	MRF207	MRF428A	MRF8004	SD1285	SD1528	TH417
2N3926	BGY23A	BLV90/SL	BLY89C	F3011	MRF208	MRF432	MRF838	SD1290	SD1530	TH430
2N3926	BGY32	BLV91	BLY90	F3012	MRF209	MRF433	MRF838A	SD1300	SD1530-1	TH476
2N3927	BGY33	BLV91/SL	BLY91A	F3013	MRF212	MRF449	MRF840	SD1301	SD1532	TH478
2N3927	BGY35	BLV92	BLY91C	F3014	MRF215	MRF449A	MRF842	SD1303	SD1532-1	TH480
2N4427	BGY36	BLV93	BLY92A	F3015	MRF216	MRF450	MRF843	SD1309	SD1532-8	TH513
2N4427	BGY40A	BLV94	BLY92C	F3016	MRF221	MRF450A	MRF843F	SD1375	SD1534	TH518
2N4428	BGY40B	BLV95	BLY93A	MHW710-1	MRF222	MRF453	MRF844	SD1401	SD1534-8	TH519
2N4429	BGY41A	BLV96	BLY93C	MHW710-3	MRF223	MRF453A	MRF846	SD1402	SD1536	TH525
2N4430	BGY41B	BLV97	BLY94	MHW7100-2	MRF224	MRF454	MRF870	SD1405	SD1536-1	TH526
2N4431	BGY43	BLV98	ESM269	MHW820-1	MRF225	MRF454A	MRF870A	SD1407	SD1536-8	TH531
2N4440	BGY45A	BLV99	ESM690	MHW820-2	MRF226	MRF455	MRF901	SD1407-8	SD1538	TH532
2N4957	BGY45B	BLW27	ESM691	MHW820-3	MRF227	MRF455A	MRF901A	SD1409	SD1538-1	TH550
2N4958	BGY46A	BLW29	ESM791	MRF240A	MRF229	MRF458	MRF904	SD1410	SD1538-2	TH552
2N4959	BGY46B	BLW31	ESM796	MRF1000MA	MRF230	MRF458A	MRF905	SD1410-3	SD1538-8	TH553
2N5016	BGY47A	BLW32	F1001	MRF1000MB	MRF231	MRF460	MRF911	SD1412	SD1540	TH560
2N5070	BGY47F	BLW33	F1001	MRF1002MA	MRF232	MRF464	MRF914	SD1412-3	SD1541	TH596
2N5090	BGY48A	BLW34	F1001B	MRF1002MB	MRF233	MRF464A	MRF931	SD1414	SD1541-1	TH597
2N5109	BGY48B	BLW50F	F1002	MRF1004MA	MRF234	MRF466	MRF961	SD1415	SD1542	TH598
2N5589	BGY48C	BLW60	F1002B	MRF1004MB	MRF237	MRF475	MRF962	SD1416	SD1543	TH9021
2N5590	BGY90A	BLW60C	F1003	MRF1008MA	MRF238	MRF476	MRF965	SD1418	SD1544	THA13
2N5591	BGY90B	BLW76	F1003B	MRF1008MB	MRF239	MRF477	RF412A	SD1421	SD1545	THA15
2N5635	BGY93A	BLW77	F1004	MRF1015MA	MRF240	MRF479	SD1005	SD1422	SD1546	THA93
2N5636	BGY93B	BLW78	F1004B	MRF1015MB	MRF243	MRF485	SD1006	SD1428	SD1546	THB13
2N5637	BGY93C	BLW79	F1005	MRF1035MA	MRF245	MRF486	SD1007-1	SD1429	SD1546-1	THB598
2N5641	BGY94A	BLW80	F1005B	MRF1035MB	MRF247	MRF492	SD1012-3	SD1429-3	SD1546-1	THB94
2N5642	BGY94B	BLW81	F1006	MRF1090MA	MRF248	MRF492A	SD1012-4	SD1430	SD1546-2	THX15
2N5643	BGY94C	BLW83	F1006B	MRF1090MB	MRF250	MRF497	SD1013	SD1433	SD1546-2	THX98
2N5849	BGY95A	BLW84	F1007	MRF1150MA	MRF250A	MRF501	SD1013-3	SD1434	SD1547	
2N5942	BGY95B	BLW85	F1008	MRF1150MB	MRF260	MRF502	SD1014-1	SD1438	SD1547	
2N5944	BGY96A	BLW86	F1009	MRF1250M	MRF261	MRF511	SD1015	SD1438-2	SD1547-1	
2N5945	BGY96B	BLW87	F1012	MRF1325M	MRF262	MRF515	SD1018-15	SD1441	SD1560	
2N5946	BLF146	BLW88	F1013	MRF134	MRF262B	MRF517	SD1018-6	SD1444	SD1560-1	
2N6081	BLF242	BLW89	F1014	MRF136	MRF264	MRF517A	SD1019	SD1446	SD1561	
2N6082	BLF244	BLW90	F1015	MRF136Y	MRF309	MRF5177	SD1078	SD1450	SD1561-1	
2N6083	BLF245	BLW90	F1016	MRF138	MRF313	MRF5177A	SD1080-2	SD1451	SD1562	
2N6084	BLT90/SL	BLW91	F1018	MRF140	MRF313A	MRF525	SD1080-6	SD1451-1	SD1562-6	
2N6093	BLT91/SL	BLW95	F1020	MRF141G	MRF314	MRF526	SD1080-7	SD1455	SD1562-7	
2N6980	BLT92/SL	BLW96	F1021	MRF148	MRF314A	MRF531	SD1089	SD1457	SD1563	
2N918	BLU20/12	BLW97	F1022	MRF150	MRF315	MRF555	SD1098	SD1458	SD1564	
BFP10	BLU30/12	BLW98	F1027	MRF151G	MRF315A	MRF557	SD1115-2	SD1459	SD1565	
BFP91	BLU45/12	BLW99	F1028	MRF153	MRF316	MRF559	SD1127	SD1460	SD1574	
BFP96	BLU50	BLX13	F1201	MRF154	MRF317	MRF603	SD1132-4	SD1468	SD1575	
BFQ22	BLU51	BLX13C	F1202	MRF156	MRF321	MRF604	SD1132-5	SD1477	SD1576	
BFQ42	BLU52	BLX14	F1207	MRF161	MRF323	MRF606	SD1133	SD1478	TH064	
BFQ43	BLU53	BLX15	F1208	MRF162	MRF325	MRF607	SD1134	SD1479	TH1002	
BFQ43S	BLU60/12	BLX39	F1260	MRF163	MRF326	MRF626	SD1134-5	SD1480	TH1005	
BFQ63	BLU97	BLX65	F2001	MRF171	MRF327	MRF627	SD1135	SD1482	TH1010	
BFR38	BLU98	BLX65E	F2002	MRF172	MRF328	MRF628	SD1135-3	SD1484-10	TH195	
BFR90	BLU99	BLX65FS	F2003	MRF174	MRF331	MRF628	SD1136	SD1487	TH196	
BFR91	BLV10	BLX67	F2004	MRF1946	MRF338	MRF629	SD1143	SD1488	TH197	
	BLV11	BLX68	F2005H		MRF340	MRF630	SD1143-1	SD1499-1		
			F2008H					SD1520		



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## TRANSFORMERS

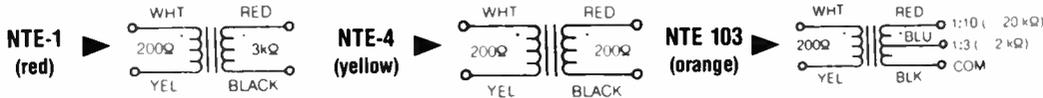
**NEUTRIK®**



As part of the modular connector system, ARS offers miniature Neutrik audio transformers for use at microphone levels. All three have the same dimensions and are designed to be used with the VM module to facilitate mating with other modules. They may also be potted in mu-metal cans. Lead lengths are approximately 1 3/4 in. (45mm), stripped. Brief technical specifications are listed below.

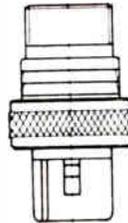


**NTE-Series**



TYPE	Colour code	Price	Turns-ratio	Frequency response at 200 Ω source	max. Input level 1% THD/50 Hz
NTE 1	red	<b>\$9.50</b>	1:1	30-20 K ± 0.5 dB	600 mV
NTE 4	yellow	<b>9.50</b>	1:4	30-20 K ± 1.0 dB	500 mV
NTE 6	green	—	1:6	30-20 K ± 1.0 dB	500 mV
NTE 10/3	orange	<b>9.50</b>	1:3 10	30-20 K ± 1.0 dB	450 mV
NTM 1		<b>24.00</b>	1:1	15-25 K ± 0.5 dB	1.5 V
NTM 4		<b>24.00</b>	1:4	15-25 K ± 0.5 dB	1.5 V
NTL 1		<b>26.00</b>	1:1	Depends on circuit.	to + 24 dBu (Line)

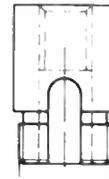
## GOOSENECKS



Female XLR Module with locking ring for tight and theft-proof mounting and securing of microphones. M 17 x 1" Male thread



Thread Adapter  
MX 17 x 1-5/8" Male



Thread Adapter with Cable Outlet  
M 17 x 1-5/8" Female and for mounting on panels up to 7 MM

A unique design in microphone holders, the Neutrik "GNS" series Goosenecks have been designed with a maximum of versatility and user comfort in mind. Standard sets are available in 3 different lengths. By using the adapters and modules that are included with each set, the user can select any one of the following combinations:

COMPLETE SETS		
Part Number	Length	Price
GNS-18	7"	\$19.20
GNS-36	14"	\$23.00
GNS-50	20"	\$33.40

**One End-Attach** to a table or console  
 Attach to a microphone stand (5/8" Threaded adapter)  
 Attach directly to a 3MX or FX connector  
 (Available separately)

**Other End-Attach** to a microphone holder (5/8" Threaded adapter)  
 Attach to a 3FX - special connector (XLR-Module)

(Contact factory for complete mounting information).  
 All components are made of Stainless Steel with a matte-black finish. Goosenecks are also available separately.

## PLASTIC MOLDED CABLE

	Price	
	1-10	10+
120 Volt AC Line Cord, 8', 10 amp	\$2.95	—
25' Molded Straight Guitar Cable	\$2.75	—
25' Male/Female Extension Cable 1/4" Stereo Phone Plug, Shielded	\$3.95	—
Molded Midi Cable, 6' Cable	\$2.10	\$1.95
Molded Midi Cable, 10' Cable	\$2.40	\$2.25



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## ELECTRON TUBES

	LIST	1-10	11-24	25+
OA2	9.40	5.00	5.00	Call
OA3	16.00	9.50	9.50	Call
OC3	16.00	5.00	5.00	Call
OD3	16.00	5.00	5.00	Call
5AR4/GZ34	23.00	7.95	7.95	Call
<b>5AR4/GZ34 USA</b>	<b>24.00</b>	<b>15.00</b>	<b>Call</b>	<b>Call</b>
5R4GB	23.25	10.00	10.00	Call
5U4G CHINA	24.00	8.95	Call	Call
5U4GB USA	23.50	15.00	15.00	Call
5Y3GT	19.95	4.95	4.95	Call
6AN8A	22.15	10.00	10.00	Call
6AQ5A	15.45	8.50	7.50	Call
6AQ8A	16.10	6.00	6.00	Call
6AU6	15.20	4.40	4.00	Call
6BA6/5749	15.60	6.00	5.00	Call
6BH6	21.75	6.25	6.25	Call
6BM8/ECL82	17.10	6.50	6.00	Call
6BQ5/EL84 (Tungsram)	18.45	5.50	5.00	Call
*Matched Pair	37.00	13.00	13.00	Call
**Matched Quartet	73.80	26.00	26.00	Call
6C10	21.00	15.00	15.00	Call
6C4	19.20	6.25	5.75	Call
6CA4/EZ81	17.10	6.50	6.50	Call
6CA7 USA	35.00	18.00	18.00	Call
*Matched Pair	70.00	36.00	36.00	Call
**Matched Quartet	140.00	72.00	72.00	Call
6CG7/6FQ7 USA	14.00	9.50	9.50	Call
6CL6	26.00	7.70	7.70	Call
6CW5/EL86	16.65	6.00	5.50	Call
6CX8	17.00	9.00	9.00	Call
6DJ8	13.00	3.25	3.25	Call
<b>LM-6DJ8</b>	<b>19.00</b>	<b>7.25</b>	<b>Call</b>	<b>Call</b>
6DJ8 JAN P	13.00	8.25	7.50	Call
6EU7	18.50	12.00	12.00	Call
6FQ7/6CG7 Foreign	14.00	6.50	6.50	Call
6GW8/ECL86	19.20	6.00	6.00	Call
6HB5	31.00	19.00	19.00	Call
6J5GT	20.00	8.00	8.00	Call
6J7	20.00	10.00	10.00	Call
6K11	20.00	10.00	10.00	Call
6K6GT	20.00	9.90	9.00	Call
<b>6L6GC China</b>	<b>36.00</b>	<b>4.75</b>	<b>4.25</b>	<b>3.85</b>
*Matched Pair	62.00	12.50	12.50	Call
**Matched Quartet	124.00	25.00	25.00	Call
***Matched Sextet	186.00	39.00	39.00	Call
<b>6L6GC USA Philips STR-367</b>	<b>36.00</b>	<b>14.90</b>	<b>14.90</b>	<b>Call</b>
*Matched Pair	62.00	33.00	33.00	Call
**Matched Quartet	124.00	66.00	66.00	Call
***Matched Sextet	186.00	99.00	99.00	Call
<b>6L6WGB/5881 USSR</b>	<b>35.00</b>	<b>6.75</b>	<b>6.25</b>	<b>5.75</b>
*Matched Pair	70.00	16.50	Call	Call
6LF6 GE	35.00	19.50	19.50	Call
6LU8	30.00	15.00	15.00	Call
6SC7	27.10	9.00	9.00	Call
6SJ7	27.10	9.00	9.00	Call

### MATCHED POWER TUBES

TUBE	MP	MQT	MSXT
6BQ5/EL84 (Tungsram)	13.00	26.00	—
6L6GC (China)	12.50	25.00	39.00
6L6GC USA STR-367	33.00	66.00	99.00
6V6GT	11.00	22.00	—
EL34 (Siemens)	16.50	33.00	—
EL34 (China)	13.50	27.00	—
KT88 (China)	31.00	62.00	—
5881 (USSR)	16.50	33.00	—
6550 (China)	25.00	50.00	80.00
6550A (GE)	50.00	100.00	150.00
7027A (GE)	39.00	78.00	—

### LOW NOISE PREAMP TUBES

LM-12AX7 (Yugo)	7.25
LM12AX7A (China)	7.25
LM-6DJ8 (Yugo)	7.25
LM-6922/E88CC	12.00

	LIST	1-10	11-24	25+
6SK7	28.40	9.90	9.90	Call
6SL7GT	19.10	5.50	5.00	Call
6SN7GTB	20.00	5.50	5.00	Call
6U8A	18.00	5.00	4.50	Call
<b>6V6GT</b>	<b>23.45</b>	<b>4.50</b>	<b>3.50</b>	<b>Call</b>
*Matched Pair	47.00	11.00	11.00	Call
**Matched Quartet	94.00	22.00	22.00	Call
6X4	18.00	6.50	6.50	Call
6X5GT	21.50	6.00	5.50	Call
12AT7/ECC81	15.90	3.95	3.95	3.50
12AU6	17.30	5.00	4.50	Call
12AU7A/ECC82	14.25	3.60	3.00	Call
<b>12AX7/ECC83</b>	<b>14.30</b>	<b>3.50</b>	<b>2.75</b>	<b>2.15</b>
<b>LM-12AX7</b>	<b>19.00</b>	<b>7.25</b>	<b>7.25</b>	<b>Call</b>
<b>12AX7A/7025</b>	<b>17.15</b>	<b>3.75</b>	<b>3.35</b>	<b>3.15</b>
<b>LM-12AX7A</b>	<b>19.00</b>	<b>7.25</b>	<b>Call</b>	<b>Call</b>
12AY7/6072A (GE)	18.00	7.50	6.85	Call
<b>12BH7A</b>	<b>18.50</b>	<b>10.00</b>	<b>10.00</b>	<b>10.00</b>
12BY7A	23.00	12.75	12.75	Call
12DW7/7247	19.00	11.80	11.80	Call
<b>EL34 Siemens</b>	<b>35.75</b>	<b>6.75</b>	<b>6.25</b>	<b>5.75</b>
*Matched Pair	60.00	16.50	16.50	Call
**Matched Quartet	120.00	33.00	33.00	Call
<b>EL34 China</b>	<b>30.00</b>	<b>5.70</b>	<b>4.80</b>	<b>4.55</b>
*Matched Pair	60.00	13.50	13.50	Call
**Matched Quartet	120.00	27.00	27.00	Call
36KD6	36.70	18.00	18.00	Call
KT66/7581A	—	Call	Call	Call
EL84/6BQ5 (Tungsram)	18.45	5.50	5.00	Call
ECL86/6GW8	19.20	6.00	6.00	Call
EF86/6267	13.00	5.50	5.00	Call
<b>KT88 (China)</b>	<b>50.00</b>	<b>14.00</b>	<b>12.50</b>	<b>Call</b>
*Matched Pair	100.00	31.00	31.00	Call
**Matched Quartet	200.00	62.00	62.00	Call
300B	—	225.00	225.00	Call

	LIST	1-10	11-24	25+
5651	15.00	6.00	6.00	Call
5691/6SL7WGTA	22.00	15.00	15.00	Call
5692/6SN7WGTA	22.00	15.00	15.00	Call
5751	12.00	6.50	5.75	Call
5879	18.00	9.25	8.50	Call
<b>5881/6L6WGB USSR</b>	<b>28.50</b>	<b>6.75</b>	<b>6.25</b>	<b>5.75</b>
*Matched Pair	56.00	16.50	16.50	Call
**Matched Quartet	112.00	33.00	Call	Call
5965	12.00	10.00	10.00	Call
6080	24.00	14.00	14.00	Call
6146B	19.00	12.75	12.25	Call
6201/12AT7WC	14.00	6.50	6.00	Call
6267/EF86	13.10	6.00	5.50	Call
<b>6550A (GE)</b>	<b>36.00</b>	<b>25.00</b>	<b>25.00</b>	<b>25.00</b>
*Matched Pair	72.00	50.00	50.00	50.00
**Matched Quartet	144.00	100.00	100.00	100.00
***Matched Sextet	216.00	150.00	150.00	150.00
<b>6550 (China)</b>	<b>35.00</b>	<b>9.95</b>	<b>9.30</b>	<b>Call</b>
*Matched Pair	70.00	25.00	25.00	Call
**Matched Quartet	140.00	50.00	50.00	Call
***Matched Sextet	180.00	80.00	80.00	Call
6922/E88CC	15.00	8.50	7.75	Call
<b>LM-6922/E88CC</b>	<b>22.00</b>	<b>12.00</b>	<b>Call</b>	<b>Call</b>
6973	16.00	17.00	17.00	Call
7025/12AX7A	17.00	3.75	3.45	3.25
<b>7027A</b>	<b>35.00</b>	<b>21.00</b>	<b>21.00</b>	<b>Call</b>
*Matched Pair	74.00	42.00	42.00	Call
**Matched Quartet	140.00	84.00	84.00	Call
7044	15.00	10.00	10.00	Call
7189A	16.00	7.00	7.00	Call
7199	38.00	23.00	23.00	Call
7247/12DW7	21.10	11.80	11.80	Call
7586	Call	Call	Call	Call
7587	Call	Call	Call	Call
7591A	36.00	17.00	17.00	17.00
7868	36.00	17.00	17.00	Call
8417 (GE)	36.90	25.00	25.00	Call
*Matched Pair	74.00	50.00	50.00	Call

### MILITARY TYPE TUBE SHIELDS

Mil-Spec Snap-on ..... 2.50 ea.  
 Mil-Spec Chrome Twist-on ..... 2.50 ea.

### TUBE SOCKETS

9 pin PC Mount ..... 1.95 ea.  
 9 pin Chassis Mount Solder ..... 2.50 ea.  
 9 Pin Chassis Mount, Solder, Tube Shield ..... 5.00 ea.  
 8 pin Octal Plastic/Phenolic ..... 2.50 ea.  
 8 pin Octal Ceramic ..... 4.50 ea.



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## TRANSISTORS & INTEGRATED CIRCUITS

NEC			TOSHIBA			Transistor Pricing			MOTOROLA			RCA		
P/N	1-9	10+	P/N	1-9	10+	P/N	1-9	10+	P/N	1-9	10+	P/N	1-9	10+
1B05	7.50	7.00	2N6609	4.00	3.70	410 RCA	4.50	4.00	MJ4502	2.60	2.25	MJ802	2.30	2.00
2N3055	.90	.80	2SA909	4.25	3.80	MJ15001 (Motorola)	3.55	3.30	MJE15030	2.50	2.25	MJE15031	2.60	2.35
2N3440	.85	.75	2SB554 (Toshiba)	4.05	3.75	MJ15002 (Motorola)	3.05	2.85	TIP29C	.80	.70	TIP30C	.80	.70
2N3441	.85	.75	2SB600 (NEC)	4.80	4.45	MJ15003 (Motorola)	3.15	2.90	TIP31C	.80	.70	TIP32C	.80	.70
2N3772	1.80	1.60	2SC1586	4.25	3.80	MJ15004 (Motorola)	3.55	3.30	TIP33C	.80	.70	TIP33C	.80	.70
2N3773	2.00	1.75	2SD424	3.90	3.90	MJ15015 (Motorola)	1.95	1.65	TIP34C	.80	.70	TIP41C	.80	.70
2N5231	5.60	5.25	2SD425	2.65	2.25	MJ15016 (Motorola)	2.40	2.25	TIP42C	.80	.70			
2N5634	4.80	4.50	2SD555 (NEC)	4.35	4.05	MJ15022 (Motorola)	3.05	2.85						
2N6284	4.25	3.90	2SJ50	9.00	9.00	MJ15023 (Motorola)	3.05	2.85						
2N6287	4.25	3.90	2SJ56	12.50	12.50	MJ15024 (Motorola)	3.35	3.15						
2N6553	.95	.85	2SK135	8.00	8.00	MJ15025 (Motorola)	3.35	3.15						
2N6556	.95	.85	2SK176	9.90	9.90	MJ2955	1.50	1.25						

### I.C. Pricing

P/N	1-9	10+	P/N	1-9	10+	P/N	1-9	10+	P/N	1-9	10+
4558	1.00	.90	7815	.95	.85	LF356	.90	.80	TL071	.95	.85
4559	.95	.85	7905	.95	.85	LF356H	1.80	1.70	TL072	1.25	1.25
5532	1.75	1.50	7912	.90	.80	LM337	2.70	2.25	TL074	.95	.85
5534	1.75	1.50	LM317T	1.00	1.00	LM339	.90	.80	TL082	.95	.85
7805	.95	.85	LF351H	1.80	1.70	LM386-100	1.00	1.00	TL084	.95	.85
7812	.95	.85	LF351N	.90	.80	LM393	1.60	1.40			

## CAPACITORS



Due to fluctuations in availability and price, please call for stock

### ★ DUAL SECTION CAPACITORS

50MFD 50MFD/500V ..... \$8.00  
 (Marshall/Laney)

### ★ SINGLE SECTION CAPACITORS

	1-10	11-49	50+
20MFD/450V (Fender)	Call	Call	Call
22MFD/450V (Fender)	1.50	1.45	1.25
35MFD/450V	1.50	1.45	1.25
40MFD/450V (Ampeg)	Call	Call	Call
70MFD/450V (Ampeg)	Call	Call	Call
80MFD/450V	2.50	2.25	2.00
100MFD/450V (Ampeg)	2.75	2.50	2.25
320MFD/450V (Marshall Major)	Call	Call	Call

## POTENTIOMETERS



Due to fluctuations in availability and price, please call for stock.

250K Ohm Audio Taper (5/16" thread, 1/4" shaft)	1.75
250K Ohm Linear Taper (5/16" thread, 1/4" shaft)	1.75
250K Ohm Audio Taper (3/32" thread, 1/4" shaft)	1.75
250K Ohm Linear Taper (3/32" thread, 1/4" shaft)	1.75
500K Ohm Audio Taper (5/16" thread, 1/4" shaft)	1.75
500K Ohm Linear Taper (5/16" thread, 1/4" shaft)	1.75
1 Megohm Pushpull Audio	3.00
1 Megohm Linear	1.75

## SUBMINIATURE TUBES

P/N	DESCRIPTION	PRICE
5702	Pentode	\$12.00
5703	Medium M $\mu$ Triode	\$12.00
5718	Medium M $\mu$ Triode	\$12.50
5719	Hi M $\mu$ Triode	\$11.00
5899	Pentode	\$ 9.50
5906	Pentode	\$14.00
5977	Medium M $\mu$ Triode	\$10.00
6111	Medium M $\mu$ Twin Triode	\$12.00
6112	Hi M $\mu$ Twin Triode	\$16.00



ACTUAL SIZE



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# Since 1945 Same Day Shipping

## CABLE CONNECTORS



Female XLR	1-49	50+	100+
NC3FX	1.92	1.79	1.68
NC3FX-B (Black Shell with Gold Contacts)	2.75	2.55	2.40



Male XLR	1-49	50+	100+
NC3MX	1.75	1.63	1.54
NC3MX-B (Black Shell with Gold Contacts)	2.48	2.29	2.16



Phone Plug, 2 Circuit	1-49	50+	100+
NP2C	1.90	1.76	1.66
NP2C-BAG (Black Shell)	1.90	1.76	1.66



Phone Plug, 3 Circuit	1-49	50+	100+
NP3C	2.81	2.61	2.45
NP3C-BAG (Black Shell)	2.81	2.61	2.45



Female XLR with On/Off Switch	1-49	50+	100+
NC3FX-S	6.80	6.38	Call
NC3FX-S-B	7.10	6.45	Call

ALL PRICES SUBJECT TO CHANGE

Female XLR—Right Angle	1-49	50+	100+
NC3FRC	6.88	6.40	Call
NC3FRC-B (Black Shell with Gold Contacts)	7.22	6.72	Call

Male XLR—Right Angle	1-49	50+	100+
NC3MRC	6.39	5.96	Call
NC3MRC-B (Black Shell with Gold Contacts)	6.60	6.12	Call

Phone Plug, Right Angle	1-49	50+	100+
NP2RC	3.79	3.50	3.30
NP2RC-BAG (Black Shell)	4.47	4.16	3.90

## SPEAKON Loudspeaker Connectors



Cable Connectors	1-49	50-99	100+
NL4FC (4 pin)	4.99	Call	Call
NL8FC (8 pin)	7.40	Call	Call

Square Panel Mount			
NL4MP (4 pin)	2.47	Call	Call

Round Panel Mount			
NL4MPR (4 pin)	3.23	Call	Call
NL8MPR (8 pin)	5.32	Call	Call

Module (Not Pictured)			
NL4MM (4 pin)	5.19	Call	Call
NL8MM (8 pin)	9.23	Call	Call

Male Panel Mount XLR	1-49	50+	100+
NC3MP	1.85	1.78	1.71
NC3MP!B (Black Shell with Gold Contacts)	2.46	2.28	2.14

Female Panel Mount XLR	1-49	50+	100+
NC3FP-1	1.92	1.79	1.68
NC3FP-1-B (Black Shell with Gold Contacts)	2.51	2.33	2.19

LOCKING Panel Mount Jack	1-49	50+	100+
NJ3FP6C	4.29	3.99	3.75
NJ3FP6C-BAG (Black Shell)	4.29	3.99	3.75



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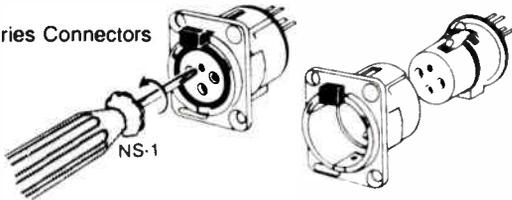
ELECTRONIC TUBE SPECIALISTS  
 7110 DE CELIS PLACE  
 P.O. BOX 7323, DEPT. C  
 VAN NUYS, CALIF. 91409  
 PHONE: (818) 997-6200  
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# Since 1945 Same Day Shipping

## PANEL MOUNT XLR RECEPTACLES NEUTRIK®

### "D" Series XLR Panel Receptacles

D-Series Connectors



Lock and/or unlock connector insert as illustrated to remove from connector shell.



NC3FD-H  
NC3MD-H  
Horizontal PC Mount



NC3FD-V  
NC3MD-V  
Vertical PC Mount



NC3FD-L  
NC3MD-L  
Solder Lug Version

Note: "BAG" suffix denotes Black Chrome Shell.

### Black Plastic Shell Solder Cup Version



NC3MPP  
1-49 50-99 100+  
1.45 — —



NC3FPP  
1-49 50-99 100+  
1.51 — —

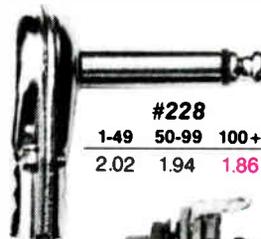
- Contact assembly removes from rear of housing via turn latch; housing remains fastened to panel. Optional front or rear panel mounting.
- Optional locking or non-locking styles.
- Satin Nickel or Black Chrome finishes available.

## CONNECTORS

## SWITCHCRAFT INC.



#280 (2 circuit) #279 (3 circuit)  
1-49 50-99 100+ 1-49 50-99 100+  
1.08 1.08 .99 2.43 2.34 2.25



#228  
1-49 50-99 100+  
2.02 1.94 1.86



#3502  
1-49 50-99 100+  
.88 .80 .80



#11  
1-49 50-99 100+  
1.01 .94 .90



#12B  
1-49 50-99 100+  
1.01 .94 .90



#12A  
1-49 50-99 100+  
1.01 .94 .90



#151, #152B  
1-49 50-99 100+  
#151 . . . . .3.38 3.25 3.13  
#152B . . . . .3.38 3.25 3.13



#EAC-303  
1-49 50-99 100+  
1.00 — —



#EAC-309  
1-49 50-99 100+  
1.00 — —



#RN111PC  
1-49 50-99 100+  
1.01 — —



#RN112APC  
1-49 50-99 100+  
1.01 — —



#113B  
1-49 50-99 100+  
1.32 — —



#70  
1-49 50-99 100+  
2.80 2.69 2.48



#RAPC3FG  
1-49 50-99 100+  
1.50 — —



#RAPC3MHG  
1-49 50-99 100+  
1.50 — —



#80  
1-49 50-99 100+  
2.60 2.60 —



#128  
1-49 50-99 100+  
2.95 — —



#121  
1-49 50-99 100+  
2.99 2.95 2.82



Banana Plug  
1-49 50-99 100+  
1.65 1.60 1.55

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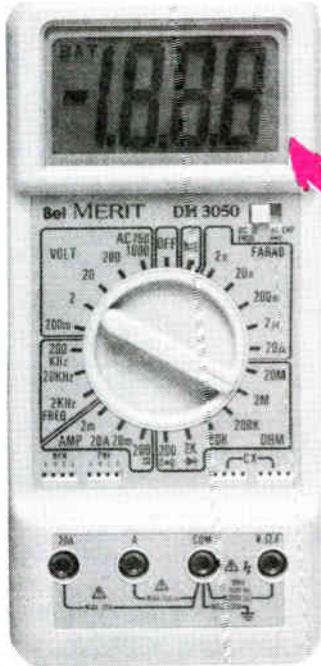


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**Since 1945**  
**Same Day Shipping**

**WIDE RANGE DIGITAL MULTIMETER**

**DM3000 . . . . . \$42.50      DM3050 . . . . . \$49.50**



**1 YEAR LIMITED WARRANTY**

**DM3000/DM3050**

- 1 1/8" DIGIT HEIGHT
- OVERLOAD PROTECTION
- 10MΩ INPUT IMPEDANCE
- HEAVY DUTY, 20 AMP
- CAPACITANCE TEST
- TR hFE TEST
- DIODE TEST
- LOW BATTERY/OVER RANGE MARK
- TILT STAND

**DM3050 Only:**

- FREQUENCY TEST
- CONTINUITY BEEPER

SPECIFICATIONS (at 23°C ± 5°C, < 80% R.H.)		
Model	DM3000	DM3050
FUNCTION/RANGE		
	8 Function/24 Range	10 Function/27 Range
DC	Range	200m, 2, 20, 200, 1000V
VOLTAGE	Accuracy	±(0.5% + 2 dgts)
AC	Range	200m, 2, 20, 200, 750V
VOLTAGE	Accuracy	±(1.2% + 2 dgts)
RESISTANCE	Range	200, 2K, 20K, 200K, 2M, 20MΩ
	Accuracy	±(0.8% + 2 dgts)
DC	Range	200μ, 2m, 20m, 200m, 20A
CURRENT	Accuracy	±(0.5% + 2 dgts)
AC	Range	200μ, 2m, 20m, 200m, 20A
CURRENT	Accuracy	±(1.2% + 3 dgts)
CAPACITANCE	Range	2n, 20n, 200n, 2μ, 20μF
	Accuracy	±(3.0% + 3 dgts)
FREQUENCY	Range	2K, 20K, 200KHz
	Accuracy	±(2.0% + 5 dgts)
DIODE TEST	Test Current 1.5mA MAX	
TR hFE TEST	10μA 2.8V	
CONTINUITY CHECK	-	Audible Beeper
GENERAL		ACCESSORIES
Power	One 9V (NEDA 1604)	9V Battery
Dimension	3.4" x 7.5" x 1.4"	Test Lead
Weight	10.6 oz	Operating Manual

**RADIO DESIGN LABS**

**STICK-ON AUDIO PRODUCTS**

- Miniature Size:** 2.9" x 1.5" x .5"0
- Mounting:** 2-sided adhesive tape
- Mounting features:** Compact size allows mounting where larger units don't fit
- Power Requirements:** 12-36V DC (external power supply)

ACTUAL SIZE ALL PRODUCTS



P/N	PRICE	DESCRIPTION/APPLICATIONS
<b>STA-1</b> Electronics Transformer/Line Amp . . . . .	<b>\$96.00</b>	1—LINE AMPLIFIER • 2—TRANSFORMER BALANCED-UNBALANCED • 3—TRANSFORMER UNBALANCED-BALANCED • 4—600 OHM AMPLIFIER • 5—BRIDGING AMPLIFIER • 6—10K OHM AMPLIFIER • 7—MONO COMBINER • 8—STEREO SPLITTER • 9—DC AMPLIFIER
WITHOUT POWER SUPPLY . . . . .	<b>\$81.60</b>	
<b>STDA-3</b> Distribution Amplifier . . . . .	<b>\$87.60</b>	1—BALANCED OR UNBALANCED INPUTS • 2—BALANCED OR UNBALANCED OUTPUTS • 3—BALANCED IN AND BALANCED/UNBALANCED/600 OHM OUTPUT • 4—600 OHM INPUT & DISTRIBUTED OUTPUT • DUAL STDA-3 USED IN 3 CHANNEL (left) & 3 CHANNEL (right) OUTPUT
WITHOUT POWER SUPPLY . . . . .	<b>\$79.20</b>	
<b>STM-2</b> Preamp Mic to Line Level . . . . .	<b>\$96.00</b>	1—PHANTOM POWER HOOKUP SUPPLIED • 2—BALANCED-UNBALANCED MIC TO LINE LEVEL • 3—INTERCOM/INTERCOM NETWORKS
WITHOUT POWER SUPPLY . . . . .	<b>\$81.60</b>	
<b>STSH-1</b> Stereo Headphone Amp . . . . .	<b>\$84.00</b>	1—STUDIO APPLICATIONS • 2—LIVE APPLICATIONS • 3—HOME APPLICATIONS
WITHOUT POWER SUPPLY . . . . .	<b>\$75.60</b>	

**ALSO AVAILABLE ★ ALSO AVAILABLE ★ ALSO AVAILABLE**

P/N	DESCRIPTION	P/N	DESCRIPTION	P/N	DESCRIPTION
<b>STA-3</b>	3 WATT POWER AMP	<b>ST-DA3D</b>	DISTRIBUTION AMP, STEREO	<b>ST-VCA1</b>	VOLTAGE CONTROLLED AMP
<b>STA-6</b>	6 WATT POWER AMP	<b>STM-DA3</b>	MIC DISTRIBUTION AMP	<b>ST-GCA1</b>	GAIN CONTROLLED AMP
<b>ST-MX3</b>	LINE LEVEL MIXER	<b>STM-1</b>	MIC PREAMP	<b>ST-GCA2</b>	FAST GAIN CONTROLLED AMP
<b>ST-MMX3</b>	MIC LEVEL MIXER	<b>ST-PH1</b>	STEREO PHONO PREAMP		

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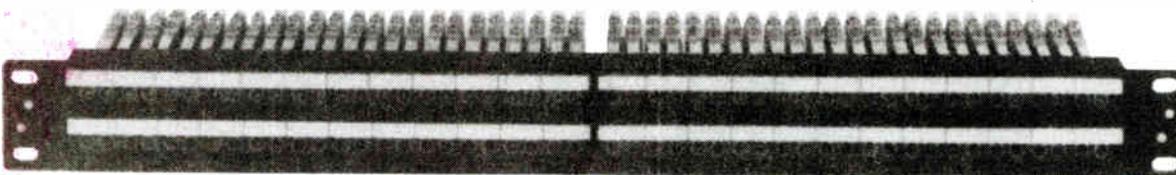
## LEANARE CABLE

<p><b>QS-6</b> Guitar/Instrument Cable</p>  <ul style="list-style-type: none"> <li>OXYGEN-FREE COPPER</li> <li>LOW NOISE</li> <li>HIGHLY FLEXIBLE</li> <li>HIGH DENSITY COPPER BRAID SHIELD</li> </ul> <p>328 ft. (100 meters) \$12100          656 ft. (200 meters) \$24200</p>	<p><b>L-4E6S</b> Microphone Cable (Star Quad) #1 Choice For Many Microphone Applications</p>  <ul style="list-style-type: none"> <li>LOW NOISE • LOW HUM • FLEXIBLE • DURABLE</li> <li>LOW CAPACITY • OXYGEN FREE COPPER</li> <li><b>GREATER THAN 95% BRAID SHIELD</b></li> </ul> <p>Colors: Black, Blue, Green, Orange, Purple, Red, Yellow, White</p> <p>500 ft. \$20000          1000 ft. \$40000</p>	<p><b>4S8</b> Quad Speaker Cable (16AWG)</p>  <ul style="list-style-type: none"> <li>LOW LOSS • FLEXIBLE • LOW CAPACITY</li> <li>4 CONDUCTOR • BRAID SHIELDING</li> <li>OXYGEN-FREE COPPER</li> </ul> <p>328 ft. (100 meters) \$15400          656 ft. (200 meters) \$30800</p>
<p><b>L-2B2AT</b> 2 Conductor, Aluminum Tape Shield Hook Up Wire</p>  <ul style="list-style-type: none"> <li>PATCH BAYS</li> <li>MIXING CONSOLES</li> <li>MIC &amp; LINE LEVEL SIGNALS</li> </ul> <p>656 ft. (200 meters) \$10400</p>	<p><b>MR-202-AT Series</b> (2-32 Pairs) Multi-Channel Microphone Cable</p>  <p>(2-conductor) Multi-Channel Microphone Cable</p> <ul style="list-style-type: none"> <li>HIGH SOUND QUALITY</li> <li>INDIVIDUAL JACKETED</li> <li>DRAIN WIRE • ALUMINUM TAPE (FOIL) SHIELD</li> <li>FOR FIXED INSTALLATION</li> </ul> <p>Call for PER FOOT or PER ROLL price</p>	<p><b>L-4E3 &amp; L-4E4 Series</b> Star Quad Cable (2-24 Quad Channels) (4-conductor) Multi-Channel Microphone Cable</p>  <ul style="list-style-type: none"> <li>HIGH CROSSTALK REJECTION</li> <li>HIGH COVERAGE BRAIDED SHIELD</li> <li>SOUND REINFORCEMENT</li> <li>L-4E4 IS HEAVY DUTY VERSION OF L-4E3</li> </ul> <p>Call for PER FOOT or PER ROLL price</p>

## PATCHBAYS

PJ739—Bantam/TT Patchbays

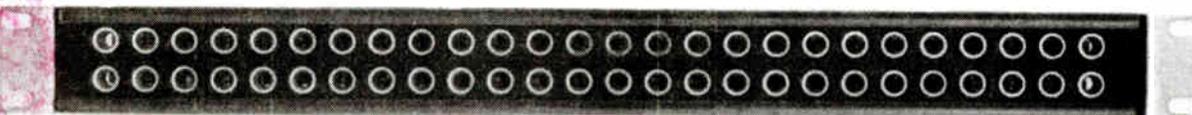
96 ea. PJ839 Bantam/TT Single Jacks; Normals brought out



**PJ739**  
\$24900

PJ390—Long Frame Patchbays

48 ea. PJ339 1/4" Single Jacks; Normals brought out



**PJ390**  
\$18900

## Studio Quality AUDIO PATCH CORDS

Longframe (1/4") Single

Length	Catalog Number	Price
1'	PJ81	\$12.00
2'	PJ82	18.50
3'	PJ83	19.90
4'	PJ84	19.90



Bantam Single

Length	Catalog Number	Price
1'	PJ712	\$11.50
2'	PJ714	11.50
3'	PJ716	12.50
4'	PJ718	12.70





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## CANARE HIGH DEFINITION VIDEO CABLE

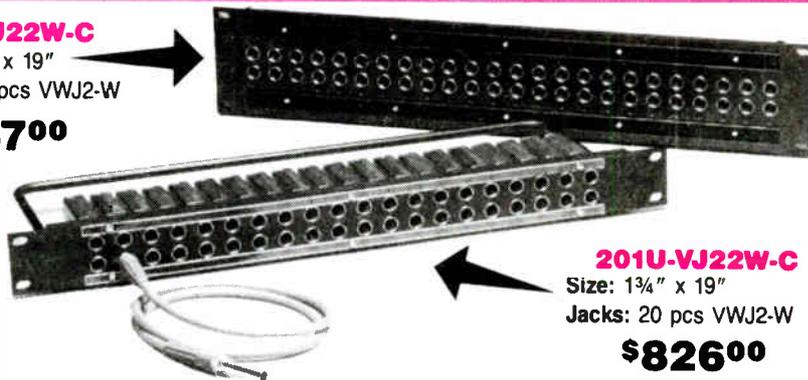
<p><b>LV-61S</b>          Coaxial Video Cable—75 Ohm</p>  <ul style="list-style-type: none"> <li>• Braided Copper Shield with Stranded Conductor</li> <li>• RG598/U Style • Thin Profile • O.D. .24 in.</li> <li>• For studio applications • Video Patch Cords</li> </ul> <p>Colors Available: Black, Blue, Green, Red</p> <p>500 Feet .....\$175.00</p>	<p><b>LV-77S</b>          Coaxial Video Cable—Heavy Duty</p>  <ul style="list-style-type: none"> <li>• "Double" outer braid high density outer shield</li> <li>• High Flexibility • Good for Long Runs</li> <li>• Low Loss • O.D. .303 in.</li> </ul> <p>Colors Available: Black, Blue, Green, Red</p> <p>500 Feet .....\$318.00</p>	<p><b>V4-3C</b>          Multi-Channel Coaxial Video Cable          (4 conductor)</p>  <p>Available in          3, 4, or 5          Conductor          (4 conductor          shown)</p> <ul style="list-style-type: none"> <li>• Maintains circuit phase • Neat cable runs</li> <li>• High density shield blocks RF leakage and electrostatic noise • O.D. .46-.56 in.</li> <li>• Use with Canare BCP-C3 75 Ohm BNC Connector</li> </ul> <p>Colors Available: Red, Green, Blue, Sync/White or Yellow</p> <p>328 Feet .....\$582.00</p>
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## VIDEO PATCHBAY

### 24IU-VJ22W-C

Size: 3 1/2" x 19"  
 Jacks: 24 pcs VWJ2-W

**\$937<sup>00</sup>**



### 20IU-VJ22W-C

Size: 1 3/4" x 19"  
 Jacks: 20 pcs VWJ2-W

**\$826<sup>00</sup>**

## VIDEO PATCH CABLE & PATCH PLUG



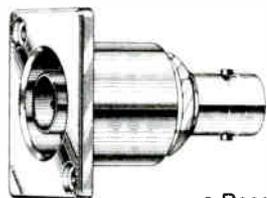
**\$15<sup>60</sup>**

• Uses Canare VWP-C4 plug and will accept LV-61S Canare Cable or any RG 59U cable • Can pass 600 MHz with less than 1.1 VSWR • Nickel plated outer and gold plated inner pin • Solder center and crimped outer shield

## PANELS • JACKS • CONNECTORS • PATCH CORDS

### PANEL MOUNT BNC PLUGS

BCJ-RU (XLR Panel Mount Style)



**\$410**

- Panel Mount
- Rack Mountable
- Recessed • Fully isolated
- Eliminates crosstalk & ground problems

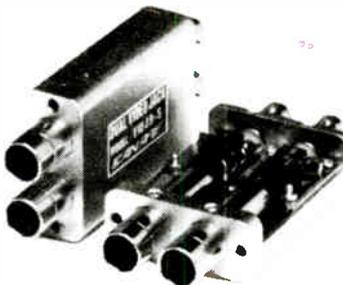
### BNC CABLE CONNECTORS



CRIMP TYPE

P/N	Cable Type	Price
BCP-C3	V-Series Multi Conductor	\$2.80
BCP-C4	LV-61S/RG59U	\$2.80
BCP-C7	LV-77S	\$2.80

### DUAL-VIDEO PATCHBAY JACKS—75 Ohm



VWJ2-W .....\$32.00

Normaled through 75 Ohm terminated

VWJ2-S .....\$32.00

Straight through 75 Ohm terminated

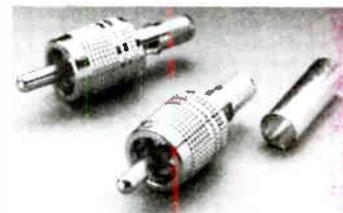
- Switching done by micro switch
- High bandwidth
- Superior Channel Isolation
- 600 MHz @ 1.1 VSWR with 45dB channel isolation

### BLANK PATCH BAY PANELS

19" x 1.75"	40 Patch Points
19" x 1.75"	48 Patch Points
19" x 3.50"	48 Patch Points

### RCA VIDEO CABLE CONNECTORS

• For High Frequency Applications • Rugged Design



P/N	Cable Type	Price
RP-C3	V-Series Cable	\$2.80
RP-C4	LV-61S/RG59U	\$2.80



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## E/V ELECTROVOICE Broadcast Microphones



**635A**  
 DYNAMIC OMNIDIRECTIONAL  
 SHAPED RESPONSE

The most popular ENG microphone in the world. Rugged, bright and natural for vocal quality.

Fhz: 80-13,000 Hz  
 Impedance: 150 ohms  
 Output: -55 dB

Case: Steel  
 Polar Pattern: Omnidirectional

**DEALER NET . . . \$93.00 • LIST . . . . . \$139.00**



**RE50**  
 ★ SHOCK MOUNTED ★  
 DYNAMIC OMNIDIRECTIONAL  
 SHAPED FREQUENCY RESPONSE

Designed for hand held ENG applications. Shock mounted "mic-within-a-mic" design for high shock noise isolation. Built in wind screen for P-POP filtering.

Fhz: 80-13,000 Hz  
 Impedance: 150 ohms  
 Output: -55 dB

Case: Aluminum  
 Polar Pattern: Omnidirectional

**DEALER NET . . . \$138.00 • LIST . . . . . \$207.00**



**RE55**  
 ★ WIDEST BANDWIDTH RESPONSE ★  
 DYNAMIC OMNIDIRECTIONAL

Widest frequency response of any E/V microphone (40-20,000 Hz). Ideal for spaced-pair stereo recording of concert music where shaped response is not necessary to solve acoustic problems. Free from distortion at high sound

pressure levels greater than 160 dB.  
 Fhz: 40-20,000 Hz  
 Impedance: 150 ohms  
 Output: -57 dB

Case: Steel  
 Polar Pattern: Omnidirectional

**DEALER NET . . . \$226.00 • LIST . . . . . \$339.00**



**RE20**  
 ★ VARIABLE-D ★  
 DYNAMIC CARDIOID

One of the finest studio announcers/voice-over microphones in the world. Provides undistorted output at extremely high sound pressure levels such as bass kick drum, up close vocals and other instrument applications. The Variable-D design reduces bass boosting proximity effects caused by high sound pressure levels. Also available is a bass frequency roll off switch for conditions where low frequency response would be detrimental.

Fhz: 45-18,000 Hz  
 Impedance: 150 ohms  
 Output: -57 dB

Case: Steel  
 Polar Pattern: Cardioid  
 Steel Shock Mount Available

**DEALER NET . . . \$350.00 • LIST . . . . . \$525.00**



**RE27 N/D**  
 VARIABLE-D N/DYM TECHNOLOGY  
 MICROPHONES

The RE27 N/DYM Microphone incorporates all the features of the RE20 with added output gain (6 dB higher), frequency response and uniform sound quality at 90 degrees of axis. Uniform sound is provided at close or far distances from the microphone. One high Fhz roll off switch and two low Fhz roll off switches are provided. The Variable-D Microphone design reduces bass boosting proximity effects.

Fhz: 45-20,000 Hz  
 Impedance: 150 ohms  
 Output: -51 dB  
 Equalization: 4 Position  
 Case: Steel  
 Polar Pattern: Cardioid

**DEALER NET . . . \$417.00 • LIST . . . . . \$625.00**



**RE38 N/D**  
 VARIABLE-D N/DYM TECHNOLOGY  
 MICROPHONES

The RE38 N/D has extended frequency response and a 16 position equalization switch which allows great flexibility in attaining the desired sound. This enables the user to adjust for many different types of proximity effects. The microphone also employs an advanced shock-mounting system.

Fhz: 70-20,000 Hz (far)  
 25-20,000 Hz (close)  
 Impedance: 150 ohms  
 Output: -53 dB

Equalization: 16 Position  
 Case: Aluminum & Steel  
 Polar Pattern: Cardioid

**DEALER NET . . . \$307.00 • LIST . . . . . \$460.00**

### OTHER ELECTROVOICE MICROPHONES ALSO AVAILABLE:

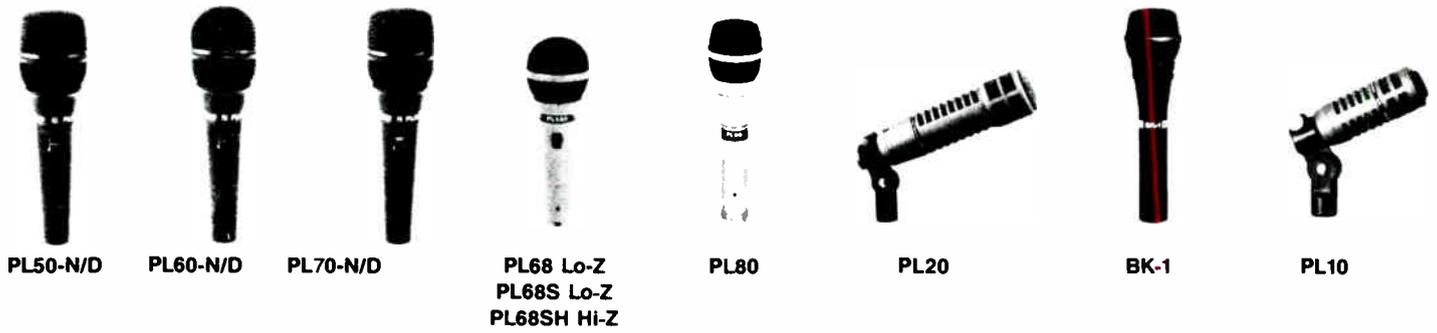
Mic	Description	Mic	Description	Mic	Description
649B	Lavalier Mic	DS35	Single-D Cardioid	RE18	Shock Mounted Variable-D Supercardioid
DL42	Cardioid Dynamic Shotgun	RE10	Variable-D Supercardioid	RE45 N/D	N/DYM Cardioid hand held dynamic shotgun
DO54	Omnidirectional	RE11	Variable-D Supercardioid	RE85	Noiseless Lavalier
DO56	Omnidirectional noiseless	RE15	Variable-D Supercardioid	CS15P	Single-D Cardioid; 8-15V Phantom Power
DO56L	DO56 with extended handle for ENG applications	RE16	Variable-D Supercardioid	RE98	Miniature Omnidirectional Lavalier; 1.35V battery



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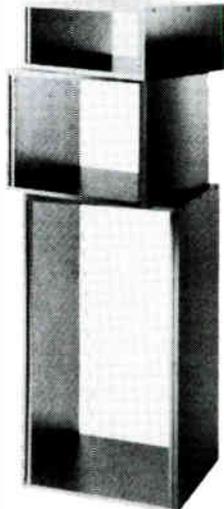
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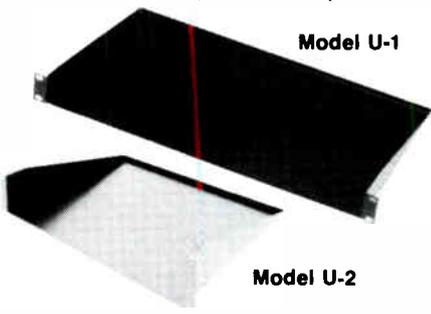
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U-2	2 space utility shelves	40.00	55.60
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*For VT-1 & VT-2, 1-10 space vented panels available			
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# The Principles of Ohm's Law

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

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

by Ed Montgomery

## Part III

**ANNANDALE, Va.** We have discussed the development of the symbols and terms used in the world of electronics. The development of potential, current, power and the opposing force of resistance also have been presented.

Voltage is necessary to produce current; however, resistance is ever-present in the electric circuitry.

A mathematical relationship between voltage, current and resistance exists and can be used to predict what will happen in various situations. This relationship was discovered by George Ohm in the 19th century. Ohm researched the relationship between voltage, current and resistance and discovered what is now known as "Ohm's Law of Resistance."

Ohm's Law states that voltage is equal to the product of current and resistance. Stated mathematically:  $V=(I)\times(R)$ , where "V" is in volts, "I" is in amperes, and "R" is resistance measured in ohms.

If a conductor has a current flow of two amperes and a resistance of 500 ohms, then how many volts are creating this current flow?

$$V=(I)(R)=(2 \text{ Amperes})(500 \text{ Ohms}) \\ =1,000 \text{ volts}$$

Using basic principles of algebra, Ohm's Law can be rearranged to solve for current or resistance. This is illustrated in Figure 1.

An example of solving for current would be having a conductor containing a resistance of 40 ohms and a potential of 100 volts applied across it. The amount of current flowing in the conductor can be found by dividing voltage by resistance:

$$I=(V)/(R)=(100 \text{ Volts})/(40 \text{ Ohms}) \\ =2.5 \text{ Amperes}$$

An example for solving for resistance when voltage and current are known would be as follows: A conductor has a current of 1.5 amperes through it with a potential of 60 volts across it. The resistance of the conductor can be determined by dividing the voltage by the current flow.

$$R=(V)/(I)=(60 \text{ Volts})/(1.5 \text{ Amperes}) \\ =40 \text{ Ohms}$$

Often the values for voltage, current and resistance are expressed in multiple and sub-multiple units. The prefixes previously discussed are used to simplify the values being stated.

When using these prefixes, it is necessary to convert all values to unity to obtain the correct answer. For example, if a current flow of 2.5 mA (milliamps) and a resistance of 40K (thousand) ohms are present, determine the volt-

age across the circuit. To do so, 2.5 milliamps must be changed to 0.0025 amperes and 40K ohms must be changed to 40,000 ohms.

$$V=(I)(R) \\ =(0.0025 \text{ Ampere})(40,000 \text{ Ohms}) \\ =100 \text{ volts}$$

If the prefixes were not recognized when applying these figures to the Ohm's Law formula, an erroneous answer would result.

Another example of using prefixes would be with a battery that had a potential of 35 volts. A conductor containing 7K ohms of resistance is connected across the battery terminals. Determine the current flow:

$$A=(V)/(R) \\ =(35 \text{ Volts})/(7,500 \text{ Ohms}) \\ =.005 \text{ Amperes} \\ =5 \text{ milliamps}$$

It is extremely important to always recognize what your prefixes are stating about the numbers you are work-

Figure 1.

$$V = (I)(R) \\ I = \frac{V}{R} \\ R = \frac{V}{I}$$

Ohm's Law

ing with before applying Ohm's Law or any other formula.

Here are some problems to check your achievement in understanding Ohm's Law.

$$V=120 \text{ Volts} \\ R=40K \\ I=$$

$$V=28.8 \text{ Volts} \\ I=6 \text{ mA} \\ R=$$

$$R=335 \text{ Ohms} \\ I=2 \text{ mA} \\ V=$$

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

## A New World of Multitracking

by Ty Ford

**BALTIMORE** During the 17 years I spent working at radio stations, I cut a lot of spots. It was part of the reason I was hired.

First, all I had was a good voice. Later, I started to enjoy creating and assembling the various elements of a spot into a finished production. I was so busy working in the production studio, I didn't realize that many of my less interested co-workers quietly slipped away after their airshifts.

There were basically two schools. The first school consisted of "cut and splice" artists. Although some were better than others, the best of these people could do amazing things with quarter-inch tape, a blade and an Editall block.

### A concept

Within their genius existed the ability to come up with a concept that could not be laid down on one pass of tape. With the concept in mind, they would then record all the parts and assemble a finished master by splicing all of the parts together.

The best of these people frequently worked with edits that called for sections of tape as short as one-sixteenth of an inch (sometimes less) to be removed or added. It was not unusual to see sections of master tape almost completely covered by splicing tape pass across the heads.

The other "school" did most of its work with multiple cart machines. Their genius was in knowing how to override cart machine stop and start cues, which allowed them to sequence sections of continuous audio on a single cart. In addition, they achieved amazing complexity with only two cart machines by careful "programming" of the order of cuts.

In case you haven't run into this before, dialogue copy can be created by one person simply by having all parts of one character on cart. After the "live" person reads his or her lines, the cart cued to the appropriate recorded line is played.

With a bit of practice, even complex conversations can be made to sound very natural. Tricks like letting the voices overlap slightly at times and making sure the copy is written in a conversational manner make a big difference.

The next evolution of production rats combined the two schools. Longer sections of voice, sound effect or ambience tracks could be cut and pasted together and then dubbed onto cart. Also known as the "knee, nose, finger and toe" method for the sometimes un-ergonomic placement of remote start buttons, this technique produced spots of increased complexity.

### Tricky timing

Timing became even trickier due to the "guesstimation" involved in trying to get the correct sections of different edited sections to line up with each other.

Multitrack tape machines put an end to the madness (excitement and fun) of on-the-fly production. There are those who believe that the production world sold its soul to the devil when it accepted multitrack tape machines.

Sure, you could lock up sound against sound as close as you wanted. But there were times when something special and unexpected happened during an on-the-fly mix; some

combination of levels and timing that made that mix . . . well, magical.

In some cases the work in progress became so complex that a track sheet was used to show, on paper, where the different parts of a spot were, according to track number and time.

While the track sheet seems a rather simple and logical tool, it offered one very powerful advantage. In addition to knowing where everything was on the tracks, you also were made aware of what spaces were left open. To the true production rat, an "open" or unrecorded track is heady stuff. It begs the question, "What else?"

The cheaper multitrack was a terrible tease. You could see the open parts of a track, but you couldn't run the risk of filling the space for fear of missing the punch and recording over what you already had laid down—until accurate and quiet auto punch in/out came along.

Track bouncing, the process of mixing many already recorded tracks to a one-track (mono) or two-track (stereo) destination, was the analog version of data compression. Mixing three recorded tracks of a four-track machine gave you three tracks left to play with.

### Only four tracks

The Beatles' "Sgt. Pepper" is an excellent example of what can be done with only four tracks. The main limitations, of course, are multi-generational tape hiss and having to mix as you go.

The ability to see tracks and fill their unused portions safely, and being able to bounce mix to infinity without noise are major advantages that digital audio workstations offer over any of the aforementioned methods of production. If you have real-time fader controls, you can see when the audio on a particular track is about to change and be there to make your move.

After using a workstation a while, additional options begin to occur to you. These new options are the direct result of being able to see the audio in graphic form. Having options doesn't necessarily guarantee that your work will be any better.

The true strength of your message will still be in the writing and the performance of the read. However, the increased perspective that visual cognition allows, in conjunction with the ability to move audio around, undoubtedly increases the impact of your work.

As the new workstations with automated mixing begin to become available, there will be no excuse for missed or sloppy mix moves. Like the SSL Series "G" console automation, if your mix is perfect except for one move, you'll be able to rewrite that one move, hit the button and get coffee while the computer does the remix. The future is here.

■ ■ ■

Although Ty Ford is now considered a workstation "power user," he still enjoys the craft of cutting tape, and has been stropping the same blade for 20 years. Contact him at 301-889-6201 or via MCI Mail 347-6635.

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# WORKBENCH

## Avoiding a Short Fuse

by John Bisset

**FALLS CHURCH, Va.** John Rohwer, station manager at WSSQ-FM in Sterling, Ill., writes that one of the most oft-quoted corollaries of Murphy's Law—that the expensive parts will blow in order to protect the relatively inexpensive fuse—was being proven with stubborn consistency at his transmitter shack.

Time after time, he'd enter the building, only to be greeted by the distinctive smell that only International Rectifier is capable of producing.

Inspection would reveal one or two rectifier stacks blown, a wire harness with a crunch that would make Kellogg's proud, and toasted wire wound resistors now of interest only to collectors of semiprecious minerals. Just as invariably, John would find three non-Type 30 Amp fuses intact—shiny and new as a kid's bike on Christmas morning.

A phone call to an electrician buddy got John a late-model catalog from the folks at Bussman. Among the many types of fusing that this firm offers are its LPN-RK LowPeak and FRN-R Fusetron dual element fuses.

These two section fuses have the ability to virtually ignore most moderate overloads and transients, yet will blow on the first cycle when confronted with a brick-wall dead-load short.

Plus, the current limit feature prevents the equipment from trying to find something to do with 200,000 RMS symmetrical amps of short circuit current (as if symmetry were important to those one ohm bleeders).

Books have been written on the subject of high voltage short circuits, and what happens to your equipment during the few milliseconds it looks directly into the gaping jaws of the Edison grid—it's not pretty reading.

Your time is better spent reading the latest brochure from Bussman. For applications information and catalog sheets, call 314-394-2877. If you have crispy component tales to swap with John, he can be reached in the afternoon at 815-625-7527. He can even tell you which leads light up the filament on the OA2 tube.

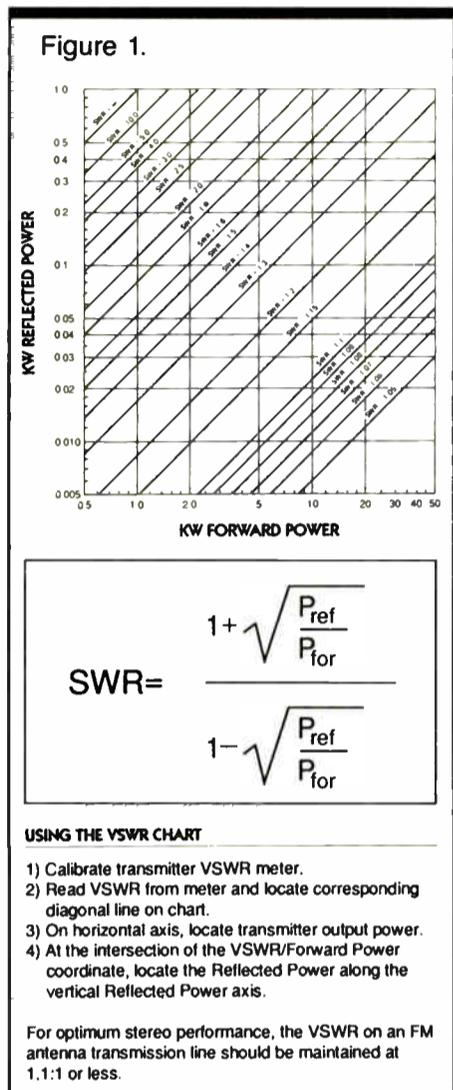
★★★

While we're on the subject of transmitter site fuse boxes, the next time you visit the shack, take along a black indelible marker. Open each fuse box—carefully—and note the type fuse used in each. Write this on the front of the electrical box with your marker.

At a site where several different types of fuses are used, the identification can assist with stocking requirements as well as making sure the right fuse gets replaced. By the way, if you're a contract engineer new to a station, check the spare fuses. Not long ago I was called to a station after a storm to restore power due to blown fuses. There were perhaps 10 fuses lying around the electrical boxes and on shelves—and you guessed it, every one was blown. After installing the second one, I got smart and checked all the others. So much for spares.

Our freebie for this issue is a useful VSWR calculation chart, provided by a

new (to the U.S.) transmitter company. Elenos manufactures a variety of FM transmitters, in use throughout the world. It has opened a United States office in the



Northeast, and intends to display at the NAB show.

The VSWR calculation chart helps you determine VSWR when you know the forward and reflected power. For your copy on heavy stock cardboard, circle Reader Service Number 102.

Tom McGinley, director of engineering

for Cook Inlet Radio, and RW's technical advisor, passed on a procedure he uses for tuning an FM transmitter for optimum performance.

Tom writes that recent studies suggest that tuning an FM transmitter for minimum synchronous AM noise does not necessarily achieve the best results. A better method involves tuning for the most symmetrical group delay response across the FM passband ( $\pm 100$  kHz).

This would be most easily accomplished using a spectrum analyzer. If such equipment is unavailable, an alternative method uses the station's stereo generator and SCA subcarrier generator, and any good companion SCA modulation monitor—either 67 kHz or 92 kHz. The procedure is as follows:

- First, use a line section sample on the transmission line at a point beyond all low pass filters and/or combiners to feed the FM and SCA monitor inputs. Do not use the dummy load for this procedure. The transmitter must be connected to the station's main antenna for best results.
- Next, turn on the 67 kHz or 92 kHz subcarrier generator to about five percent injection. Do not modulate the SCA.

Use a pink noise generator (available in the Sidekick SCA generator, off the NAB Test CD Volume 1 or Delta's Stereo Noise Generator) to feed the input of the station's stereo generator left or right channel only.

Modulate the single channel to 100 percent (remember that total modulation will be less than 100 percent). If no pink noise source is available, a stereo L-R signal consisting of a 3.5 kHz sine wave modulated to 100 percent will do.

- Now, monitor the demodulated output of the SCA modulation monitor. Most of these monitors have a calibrated noise meter built in, which is the easiest to use. What you are looking at is residual main and stereo subchannel to SCA subchannel crosstalk.

Tune each stage of the transmitter for minimum indicated crosstalk. On a well-tuned system, you should be able to achieve at least 45 dB. Modern transmitter and antenna combinations can produce levels to -55 dB or better.

Minimum main-to-subchannel cross-

talk performance always coincides with the most symmetrical group delay response under these test conditions. This may or may not correspond to minimum synchronous AM noise. If a good null is achieved, you will notice cleaner SCA performance, enhanced stereo separation and reduced multipath degradation.

Tom McGinley can be reached at WPGC in Washington. His number is 301-441-3332.

◆◆◆

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

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**EXAMPLE #3**

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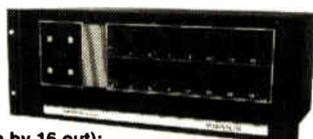
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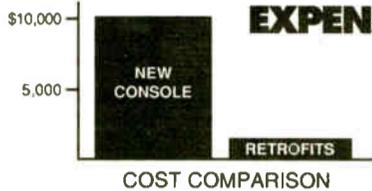
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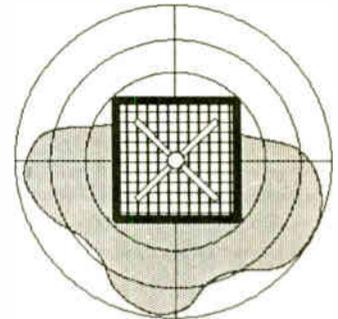


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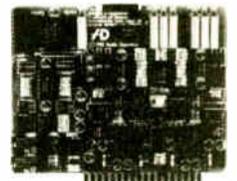
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World Radio History

# Do Microwaves Cook S-Band?

by Steve Crowley

**WASHINGTON** Satellite DAB proponents have long preferred operation in L-band around 1500 MHz because of lower power requirements and operating costs. The prospect of microwave oven interference is another factor they point to in support of an L-band allocation.

Operating in the S-band, (around 2500 MHz), the ovens emit energy that might cause interference to nearby DAB receivers operating in that band.

In earlier recommendations for the World Administrative Radio Conference (WARC-92), the FCC decided to continue consultations with the Executive Branch before choosing specific recommenda-

tions for the United States' position at WARC-92.

## Taken from S-band

The FCC felt that since it might not be able to come up with enough spectrum in L-band, it might have to take some

## CONSULTANTS CORNER

spectrum from S-band. It proposed taking S-band spectrum from the 2300 MHz to 2390 MHz band as required to satisfy DAB requirements, selecting a portion of the band that would not

be subject to interference from industrial, scientific, and medical equipment (ISM) interference.

ISM equipment includes industrial radio-frequency plastic sealing devices and equipment for medical diathermy. The biggest problem satellite DAB proponents see, however, is microwave ovens. They feel that background radi-

ation levels generated by microwave ovens might interfere with S-band DAB.

There are government emission standards for microwave oven emissions, but they are apparently not strict enough to prevent interference. Within the 2400 MHz to 2500 MHz band, for instance, emitted power density cannot exceed 1 mW/cm<sup>2</sup> at a distance of five centimeters when the oven is tested at the factory, and cannot exceed 5 mW/cm<sup>2</sup> at the same distance over the life of the oven.

(continued on page 33)

# EIA Holds DAB Meeting

(continued from page 12)

Brunts said the expectation was to reach some sort of consensus on a DAB standard, and that while disagreements over standards may prove to be a challenge, they will help drive the process as well.

## Stay focused

"We want to stay focused on our overall objective," Brunts said, "There's a real opportunity here and we don't want to lose sight of that."

Brunts expected the committee's

work to last for the usual duration of standards setting efforts—between two and five years—but said no timetable has been set yet.

For the next meeting, Brunts said the DAB committee hopes to formally invite representatives from Canada and Mexico, complete the definition of the working groups, develop some initial time lines, and solicit broader industry participation.

The committee will meet next in Washington, D.C., on Nov. 18. Another meeting is scheduled for Jan. 20, 1992.

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# Exploring Computer Software

## Product Introductions for the Computer Industry Offer New Applications to Make Your Job Easier

by Barry Mishkind

**TUCSON, Ariz.** During the past decade, changes in the broadcast industry have accelerated on many fronts. Deregulation has created a new business and work environment for most of us. Also, advances in ICs and microprocessors have brought new approaches to the technical side of the industry.

Of course, broadcasting is not the only

industry undergoing change. The computer industry also experiences innovation virtually every week.

As I write this, the computer industry is preparing for COMDEX, its equivalent of the NAB show. Press releases are flying left and right announcing the new products and upgrades that will be shown. I'll be telling you about many of these in the months ahead.

This year, one of the hottest areas

is in applications that work in connection with Microsoft Windows. Over the past year, since the introduction of Windows version 3.0, software companies have been falling over one another to produce applications that exploit the graphic interface.

Between the shareware and commercial software houses, almost anything you could want is available in the market, from calendars and schedulers to drawing and graphics programs, to word processors and more.

Obviously, not everyone needs the same things in a word processor. In the

newsroom, perhaps all that is needed is a simple program to type copy and edit it with the ability to do a block move.

In the sales department, formatting may

## KEYBOARD CONNECTION

be the main focus. The ability to use various type fonts and effects, include charts and drawings and merge with mailing lists, are likely to be essential.

At home, your needs may be a combination of the things you use at work, but on a smaller budget.

Let's start at the bottom. Several basic word processor programs are available that allow you to knock out news copy, memos and short, simple letters. The cost ranges from moderate to free.

If "free" is a word that meets your budgetary situation, start by looking at the programs you already have. For example, if you upgraded to MS-DOS 5.0 this summer, you will find the old EDLIN program replaced by the MS-DOS Editor.

Where EDLIN was a clunky, if handy, way to enter short amounts of text, the MS-DOS Editor allows you to do most basic operations. You can enter text, edit it, cut and paste, even do a search and replace. Printing also is supported, but if you want lots of enhancements, it helps to know how to use those odd buttons on the printer.

You bring up the MS-DOS Editor by typing "Edit" at the command prompt. Whether you use it to modify the AUTOEXEC.BAT or CONFIG.SYS files or the morning weather report, the price is right, and it's one more reason to upgrade to DOS 5.0 for those of you who are undecided.

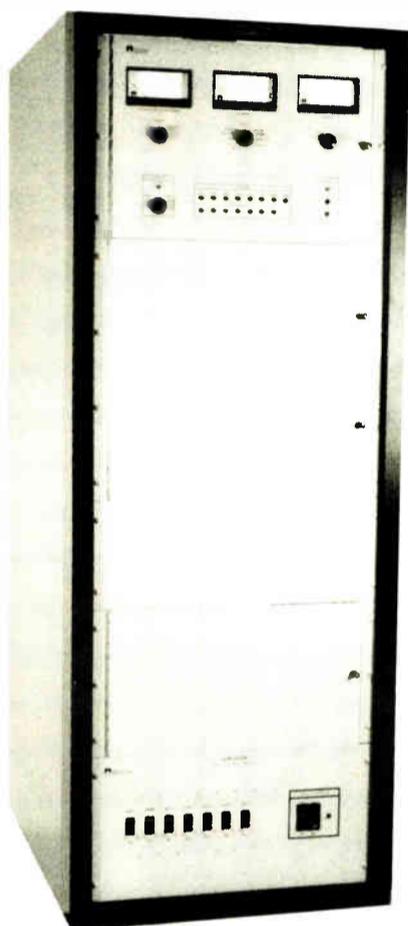
If you are in the Windows environment, there are two simple word processors included free: Notepad and Windows Write™. Like the MS-DOS Editor, neither is an extremely sophisticated word processor, but they get many jobs done. Try them both. One may work for you.

Speaking of Notepad, that is a name used by word processors included in many utilities such as Central Point Software's PC Tools™, Borland's Sidekick™ and others. If you have Xtree Gold™, look for 1Word. Each has similar basic features.

Nevertheless, what works in the newsroom or production room may not be efficient for other departments. So next time we'll start looking at programs with more features. If you're planning to buy a word processor soon, watch this space for some information on these features, as well as news of some of the newer items shown at COMDEX.

Before leaving, I'd like to mention a few of the recent upgrades that have been released for programs we've talked about recently: PC Tools version 7.1, Symantec's The Norton Utilities™ version 6.01, and Fifth Generation's Fastback Plus™ 3.02. All are being shipped to registered users to cure some reported problems.

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



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# FROM THE TRENCHES

by Alan Peterson

## Great Grumbyisms

Dear Alex,

Fairly quiet November here in Connecticut. Halloween was fun, Thanksgiving should be pleasant and there's just a month and change left until Christmas.

No obligation, you understand, but I really like blue wool sweaters.

Two winters back, I dropped RW a little note about the death of AM radio (RW, Jan. 24, 1990, "Saving the Corn Crib"), and how WSBS-AM Great Barrington, Mass., came through with several tons of clothing for fire victims. Well, good ol' Amplitude Mod has *dood* it again, and offered me the opportunity to witness one of the greatest "Grumbyisms" of all time from my p.m. news anchor Lisa Romanello.

First, I'd better explain a Grumbyism. The late Alan Hale, Jr., perfected a comic "take" on Gilligan's Island: when Gilligan pulled some bonehead move, the Skipper (Hale's character) would go through the following ritual ...

- ✓ He'd start to say something and stop, then go "Yeegh" ...
- ✓ Turn briefly away to absorb exactly what Gilligan said or did ...
- ✓ Finish with "Exactly, little buddy," or swat him with his hat.

This was all accomplished in a single, liquid motion I call a Grumbyism, named after Skipper Jonas Grumby

piloting the Minnow (one of my favorite trivia questions of all time).

End of setup, now on with the story.

WLAD—like a good number of full-service AMs—airs a swap show on Sundays we call "The Vinnie James Bargain Express." Two hours of buying, selling, bartering and more. It is extremely popular, as this anecdote reveals.

Lisa had just moved into a new apartment and was very much in need of a gas stove. She found nothing in the stack of 3x5's from last week's show, so she went to the classifieds in the paper. Strike two.

I suggested she give a ring-up to the Salvation Army folks across town. They've always got some old range knocking around by the loading dock, so why not call up to see if it's a gasser?

Well, it wasn't, and it was nearly strike three for Lisa until the voice at the other end offered her a suggestion.

Lisa never told them she was with our station, which is why it was so hysterical when she was told, "No, we haven't got one. But there's this show on 'LAD called 'Vinnie James.' Give him a call on Sunday. Ever hear of it?"

Ever hear of it? Yeegh ... turn ... nobody to swat with a hat!

Who cares? It was still among the finest Grumbyisms ever executed. And it happened because of the widespread popularity of a show on a Sunday *on my station*.

Back in October, I read an account of many AMers that have gone dark (including several I was familiar with). Add to this list WSPR-AM in Springfield, Mass., pulling the plug only recently. Sorry to know we are still in a period where the only way to make money with an AM is to screw a 75 W light bulb into a transmitter and sell it as a Kenner Easy Bake oven.

But for me, it is most gratifying to know an AM station can still be the best friend of a community (not a bad way to position oneself against those 12-in-a-row boys). Danbury's mayor did his own survey to find out who listens to us ... he actually found out who *depends* on us. Big difference.

So, to all the folks looking in on this note to you, Alex, AM is still very much alive and doing fine by me. Talk to you, say, Christmastime?

—Exactly, Little Buddy.  
—Al

Al writes from WLAD/98Q in Danbury, Conn., and would like to hear from any other believers in AM. By the way, he always did have the hots for MaryAnne and not Ginger.



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# KSRR Occupies Osmond Legacy

by Dee McVicker

**OREM, Utah** It might not be so surprising, on any given night, for KSRR-AM General Manager Bob Morey to hear a faint chorus of "One Bad Apple" or "Yo Yo" emanating from the station's new studio walls.

The station's new complex, after all, had originally been built for the famous singing Osmond family. And Jimmy Osmond himself previously occupied Morey's new office.

Formerly called Osmond Studios, it was the site of a good many of the group's recording gigs in the '70s and early '80s. Now owned by Ventura Media Inc., the complex is the new home of KSRR-AM, along with five independent companies specializing in the visual or sound mediums.

## FACILITIES SHOWCASE

The Ventura Media Center has under its roof video and audio services ranging from 24-track audio production to the construction of studio sets for television. Original audio and video production studios built by the Osmond group have been parceled out to these various companies, including two for AM station KSRR.

"The production studio we're in was the master audio control for the Osmonds' TV show," says Morey, who used to work for the Osmond group at the facility and is now glad to be back. The AM station also has taken over a former Osmond dubbing/announcer studio for its on-air control.

### Surrounded on all fronts

Coming from a studio complex elsewhere in Orem, where an expired lease had encouraged the station to pursue a new location, KSRR-AM had, like most established stations, a full inventory of equipment. Most of this, however, was in need of repair—or would be soon.

Relates Morey, "After we bought the station in 1985, we worked steadily to upgrade the equipment, if for nothing else than because it kept breaking down." Now surrounded by leading-edge technology on all fronts in Ventura Media Center, Morey was determined to complete equipment upgrades without digging too deep into the AM's budget.

Morey cites the station's new Technics cassette decks as an example of equipment resourcefulness. "We use the cassettes mainly for ABC affiliate playback of Paul Harvey," he says. Instead of the more traditional reel playback of the satellite feed, with its cumbersome threading of tape, KSRR's staff plugs in a cassette.

Technics compact disc players are also used for the station's esoteric mixture of adult contemporary and religious programming. "We're doing something that is kind of unique—an AC format and a lot of locally-produced LDS (Church of Jesus Christ of Latter Day Saints) music featured as well."

The market appears to be receptive to the marriage of formats, if KSRR's recent Arbitron is any indication. "Half of the FMs here have a lower listenership in

Utah County than we do," reports Morey.

Why is this strange combination of music such a hit? "The area has become a mini-Nashville in this country for (LDS) music," he replied.

With AC hits and a good majority of the LDS cuts each available on compact disc, KSRR-AM elected to air its programming directly from CD. This made it mandatory that the station purchase CD machines with Auto Cue.

"We like the Technics for this reason," Morey says. "You don't have to worry about cueing, which of course with some operators—when they're busy trying to

figure out what their next comment is going to be on the air—is a very difficult thing to do."

### On-air console

Where Morey and his staff elected not to cut corners was with the station's new on-air console. They purchased an Arakis six-channel board, choosing a stereo model. "We've been trying to go stereo on everything," says Morey.

Being located in the Ventura Media Center, KSRR-AM is able to take advantage of its many facilities. One of the most prestigious and useful, Morey says, is Jazz-Ranch, the 24-track studio just a

short stroll down the hall.

"If we have a client that wants a lot of music tracks, we just walk down the hallway," he says, naming digital delays, a MIDI and the Eventide Harmonizer as some of the equipment the recording studio has to offer.

Jazz-Ranch, Morey is quick to point out, also is fully staffed with talent such as part-owner and jazz artist Sam Cardon, known for his albums "Impulse" and "Serious Leisure."

This alliance, as well as others in Ventura Media Center, has enabled KSRR-AM to focus on what it does best: as Morey puts it, "bringing people to our edge of the dial."

■ ■ ■

Dee McVicker is a free-lance writer and regular contributor to RW. She can be reached at 602-899-8916.



# Convert Leads into Customers

## Include the Components of a Sales Presentation When Developing a Sales Information Package

by John Cummuta

**DOWNERS GROVE, Ill.** Over the past few months, we've put together a basic marketing strategy and process for contract or free-lance engineers to use in building their businesses.

In this issue, we'll take up with the next component of that process. What we're going to cover also may be of interest to your favorite station managers

and sales managers.

In past columns, we've discussed the steps necessary to running a successful lead-generation campaign. Now it's time to consider what to do with those leads once they start showing up.

And whether you're a contract engineer looking to develop new accounts or an advertising sales manager hoping to generate new clients for the station, your leads are just that: *leads*. Now be-

gins the process of converting leads into customers.

If you're responding to leads you've developed through the mail or over the phone, your first response to them could either be back through the mail or in person. In either case, you'll need more than a smile to make your presentation.

### Responding through mail

If you're responding through the mail, you can call it your sales information kit. If you're making an in-person response, you could call it your leave-behind information package. If you're selling spot

time on a station, you might call it your media kit. It's all the same thing: a sales information package designed to make a self-contained sales presentation.

## ENGINEERING MANAGER

And since it is a sales presentation in every sense of the word, let's make sure that it has all the components of a sales presentation.

The first component of any sales presentation is "image." Many so-called professionals don't think that they need any type of formal sales materials. They can give presentations off the cuff and be as impressive as anyone else. But that just shows their ignorance of marketing.

Burn these words into your mind: "Perception is reality." However your prospect *perceives* you to be is how you are—whether or not it's true.

They will act based on their perception. So the only chance you have to get them to do what you want them to do is to give them the best possible perception you can.

If you have credible materials, along with an equally credible personal presence, you will have a better chance than someone with as good an in-person appeal as you . . . but no sales support materials to give credibility to the substantiveness of their business.

### Better chance

If your initial response is a complete information package through the mail, you will have a hundreds-of-times better chance than someone just writing a letter or scribbling a note.

The first component of any through-the-mail presentation is the sales letter. We covered sales letter writing basics a few issues back, but suffice it to say that the sales letter represents the live salesperson in print. The letter is the human element and should have that natural, "un-business" feel to it. Do not try to impress a reader with your business-sounding language. You're communicating with a regular person. Make it comfortable.

The sales letter also is where you want to stress the benefits of your services. Many of these benefits will be restated in other components of the package, but in your sales letter, you can take the gloves off and really blow your own horn. And remember, shyness and humility don't put bread on the table.

The next part of your sales information package is the brochure. A brochure is the visual aids element of your presentation and is more fact-based than pitchy. Brochures generally will have fewer adjectives than sales letters, but not a complete absence.

The one thing your brochure should not be short of is benefits for your prospect. Beware of the tendency to write about "features" of your service without tying them back as benefits to the reader. Near the end of your brochure you want to park any credibility-enhancing information like licenses, scholastic accomplishments, certifications and so on.

If possible, put pictures in your  
(continued on page 33)

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## AMPLIFIERS

### Want to Sell

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

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

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

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

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

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

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

WE tube mono amp (2), made by McIntosh, 19" rack mounting, service info, gd cond, \$200. R Glenn, WTGR, 1718 Shandoha, Wimauma FL 33598. 813-834-1940.

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

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

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

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

Soundcraftsman 5002 (2), 750 W, excel cond, \$500 ea. A St John, WLKI FM, POB 999, Angola IN 46703. 219-665-9554.

Russco DA-2418 dist amp; Bogen C-20A mono 20 W amp; (2) McMartin B-200B TT preamps; call for info & pricing. M Cooney, Radio 1, 610 N Kiwanis, Sioux Falls SD 57104. 605-336-2706.

### Want to Buy

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

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

McIntosh, Marantz, Harmon-Kardon & Dynaco tube amps, preamps, tuners, tubes & manuals. R Glenn, WTGR, 1718 Shandoha, Wimauma FL 33598. 813-834-1940.

Tube amps & remote mixers, incl RCA OP-6, OP-7, WE 22-D & RCA T3A series. B Davies, Virgo Prod, 5548 Elmer Ave, N Hollywood CA 91601. 818-761-9831.

## ANTENNAS & TOWERS

### Want to Sell

Dielectric 6-1/8" xmission line, rigid copper, 75 ohm w/EIA flanges, (25) pieces of 20' line on gmd now, BO by 10/15. FAX: 419-229-7091.

Solid dielectric coax, 200', 1-5/8"; also, 3-bay CP antenna, tuned to 93.9; negotiable. D Jordan, WDTM Inc, POB 3417, Jackson TN 38303. 901-668-1153.

Andrew HJ8-50B 3" Helix air dielectric xmission line, 350', w/gas pass connector & gas barrier connector installed, slight leak may be traced to faulty connector O-rings. Call for details, BO. K Eilert, KWED, 609 E Court St, Seguin TX 78155. 512-379-2234.

Phelps-Dodge CFM-LP4 4-bay circ FM antenna on 95.9 MHz, gd cond, \$1500. J Ingram, WBLE, Box 73, Batesville MS 38606. 601-563-4664.

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

Jampro 2-element panel antenna, custom design, up to 10 kW, on 93.9 MHz, (4) cables, never used, BO. B Kingman, KRLT/KOWL, Box 15460, S Lake Tahoe CA 96151. 916-541-6681.

Rohn 8R-4R self-standing 100' tower, 1 yr old, new cond; RCA 5BTFD 5 kW tuned to 92.7 MHz, gd cond; Shively Labs 6613 3-bay tuned to 92.7 MHz; 70' 1-5/8 air coax. C Hall, KCDH, POB 165, Nephi UT 84648. 801-623-4010.



## ICE KRACKERS, INC.

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

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

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

Cablewave 1/2" foam, 130', \$130; Andrew FHJ4-50B 170' 1/2" foam, \$170; 60' 1/8" foam w/(1) female 75AN, \$150; 7/8" Andrew foam, 50', no fittings, \$100. L Bawinkel, WWWJQ/WJQK, 5658 143rd Ave, Holland MI 49423. 616-394-1260.

Rohn Tower 80, 492' w/beacons & guys, standing, BO. O Eatmon, WAHD FM, 19 W Hargett St, Raleigh NC 27601. 919-833-6259.

Galvanized tower, 500', 30" face w/tubular side rails, chnl horizontals & bar diagonals, complete w/base insulator, set for 7 levels for guy wire, reasonable. B Gibson, Seacom Comm, POB 5086, Kent WA 98064. 206-228-4393.

CSP 5 kW 4-tower phaser. V Baker, WKGm, POB 889, Blacksburg VA 24063. 703-552-4252.

Phelps-Dodge CO-LP 1-bay antenna, tuned to 92.7, \$900; 197' Andrews 1-5/8" coax, \$1100. J Sokolosky, KKBS-FM, 3125 Norcrest, Oklahoma City OK 73121. 405-427-6869.

Andrew RG-322/HJ8-50B 3" Helix coax cable, 40', BO. D Quinlan, KCHQ, 1415 Laverne Ave, Klamath Falls OR 97603. 503-884-3257.

Liberty tower, 900', 20" face, on grd in 6 pieces, \$10/foot; (6) Gates & (6) Collins antenna tuning units; (1) Gates & (1) Collins 6-tower phasing cabinet; BO. F Weinberg, KTRT, 11330 E 21st St, Tulsa OK 74129. 918-234-1270.

Phelps-Dodge 20 kW 3-1/8" 5-port directional coupler, \$350/BO; Shively 5826D-E 1-5/8" 10 kW 4-port directional coupler, \$200/BO. J Robillard, WYLD AM/FM, 2228 Gravier St, New Orleans LA 70119.

Jampro JHPC 4-bay tuned to 102.5, wrking when removed, \$4500. D Miller, KYTE FM, 906 SW Alder, Newport OR 97365. 503-265-2266.

## Want to Buy

Transmitting plant, complete 3-tower 1 kW, w/phasing towers, (2) Gates xmtrs, processing, remote, 11 yrs old, will sell all/part. J Randolph, WHIR/WMG, Box 1230, Danville KY 40422. 606-236-2711.

UHF TV brdct/translator antennas on old chnl 70-83 band; Scala parapanel, any chnl; Scala SL-8 chnl 19-23, 32-38, 60-64; Bogner B series, chnl 20-30, 31-42, 55-69; Bogner LPS 1, 2 & 4; Thomas UHF panels, any chnl; Emcee DGA-10 corner reflectors. J Powley, WIIM TV, 1536 Logan Ave, Altoona PA 16602. 814-944-8571.

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

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

Coaxial relay, capable of handling up to 10 kW. R Osborne, WMOU, POB 667, Ravenswood WV 26164. 304-273-2544.

Guyed/self-supporting tower, 180', on ground, w/in 200 miles of S IN, 18-24" face at top, med/hvy duty. B Hawkins, RR2 Box 232, Edinburg IN 46124. 317-684-6568.

EIA flange xter switch, 4-port, 1-5/8", any make in gd cond. R DuFaut, WSBY, 1833 N Division St, Salisbury MD 21801. 301-742-5191.

Any Class A antenna, horiz/circ, 2/more bays, on/near 96.1 MHz, ie Phelps-Dodge, RCA, Shively, Collins, etc, reasonable. T English, WEZN, 10 Middle St, Bridgeport CT 06604. 203-366-9321.

Coax flanges, 1-5/8". V Baker, WKGm, POB 889, Blacksburg VA 24063. 703-552-4252.

Cablewave HFM-LP-4 antenna, 4 bay horiz only, on/near 95.9 MHz; also, Cablewave HP-1000-4 antenna, 4 bay horiz only, on/near 95.9 MHz. T English, WEZN, 10 Middle St, Bridgeport CT 06604. 203-366-9321.

Grid dishes, 8' & 10', for 950 MHz STL system; (6) pieces 7/8 Helix, 300' long, w/connectors, priced right. K Austin, Austin Brdctng, 1101 Hwy 81 N, Marlow OK 73055. 405-658-9292.

Coax flanges, 1-5/8". V Baker, WKGm, POB 889, Blacksburg VA 24063. 703-552-4252.

Cablewave HFM-LP-4 antenna, 4 bay horiz only, on/near 95.9 MHz; also, Cablewave HP-1000-4 antenna, 4 bay horiz only, on/near 95.9 MHz. T English, WEZN, 10 Middle St, Bridgeport CT 06604. 203-366-9321.

## AUDIO PRODUCTION

### Want to Sell

Tapco EX18 active x-over, 3-way mono, 2-way stereo, new, \$150. E Davison, 135 N Illinois, Springfield IL 62702. 217-787-0800.

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

Shure SE30 gated compressor mixer, gd cond, \$125. Gary/Mike, KFYI, Phoenix AZ. 602-258-6161.

Universal Audio 962 1/8-frame click-trk gen, \$250/BO. R Rhodes, R Rhodes Music, POB 1550, NY NY 10101. 212-245-5045.

Orban 536A dynamic silibance controller, BO. J Miller, KGNQ, 908 Frontview, Dodge City KS 67801. 316-227-4444.

## Want to Buy

Sony PCM601ESD digital processor, vgc, will pay cash. A LeFay, APC Prod, POB 371, Walnut CA 91788.

Yamaha SPX-90 Series II audio effects processor, must be vgc. M Carta, KM Prod, Austin TX. 512-218-1610.

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

## AUTOMATION EQUIP

### Want to Sell

Otari ARS 1000, in use, tone sensors, 5 yrs old, clean; also, MW Persons Programmer 3A, recently overhauled, \$600; (4) R-R, \$850 ea; \$3700/comp package. B Hickman, WMFM-FM, POB 16928, Hattiesburg MS 39404. 601-545-1063.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Beehive Micro B2 terminal, white screen, works, \$125/BO/trade for gd mic. J Hutson, 3220 72nd Ave Ct W, Tacoma WA 98466. 206-566-8489.

Mark Persons Programmer 3A controller; (4) Revox AR77 R-R; BO. J Miller, KGNQ, 908 Frontview, Dodge City KS 67801. 316-227-4444.

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SMC DS-20 switcher, as-is w/manual, \$150; SMC PDC3 clock, RP1000 programmer w/pwr supply & manuals, as-is, \$300. E Stanley, KBTO, Box 12, Bottineau ND 58318. 901-228-2483.

IGM 48-tray stereo Instacarts (2), boxed & ready to ship, incl all cables. \$4200 ea/\$7500 both. T Hansen, KWSP, 805-438-3221.

### Want to Buy

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

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

## BUSINESS OPPORTUNITIES

### Want to Sell

Radio vet, 23 yrs, seeks co-signer for \$110,000 note for sm mrkt AM in S GA, 40% for signature. B Rachels, 912-228-1204.

Seeking joint venture w/person or company that is familiar w/promoting radio music formats, goal is to deliver via satellite. J Gelo, 813-642-6899.

## CAMERAS (VIDEO)

### Want to Sell

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

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

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

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

Ikegami HL-79E (2), no lens/pwr supply, w/manuals, plates, cases, & Anton Bauer battery mount, lw hrs, vry clean, mint, \$18,500/ea; (4) Ikegami TA-79E/HL-79E Triax adaptors, mint cond, \$1600 ea/trade for camera unit. D Eitzroth, Ritz AV, 6620 Virginia Manpor Rd, Beltsville MD 20705. 800-543-0582.

### Want to Buy

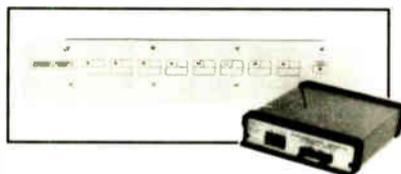
Panasonic AG-450. Bud, TV-40, 4237 Airline, Norton Shores MI 49442. 616-733-4040.

## CART MACHINES

### Want to Sell

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

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International Tapetronics Corporation  
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Bloomington, IL 61704

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

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

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

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

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

Ampro cart tape reloader, gd cond, \$150. D Collins, 3354 Cove Lake Dr, Lexington KY 40515. 606-263-4250.

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

RCA BA27, P only, wrking, \$50 + shipping. J Cunningham, YSDA San Salvador, Rt 2 Box 113B, Stonewall OK 74671. 405-265-4496.

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

Mono cart deck w/reproduce & record capabilities, 3-slot, for sale by sealed bid due 1/92, call for more info. F Urtuzastegui, Purch Office, Maricopa County Comm College. 602-731-8524.

BE 5302 mono 3-deck, '82; (2) Audi-Cord TDS-1 mono P only carts; Audi-Cord E21 R/P w/tones; Tapecaster 770 R/P snl cart; Tapecaster 700 R/P snl cart; Spotmaster 5000 R/P; Gates R/P; Audiolab TD-1B cart eraser; call for info & pricing. M Cooney, Radio 1, 610 N Kiwanis, Sioux Falls SD 57104. 605-336-2706.

ITC SP mono snl P cart (3); (3) ITC trpl-deck mono 1 w/rcrd amp; ITC mono snl R/P w/tones; (2) ITC ESL-IV splice finder/eraser; Dynamax CTR-33 mono trpl-deck w/rcrd, '89; BE 5304-B mono 3-deck w/5310 record unit, '83; call for info & pricing. M Cooney, Radio 1, 610 N Kiwanis, Sioux Falls SD 57104. 605-336-2706.

Audi-Cord series E R/P mono cart machine, never used, new in '86, w/manual, guaranteed, \$1200. IKE-Houston, 713-479-1614.

Gates Criterion 80 mono R/P, gd cond, \$245. G Wachter, KFYI, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

BE Spotmaster 605B, 5-slot, 90 day warranty, \$450. J Von Vleck, VTECH Services, 1200 J North Henry St, Alexandria VA 22314. 703-836-4120.

### CASSETTE & REEL-TO-REEL RECORDERS

#### Want to Sell

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

Magnecord PT-6, (2) stereo, (3) FT mono, amps, cases, parts, manuals, all/part, fair-gd cond, BO; RCA 2" tape transport components, (1) capstan motor, (2) reel motor w/platters, brakes, guides, pinch rollers, gd cond, BO; Shafer logging recorder, 10-1/2 reels, 3/6 ips, 1/4-trk, 2-chnl, gd cond, \$200. R Meyer, Benchmark Comm, 4700 SW 75 Ave, Miami FL 33155. 305-264-5963.

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

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

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

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

Studer/Revox HS77 Mk IV FT mono, 10 hrs use, as new, \$975/BO/trade; portable case for A77 w/m on spkrs & pwr amps, excel cond, \$375; Nakamichi 1000ZXL computer-controlled cassette deck, top-of-line, w/NR100 Dolby C, rackmount w/rosewood case, 1w hrs, \$1375/BO/trade. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 213-859-5543.

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

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

MCI JH-110B FT stereo for 14" reels, in metal roll-around cabinet, \$1675/trade for computer, etc. P Wells, KJOY San Diego, 619-238-1037. FAX: 619-238-6157.

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

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

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

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

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

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

**EXPERT REVOX REPAIRS**  
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15 ips mod. for A&B77's \$350  
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Nashville, TN. 37203 (615) 244-6892

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

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

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

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

Crown vintage tube machines (5): LL802, 751, XB801, LL822, GCSX, \$250/all. Ron, WAWZ FM, Weston Canal Rd, Zarephath NJ 08890. 908-469-0991.

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

Telex 3:1 cassette duplicator, excel cond, needs minor work, \$500 + shipping. S Russell, 60410 Klett Dr, Decatur MI 49045. 616-782-9256.

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

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

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

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

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

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

Revox A77 stereo R-R w/built-in Dolby NR, some spare parts, w/manual, excel cond, vry clean, \$400 + shipping. C Wagoner, Vision West, 12410 12th Ave S, Seattle WA 98168. 206-242-2042.

Ampex 600 series recorders (6). V Baker, WKGM, POB 889, Blacksburg VA 24063. 703-552-4252.

Otari ARS 1000, new. J Phillips, WZOM-FM, 408 1/2 Clinton St, Defiance OH 43512. 419-784-1059.

Tascam 40-4 1/4" 4-trk, gd cond, BO. S Winthrop, Winthrop Prod, 156 W 94th St, NY NY 10025. 212-682-8685.

Recortec ACD automatic audio cassette dup system, w/bi-directional master R-R reproducer & cassette slave recorder/loader, incl parts, supplies & manual, 1w use & well maintained. C Wagoner, Vision West, 12410 12th Ave S, Seattle WA 98168. 206-242-2042.

MCI JH110B 2-trk R-R, mounted, excel cond, several avail. B Massey, WKHX, 360 Interstate N, Atlanta GA 30339. 404-955-0101.

Technics RS1500 2-trk deck; also, Sony/MCI JH110C on roll-around metal cabinet; both excel cond. J Gelo, 813-642-6899.

#### Want to Buy

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

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

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

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

MCI/Ampex 1/2" 4-trk rcrdr, vgc; also, remote PK & dbx; other 4-trks considered. M Carta, KM Prod, Austin TX. 512-218-1610.

#### CD's

#### Want to Sell

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

#### COMPUTERS

#### Want to Sell

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

TI Silent 700 electronic data terminal, \$50. Bud, TV-40, 4237 Airline, Norton Shores MI 49442. 616-733-4040.

Wang CPU, (2) terminals, modem, etc, ran Computer Concepts Business System, BO. A McCarthy, KJUC, 600 E Main, Vacaville CA 95688. 707-446-0200.

#### CONSOLES

#### Want to Sell

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

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

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

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

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

Classic British Helios 2416/24, circ 70s, many updates/models, w/documentation, discrete mic preamps, (9) sep pieces, w/wood rack cab, mahogany desk, \$9500/BO/trade. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 213-859-5543.

Ramsa WR8616 16x4x2 mixing console, 1w hrs, like new, \$2950/BO. G Jones, SW Mediacast, 110 Sierra Rd, Kerrville TX 78028. 512-367-4587.

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

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

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

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

Ampro AC65B 6-chnl control board, stereo/mono, vgc, \$475. J Lee, JL Prod, 208 Hampton Circle, Jupiter FL 33458. 407-575-1828.

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

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

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

LPB M-85-03, '85; Shure M63 mixer; Shure M64A stereo mixer; Shure M675 prod mixer; call for info & pricing. M Cooney, Radio 1, 610 N Kiwanis, Sioux Falls SD 57104. 605-336-2706.

McMartin B-501 5-chnl mono mixer, gd cond, \$325. G Wachler, KFYI, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

Shure M67 & M675 mic mixer & prod master, excel cond, \$300/BO. M Saady, 1st City Rec, 141-60 84 Rd 3E, Briarwood NY 11435. 718-846-2062.

McCurdy SS8500 custom 10 mixer/dual stereo brdcast console, excel cond, \$4250. D Vernier, KUNI, Univ N IA, Cedar Falls IA 50614. 319-273-6400.

#### Want to Buy

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

**PHONE: 703-998-7600 FAX: 703-998-2966**



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**CONSOLES . . . WTB**

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

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

Howe 10,000 parts, any/all, please no 10K series. A McCarthy, KUIC, 600 E Main, Vacaville CA 95688. 707-446-0200.

Pacific Recorders BMX series mic modules, need (2) in wrking order. B Larson, WUSN, 875 N Michigan Ave, Chicago IL 60611. 312-649-0099.

Tascam/Teac/Yamaha 8-12 chnl stereo console. T Crockett, Hot Tracks, Box 10501, Blacksburg VA 24060. 703-953-0222.

**DISCO & SOUND EQUIPMENT**

**Want to Sell**

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

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

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

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

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

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

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

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

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

Bose 802 Series II spkrs & 802/302 EQ. Ultimate 12' stands, like new, excel cond, orig cartons, lifetime warranty, \$1600 firm. P Paquin, Sound Dynamics Assoc, Box 132, Acushnet MA 02743. 508-783-3447.

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

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

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

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

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

SAE 5000 impulse NR, removes clicks & pops, \$125; JBL 4312-A 12" 3-way studio mons, 035T.1 tweeter, 3 yrs old, grt cond, \$500/BO. R Glenn, WTGR, 1718 Shandoha, Wimauma FL 33598. 813-634-1940.

Audio Arts Eng 4200 parametric EQ/preamp, like new, \$225+shipping. C Wagoner, Vision West, 12410 12th Ave S, Seattle WA 98168. 206-242-2042.

**Want to Buy**

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

**LIMITERS**

**Want to Sell**

Quad-8 Cleg compressor/limiter/expander/gate modular units, console/rack mountable, not used, \$150 ea/trade. J McLane, Oddeo Eng, 115 W Gutierrez, Santa Barbara CA 93101. 805-963-3941.

dbx 165 comp/limiter stereo pair (2), new, \$350 ea. E Davison, 135 N Illinois, Springfield IL 62702. 217-787-0800.

Gates Solid Statesman, needs parts, \$50. G Muse, KMRF, POB K, Marshfield MO 65706. 417-468-6188.

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

CRL FM4 system, SPP-800, SEP-400A (2), SMP-800, Dynafex DX-2 NR unit, \$2600; Valley People 440, gd cond w/manual, mic processor, \$250; UREI 535 stereo EQ w/manuals, gd cond, \$200. Donovan, KSKS, 5265 W Magill, Fresno CA 93722. 209-233-9393.

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

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

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

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

Texar Audio Prism (2), for stereo use, (2) RCF-1 cards, brand new, never used, \$1500/BO. L Martino, 714-889-2651.

Orban 9000-A Optimod, AM stereo compatible. D Lang, 503-774-0459.

dbx 166 dual gated compressor/limiter, like new, \$500. B Dierking, KNDY AM/FM, RR3, Marysville KS 66508. 913-562-2361.

Orban 8000A, excel cond, \$1300. Ron, WAWZ FM, Weston Canal Rd, Zarephath NJ 08890. 908-469-0991.

Valley People 610 limiter/expander, call for info & pricing. M Cooney, Radio 1, 610 N Kiwanis, Sioux Falls SD 57104. 605-336-2706.

Gates Solid Statesman, gd cond but AGC needs new pwr xformer, \$45. M Knight, 339 New Kent Rd, Blacksburg VA 24060. 703-552-5809.

Optimod 8000, clean. J Phillips, WZOM-FM, 408 1/2 Clinton St, Defiance OH 43512. 419-784-1059.

**Want to Buy**

Orban 8100A, fair/gd cond, will pay cash. F Vobbe, WLIO TV, 1424 Rice Ave, Lima OH 45805. 419-228-8835.

Greg Labs 2530 tri-band compressor/limiter, check your junk rooms. J Mauk, KMJ/KSKS, 1110 E Olive Ave, Fresno CA 93744. 209-266-5800.

Gregg Labs 2530 tri-band compressor/limiter, check your junk rooms. J Mauk, KMJ/KSKS, 1110 E Olive Ave, Fresno CA 93744. 209-266-5800.

**MICROPHONES**

**Want to Sell**

EV 635A, as new, orig box & access, \$50+shipping. B Leslie, Pro Rcrdng Service, 13709 Maple Leaf Dr, Cleveland OH 44125. 216-662-1435.

# 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**

15-yr host of oldies show on college FM lost time slot, seeking weekends w/in radius of St Louis. D Hogenmiller, 4612 Theiss, St Louis MO 63128. 314-894-8194.

Run it lean, exper radio pro knows how to lwr overhead, increase sales/audience, former owner/operator lking for new challenge, reply in strictest confidence. MMAS, POB 77, Spofford NH 03462. 603-256-6929.

Medium/major market wanted, 22 yrs exper, i.e. KFYI-Phoenix & KQIP-Odesa TX, TV/VO, prod director. R Lane, POB 2764, Odesa TX 79760.

Attn N Mich FM owners, want long term market dominance, untapped nat'l accounts, pro image, reduced overhead, spin of income, nat'l recognition? Joseph, 517-379-4803.

Straight annrc w/20 yrs exper seeks On-Air pos w/mature station, NW AR, SW MO, NE OK. T Horne, 501-337-7218.

Blues & jazz host/producer, in depth collection & knowledge, PT OK, San Francisco/North Bay area. S Lawson, 928 Hyland Dr, Santa Rosa CA 95404. 707-528-4055.

General Manager, experienced all phases. Sales manager, salesman, trainer, 25 yrs in radio, prefer Florida or Georgia. Write to: Radio World, POB 1214, Falls Church VA 22041. Attn: Box #91-11-01RW.

We'd like to be your morning team, funny, creative & professional. J Reynold, 919-671-1162.

Engineer w/20+ yrs major mrkt exper in all phases of radio. Cecil, 214-544-3799.

Top 40, A/C college & sm market prod, DJ, 6 yrs exper, will relocate anywhere in US, any market, FT only. M Ailyn, 708-673-0783.

If PT eng is needed for older tube-type equip, have tubes & can travel in N New England. Mark, 603-625-1165.

Maint eng, CET, FCC gen w/radar, NABER, NARTE certified, CE college station, NBN chief eng & MDS exper, FT/PT, contract work. M Rakoff, 114-41 Queens Blvd #148, Forest Hills NY 11375.

Music volunteer, college professor for 32 yrs w/15 yrs radio exper looking to help collegelcommerical station w/music & programming, no pay, Philadelphia/S NJ. 609-784-5782.

Radio veteran, 20+ yrs, seeks mgt pos in sm/med SE mrkt, BS degree, exper GM, Ops Mgr, Bus Mgr, all on-air & sales. Bob, 803-536-1491.

CE w/big prod voice & over 15 yrs hands-on eng exper, seeks CE pos w/prod or air shift in competitive top 100 market. G Morgan, 704-563-8676.

Leading country music TV/radio personality has 50 TV/radio shows of national C&W celebs, looking for TV/radio shows/cable to air them. 908-271-8244.

Combo eng/annrc, exper in AM/FM/SAT, 20+ yrs exper, General Class License, prefer TX area. P McKaig, 512-664-1106.

Chief engineer top 100 mrkts/20 yr vet, you will get high integrity routine audio & xmtr maintenance, exper in all phases, high pwr AM directional & high pwr FM, plus super audio. 516-265-5372.

Group Chief w/20 yrs+ exper seeks eng mngmt position. SBE Senior cert. FCC license. AM/FM dir exper, const maint FCC compliance. Send responses to: Radio World, POB 1214, Falls Church VA 22041. Box #91-11-02RW.

Announcer w/5 yrs exper seeks FT pos in N CA area, all formats, prod exper, any shift. Clint, 318-847-4635.

**BROADCAST ENGINEER** at 30,000 W, NPR affiliate WMUB, Miami University, Oxford, Ohio. Reports to the Director of Engineering & performs studio & xmtr maintenance to the component level. Supervises all out-of-studio broadcasts. FCC General Class or SBE certificate preferred. Competitive salary w/full benefit package. Review of applications will begin November 22, 1991 & continue until position is filled. Send resume & 3 letters of reference to General Manager, WMUB, Miami University, Oxford OH 45056. Miami University is an Affirmative Action/E.O.E.

**HELPLESS?**  
If you are looking for broadcast professionals to work for you, the people you are looking for are looking through *Radio World*. For information on Help Wanted ads, call Simone at 703-998-7600.

**HELP WANTED**

Audio Manufacturer, Supplier to Major BBC TV & Radio Broadcasters seeks Sales Representatives in the U.S.A. You must be established in the Broadcast Field. We are an award winning company in the U.S. Recording & Sound Reinforcement Industries and are expanding into the U.S. Broadcast market. Come grow with us. Please apply by FAX to 805-379-2648. All inquiries will receive a prompt response.

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# ACTION-GRAM

**Equipment Listings**

Radio World's Broadcast Equipment Exchange provides a FREE listing service for all broadcast and pro-sound end users. 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 \_\_\_\_\_  
 Phone Number: \_\_\_\_\_

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	G. TV station/teleprod facility
B. Commercial FM station	H. Consultant/ind engineer
C. Educational FM station	I. Mfg, distributor or dealer
E. Network/group owner	J. Other _____

**II. Job Function**

A. Ownership	D. Programming/production
B. General management	E. News operations
C. Engineering	F. Other _____

WTS:  WTB:  Category: \_\_\_\_\_  
 Make: \_\_\_\_\_ Model #: \_\_\_\_\_  
 Brief Description: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 Price: \_\_\_\_\_

WTS:  WTB:  Category: \_\_\_\_\_  
 Make: \_\_\_\_\_ Model #: \_\_\_\_\_  
 Brief Description: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 Price: \_\_\_\_\_

\*Closing for listings is the first and third Fridays for the next month's issue. All listings are run for 3 issues unless pressed for space or otherwise notified by listee.

**Broadcast Equipment Exchange**

703-998-7600 PO Box 1214 • Falls Church VA • 22041 FAX: 703-998-2966

# EMPLOYMENT SECTION

**HELP WANTED:** Any company or station can run "Help Wanted" ads for \$1.50/word or buy a display box for \$55/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 3 issues of Radio World. Contact information will be provided, but if a 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.

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 PO Box 1214, Falls Church, VA 22041

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 Joe McClish Stan White  
 Corpus Christi, TX (512) 892-1126

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**COMREX RENTALS**  
**1, 2 and 3-Line Systems**  
 Call Steve Kirsch for details  
**Silver Lake Audio (516) 623-6114**

Sony RMM501 rack mount kit (5), new Type 5, never used, (2) in orig boxes, \$800. D Jordan, WDTM Inc, POB 3417, Jackson TN 38303. 901-668-1153.

Digital LED up timer (5), 2", resets to 0 when 9:59 is reached or momentary closure made, self-pwr'd, \$57.50 ea prepaid, UPS. D Peluso, KJUL FM, 2880 E Flamingo Rd Ste E, Las Vegas NV 89121. 702-732-2200.

Neumann U-67, excel cond, pwr supply, \$3000; Sony C-35P, excel cond, pwr supply, like new, \$325. F Virtue, Virtue Reading, 8809-11 Rising Sun Ave, Philadelphia PA 19115. 215-763-2825.

Electro Voice 666 (2), gd cond, \$40 ea. T Rose, Joiner-Rose Group, 4125 Centurion, Dallas TX 75244. 214-392-7800.

EV 635A dynamic mic, fair cond, \$40/BO. M Saady, 1st City Rec, 141-60 84 Rd 3E, Briarwood NY 11435. 718-846-2062.

RCA classic ribbon mics, others, send for list. B Davies, Virgo Prod, 5548 Elmer Ave, N Hollywood CA 91601. 818-761-9831.

Neumann U-87, excel cond, BO. S Winthrop, Winthrop Prod, 158 W 94th St, NY NY 10025. 212-662-8685.

Electro Voice RE-20, gd cond, no stand adaptor, \$175. T Crockett, Hot Tracks, Box 10501, Blacksburg VA 24060. 703-953-0222.

Electro Impulse DPTC 10 kW FM dry dummy load, wattmeter incl, \$450. Ron, WAWF FM, Weston Canal Rd, Zarephath NJ 08890. 908-469-0991.

Onan series OT pwr sentry/automatic xfer switch, #OTUDD225-4/1202B, 225 amp, 120/208 3-phase, 4-wire, wrking when removed. BO. D Culp, WRQX, Washington DC. 202-686-3100.

TV station surplus equip: Drake 2220 sat rcvr freq agile; cassette decks, Scala CL-1483 antenna UHF; Scalla chnl 35 xmit antenna; Sony VO-4800 3/4" rcrdr; Wegener 1601 mainframe; (3) Unicom 2 W 2-way radios; call for list/BO. John, 509-826-0100.

Xmas tree terminal block (18), ADC, A-66, 6x20, \$3.50 ea; (12) PJ318 dbl row jack field, \$15 ea. T Rose, Joiner-Rose Group, 4125 Centurion, Dallas TX 75244. 214-392-7800.

Telefunken/Schoeps CM-61 tube mic pwr supply & cable. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 213-859-5543.

American Mic D-33 & DR-330, gd cond; also, Shure 333 & Greybar heavy boom stands. D Igou, KMMX/KCHL, POB 1067, San Antonio TX 78294. 512-359-3167.

WE/RCA tall boom stand, over 15' tall for field prod, any cond. P Jacoby, 803-881-1160.

RCA 44s & 77s, WE 639, other ribbon mics, working or not; also, dynamic & other types of mics. B Davies, Virgo Prod, 5548 Elmer Ave, N Hollywood CA 91601. 818-761-9831.

**Want to Buy**  
 Radio/TV station buttons, collector wants to buy/trade. B Massey, WKHX, 360 Interstate N, Atlanta GA 30339. 404-955-0101.

**FM dummy load, 5-10 kW. V Baker, WKGM, POB 889, Blacksburg VA 24063. 703-552-4252.**

**MONITORS**  
**Want to Sell**  
 McMartin TBM3700 FM mod mon & matching TBM200A stereo mon. B Schloss, KRRO, Sioux Falls SD. 605-335-6500.

**MOVIE PROD EQUIP**  
**Want to Sell**  
 Bolex H165 (2), w/400' mag port, drive & mag motors, battery packs, 17-85mm zoom w/rt angle view finder, voltage regulators. K West, SRSU, Dept Fine Arts/Comm, Alpine TX 79832. 915-837-8219.

Cine Kodak Special II, 100' mag lens & case, vgc, clean, 16mm, \$250. C Potorti, Potorti Video, 10005 Lacy, Morrisville PA 19067. 215-945-3990.

B&H 16mm 202 opt/mag proj, w/sync motor for interlock, M-H 816 hot splicer, Beaulieu R16E camera w/ANG 12-120 zoom lens, Hollywood rewinds, sound readers, split & solid reels, send for more info. B Howard, Academy Film Prod, 3918 W Estes, Lincolnwood IL 60645. 708-674-2122.

**RECEIVERS & TRANSCEIVERS**  
**Want to Sell**  
 High quality micro-miniature 67 kHz SCA decoder, about 1" square, prewired and ready to install, \$15. D Jackway, Background Music Eng, 5742 Fairoak, Springfield MO 65810. 417-681-1846.

**AM STEREO RECEIVERS**  
**Portable, Home/Studio, Auto RRADCO GROUP 708-513-1386**

GE MPI (2), UHF hand-helds, 2 W, 2 chnl, xtra batteries, chargers, \$150 both. P Rus-sell, Bowdoin College, Brunswick ME 04011. 207-725-3066.

Precision PE112A AM/FM tuner, rack mounting, SS, gd cond, \$35. E Davison, 135 N Illinois, Springfield IL 62702. 217-787-0800.

AM EBS rcvr on 1430 kHz, call for info & pricing. M Cooney, Radio 1, 610 N Kiwanis, Sioux Falls SD 57104. 605-336-2706.

GE Executive (2), w/cables & control heads, (1) lw band, (1) high band, mics incl, \$100. M Stoin, WGTOT-TV 60, 457 Varney St, Manchester NH 03102. 603-625-1165.

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**MICROPHONES . . . WTS**  
 Shure SM57, special made 12" dynamic, perfect, \$75; (2) Shure 548 special made 11", as new, \$75 ea; Shure SM82 12" interview cardioid, line level out, new, \$100; Shure wireless hand-held WISHT/58/W20R, 1000' range, 177.8 MHz, new, \$525; (2) Shure SM54 dynamic quality mic, mint cond, \$150 ea. E Davison, 135 N Illinois, Springfield IL 62702. 217-787-0800.

Altec M-11 pwr supply system for '48 era tube mic, \$125/trade. J McLane, Oddeo Eng, 115 W Gutierrez, Santa Barbara CA 93101. 805-963-3941.

AKG D224E (8), all need about \$200 in repairs, \$150 ea/BO. G Tyson, AMP Rcrdng, 307 W Main St, Maple Shade NJ 08052. 609-667-1667.

Beyer 101 omni mic, gd cond in case, \$100. P Paquin, Sound Dynamics Assoc, Box 132, Acushnet MA 02743. 508-763-3447.

Sennheiser 441-U new in box, \$200. Donovan, KSKS, 5265 W Magill, Fresno CA 93722. 209-233-9393.

Telefunken/Schoeps CM-61 tube mic, very rare, uses std 6AU6 plug-in tube, w/o cables/pwr supply, mint cond, \$975/BO. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 213-859-5543.

Shure Uniron 330 vintage late 40s-early 50s ribbon mic, excel cond, w/original box & spec sheet, \$275. J Lee, JL Prod, 208 Hampton Circle, Jupiter FL 33458. 407-575-1828.

EV 1776; RCA 44DX; Altec Salt Shaker; \$225/all+shipping. J Deering, Great Com, 114 Walton Ferry Rd SE #B, Hendersonville TN 37075. 615-264-2886.

Neumann U-67, excel cond, pwr supply, \$3000; Sony C-35P, excel cond, pwr supply, like new, \$325. F Virtue, Virtue Reading, 8809-11 Rising Sun Ave, Philadelphia PA 19115. 215-763-2825.

**Want to Buy**  
 Telefunken/Schoeps CM-61 tube mic pwr supply & cable. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 213-859-5543.

American Mic D-33 & DR-330, gd cond; also, Shure 333 & Greybar heavy boom stands. D Igou, KMMX/KCHL, POB 1067, San Antonio TX 78294. 512-359-3167.

WE/RCA tall boom stand, over 15' tall for field prod, any cond. P Jacoby, 803-881-1160.

RCA 44s & 77s, WE 639, other ribbon mics, working or not; also, dynamic & other types of mics. B Davies, Virgo Prod, 5548 Elmer Ave, N Hollywood CA 91601. 818-761-9831.

Neumann U-87, excel cond, BO. S Winthrop, Winthrop Prod, 158 W 94th St, NY NY 10025. 212-662-8685.

Electro Voice RE-20, gd cond, no stand adaptor, \$175. T Crockett, Hot Tracks, Box 10501, Blacksburg VA 24060. 703-953-0222.

**MISCELLANEOUS**  
**Want to Sell**  
 Several audio xformers: Ampex 15095 & 4580116-20, Triad A10J & A11J, \$15/ea. S Lawson, KAK Prod, 928 Hyland Dr, Santa Rosa CA 95404. 707-528-4055.

Blower, BVD B25A, rack mounting, 2 speed, gd cond, \$35. E Davison, 135 N Illinois, Springfield IL 62702. 217-787-0800.

Radio Design Labs pods to make up (2) audio control boards, modular design, new, unused, \$10,000 FOB; Sparta Elec Corp misc audio & RF tech manuals; call/write for compl list. D Peluso, KJUL FM, 2880 E Flamingo Rd Ste E, Las Vegas NV 89121. 702-732-2200.

GKI K80 1/2" tape eraser, rack mount, top shape, \$450. Gene Sive Prod, 619-749-7662.

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### Want to Buy

**Zenith Stratosphere** AM/SW radio, '36; also, EH Scott/McMurdo silver rcvrs; can pick up. D Hauff, Box 16351, Minneapolis MN 55416.

**Motorola HT90/440** dead VHF/UHF rigs, need 2-3. A McCarthy, KUIK, 600 E Main, Vacaville CA 95688. 707-446-0200.

### REMOTE & MICROWAVE EQUIP

#### Want to Sell

**Harris satellite dish**, 3 meter delta gain white, solid, durable, set on concrete slab, \$900. 816-359-2261.

**Mork STL dish**, 5', \$450+shipping. D Donovan, KCGR, 1620 American Bank Plaza, Corpus Christi TX 78475. 512-888-8555.

**Moseley TRC-15AW** remote, excel cond, w/manual, \$750/BO. T Bryan, KARO, 503 Old 63 N, Columbia MO 65201. 314-442-3116.

**Moseley PCL-SCG-6** 135 kHz subcarrier gen; SC-2 135 kHz subcarrier rcvr; \$250 ea. Ron, WAWZ FM, Weston Canal Rd, Zarephath NJ 08890. 908-469-0991.

**Marti R10/STL10** monaural STL system, recently aligned & tuned on 950 MHz, \$2950. A Thompson, KXDD/KUTI, 706 Butterfield, Yakima WA 98901. 509-248-2900.

**Stromberg Carlson PABX** dial phone system w/5) 6-line phones, complete, \$1000; (50) GTF LC-4003 phone line cards, wrkng, \$10 ea. Bud, TV-40, 4237 Airline, Norton Shores MI 49442. 616-733-4040.

**Marti RMC-2AX**, gd cond w/manuals, \$400. J Bolton, KKRK, POB 454, Rayville LA 71269. 318-878-9469.

**Moseley TRC15AR** 15-chnl remote, '82, recently aligned by mfr, \$500. K Austin, Austin Brdcsng, 1101 Hwy 81 N, Marlow OK 73055. 405-658-9292.

**Moseley PBR-15AW** wire line remote; Micro-Controls RCR-9 & RCT-9; call for info & pricing. M Cooney, Radio 1, 610 N Kiwanis, Sioux Falls SD 57104. 605-336-2706.

**Ma-Com MA23CC** 23 GHz microwave system w/xmtr, rcvr & antennas, \$4000 complete. C Haynes, WJMI/WOAD, 1850 Lynch St, Jackson MS 39203. 601-948-1515.

### Want to Buy

**Gates RDC10** studio & xmtr units, must be in gd wrkng order. A Calisti, WBCW, Jeanette PA 15644. 412-527-5656.

**Moseley PCL505C**, Marti or TFT 950 MHz STL equip for export, priced right. K Austin, Austin Brdcsng, 1101 Hwy 81 N, Marlow OK 73055. 405-658-9292.

**Scala MF-960** Miniflector for 950 MHz, reasonable. T English, WEZN, 10 Middle St, Bridgeport CT 06604. 203-366-9321.

### SATELLITE EQUIPMENT

#### Want to Sell

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**(719) 635-8151 Fax**

**Drake ESR 2240** satellite receiver, receives AV signals. P Bailon, 612-222-5555.

**CA Microwave AD-2** downconverter for satellite system, \$200/BO; Amplica CD-304302, LNA, 120° s/n 558, \$75/BO. K Eiert, KWED, 609 E Court St, Seguin TX 78155. 512-379-2234.

**Wegener 1601** satellite receiver for SMN Stardust, compl wall cards & manuals, \$1200. S Schweiger, WXLO FM/AM, 146 Worcester Ctr, Worcester MA 01608. 508-752-1045.

**Wegener 1601**, w/SMN cards, ready to wire up, \$800. G Muse, KMRP, POB K, Marshfield MO 65706. 417-468-6188.

**Dart 384** w/15 KHz, +75 KHz, voice cue card, complete. D Lang, 503-774-0459.

**Wegener 1602 & 1601** mainframe w/cards for Unistar country format system, 18 mnths old, like new, \$2800. K Austin, Austin Brdcsng, 1101 Hwy 81 N, Marlow OK 73055. 405-658-9292.

**Adcomm 7560** satellite rcvr for Unistar ACII & CNN, 2 yrs old, \$3500. B Hearst, WWCH, 725 Wood St, Clarion PA 16214. 814-226-8600.

### Want to Buy

**Scientific Atlanta 6600** satellite rcvr. J Wagner, WMBI AM/FM, 820 N LaSalle Dr, Chicago IL 60610. 312-329-4279.

**Fairchild Dart 384** or Scientific Atlanta equiv rcvr w/15 kHz & SEDAT 21 kHz cards. B Brown, WEQX, Box 102.7, Manchester VT 05254. 802-362-4600.

### STATIONS

#### Want to Sell

**AM daytimer** in NE TN serving 5 counties, 1 kW, county of license population: 45,000+, vry lw operating overhead, relatively new studio facilities in modern mall, Continental 314R, AM xmtr, less than 5 yrs old, station owns satellite facilities, terms neg w/sm down payment, shown only by appt, ref req'd, serious inq only. B Mounjoy, POB 1240, Elizabethton TN 37644. 615-543-5849.

### SHORTWAVE STATION

**Shortwave Radio Antenna/Transmitter site** in New Jersey Wetlands next to Station WOO, Ocean Gate, NJ. State approval for 6 towers & transmitter building. Information: Mr. Knox, POB 250, Toms River, New Jersey 08754 or call 908-349-1100.

**Class A, WIST 94.3 FM**, Lobelville TN w/50 kW CP on hand is once again being offered at a reasonable price of \$150,000. We will consider \$50,000 down, balance on easy terms w/references required. Located 1/2 way between Jackson & Nashville TN, just 10 miles south of I40 & the famous Loretta Lynn's Dude Ranch. Call for appointment today & inspect this nice facility. Bill Coleman Jr, 615-593-2294.

**AM & FM** in stable TX market, owner financing possible, grt opportunity for owner operation, real estate & home incl. 216-331-8012 or 305-296-7575.

**New 50K FM in Southern Missouri Lakes area.**  
417-273-4308  
(evenings & weekends)

**50 kW AM clear daytime**, 500 Watts DA night southern gospel in bible belt, some financing. 919-734-8000.

**Broadcast facility**, complete, set up for talk, news & music, all late/high quality equip, 14'x30' 2-axle mobile studio, less than 5 yrs old, w/air conditioning & restroom. D Lang, 503-774-0459.

#### Want to Buy

**LPTV CPs**, in AZ, CA, CO, FL, TX, exper brdcsr seeking gd father/daughter operation, send compl details w/\$. J Powley, WIIM TV, 1536 Logan Ave, Altoona PA 16602. 814-944-8571.

**AM, FM, AM/FM combo**, no cash down w/some owner financing, prefer an owner ready to retire or pursue other interests, all areas considered. K Weiss, POB 550515, Jacksonville FL 32255. 904-928-3257.

### STEREO GENERATORS

#### Want to Sell

**Marcom/Rood SC 203** w/manuals, new, \$2000. Donovan, KSKS, 5265 W Magill, Fresno CA 93722. 209-233-9393.

**Moseley SCG-4T** 67 kHz subcarrier gen; McMartin BFM-2001 67 kHz subcarrier gen; Johnson Elec 1C-1 67 kHz tuner; Belar SCM-1 SCA mon, BO. Ron, WAWZ FM, Weston Canal Rd, Zarephath NJ 08890. 908-469-0991.

**Motorola C-Quam** stereo gen mon & CRL 950 SMP stereo processor, \$6000/BO. B Shannon, WYWR, 401 N Blaine, Youngstown OH 44505. 216-746-1330.

### TAPES/CARTS & REELS

#### Want to Sell

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**Christian music library** w/over 2,200 record LPs, 12" sncls, & a few 45s & CDs, some never opened, several collectors items, \$3000. E Finley, KNYN, 2015 W Cactus Rd #193, Phoenix AZ 85029. 602-861-0311.

**Comedy music show**, 30 min weekly, well done feature, audition tape \$1, subscription \$2/week. R Schoedel, WMCR-AM, 6630 Monclova, Maumee OH 43537. After 3PM EST: 419-893-7968.

**U-matic cassettes** (400), 1 pass only, like new, incl library cases, some shipping cases, 5/10/15 min lengths, \$2 ea; 20/30/60 min, \$3 ea; shipping xtra. J Powley, WIIM TV, 1536 Logan Ave, Altoona PA 16602. 814-944-8571.

**Transcription file cabinets** (6); (450) standard transcriptions; (170) world transcriptions; (30) various holiday prog transcriptions; BO. B Beattie, 6200 16th St N, St Petersburg FL 33702. 813-526-4275.

**Ampex 642** NAB reels (500), 10-1/2", w/boxes; (100) poly cassette boxes. B Dierking, KNDY AM/FM, RR3, Marysville KS 68508. 913-562-2361.

**Audiopak AA4 & AA3** (1000), 2.0-3.5 min carts, clean, unused rebuilds, loaded w/new tape, gd cond, \$350/100, free shipping; (900) Audiopak AA4 & AA3, various lengths w/diff programs, used, gd cond, \$1/100; (20) blank 10" reel tapes, new, in boxes, \$10/reel. D Kincaid, 1445 Parran Rd, St Leonard MD 20685. 301-586-2177.

#### Want to Buy

**Large collections of 45s**, '50s, rock, R&B, country. K Gutzke, Custom Rcrdng, 7134 15th Ave S, Minneapolis MN 55423. 612-866-6183.

**Large collections of 45s**, '50s, rock, R&B, country. K Gutzke, Custom Rcrdng, 7134 15th Ave S, Minneapolis MN 55423. 612-866-6183.

**World library 16"** radio transcriptions from '43-45: 6079, 6089, 7049, 7059 & 8349, will pay \$50/disk. H Medina, 181 Thomas St, Brentwood NY 11717. 516-273-1832.

### TAX DEDUCT EQUIP

**Educ radio/TV** needs cart R/P & player; 78 rpm TT; stereo R-R for prod; all wrkng cond; will pay shipping. K West, SRSU, Dept Fine Arts/Comm, Alpine TX 79832. 915-837-8219.

**Educ/college station** seeking wrkng A-size mono P cart machine, BE, ITC, UMC 100 series, etc, will pay shipping. E Ford, KBPK, 321 E Chapman, Fullerton CA 92634. 714-992-7418.

**Private college** seeking studio equip for campus radio station in the works, ie console, cart decks, TTs, CD players, etc; also, donors sought for funding. E Finley, KNYN, 2015 W Cactus Rd #193, Phoenix AZ 85029. 602-861-0311.

**Christian radio ministry** needs AM xmtrs, wrkng/not, any & all appreciated, will pay shipping. R Schoedel, WMCR-AM, 6630 Monclova, Maumee OH 43537. After 3PM EST: 419-893-7968.

**Educ station** seeks tax deduc donation of any brdcsr equip, computers, carts, etc, will pay shipping. J Violanti, WSJR, 5600 City Ave, Philadelphia PA 19131-1395. 215-660-1082.

**TTI/Tautron 1120** xmission test set (2). (1) AC only, (1) AC/battery, digital display of dBm & freq, 35 Hz-23 kHz, -40 to +10 dBm, 600/900 ohms, full duplex testing w/C-message, much more, call for details, \$1000. T Wright, WJDN/WJMK, 160 N Michigan Ave, Chicago IL 60601. 312-977-1800 X100.

**B&B Systems AM-2** audio phase mon, CRT X/Y display, w/calibrated graticule for phase, ANSI calibrated VU meters & peak meters for every chnl, magnetic & EMU/RF shielding, excel cond, \$2000. G Fern, POB 2366, Van Nuys CA 91404. 818-778-6756.

**HP 206** audio sinewave gen, uses tubes, \$300/BO; HP 330B audio distortion analyzer, uses tubes, \$350/BO. K Eiert, KWED, 609 E Court St, Seguin TX 78155. 512-379-2234.

**Leader LPM880** RF wattmeter, 3 scales: 0-5 W, 0-20 W & 0-120 W, new, \$150. S sawpm. KAK Prod, 928 Hyland Dr, Santa rosa CA 95404. 707-528-4055.

**Leader LAG-120B** audio gen, BO. L Penke, WKTT-FM, POB 26, Cleveland WI 53015. 414-693-3103.

**Kinematics/Truetime 60-DC** WWVB sync digital clock, mint cond, \$1000; Kinematics/Truetime 60-TF WWVB rcvr freq comparator, excel cond, \$1200. A Ross, 6022 27th NE, Seattle WA 98115. 206-525-4624.

**Tech Materials Corp** 5 kW dummy load, convection cooled, 50 ohms, up to 30 MHz, in 6'x4'x2.5' ventilated weather-proof fiber glass cabinet, new, \$1000/BO; ITT 17" oscilloscope w/manuals, fair cond, \$500/BO. R Meyer, Benchmark Comm, 4700 SW 75 Ave, Miami FL 33155. 305-264-5963.

**HP 8690 B** sweep gen mainframe, \$450; HP 8699B 100 MHz-4 GHz YIG tuned plug in, \$500; HP 8696A 19-26.5 GHz plug in, \$400. Gary/Mike, KFYI, Phoenix AZ. 602-258-6161.

**Leader LPM880** RF wattmeter, 3 scales: 0-5 W, 0-20 W & 0-120 W, \$150. S Lawson, KAK Prod, 928 Hyland Dr, Santa Rosa CA 95404. 528-4055.

**Knight KG-635** oscilloscope, \$50. Bud, TV-40, 4237 Airline, Norton Shores MI 49442. 616-733-4040.

**Sencore FC71** freq counter, \$650; HP 239 oscillator, \$385; HP 331A distortion meter, \$500; HP 400E voltmeter, \$200. B McKenney, 501-967-5451.

**Fidelipac 390** flutter meter; Heath IM-58 harmonic distortion meter; Heath IG-72 audio gen. P Wahl, WWIB/WOGO, 5558 Hallie Rd, Chippewa Falls WI 54729. 715-723-1037.

**Tektronix 1420** vectorscope, excel cond, \$1100; Tektronix 528A waveform mon, \$1100. G Guarino, Sorcerer Sound, 19 Mercer St, NY NY 10013. 212-925-1365.

**Quest Electronics 215** sound level meter & CA-12 permissible sound calibrator, w/case, pristine cond, \$425+shipping. C Wagoner, Vision West, 12410 12th Ave S, Seattle WA 98168. 206-242-2042.

**RCA WX-2-E** field intensity meter, excel cond, \$600; HP 330B audio distortion meter, gd cond, \$100; Heath distortion meter, \$50; General Radio 918A RF impedance bridge, gd cond, \$200. D Messing, KNCY AM/FM, 722 Central Ave #1, Nebraska City NE 68410. 402-873-3348.

**Student operated** community NP radio station seeking prod & brdcsr equip of all kinds, tax deductible receipt given. L Copeland, Ivanhoe Civic League, POB 201, Ivanhoe VA 24350. 703-699-1363.

**Red Cross** needs video & audio equip incl video switcher & recorder, will pay shipping & provide tax certificate, call w/avail equip. G Kirby, 614-261-8871.

**Culturally diverse** community radio station needs xmtr & board, will also accept other equip incl cassette decks & CD players. B Rawlins, WAIF FM, 2525 Victory Pkwy, Cincinnati OH 45206. 513-241-4260 X225.

### TEST EQUIPMENT

#### Want to Sell

**B&W distortion meter** & audio oscillator, both work, \$50 both. G Muse, KMRP, POB K, Marshfield MO 65706. 417-468-6188.

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### TRANSMITTERS

#### Want to Sell

**RCA MI-560719** module extender for BTE-15A exciter, new, \$75; RCA front door fingerstock for BTF-10E FM xmtr, never used, silver-plated, tarnished, \$50/BO. K Eiert, KWED, 609 E Court St, Seguin TX 78155. 512-379-2234.

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**McMartin B-910** exciter. B Schloss, KRRO, Sioux Falls SD. 605-335-6500.

**Collins 20V3** 1 kW xmtr, wrkng when removed, needs re-tubing, \$2000. G Erway, KKSB, POB 40309, Santa Barbara CA 93140. 805-568-1444.

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B-300, 300 W SS RF amp, full metering, remote control. C Springer, KSEC, Box 890, Lamar CO 81052. 719-336-2206.

RCA BTA-1R2 1 kW xmr, on air at 1490 kHz, \$2500. L Afflerbach, CTC Media, 5550 Sterrett Pl, Columbia MD 21044. 301-964-5780.

Harris MX-15 FM exciter on 101.7, easy freq change, excel cond, manual. \$3500/BO. T Bryan, KARO, 503 Old 63 N, Columbia MO 65201. 314-442-3116.

Triad isolation xformer (2), 120 V/120 V, (1) conducts 7 amp load, \$70; (1) conducts 300 W load, \$15. S Lawson, KAK Prod, 928 Hyland Dr, Santa Rosa CA 95404. 528-4055.

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20 kW RCA BTF-20E1

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Kahn STR-84 Powerside, tuned to 1270 kHz, \$6000. J Wilks, KNWZ, POB 1270, Palm Desert CA 92255. 619-346-1270.

GE BT-1-B 4BT181 10 W tube exciter, w/book, no pwr supply, compl set tubes, \$70. J Cunningham, YSDA San Salvador, R1 2 Box 113B, Stonewall OK 74871. 405-265-4496.

QEI 675 freq agile exciter, excel cond, w/QEI 675T 500 W xmr, \$4500. A Charles, WDLY FM, POB 4340, Sevierville TN 37864. 615-453-2644.

Gates BC5P-2 w/tubes, BO; 5 kW AM dummy load. V Baker, WKGM, POB 889, Blacksburg VA 24063. 703-552-4252.

RCA BTF-5, -10, -20E1, over \$15,000 in new parts, some gently used, writecall for list, BO; (2) RCA BTE-15A w/spares & manuals, tuned to 102.1 MHz, w/stereo gen & 67 kHz SCA, BO. M Tomlinson, WMUK, W Mich Univ, Kalamazoo MI 49008. 616-387-5715.

CSI 1 kW FM, 94.3, clean; 10 kW dry load; 4-port 1-5/8" relay. J Phillips, WZOM-FM, 408 1/2 Clinton St, Defiance OH 43512. 419-764-1059.

Bauer 707 1 kW AM xmr, 1000/250 pwr settings, gd for parts, \$500. R Chambers, KSUE, 916-257-2121.

Harris 80 FM 2.5 kHz xmr w/MS-15 exciter, spare 4X150A & 5CX1500A tubes, all manuals, currently on-air in excel cond, delivery in 45 days, \$12,000. J White, 616-796-7684.

Wilkens 1000B 1000 W AM xmr on 1300 kHz, needs filter choke, \$1500. B Hearst, WWCH, 725 Wood St, Clarion PA 16214. 814-226-8600.

## Want to Buy

RCA BTF-10E1 & BTF-20E1 wanted for parts. W Florian, WNIB, 1140 W Erie, Chicago IL 60622. 312-633-9700.

CCA/McMartin 5-10 kW FM xmr, up to 15 yrs old, units in disrepair accepted at lwr negotiable cost. R DuFault, WSBY, 1308 White Way, Laurel MD 20707. 301-792-0851.

UHF/VHF TV translators, 10-100 W, will consider old UHF band 70-83 equip: RCA TTU-2A/TTU-10A UHF TV xmr for parts; GE TT-24-A, 100 W, or TT-20-A, 1 kW, UHF TV xmr for parts. J Powley, WILM TV, 1536 Logan Ave, Altoona PA 16602. 814-944-8571.

**WE BUY  
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Low pwr, 3-10 W. J Benjamin, JC Enterprises, 3923 E Thunderbird Box 139, Phoenix AZ 85032.

Gates AM BC-5B oscillator coil L1, Harris A-3263-101 or 910-3263-001, new/used or info on specs. G Reinheimer, WGOL, Radio Lane, Lynchburg VA 24506. 804-237-4700.

If your station was trying to sell a HARRIS 5H/5KW xmr with MX-15 exciter through Imperial Transmitter, a Nebraska equipment broker, we still want to buy it or a similar FM xmr & exciter. We want to buy that 96.1 antenna too. Please contact our station's GM at 205-764-8170 or FAX: 205-764-1240.

Any LPTV xmr, for chnl 60, lw priced only. O Eatmon, WAHD FM, 19 W Hargett St, Raleigh NC 27601. 919-833-6259.

Harris MW1 1 kW AM xmr, gd cond. Howard/Chuck, KWKY, 515-981-0981.

## TUBES

## Want to Sell

Penta premium output tubes: KT88, \$25; KT99, \$49, EL34(HD), \$12; custom match & quan \$ avail; also, fabled 12AX7B. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 213-859-5543.

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New tubes in original boxes (250), send for list. SASE, BO. S Warren, RR Studio, 970 E Lake Dr, Bartow FL 33830. 813-533-4650.

Eimac 4CX3000A radio xmr tube, M Warren, WMEJ, Box 7575, Huntington WV 25777. 614-867-5333 after 1:30 PM EST.

## Want to Buy

6072/6072A, any quantity, send brand # & S. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 213-859-5543.

## TURNTABLES

## Want to Sell

Russco (2), vgc, w/100 arms, \$50 ea+shipping. D Morgan, KNZZ-KJYE, 1360 E Sherwood Dr, Grand Junction CO 81501. 303-241-9230.

QRK w/Micro Trak arm, \$125+shipping. J Deering, Great Com, 114 Walton Ferry Rd SE #B, Hendersonville TN 37075. 615-264-2886.

Presto 6N disc cutter, 78/33-1/3, perfect cond, \$600. B Rose, Program Rcdngs, 228 E 10th St, NY NY 10003. 212-674-3060.

Russco 2-speed (2), \$100 ea/\$175 both; (2) ORK 3-speed, \$100 ea/\$175 both; \$300/all. G Erway, KKSB, POB 40309, Santa Barbara CA 93140. 805-568-1444.

Scully 351 disc cutting lathe, used by RCA Records Hollywood, call for details. R Becker, 313-581-0520.

Presto disc cutter, w/amp-mixer, will do 33-1/3, 78 or 45 rpm, \$500+shipping. R Osborne, WMOU, POB 667, Ravenswood WV 26164. 304-273-2544.

Scully/Westrex VP131, remodeled lathe by Hazco Westrex, DAM-II cutting head & all related disc mastering equip, wrking cond, \$35,000. F Virtue, Virtue Rcdng, 8809-11 Rising Sun Ave, Philadelphia PA 19115. 215-763-2825.

Howard rcdng discs, metal core, slow burning, 6.5"/\$1.50, 8"/\$2. W Keepers, Nostalgia Tape Club, 215-338-3639.

Harris CB1200 w/Micro-Trak tonearm & preamp, gd cond, \$75. G Wachter, KFYL, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

QRK 12-C (2), need little work & tonearms, \$25 ea. M Knight, 339 New Kent Rd, Blacksburg VA 24060. 703-552-5809.

Technics SL1015 DD quartz w/±10% speed adj, w/Technics EPAA501H arm, used little, local area delivery, \$800. B Rosenberg, WVXU FM, 3684 Saybrook, Cincinnati OH 45208. 513-321-0606.

## Want to Buy

Fairchild disc rcdng equip, #740 & similar, Presto, Rek-O-Kut, RCA, etc; also, accessories incl amps, limiters, heads, manuals, needles. K Gutzke, Custom Rcdng, 7134 15th Ave S, Minneapolis MN 55423. 612-866-6183.

Fairchild disc rcdng equip: 670 stereo limiter, 602 conax, 641 rcdng system, 605 stereo preamp, 880 pwr amp, 740 lathe, 741 auto pitch, 742 cabinet; also, disc equip from Neumann, Gotham/Grampian, Presto, etc. K Gutzke, Custom Rcdng, 7134 15th Ave S, Minneapolis MN 55423. 612-866-6183.

Rek-O-Kut CVS 12/125 or similar w/78 rpm variable speed & 16" arm. R Caldwell, WTVF, 474 Jas Robertson Pkwy, Nashville TN 37219. 615-244-5000.

RCA, Presto disc rcdngs & assoc equip, blanks, needles & pre-recorded acetates or pressed transcriptions. B Davies, Virgo Prod, 5548 Elmer Ave, N Hollywood CA 91601. 818-761-9831.

Player, 16", or arm; also, 16" discs. H White, Bijou Rcdng, 8332 Colfax Ave S, Bloomington MN 55420.

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Strand Century '81 lighting pantograph (4), new, \$40 ea; Sylvania studio lamps: (9) EGK, (1) BTL, (1) EHK, (4) Colortran 176-018, (1) 176-022, \$5 ea. A Ross, 8022 27th NE, Seattle WA 98115. 206-525-4624.

RCA TK-27-TP-66 complete film chain, gd cond, opti & mag sound, all manuals, exterior boards, spare parts, \$2000/trade. Bud, TV-40, 4237 Airline, Norton Shores MI 49442. 616-733-4040.

## VIDEO PROD EQUIP

## Want to Sell

Channelmatic Spotmatic Jr (3), w/Net-Share 4-chnl switcher, cable & insertion equip, \$1150 ea; Tele-Engineering Ad Cue Jr cable ad insertion controller, \$1000. R Stone, W-AIR, 322 Bay St, Petroskey MI 49770. 616-348-2000.

Laird CG-7000 charac gen w/(3) fonts, \$1000. J Soyk, Soyk Adv, 525 Main, Lewiston ID 83501. 208-746-8134.

Trompeter JSI-24W/J3, RCA type, 24-jack video patch panel w/(12) looping plugs & (4) patch cords, excel cond, \$200. A Ross, 8022 27th NE, Seattle WA 98115. 206-525-4624.

Microtime 1020 TBC w/manuals, \$200/trade; EIA sync gen, Sylvania M-SCA12 034, \$50; Sylvania G-100 sync gen, \$50; Cone/Cohu video Multi-Plexus, \$25 ea; Telemation TDM-1425/TCG-1425 elect charac gen w/disk drive memory, (2) keyboards, manuals, cables, \$50; Systems Programmer Zectex control unit, \$50. Bud, TV-40, 4237 Airline, Norton Shores MI 49442. 616-733-4040.

Sony CVM 1250 12" color video mon, UHF/VHF, A/V, I/O, excel cond, \$300/BO. R Glenn, WTGR, 1718 Shandoha, Wimauma FL 33598. 813-634-1940.

Dubners CBG2 charac gen, complete, excel, w/DBG keyboard, (2) 10 meg drives, main frame w/memory expansion, Lambda pwr supply, b1 pad, TCE 2000 encoder, some shipping cases & manuals, \$15,000/BO; General Parametrics Video Show 150 video presentation system w/pri-ter interface option, \$300; WYSE terminal, futuristic design, BO. MRG Assoc, 95 Colony Dr, Holbrook NY 11741. 516-447-1041.

Blonder-Tongue ESM TVRO modulator, wrks grt, \$50. M Knight, 339 New Kent Rd, Blacksburg VA 24060. 703-552-5809.

CEL P156-2 digital standards converter, PAL to SECAM to NTSC, excel cond, \$4000. P Russell, Boudcin College, Sills Hall, Brunswick ME 04011. 207-725-3066.

## Want to Buy

Will trade (2) 5 acre lots in San Luis Valley CO, subdivision of Rio Grande Ranchos, surrounded by mountains, for video prod equip. 913-672-3428.

## VIDEO TAPE RECORDERS

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VCR M-1 studio editing deck (3), brdct quality, \$1000/ea; editing controller, \$500 cash. 913-672-3428.

Ampex VPR-2B/TBC-2B training & tech manuals, complete, \$200. D Collins, 3354 Cove Lake Dr, Lexington KY 40515. 606-263-4250.

Panasonic NV9400 3 1/4" portable, mint, less than 50 hrs, w/(3) new NiCads, 14-10 pin cable optional, \$650 incl UPS. Patrick, Video Velocity, 800-264-3362, 9-9 PST.

Sony BVU-110 3 1/4" VTR w/Portabrace case, like new, \$1000. MRG Assoc, 95 Colony Dr, Holbrook NY 11741. 516-447-1041.

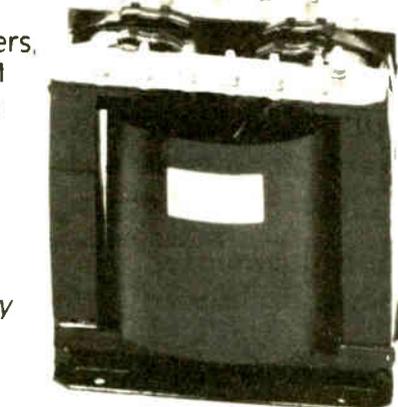
JVC RM83-U 3 1/4" edit controller, \$300; Sony VP-2000, \$175; Sony VO-2610, \$325. J Von Vleck, VTECH Services, 1200-J North Henry St, Alexandria VA 22314. 703-836-4120.

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**ARMSTRONG SOUTHEAST**  
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Fax 615-826-0082  
Hendersonville, TN.

# Convert Leads into Customers

(continued from page 25)

brochure, certainly one of yourself looking as friendly and professional as possible. But also photos of any good-looking vehicles, equipment or on-site action shots. You want to assure your prospect that they are not your first client . . . even if they are.

The next element you will find in any good sales information package is testimonials. When you say something great about yourself, the applause meter goes up about halfway. When someone else says something great about you, you get plus dB in the reader's mind. You cannot have too many testimonials in your package. If you have so many that the reader would get tired of looking at them, you win.

A note here. If you wait for unsolicited testimonials to roll in, you'll be old and gray before you have enough. Ask for them. Try to get them on the client's letterhead. The easiest way to do that is to have a text already written up before you ever ask.

You say something like, "Have you been happy with the service I've given you and your station?" Presuming that the answer is yes, just tell them that it's obvious that it would be helpful to you if they would give you a testimonial that you could use to establish relationships with *non-competitive* colleagues of theirs. They will gener-

ally agree to do one for you.

Here's the spot where you say, "I know that you're busy, so I've taken the liberty of coming up with a generic kind of statement. If you agree with it, we could have your secretary type it up right now and be done with it." It almost always works. Of course, you vary this text from client to client.

The last element of your sales informa-

tion package is a call to action. You want the prospect to *do* something. Tell them what that is and exactly how to accomplish it. If you want a call, tell them to call now and give them the number. If a mailback response is adequate, give them an addressed envelope (does not need to be postage paid) and a response card that needs very little information.

Well, we're out of room for this month,

but I think you get the idea. Your sales information package is a convenient little salesperson that can be pulled out of the envelope at your prospect's convenience. Make it as convincing as you can.

■ ■ ■

*John Cummuta is an independent marketing and management consultant. Reach him at 708-960-5999.*

## Do Microwaves Cook S-Band?

(continued from page 19)

This means about two watts are allowed to leak from the oven—not much, but enough to cause interference to nearby receivers.

Typically, microwave oven emissions are centered near 2450 MHz, but this frequency is varied during the cooking cycle to change the position of standing waves that can cause hot and cold spots in food.

This means microwave oven interference occurs over a broad range of frequencies, making it harder for other services to operate nearby. The satellite proponents want to be as far from this region as possible.

Along with satellite DAB proponents, the American Radio Relay League (ARRL) is also opposed to a DAB

allocation in the ISM band—but for different reasons. It plans to use 2400 MHz to 2410 MHz as a downlink band for amateur satellite operations.

### Statistically unlikely

The ARRL says amateurs can cope with microwave ovens because, with oven frequencies centered at 2450 MHz, it is statistically unlikely there would be interference at the League's requested band. Also, amateurs have a better understanding of interference problems and should be able to identify and compensate for them, perhaps by using highly directional receiving antennas.

Other communications services are better able to co-exist with the ISM band.

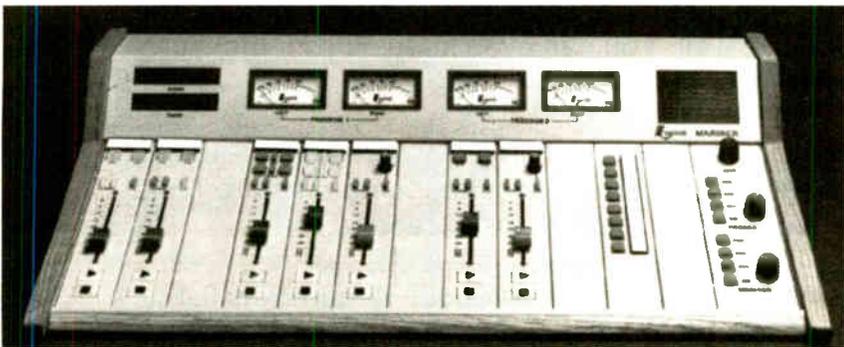
Television broadcast auxiliary stations such as studio-to-transmitter links can use 2450 MHz to 2483.5 MHz, subject to the requirement that they accept interference from ISM equipment.

This isn't too big a problem because television auxiliary communications are usually point-to-point using directional antennas that more readily reject interfering signals. Another factor is that microwave ovens are far away from auxiliary receive antennas, which typically are mounted several hundred feet above ground, and several hundred feet horizontally from homes.

■ ■ ■

*Steve Crowley is a consulting engineer with the Washington firm of du Treil, Lundin & Rackley, Inc. He can be reached at 202-223-6700, or by fax at 202-466-2042.*

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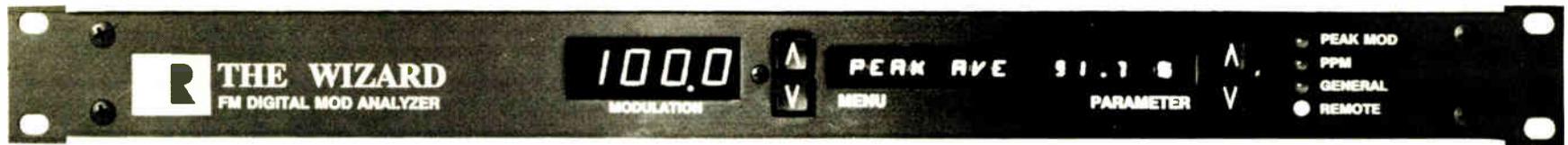
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With The Wizard, you can even analyze the competition! Just combine The Wizard with our new RFA-4 Frequency Agile FM RF amplifier. Now you don't have to guess what the competition is doing; nor do you have to hire an expensive monitoring service to give you after-the-fact data. Everything you learn from The Wizard about your station, you can learn about your competition as well. You can even keep all your measurements permanently—just save and print out the computer file.

The Wizard even includes a loss-of-program alarm—just set the minimum modulation (anywhere from 0 - 100%) and the maximum time you can fall below this modulation (0 sec - 60 sec, in 1/2-second increments) from the front panel (or remotely), and the alarm will be triggered when the parameters are exceeded.

Naturally, The Wizard has the performance you've come to expect from any Belar product. Accuracy is 0.1%, for example. Since performance is to a great degree a function of the quality of your composite signal, we offer an optional demodulator card, with specs that can't be beat—distortion typically less than 0.003%, S/N typically better than 95dB, and separation typically better than 70 dB. It will even self-calibrate remotely to 0.1%. With The Wizard, you'll be measuring your signal, not your monitor.

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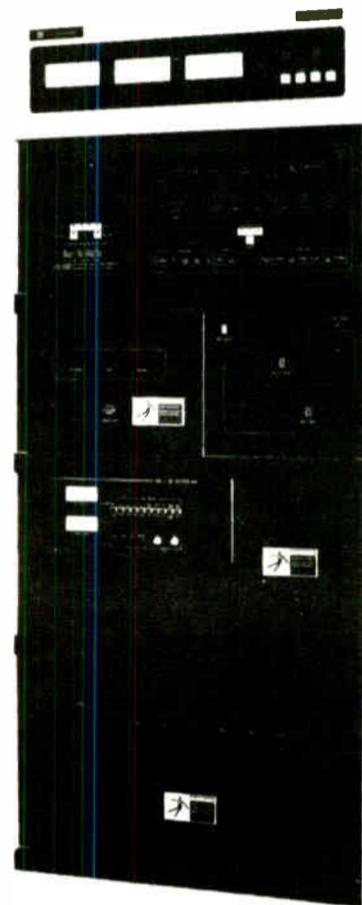
# BUYERS GUIDE

FM Transmitters, Exciters & SCAs

## Warm 107 Hot for Harris HT-35

by David Solinske  
CE, WWRM

**TAMPA, Fla.** As Tampa exploded into major market status, stations began to rebuild long-neglected facilities, for years



WWRM was the second station in Tampa to go with the Harris HT-35 35 kW FM transmitter.

abused by lightning and tropical, salt-laden air.

In 1988, when I left a frozen New York town for Florida's "Warm 107," I was confronted with a recently installed single-tube 60 kW transmitter that wouldn't stay on the air. It became apparent that the \$125,000 investment, abandoned by its manufacturer, would never work.

We needed a replacement and were the second in town to choose the Harris HT-35 35 kW FM transmitter.

Our experience with the new 60 kW tube and several horror stories of other recently designed tubes indicated tube type should be the primary screening factor.

Since neither the EEV 4CX15000 nor triodes were being used at 35 kW, only the well known, reasonably priced 4CX20000 series would be sought.

### Down to the wire

The two finalists exhibited similar specifications, features and reputations. The day of decision, I phoned our sister station with the other brand to find his IPA module burned out in an overnight lightning storm. The HT-35 had favorable user comments, a large corporation behind it and

the Flex Patch system.

From Florida's lightning capital, I called my Harris rep.

The Flex Patch is a fast way to bypass a failed stage (or stages) with a simple patch cord change. The transmitter can then be brought up at reduced power while you obtain replacement parts. (Bypassing the final tube also requires a strap change.)

Flex Patch relieves the stress of being on your last transmitter because you really never are. On one hand, I look forward to using it. On the other hand, I hope I never have to.

A failed stage can be identified in seconds with a glance at the LED status indicators on the eye level front panel block diagram. What I thought would be a silly frill, the memory turned out to be useful, as it stores overloads (with date and time stamp) to aid in finding the cause of a failure or non-fatal momentary shutdown.

It's nice to know it popped off due to a power company phase loss, when you otherwise might tear into it looking for signs of an intermittent component.

My greatest fear from "the 60 kW experience" was another microprocessor logic control system. I was pleasantly surprised to find on the HT-35 that it works and ignores our daily lightning strikes. If it should fail, control would fall to a separate basic system. I did find that RF from a 50 kW air-cooled dummy load alongside the transmitter adversely affects its microprocessor control system operation.

Installation went quickly with the easiest and most thorough remote control

interface I've come across. Problems amounted only to loose nuts and contradictory filament regulator kit installation instructions.

### Customer focus

Showcasing renewed customer focus, Harris people phoned frequently to check on performance. One day a tech showed up on my doorstep, wanting to inspect the rig. He made a quick

## USER REPORT

relay update and did a brief show-and-tell at no charge. Harris sent a questionnaire about tube life as my first was going soft at 8,000 hours.

Using filament management and a regulated filament supply, I had hoped for at least 15,000 hours at 35.8 kW. I trust Harris will find a way to extend tube life soon.

My line voltage sags at peak summer electric demand hours. In conjunction with the tubes' downward emission spiral, the screen voltage method of power control served mostly to detune the final, requiring retuning trips. In normal operation with either a good tube or good line voltage regulation, this has not been a concern.

After 18 months of failure-free operation, my only true complaint is the large, flimsy power supply covers that flop around while one tries to negotiate screws into the sliding slip-on speed nuts they love to use. A nightmare at 4 a.m.

The highest praise for the HT-35 is that my wife, listening to her typical car radio, can identify it on the air. She says it sounds crisper and brighter than the brand "C" 60 kW rig. I like to point out it hasn't disturbed a night's sleep.

Oh, one more thing. For anyone who's interested, I have a three-year-old single tube 60 kW FM transmitter for sale.

For information from Harris, contact Gaylen Evans at 217-222-8200 or fax: 217-224-1439.

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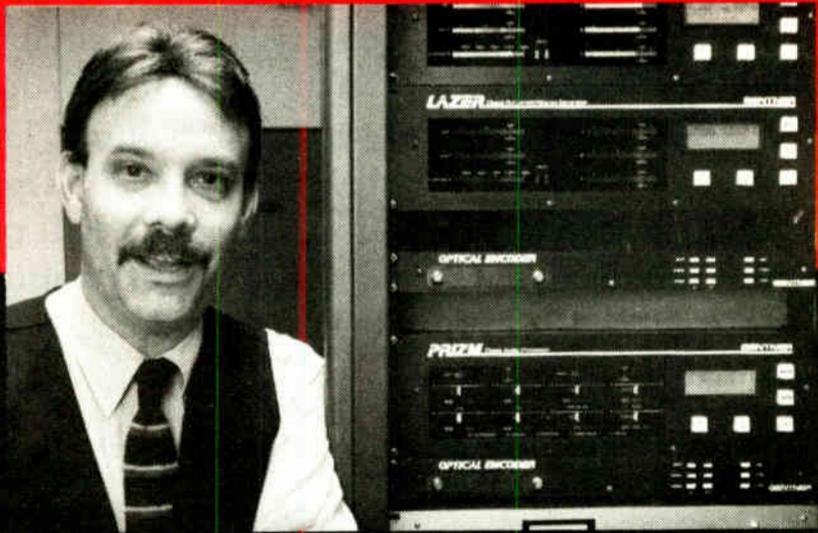
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Also: Information from Econco, CCA and EEV.

“Literally overnight, the Lazer made us the loudest, clearest, and best sounding station in town.”

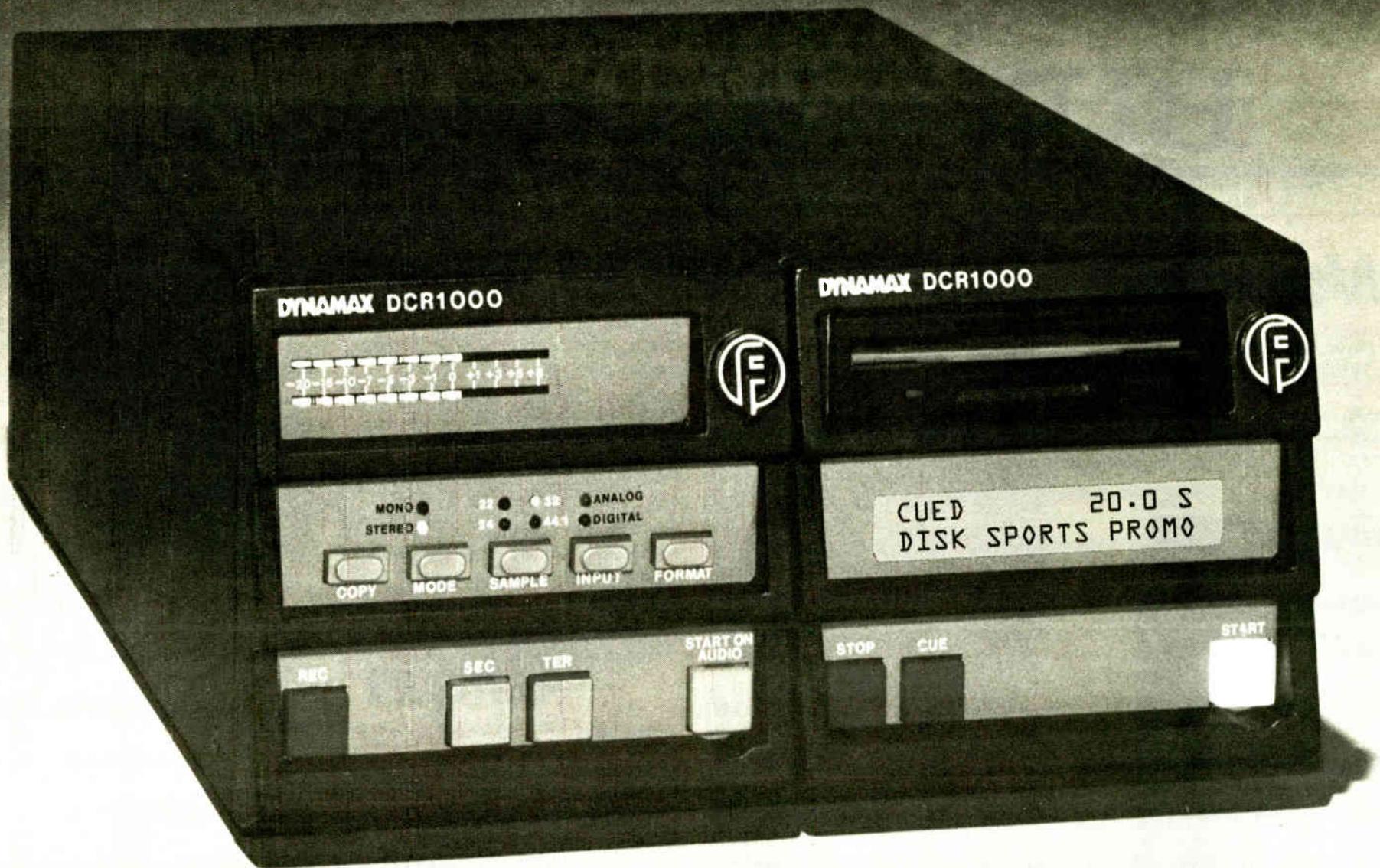
*Kim Hall, Creative Director  
KSOP, Salt Lake City, Utah*



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Our staff of veteran broadcast professionals preserved all the familiar user-friendly functions and flexibility of conventional cart machines in the DCR1000. We know the ins and outs of on-air studios as well as the needs of station personnel. Engineers will appreciate the durability and virtually maintenance free design of the DCR1000. (The disk drive offers over 20,000 hours MTBF yet requires less than 15 minutes to replace.) D.J.s will put their hands on instant cue and start buttons. The production staff will enjoy CD quality audio and the ease of direct digital dubbing. And Station Management will find the price reasonable – about the same as Dynamax CTR90 Series Cartridge Machines.

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World Radio History

# WJCT Upgrades to BE's 20-B

by Lee Young  
CE, WJCT-FM

**JACKSONVILLE, Fla.** Over the last three years, our engineering staff has studied almost every available high power FM transmitter in the marketplace, in hopes of replacing our transmitter, which has given us 18 years of faithful service.

Each time I looked at a Broadcast Electronics transmitter, a clear message came through: a careful blending of fundamentals and necessary innovation.

The bottom line for us was to select a transmitter that offered the best design, a reputation for reliable operation, excellent

## USER REPORT

performance and easy access for serviceability. Knowing we would not be replacing this transmitter for many years to come, we insisted also on a manufacturer

with a good record of customer support. Therefore, WJCT-FM purchased a Model 20-B 20 kW transmitter from Broadcast Electronics.

The installation phase of the project had some built-in restrictions. We had to use the existing space and transmitter, operating uninterruptedly while moving in the new transmitter and support equipment.

A temporary location five feet away was carefully marked for our Bauer 625. We then determined the lengths of RF hard line and power cable required, and the location of PA air venting, which we accessed through the ceiling.

The old space required some carpentry and conduit changes, along with new cabling, prior to the 20-B's delivery. The electronics movers set up the cabinets, new duct work (connected with power), RF and control during the next five days.

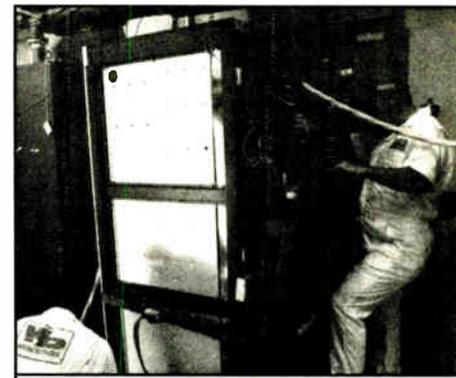
The transmitter was operated for seven days at 19 kW into a new Altronics air-cooled dummy load. During that time, two bugs were found and easily repaired with warranty exchange circuit cards. The 20-B went into full-time service June 13 with a cutover time of 30 minutes.

After a month of 24-hour operation, power usage has been reduced by 13 percent—an annual savings of \$2,500.

There are several design features that truly stand out, such as two independent IPA drivers built by BE. If we lose one driver, the other will give us 75 percent of our licensed T.P.O. with a quick cable change.

There is no plate blocking capacitor used in the PA circuit, and changing the tube is a two-minute job in an emergency. Power regulation even without the automatic system engaged is within five percent and the measured FM noise level is -80.6 dB.

Aided by good common sense, a helping of objectivity and a practical outlook, our station is getting its money's worth—



After minor modifications, the Broadcast Electronics Model 20-B transmitter was a perfect fit at WJCT.

and so are our listeners.

For information from Broadcast Electronics, contact Russ Erickson at 217-224-9600; fax: 217-224-9687; or circle Reader Service 71.

# KRIO's Grand 816A

by John Furr  
Partner, KRIO-FM

**SAN ANTONIO, Texas** I am impressed at what a nice box the Continental 816A transmitter is.

We made our decision to purchase the 11 kW transmitter based on our past

experience in maintaining a variety of transmitters, I know you have experienced the joy of tube socket maintenance. Check this: The 816A tube socket is also mounted

(continued on page 38)

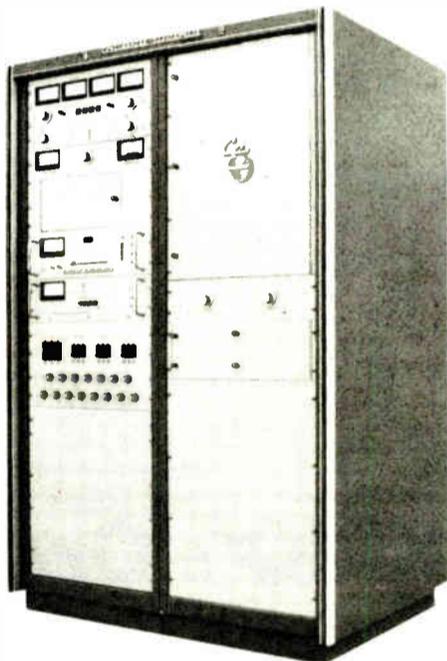
## USER REPORT

experience with Continental products. Although we expected simplicity and reliability, we also were pleased with features not seen previously in transmitter products.

The cabinet is only two rack units wide, instead of the older 10 kW transmitters, which were three rack-units wide. I suspected, on initial inspection, that the components were too cramped and access would be difficult.

Closer inspection revealed that all of the front-mounted equipment—including the 802A exciter, solid state driver and amplifier—are mounted on rails. This allows the units to slide forward for easy access to all components, inside and out.

If you have had at least 10 years of ex-



The Continental 816A was purchased by KRIO in San Antonio, Texas.

## Fishing For A Phone Number?

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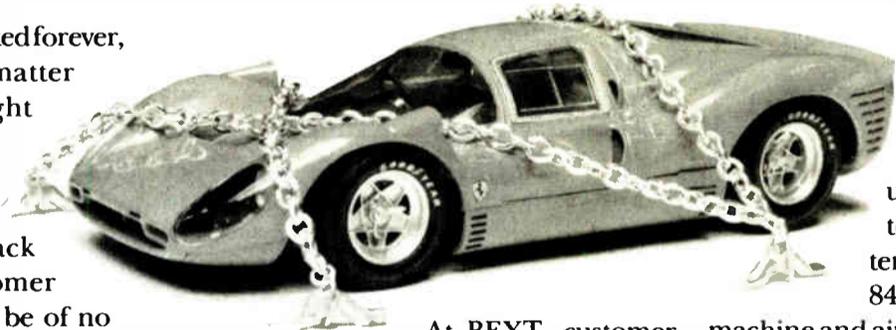


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## What happens when you buy a "high performance" product from a low performance company?

If electronics lasted forever, it wouldn't matter where you bought your next exciter, amplifier, STL, translator or transmitter. Track records of customer frustration would be of no concern as you simply chose the box which suited you.

Since failures not only occur, they usually take place at the worst possible time, it's a good idea to go into the purchase knowing exactly what the manufacturer will do if you need help. Will they handle your need themselves? Will they take action? Will they follow up to see if you're okay?



At BEXT, customer service is a way of life. We freely share our reference list so that those whose experience with other companies leads them to doubt our claim can hear what a difference BEXT has made in our customers' lives. Beside our service, you'll hear about the technical superiority and reliability that have made our products the growing choice of the engi-

neering community.

To find out what it's like to have a relationship with BEXT, unchain that high tech telephone system and call 619-239-8462, or rev up the fax machine and aim it at 619-239-8474. We'll promptly return the complete BEXT catalog of FM, UHF and VHF equipment, with reference list.

And don't be surprised if we call to be sure you got it.



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# QEI First Choice for WWWQ

by Robert L. Beasley  
CE, WWWQ-FM

**GLASGOW, Ky.** When we here at WWWQ-FM began the search for a new high-power transmitter, there were many factors that led us to QEI. The station had just been granted a C3 upgrade when a tornado destroyed our old tower site, transmitter and all.

Naturally, being off the air, time became the number one priority. A new tower site already had been selected, but it was so remote that getting electrical service to the site was an im-

mediate problem.

The new site was located on an 1,100-foot ridge, 12.5 air miles from our studio location and three-phase power was

## USER REPORT

about three miles away through the woods. The utility company gave us an estimate of \$44,000 to run three-phase power to the location—it may as well have been \$44 million, because

at the time, we couldn't afford either.

Our first solution to the power dilemma was to purchase a Kay Rotary converter to convert single-phase to three-phase. At that time, we also were considering a smaller transmitter with an eight-plus bay antenna system to get around the electrical dilemma.

After beating our heads against the wall for a couple weeks, the consulting engineer that had done the upgrade survey and studies for the previous station owner pointed us in the direction of QEI.

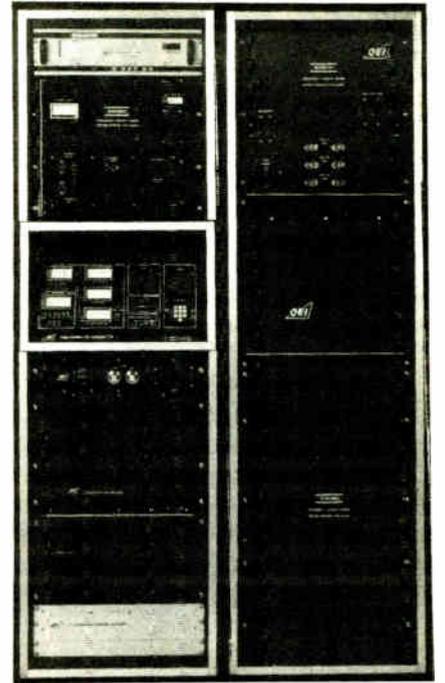
After talking with QEI and discussing our needs and concerns about the performance of its transmitter line, we were convinced that the QEI 20,000 B single phase transmitter was a true Godsend.

Those three words still sound so sweet: "Single Phase Power." I would never have thought that a high-power FM transmitter could be efficiently operated on single phase power, but QEI does it.

We've been on the air now since July 9 with our new QEI exciter and transmitter. There have been a lot of problems, but none of them with our RF chain.

The electric utility has had problems keeping our service up, due to the fact that they underestimated our load requirements. Our STL path was obstructed by a water tower that was not on the topographical map used on the upgrade study.

The transmitter shack failed its first electrical inspection over a new double grounding requirement imposed by the utility company, and just one week before moving into the new studios, light-



The QEI 20,000 B transmitter was part of WWWQ's C3 upgrade.

ning ran in through the electrical feed to the studio and severely damaged most of our new studio gear.

All in all, it's safe to say that the only thing that went right during this project was QEI.

With features like Auto Mod, on-board composite clipping, single phase power supplies, solid state IPA, single tube operation and overall outstanding performance and field support, you can bet that QEI products will now be our first choice, when it's time to upgrade or replace our existing equipment.

For information from QEI, contact Jeff Detweiler at 609-728-2020; fax: 609-629-1751; or circle Reader Service 62.

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- ColorStat™ front panel signal flow diagram with red/green LEDs shows status at a glance
- Harris power supplies are designed for continuous duty operation with 100% sine wave modulation
- Modular construction with readily available FET output devices
- Bandpass filter and output matching network for effective lightning protection
- 100% solid state design totally eliminates tube replacement costs and reduces maintenance costs sharply
- Output impedance matching controls provide tuning flexibility for non-standard or changing loads

AM stations around the world have already discovered the competitive advantage of DX Series transmitters in 10, 25, 50 and 100 kW power levels\*. Isn't it time you did too? Call Harris Allied today at 800-622-0022 for more information on digitally modulated DX Series AM transmitters.

\*Contact us for applications to 500 kW and beyond.

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## KRIO's Grand 816A FM

(continued from page 37)

on slide-out rails for "lap top"-style inspection and maintenance.

The 816A uses a 4CX15,000A power tube. In previous 20 kW transmitters, I have achieved 25,000 hours at full 20 kW power. This "overkill" on the PA tube should ensure a greater tube life operating at half that power.

Because the power heat loss of the tube is low for the rating of the tube, the blower operates at lower velocity than I expected. This has resulted in a much lower overall room noise level than I expected.

We've gotten superb audio quality from the 802A exciter. Installation was immediate with no "tune up" required. There's nothing more to say of the smooth ramp-up plate-on or rock-solid automatic power adjust.

At KRIO-FM in San Antonio, we are pleased. We brag to our Texas listeners that our transmitting equipment is manufactured by Texans in Dallas.

For information from Continental, contact Steve Claterbaugh at 214-381-7161; fax: 214-381-3250; or circle Reader Service 10.

### DIGITAL ANTENNA MONITORS In Stock — Available for Immediate Delivery



Price \$2400.00 2 Towers Will operate with any remote control equipment.

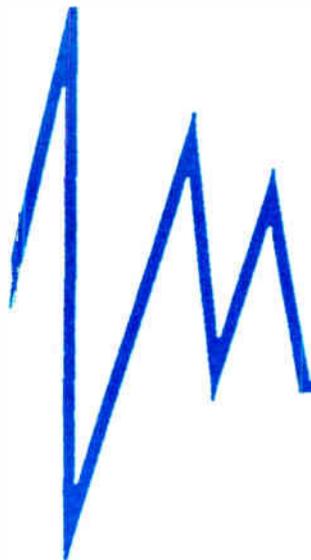


Price \$1780.00 2 Towers For AM directionals with studio located at transmitter site.

These monitors are state-of-the-art instruments of unequalled accuracy. (.5% or better on ratio and .5° or better on phase) and stability. With typical modulation the true ratio readout of these monitors is a factor of 10 more stable than instruments that measure normalized amplitude, and their phase readouts are rock solid. Phase sign is automatic, no extra operation. In addition to the analog DC outputs for remote control the Model CMR has a multiplexed BCD digital output which can be used to drive the Remote Indicator Model CMR-1. RF inputs have dual protection. Gas discharge tubes across the sample line terminations plus relay protection.

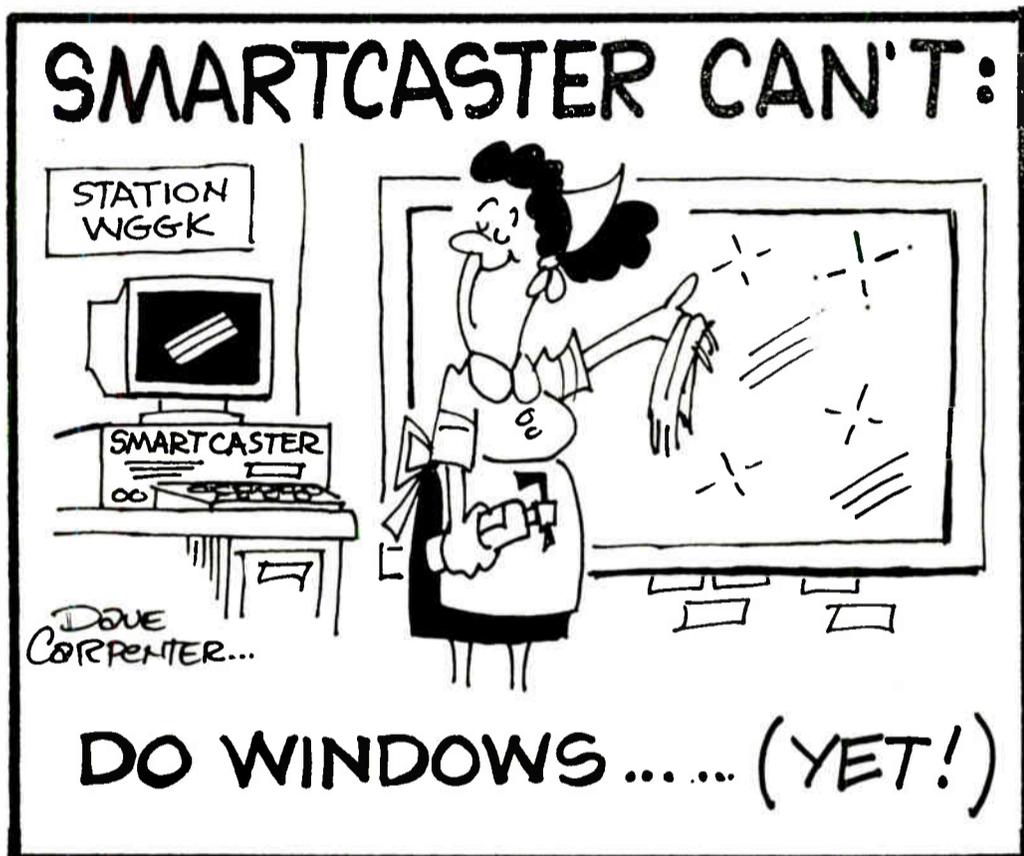
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# Richardson Offers MMD FM Broadcast Modules

by Greg Peloquin  
Product Manager, RF Components  
Richardson Electronics, Ltd.

**LA FOX, III.** Microwave Modules and Devices (MMD) has agreed to allow Richardson Electronics to stock and distribute its standard 700 W, 300 W and 150 W FM broadcast modules.

## TECHNOLOGY UPDATE

These are the same modules that have been available for more than five years,

sign, 50 ohm interfaces 1.5:1 VSWR; low cost and high efficiency (70 percent); and a 1.25 kW solid-state "FET" architecture feature.

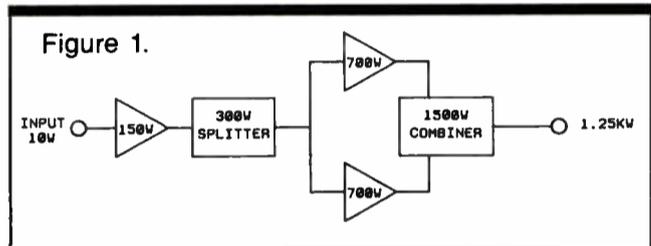
### Two identical modules

The 1 kW set (Figure 1) uses two identical 700 W amplifier modules driven by one 150 W module. Included in the FET is one 300 W combiner/splitter and one 1500 W combiner/splitter.

The heart of the 700 W module is the RF amplifier section (Figure 2). The unit uses eight 125 W silicon FETs. The die are similar to those used in the Motorola MRF174 transistor. These die are mounted in special high-performance MMD packages.

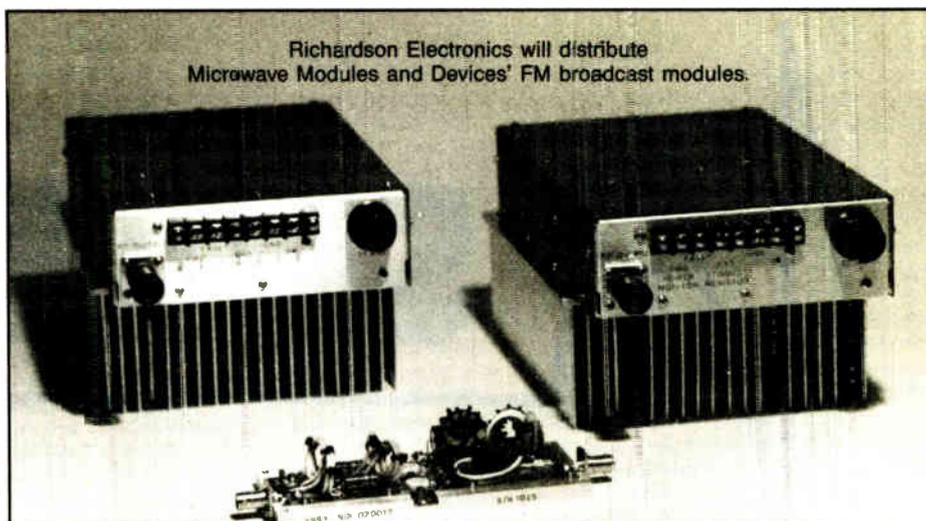
Since high temperature reliability is crucial and small size is not a driving consideration, MMD's modules are targeted for minimum thermal density. The unit delivers the rated 700 W of power with eight FETs operating at well under 140 degrees Celsius, even during worst-case environmental conditions.

The eight thermal, individually packaged transistors are binarily interconnected through three levels of combining. To end up with the maximum combina-



but only to select transmitter manufacturers. In using these proven building block modules, a solid-state FM 1.25 kW set now is available to everyone.

Primary features of these power modules include their totally self-protected de-



tion of benefits, each level of combining uses a different technique. At the first level, a pair of transistors is combined in the simplest possible way (in phase or parallel combined).

Isolation resistors are used across the pair to smooth out slight amplitude or phase imbalances. The next level of interconnecting uses 180 degrees (push-pull combining techniques). An optimally designed transmission line transformer structure accomplishes this.

### Final combiner level

The third and final level of interconnection uses a special 90 degree combiner. This combiner is the key to making the 700 W module a true building block unit. Use of the 90 degree (or Quad) combiner produces a module with the following advantages: 1:5:1 VSWB input and output, improved forward power delivery into a mismatched load, improved back IMD, reduced third harmonic levels, sub-module isolation and improved efficiency into a mismatched load.

Because it is crucial that the 700 W building block module be indestructible, sophisticated protection circuitry is built in. As seen in Figure 3, the module contains both an input power sensor and a load VSWR detector.

The critical parts of these sensors are the special low-loss, bi-directional couplers used to pick off forward and reflected power samples that are then rectified and converted into DC reference levels.

The 700 W module also contains DC voltage, DC current and baseplate temperature monitoring circuits. If abnormal con-

ditions appear, the unit can automatically reduce the DC voltage to the module or crowbar the supply to the ground, de-

Figure 2.

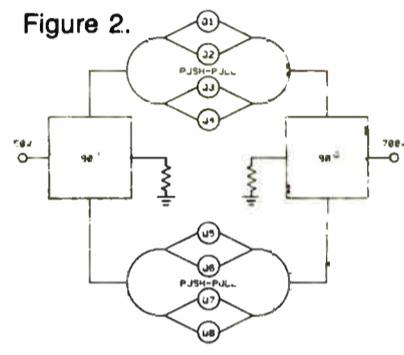
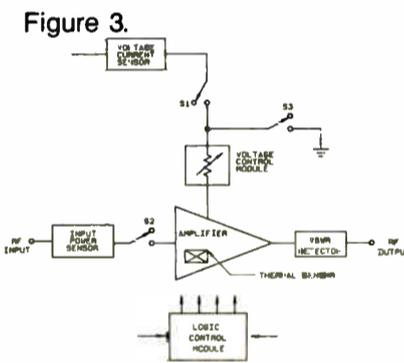


Figure 3.



pending on what is required. The entire 600 W module can be shut down in less than two milliseconds.

When any module shuts itself off after sensing an abnormality, it must wait a preset time (not more than two seconds) before resetting itself and trying to come back on line.

(continued on page 45)

It's hard to stop.  
It's hard to stop.  
It's hard to stop.



What is it about the Signature III that keeps so many leading station groups and consulting engineers coming back for another, and another, and...? Is it this console's unparalleled record of reliability and longevity? The LPB Signature III's easily maintained modular electronics? Its excellent RFI immunity? Or is it designed-for-radio features like the following:

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Chances are, it's all of the above. But whatever the reasons, leading stations and engineers across the country demand Signature III's "unstoppable" performance. In fact, they've made it one of the most popular consoles ever built. If you've been spending too much time inside your console lately, contact your broadcast equipment dealer or call LPB for full information and specifications at (215) 644-1123.

LPB Signature III audio consoles are available in 6,8,10 and 12 channel stereo and 6,8 and 10 channel mono configurations.

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- 013 035 057 079 101 123 145
- 014 036 058 080 102 124 146
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- 018 040 062 084 106 128 150
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# Nautel Brings Solid State to FM

by Jorgen B. Jensen  
Manager Sales & Marketing  
Nautel Electronic Laboratories

**HACKETT'S COVE, Nova Scotia** The Nautel FM7 transmitter is a totally solid state 7000 W unit, capable of 7500 W and housed in a single rack.

It incorporates all of the advantages of solid state design, including on-

mitter on the air.

A benefit of the solid state FM design is the reduction in AM noise, both synchronous and asynchronous, over a tube-type transmitter. Broadcasters can therefore realize the full potential of their exciter.

The Nautel FM7 is practically transparent to the exciter. Thus, the quality of the transmission is determined solely by the quality of the exciter used. (Nautel does not, at this time, manufacture its own exciter.)

The AMPFET FM7 incorporates a practical design to overcome the factors that have previously made solid state FM appear commercially unattractive, in spite of technological benefits.

The single most significant constraint on solid state development is the high price of the RF switching devices for

very high frequencies. Devices utilized in AM transmitters at medium frequencies have a multitude of industrial applications, so they are manufactured in large quantities, resulting in low unit prices. The devices required for FM have no general application. As a result, unit prices typically exceed \$100.

## Finances

Nautel has worked to overcome this cost disadvantage by simplifying design to minimize add-on manufacturing costs. Nautel utilizes one dual device rather than two single devices for each 250 W power amplifier. The AMPFET FM7 combines 28 PAs using Nautel's patented 60 degree combining system.

This combining method is virtually without insertion loss. Therefore, fewer devices are required for a given output power level. The combiner gives good isolation without need for resistive dissipation networks common to conventional combining methods. Again, the result is manufacturing economy.

A second deterrent to solid state FM development is the poor transmitter efficiency resulting from traditional design approaches—typically about 50 percent overall. Operating efficiency has been an important factor in the solid state displacement of tube-type AM transmitters.

Nautel's FM design offers overall efficiency of about 65 percent. This is ac-

complished by operating the power amplifiers in a highly efficient mode. This requires power amplifiers to have input and output circuits tuned for the operating frequency. Therefore, the transmitter

## TECHNOLOGY UPDATE

is not suitable for "frequency agile" requirements.

The usual North American requirement, however, is for single-channel

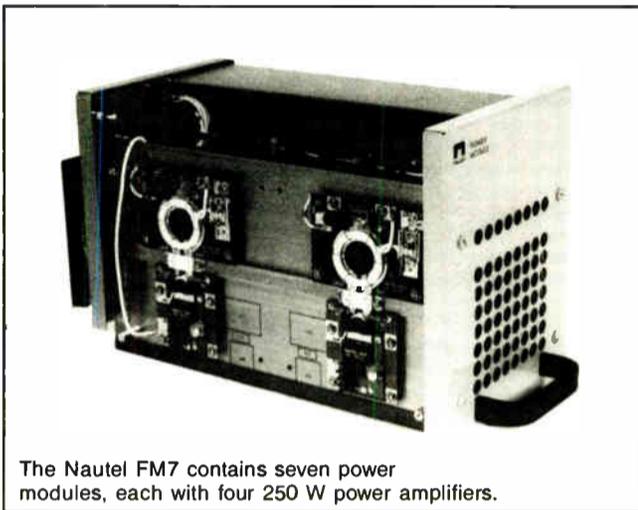
broadcasting. The only concern would be any impact on the transmitter's serviceability. Field repair or replacement of AMPFET FM modules is readily accomplished. A cable adaptor is provided to quickly tune a module using the transmitter as a test bed even while it continues to broadcast using the remaining modules.

With the module terminated to a 50-ohm test load, one simply adjusts the input capacitor for minimum voltage. That's all there is to it.

The AMPFET FM7 7 kW model will soon be joined by a 4 kW version (look for the AMPFET FM10 in 1992).

■ ■ ■

For information from Nautel, contact Jorgen Jensen at 902-823-2233; fax: 902-823-3183; or circle Reader Service 123.



The Nautel FM7 contains seven power modules, each with four 250 W power amplifiers.

air serviceability and modular redundancy. As well, it overcomes factors that previously were major deterrents to the development of solid state FM transmitters.

The power section of the transmitter is made up of 28 independent 250 W solid state power amplifiers, mounted for convenience in seven power modules. Each module consists of four 250 W power amplifiers, one cooling fan, input splitter and temperature sensor. An eighth module, with two 250 W power amplifiers is used for the IPA to drive the other power modules.



Nautel's FM7 transmitter.

## Replacement IPA

In case of an IPA failure, one of the seven power modules may be used as a replacement IPA, allowing the transmitter to continue operating at a reduced output power level. The outputs of the 28 power amplifiers are combined and filtered in Nautel's patented combiner/filter. The modules are isolated; in the event of a failure they can be removed from service with the trans-

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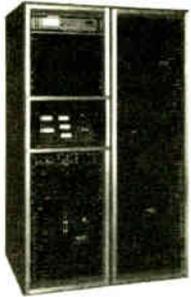
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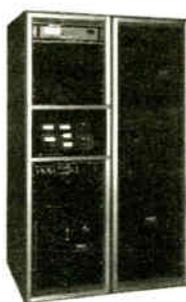
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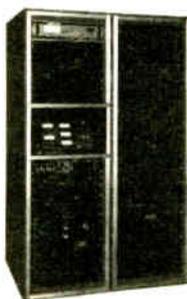
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# Bext Amplifiers Suit User Needs to a "T"

by B. Boehme  
Engineer, Bext Inc.

**SAN DIEGO, Calif.** For some time now, Bext Inc., has offered tube-type amplifiers. Known as the "T" series, these medium-power amplifiers range from 800 W to 2000 W, and use EIMAC triodes

## TECHNOLOGY UPDATE

in a grounded grid configuration.

The 3CX800A7 triode is used in the 800 W version, and the 3CX1500A7 is used in the 1200 W, 1500 W, 1800 W and 2000 W versions. The amplifiers are compact, packaged in a 14"×19"×25" cabinet. The T800 model weighs 198 pounds; the T1800 and T200 each weighs 220 pounds.

Access to the unit is simple. The tube is replaced by removing a small plate on the side of the amplifier. The top cover is opened by removing two screws. The telemetry and remote control card are mounted on the inside of the top cover.

The power supply components are protected by a clear plastic cover with relatively easy access to the major components. The RF cover deck is a separate module, making up part of the cabinet. It is machined from cast aluminum and accessed through a single cover. The entire RF deck may be removed if necessary.

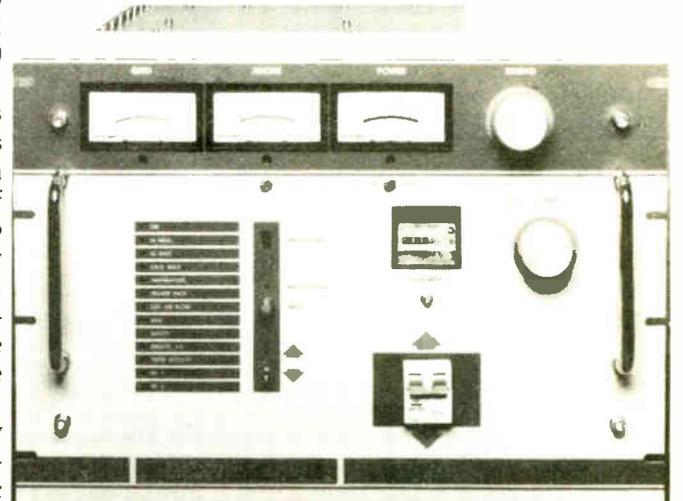
Amplifier safety features include monitoring of the air flow volume, air flow temperature and temperature of the power transformer. The power transformer has been vacuum saturated with epoxy and

comes with an electrostatic shield.

The entire line, except the T2000, will operate from 220 VAC, single phase. The T2000 is the same as the T1800, but with a three-phase power transformer.

The amplifiers will exhibit between 15 dB to 16 dB of gain. This means the T800 delivers 800 W output with 20 W to 25 W of drive; the T2000 delivers 2000 W output with 60 W of drive. Front panel metering is accurate and completely monitors the parameters of the amplifiers.

Meters monitor anode current and voltage, grid current, direct power and reflected power. Overload conditions, which shut the amplifier down, are indicated on the front panel through a series of LED indicators. Also indicated is the number of times the amplifier attempts to automatically recover from a fault.



The T 1200 is one of a family of single-tube Bext FM amplifiers, ranging from 800 W to 30,000 W.

The amplifier may be monitored and turned on or off via a telemetry interface provided on the rear panel. Most components, such as tubes and solid state devices, are available from various sources, making the unit easy to support.

For information from Bext Inc., contact Michelle DeFazio at 619-239-8462; or circle Reader Service 111.

## Selecting a Dummy Load

by Mark Rubin  
President  
Electro Impulse Laboratory

**NEPTUNE, N.J.** Radio frequency dummy loads for radio stations, once considered an optional piece of test equipment, have become a necessity for testing and for reject load functions.

## TECHNOLOGY UPDATE

Electro Impulse Lab makes a wide range of dummy loads for nearly all standard and many special requirements.

To select a dummy load, you must specify maximum average power, including modulation, frequency range, input connector, cooling requirements and AC line voltage available.

Most station loads will dissipate all

of the incident power into the ambient. If that space is air conditioned or poorly ventilated, however, the temperature could rise to unacceptable levels, causing the dummy load over-temperature safety interlock to cut out.

Therefore, the location for installing the dummy load should be considered carefully. It should not be installed in an air conditioned room unless the air conditioning is sufficient to handle its load.

The heat from some types of loads can be ducted, but check with the factory first. Forced air-cooled loads are designed for free air use; the back pressure of ducts may cause the load to overheat.

Loads are normally fitted with an interlock circuit, which provides for a set of dry floating form C relay contacts and a mating interlock connector, which should be tied into the transmitter plate circuit. Depending on the type of load,

(continued on page 46)

# MARKETPLACE

Radio World's Marketplace, a compendium of new and recently introduced radio broadcast products, appears monthly in Buyers Guide.

## World Plotting Services

Dataworld computer-generated maps are available for any region in the U.S. and include information on coastlines, islands, lakes, rivers, highways and boundaries.

A wide variety of data can be overlaid on the map. Broadcast facility coverage contours based on either the FCC F(50,50) and F(50,10) curves or the FCC groundwave and skywave propagation curves can be plotted. Locations illustrating population density, as well as demographic information, also is available.

For information, contact John Neff at: 301-652-8822; fax: 301-656-5341; or circle Reader Service 25.

gon digital audio transmission processor. The system enhancement will be shipped with all new orders for the paragon and will be supplied to existing owners at no charge.

The enhancement features daypart programming, which allows the station to pre-specify setup files to be placed on-air on a user-determined day or at any specific time within that day; full-parameter zoom screens, allowing users to have complete detailed control over every functional parameter within a specific paragon functional processor; and an on-line keyboard editor, to al-

low users to custom-name any user-created setup file using the touch screen.

For information, contact the Audio Animation Sales Department at 615-689-2500; fax: 615-689-7815; or circle Reader Service 95.

## Bel Profanity Delay

Bel's BDE-5000S stereo broadcast profanity delay provides eight seconds of delay and has a "catch-up" facility that enables the delay to be built-up in real time.

A remote control is provided that contains dump and delay in/out switches. A cart player interface offers automatic cat insert and a failsafe bypass system is incorporated as standard.

Additionally, an optional on-board solid-state recorder with up to 10.5 seconds memory is available for storage and replay of jingles or station in-dents in stereo.

Bel's products are distributed worldwide by Michael Stevens & Partners Ltd. at +44-081-460-7299; fax: +44-081-460-0499; or circle Reader Service 88.

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Before



After



Before

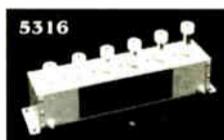


After

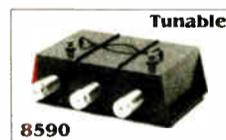


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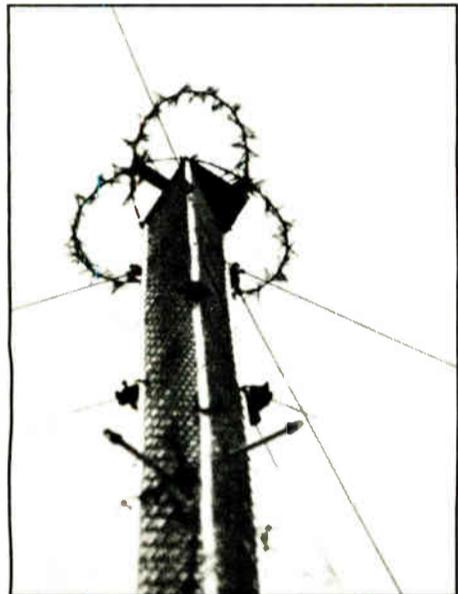


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## Lightning Protection

LightningMaster Corp. specializes in reliable, cost-effective lightning protection for broadcast facilities, including transmitter towers, STL towers, satellite dishes and buildings.

The company offers a complete line of structural lightning protection, surge suppression and grounding products and services. Recently introduced is complete transmission line testing from 10 MHz to 18 GHz with LightningMaster's Hewlett Packard HP 8328 A system.

For information, contact Bruce Kaiser at 813-447-6800; fax: 813-461-3177; or circle Reader Service 69.

## JVC Parametric Controller/EQ

JVC Professional Products Co., now offers the DS-LC900U digital parametric controller and equalizer, a professional-grade system designed to emulate the feel of an analog equalizer.

The DS-LC900U uses an FIR-type digital filter to provide high-quality digital audio. Twenty-eight fixed frequencies are available over four overlapping bands that provide a total of 54 EQ points. In addition to shifting center frequency, response sharpness and level boost and cut can be varied by the user.

For information, contact Matthew Weiner at JVC: 201-794-3900; fax: 201-523-2077; or circle Reader Service 137.

## Audio Animation Ver. 2.0

Audio Animation has released Version 2.0 operating software for the para-

# Revolution at the Push of a Button

Rohde & Schwarz will manufacture the encoding and decoding portions of the highly-touted Radio Data System (RDS). In the following piece, the company explains the technology's potential uses and its part in its development.

by **Matthew Straeb**  
Marketing Manager  
Rohde & Schwarz

**LANHAM, Md.** The Radio Data System (RDS) is expected to revolutionize FM transmission in the U.S. The service provides additional information to listeners at home and in the car, including type and source of programming, radio texts, radio

paging, emergency alerting, remote control and many other services.

RDS was introduced at the 1987 International Radio Show in Berlin and is used according to the CENELEC 50067 standard developed by the European Broadcast Union (EBU). Currently, there is an installed base of more than 1,500 RDS encoders throughout the world, including Germany, France, the United Kingdom and Switzerland.

In the U.S., the Radio Broadcast Data System subcommittee to the National Radio System Committee, is preparing a standard for the United States. The U.S. standard will utilize a large portion of the

proven CENELEC standard with modifications to address the U.S. FM market.

## Other features

Another service provided by RDS is the ability to automatically switch a car radio over to your frequency. Listeners can select a particular format. RDS will find a station with the pre-selected format as you travel from one listening area to another.

For example, if a driver is listening to a station with a format similar to your station format and moves out of the range of that station, RDS can automatically tune in to your station.

FM stations could further increase their revenue stream by becoming a transmitting site for local, national and international radio paging. Alphanumeric RDS pagers with four-line LCD displays are capable of displaying a message of 80 characters in length.

In areas near nuclear plants or other hazardous facilities, RDS will be used to transmit emergency notifications to the population.

When considering an advanced broadcasting system like RDS, it is easy to find specific applications varying from the described ones.

Since the RDS operates on a data rate of 1187.5 bits/second, not all applications can be used at the same time via one FM station.

The radio data signals are inaudibly transmitted within monophonic or stereophonic FM broadcasts in a way that does not interfere with existing sound and data signals.

A suppressed subcarrier at 57 kHz transmits the radio data signals, which are amplitude modulated by shaped biphasic coded data signals. During stereo broadcasts, the subcarrier frequency will be locked to the third harmonic of the 19 kHz pilot tone.

## Frequency tolerance

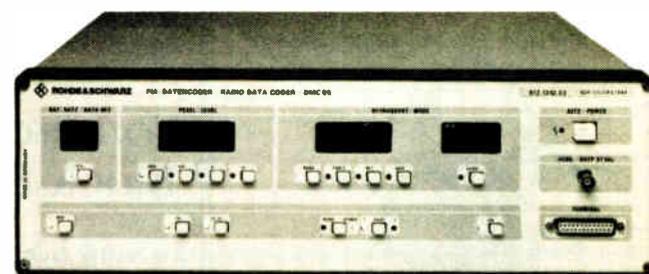
Because the tolerance of the 19 kHz pilot tone is  $\pm 2$  Hz, the tolerance on the frequency of the subcarrier during stereo broadcasts is  $\pm 6$  Hz. The subcarrier

will be locked in phase to the third harmonic of the 19 kHz pilot tone. The tolerance on this phase angle is  $\pm 10$  degrees, measured at the modulation input to the FM transmitter.

## TECHNOLOGY UPDATE

The data is transmitted in a baseband coding structure called "groups" and different types of groups are specified to cover the various applications of the RDS system. Each of the 15 groups consists of 104 bits. Each group comprises four blocks of 26 bits. Each block comprises an information word and a checkword. Each information word includes 16 bits. Each checkword comprises 10 bits.

Rohde & Schwarz will provide the encoding and decoding portions of the system. Radio Data Coder DMC generates digital RDS signal and 57 kHz signals for traffic information. An integrated 16-bit

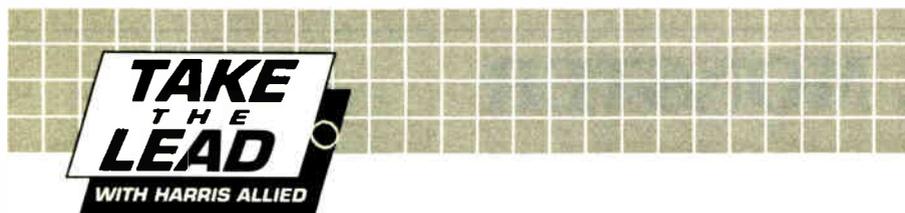


The Rohde & Schwarz RDS FM Datencoder.

microcomputer is capable of managing several RDS data sets and controls the interface for five RDS data channels. Alphanumeric displays for data sets, levels, modes and messages show operating status at a glance.

In addition to the FM coders generating the RDS signal, a Radio Data Decoder DMDC will perform the decoding function, monitoring, measuring and transferring of data for transmission. The decoder acts as a data link with simultaneous abilities to monitor signal parameters and make critical measurements. Both the coder and decoder are constructed using modern surface mount techniques and packaging that allows for easy servicing.

For information from Rohde & Schwarz, contact Matthew Straeb at 301-459-8800, ext. 229; fax: 301-459-2810; or circle Reader Service 56.



## THIS JUST IN



Teac's new **DA-P20** delivers digital quality for your portable broadcast needs.

It passes the broadcast quality test with real broadcast connectors, levels and impedances.

It passes tight budget limitations with its super price.

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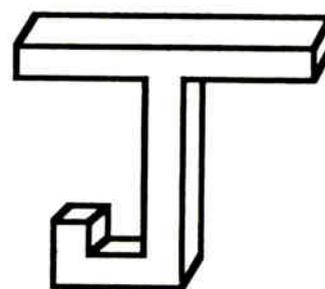
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# Tetrodes Versus Triode Tubes

by Ernie Belanger  
Energy-Onix

**HUDSON, N.Y.** The state of the RF industry is clouded with a number of myths, half truths and untruths.

One of those myths involves the contest between tetrode tubes and triode tubes. The tetrode tube transmitter design has become the most popular in recent times, I believe, due to the lack of a strong promoter, marketer and believer, in the grounded grid triode transmitter design.

Because of the lack of a strong advocate, there have been several myths that have gone unanswered. Triode tubes, when used in grounded grid configuration, are extremely stable. They do not

## TECHNOLOGY UPDATE

require neutralization and they do not oscillate. Triode tubes do not require the complex and sophisticated bias and screen circuitry that is required with tetrode tubes.

### Triodes more efficient

At Energy-Onix, we feel that triode tubes are more efficient than tetrode tubes. Triode tubes in grounded grid configuration have a PA efficiency of 79 per-

cent to 80 percent. Tetrode tube PA efficiencies in power levels below 10 kW vary.

Tetrode tube PA efficiency can be as high as 80 percent, but in general, since these have such high gain, design engineers work with relatively low RF drivers. In doing so, these low RF drivers do not achieve deep Class C operation, so it is not unusual to find tetrode FM transmitters with PA efficiencies of 62 percent.

The requirement for more drive also proves to be an advantage for the triode user. The larger driver sections of high power triode tube transmitters can be used to provide higher power emergency operation.

For example, an Energy-Onix MK25, 25 kW transmitter, utilizes a 3.5 kW driver, whereas a tetrode tube transmitter of the same power level utilizes only as much as 250 W. Thus, in an emergency the Energy-Onix can provide more power.

As well, triode tubes have a long life expectancy: 15,000 to 20,000 hours for triode tubes is not unusual. Conversely, tetrode tubes have only a 5,000- to 10,000-hour life expectancy. This is due in part to their fragile screen grid structure, which is prone to short circuiting, thus reducing life expectancy.

### Superior in design

Another belief is that tetrode tube transmitters are superior in design. At Energy-Onix, we find that the tetrode

tube design requires complex bias and screen circuitry.

By its nature, the tetrode tube is unstable and prone to oscillate; therefore, it must be properly neutralized to achieve necessary stability to function in an FM broadcast transmitter.

The practice of good engineering standards mandates reneutralizing tetrode tubes when they are changed. This, as any engineer will attest, is a long and tedious process.

## Richardson Offers MMD

(continued from page 40)

Each 700 W module has a slightly different preset time so that if an entire subsystem shuts down, all the modules will not try to come up at the same instant and overload the power supply.

The MMD 150 W FM module is a high efficiency CW FET wideband power amplifier that covers the frequency range of 86 MHz to 108 MHz. It operates at more than 60 percent efficiency to provide 150 W of output power.

With an input power of 10 W, it can deliver a smooth, controllable, 25 W to 150 W by simply varying the DC voltage to the module (25 V to 50 V). A single module will drive a pair of MMD 700 W modules to deliver more than 1000 W of output power.

The 300 W module is the "little brother"

The circuitry required in the grounded grid triode tube transmitter is less extensive and more user-friendly. The triode tube in grounded grid configuration never requires neutralization, it is highly efficient and its low power dissipation leads to substantially longer tube life.

If you define the superiority of design as the least number of inherent weaknesses, we at Energy-Onix believe the grounded grid triode transmitter design is superior.

■ ■ ■

For information on triode-based transmission products from Energy-Onix, contact Ernie Belanger at 518-828-1690; fax: 518-828-8476; or circle Reader Service 41.

of the 700 W module. It also is a self-protected, 86 MHz to 108 MHz power amplifier that provides 300 W of output at 50 percent efficiency. The module incorporates wideband 90 degree quadrature combiners, resulting in predictable 50 ohm system interfaces into imperfect loads.

A 1.25 kW "set" is now also available in using two MMD 700 W modules being driven by one MMD 150 W module. The real advantage falls on the availability of the modules. All the modular components (power amplifiers, power splitter and power combiner) are available off the shelf through distribution for anyone looking to build a solid-state FM 1 kW transmitter.

■ ■ ■

For information from Richardson, contact Greg Peloquin at 708-208-2631; fax: 708-208-2553; or circle Reader Service 99.

# CD Quality Stereo Audio In 128Kbps...

## CCS Makes MUSICAM™ Reality

In 1989 CCS Audio Products set new standards for 7.5kHz digital audio CODECs with the Micro56. Now CCS is proud to introduce CDQ-2000, the world's first commercially available CD quality stereo MUSICAM CODEC. CDQ-2000 delivers high quality audio yet requires only 128 Kbps of digital facility. This means stereo music can be transmitted using as little as half the digital bandwidth of other competing systems. Furthermore, only CDQ-2000 offers you multi-rate flexibility between 384 Kbps to 128 Kbps, permitting connectivity between satellite services and terrestrial digital telephone networks such as ISDN, switched 56 or fractional T1.

For stereo remotes, STLs or symphonic concerts, CDQ-2000 gives you *Crystal Clear Digital Audio™* with 12 to 1 digital Compression. Another first from CCS Audio Products.

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# The Ins and Outs of Dummy Loads

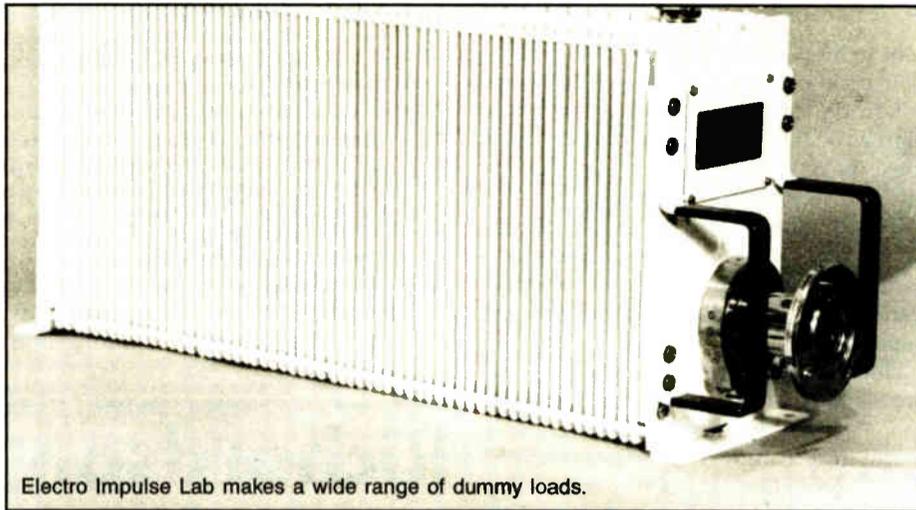
(continued from page 42)

sensors are provided for load over-temperature, low coolant or air flow, loss of line voltage to the load, etc.

A device to measure RF power is normally installed with the dummy load. This device, depending on the frequency range, can be a voltage divider-type power meter, a directional coupler or a calorimeter. Of those devices, a calorimeter is the most accurate and has the widest frequency range, but is relatively expensive to purchase and calibrate.

An in-line wattmeter (directional coupler) is the most popular and is easily recalibrated by checking or replacing the plug-in element. Mount the coupler in the transmission line away from the hot air discharge.

For AM band operation, many Electro Impulse loads can be fitted with a voltage divider-type power meter connected



Electro Impulse Lab makes a wide range of dummy loads.

through an attenuator to the resistive bank; this provides an accurate calibrated method of measuring power from DC to 2 MHz.

For information from Electro Impulse, contact Tom McNicholas at 908-776-5800; fax: 908-776-6793; or circle Reader Service 45.

## BUYERS BRIEFS

**WOODLAND, Calif.** Econco states it can rebuild a station's transmitter tubes at about half the cost of new tubes. All are rebuilt and tested to new specifications.

All tubes are covered by Econco's established 3,000-hour unconditional guarantee against defects in materials and workmanship. The warranty begins when the tube is installed, regardless of the purchase date.

Application and engineering support also are available.

For information on Econco's services, contact Debbie Storz at 916-662-7553; fax: 916-666-7760; or circle Reader Service 144.



**ELMSFORD, N.Y.** EEV's line of broadcast tetrodes are designed for enhanced longevity and improved audio performance over equivalent tube types currently available.

Each EEV 4CX broadcast tetrode is manufactured with a mesh filament design. This mesh filament ensures long-lasting concentricity of the filament and consequently provides better linearity

and less noise.

The design also helps eliminate warm-up variations, for longer life performance.

EEV offers a number of tetrodes for AM/FM radio, including a 5 kW AM/FM, a 16 kW AM/FM, an 82 kW AM and a 36 kW FM.

For information from EEV, contact Perry Priestly at 914-592-6050; fax: 914-682-8922; or circle Reader Service 104.

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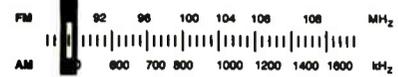
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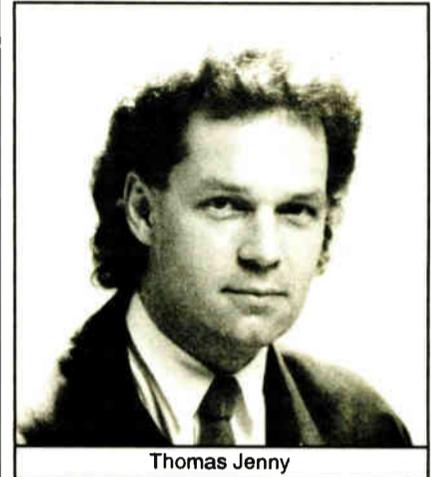
### Advertising Sales Representatives:

Eastern U.S., Art Constantine: 800-336-3045 Fax: 703-998-2966  
 West & Midwest U.S., Jack Ducart: 916-962-2240 Fax: 916-962-2194

## Tuned In



**People . . . Neil Glassman**, former sales and marketing manager for Bradley Broadcast, has become creative director of Cate Cowan Communications in Washington. Glassman is to bring marketing, sales training and advertising expertise to the firm's public relations practice. Glassman had been with Bradley since 1984.



Thomas Jenny

Western Regional Manager **Thomas Jenny** has been appointed to the newly created position of VP and GM at the Studer Division of Studer Revox America (SRA). Jenny will take charge of sales, service and promotional activities for all Studer product lines in the U.S. market.

Concurrently, Studer International Managing Director **Bruno Hochstrasser** has taken on additional responsibilities as president of SRA.

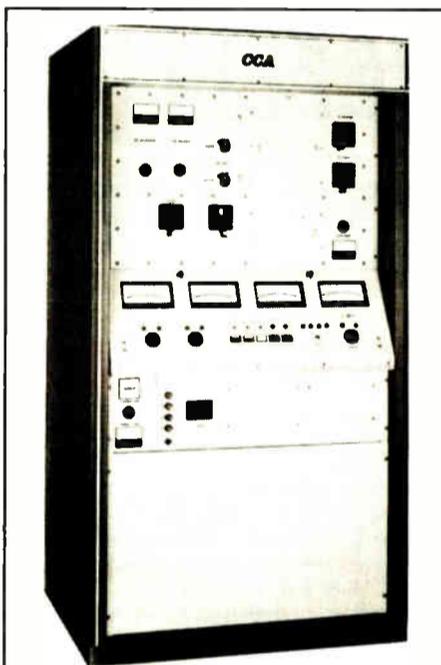
**Dave Burns** has joined New York ad agency Media Scan after four years as marketing manager for Harris-Allied Corp. Media Scan specializes in working with broadcast equipment manufacturers.

Symetrix has appointed **Bill Daniels** of Quad-Tech Marketing as its representative for the Midwestern states of Kansas, Missouri, Nebraska, Iowa and North and South Dakota.

Harris Corp. has appointed **Brian Maloney** as VP/GM of the Harris Broadcast Division. He succeeds Thomas Yingst, who retired from full-time management, but will continue to serve on special assignments. Maloney joined the company in 1978 as director of programs in the Government Support Systems Division.

**Purchases . . . Audi-Cord Corp.** has been purchased from Carl Martin by Andrew Rector. Martin, who will continue with the company, founded Audi-Cord in 1976. Rector has had a long relationship with the broadcast tape cartridge industry.

**Distribution . . . Promusic** has taken over distribution of the UBM/Largo music libraries. Containing around 50 CDs, they offer a number of music styles, including light jazz, comedy, industrial and classical. The addition brings Promusic's Library to more than 400 CDs.



**FAIRBURN, Ga.** CCA FM transmitters offer simplicity, 30-year design evolution and quality conservatively rated components.

The company's products feature grounded grid PA design, which is inherently stable, requires no neutralization and is considered free from developing destructive self-oscillation. Transmitters utilize thoriated tungsten filament-type triodes.

Also featured is simple relay control and overload circuitry and 24-hour emergency parts and technical assistance.

For information on CCA FM transmitters, call John Binsfeld at 404-964-3530; fax: 404-964-2222; or circle Reader Service 14.

# *The Closer You Get...*

**WE MEAN IT**—we really DO provide the quality, performance, technical support, and innovation we promise!

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

factory support from a technically competent and responsive staff.

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

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



# *The Better We Look!*

*A-500*

# The New Wheatstone Production—Air Console



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

These consoles give you full multitrack production capability while at the same time providing familiar program and audition busing so your production room can double as a back-up on-air facility. They free up your primary Air studio for routine calibration and maintenance sessions. They are a perfect solution for complex talk or news formats.

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

doesn't tie up your line inputs; an intercom module that lets you communicate with other Wheatstone consoles and rackmount locations throughout your facility; plus a studio control module, line preselectors, tape controllers, and automatic timers.

And, of course, there's the componentry: all gold contact switches for the ultimate in reliability, gold bus connectors, gold I/O connectors, solid state on/off lamps, and triple burned-in ICs. Naturally, each console is also triple-tested.

**The fact is,** Wheatstone's got the features, the componentry, the reliability, the performance and the reputation you can depend on.

Call us.

*SP-44/4-Track*