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GENERATION 9 DIGITAL CONTROL SURFACE

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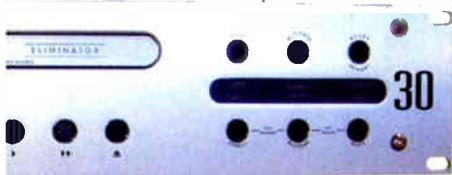
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ON THE COVER:

A good on-air sound begins with a good on-air mic. Look under the mesh and take a mic test drive to check-check-check out which mic is best for you.

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Currents Online

Highlights of news items from the past month

FCC Seeks Comment on Separate Antennas for IBOC

Comments are due Jan. 8 and reply comments are due Jan. 23.

No Ownership Resolution Until 2004

No Senate vote is expected before the Senate returns on Jan. 20, 2004.

MacBride to Head NAB Legal and Regulatory Affairs

She replaces Jeff Baumann, who retires from the NAB in February following 20 years of service.

Sirius Reaches 200,000 Subscribers

Sirius currently has four plug-and-play products available at retail outlets with more receivers scheduled for release.

Site Features

Find the Mic Sweepstakes

Enter today for your chance to win a Neumann BCM 104 microphone, Sonifex RB-MA2 mic preamp or LPB Silent Mic Boom.

Buyers Guide Online

The December issue included the annual *Radio* magazine Buyers Guide. Access the Buyers Guide online as well.

Radio magazine Cover Gallery

Do you remember the past covers of *Radio* magazine? See them all as well as the past Pick Hit award recipients.

Step inside the Demo Room

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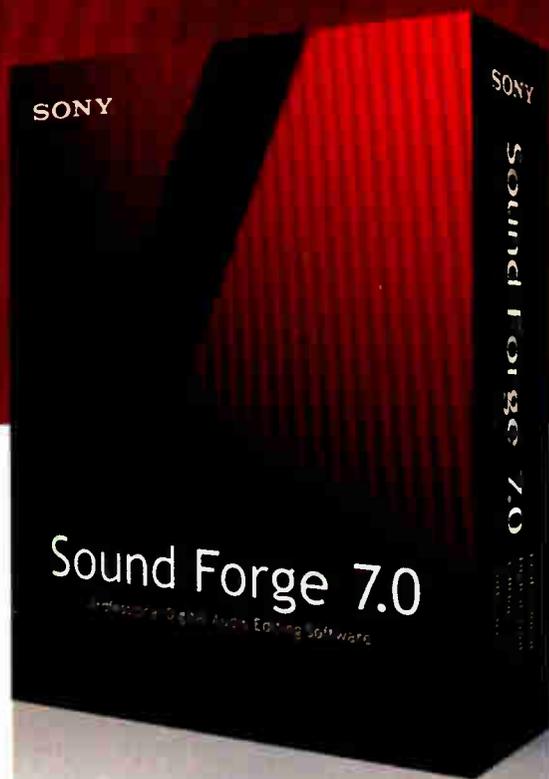
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The data dilemma

A new year has begun, and with the calendar change comes the promise of new methods and new technologies. The year's first technology event, the 2004 International Consumer Electronics Show will feature plenty of consumer technology introductions. Among these will be the commercial launch of IBOC digital radio products using Ibiqity's HD Radio.

We have seen several official launches of IBOC technology at past conventions. This launch touts the availability of consumer receivers that will be available after the show. The road to IBOC has been a long one that appears to now have a real goal in sight.

One of the top promises of IBOC is the delivery of data. This data can be program-associated data (PAD), such as song titles and artist information, or non-program-associated data, such as weather, traffic and stock information. Regardless of the source, this added information presents a new element that radio has not yet experienced. Or have we?

FM stations have had the capability to transmit data for many years via subcarriers and RBDS. In 1993, the NRSC approved the RBDS standard, which is undergoing a review process now. In 1995 the EIA launched a project to put RBDS encoders in radio stations to end the chicken-and-the-egg stalemate that was already occurring.

Despite the efforts, RBDS never really took off in the U.S. Many stations that turned RBDS encoders on in the mid-90s turned them off a few years later. We have all heard the stories of the single listener that had an RBDS receiver who would always call the station when the clock was off or when the decoder was shut down.

Slowly, more RBDS radios appeared, but RBDS remained a novelty. Now it seems that the novelty has found a new champion with Clear Channel, which is installing RBDS encoders in its stations nationwide.

This new pursuit may spur interest among broadcasters and consumers for broadcast data services. Indeed another broadcast data system is also giving it a try, this time from Microsoft with its SPOT watch system.

In the case of Clear Channel, the move to RBDS seems to have awkward timing with the continued promise of IBOC in sight. On the contrary, I believe that the timing will help raise awareness of the data potential. Likewise, Clear Channel will have already worked out its data-stream scheme, which can be ported to the digital transmission.

The program data naysayers oppose in-car data displays already. I too object to irresponsible drivers who try to multitask while driving a car, but it's not up to us to design the car's interior. It's up to us to decide what information is of interest to the listener and how we as broadcasters can benefit from it.

I'm seeing more and more data available with audio streams in other forms. Satellite radio has provided PAD from the start. My cable TV carrier provides a music service from Music Choice that shows the song title, artist name, album name and an artist factoid. This is limited information but useful nonetheless. Online radio offerings, such as Shoutcast or Radio@Netscape offer similar information as well as an opportunity to buy music or select similar listening choices. Some multichannel online offerings even provide a preview of what is playing on other channels without actually going there.

Listeners—and media consumers overall—are embracing data services, which continue to grow. Terrestrial radio needs to be aware of this and not let the opportunity slip away. We're already behind the mark in providing digital audio services, but that too is changing. It's time to start thinking ahead for the data future.



Chriss Scherer, editor
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New transport methods

By Kevin McNamara, CNE

When considering methods to move information from one point to another, it is interesting to reflect on how our needs have changed over just the past 20 years. It doesn't seem long ago that we had two options to get program information to the transmitter—equalized telephone lines or analog STL systems. Remote broadcasts were limited to equalized telephone or dial-up POTS lines. Life was simpler then, but now we need to move huge amounts of digital encoded program audio streams along with the usual amount of typical data generated by Internet, e-mail and video conferencing and voice over IP applications.

It is interesting that there hasn't been a marked increase in the amount of new commercially available data transport methods during the past five

the 2.4MHz frequency spectrum. The 802.xx standard essentially defines an Ethernet protocol to be used in conjunction with a wireless medium.

In 1999, an enhancement to the 802.11 standard designated 802.11b was approved. This standard increased throughput to 11Mb/s with the capability to reduce its speed as needed to account for poor signal conditions in intervals of 5.5Mb/s, 2Mb/s or 1Mb/s. The only modulation scheme 802.11b uses is DSSS. This standard is also called Wi-Fi, which is becoming widely deployed within schools, businesses and a multitude of local hotspots such as those found in coffee shops and some hotels.

The 802.11a standard permits the use of the 5.8MHz frequency spectrum. 802.11a uses orthogonal frequency division multiplexing (OFDM) modulation to provide as much as 54Mb/s of data throughput in one of eight possible channels. While 802.11a may also be called Wi-Fi, it is in reality not compatible with 802.11b systems operating in the 2.4MHz band.

The 802.11g standard permits data rates up to 54Mb/s in the 2.4MHz band using a combination of OFDM for rates above 20Mb/s and DSSS for rates below 20Mb/s. Certified as a Wi-Fi device, 802.11g will ultimately replace 802.11b.

Blue Tooth is the code name for yet another wireless standard that provides wireless communications on the 2.45MHz band using FHSS modulation. Probably the biggest negative for Blue Tooth is that it does not support IP and TCP/IP protocols, which may limit its use to certain proprietary applications or for localized communications such as that between a cell phone and laptop PC, for example.

Free-space optics

Free-space optics (FSO) is actually a technology first developed by Alexander Graham Bell in the late 19th century before he demonstrated the telephone. At that time he had created a wireless optical system that traveled about 600 feet and was aptly named the Photophone. The technology emerged again in the 1960s when significant improvements permitted it to be used for military applications.

FSO is an optical line-of-sight wireless method to send data between different locations. It uses a laser to send signals through space, similar to a traditional microwave radio link, but operating in the infrared spectrum. An FSO transmitter system consists of a digitally modulated low-power (about 50mw) infrared laser diode focused through a high-performance lens. The laser is focused on a highly sensitive photon detector-based receiver based on PIN-diodes or a newer technology (derived from an older device) called avalanche photodiode that allow the receiver to work under lower signal conditions. Commercially



Wireless networks provide untethered convenience. Photo courtesy of Linksys.

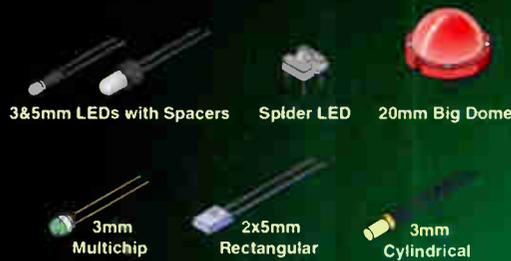
years, particularly with regard to choices of wired connections. The major advancements, and where most of the research and development money has been spent, is in the non-licensed microwave and optical link markets.

Wireless microwave

In 1997, the IEEE adopted the 802.11 standard that provides for a wireless interface between a base station and wireless devices at data rates of 1Mb/s or 2Mb/s either frequency-hopping spread spectrum (FHSS) or direct-sequencespread spectrum (DSSS) on one of 11 channels designated within

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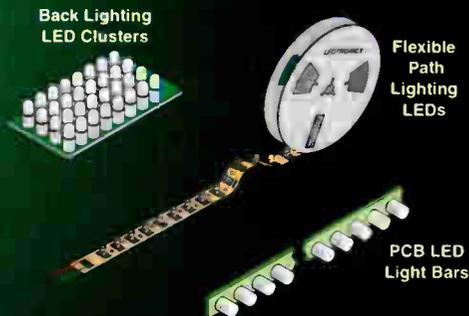
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available FSO systems operate full-duplex, similar to radio-based DS-1/DS-3 links.

Are FSOs as reliable as RF radio systems operating in the microwave spectrum? Of course, similar to microwave systems, FSOs need to have a clear line-of-sight. However, unlike microwave systems, light can be blocked and reflected by a number of environmental conditions such as rain,

snow and fog. Current FSO systems uses a number of advanced techniques to mitigate some of the problems caused by weather using a combination of multiple-beam transmitters and automatic tracking receivers. If the beam is blocked, such as that caused by birds or another object in the path, the IP stream would be retransmitted until the connection is re-established.

Similar to fiber optic technology, FSO is capable of supporting bandwidths far in excess of what can be provided by microwave-based systems—up to 2.5Gb/s and 4,000 meters.



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FSO links are proving to be practical and do not require frequency coordination.
Photo courtesy of Lightpointe.

The use of RF-based and optical wireless systems is growing at a steady rate and is expected to surpass that of wired connections within the next 10 years. Additional spectrum, strengthened security, equipment prices and overall ease and cost to deploy wireless systems will no doubt drive this trend.

While most discussions of wireless systems deal with point-to-point connections, many manufacturers are producing base stations that not only communicate with remote clients but also with other base stations. This ability allows the creation of local meshed networks that can be propagated through a small campus or an entire region, similar to that of cellular telephone networks. Meshed networks are inherently much more reliable and robust compared to that of a simple point-to-point connection due to the ability to re-route traffic based on usage and most available connections to the switched network.

McNamara is president of Applied Wireless, Elkins Park, PA.



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FCC, NIMA share tower data

By Harry Martin

Tracking the proliferation of communications towers is becoming more and more difficult for federal agencies. As a result, the FCC and the National Imagery and Mapping Agency (NIMA) have decided to join forces. NIMA is a national intelligence and combat support agency that provides information related to physical features and geographically referenced activities in support of national security. The new combination will mean added scrutiny of the FCC's tower database, which could lead to significant fines where inaccurate data is uncovered.

In October, the FCC and NIMA entered into a Memorandum of Understanding providing for the exchange of unclassified database information on tower locations on a quarterly basis. The two agencies will also work with other federal agencies to ensure that the comprehensive information they compile is available for national security and aircraft navigation safety.

Under the Memorandum of Understanding, the FCC will provide information contained in its Antenna Structure Registration (ASR) database. The ASR contains information about antenna structures throughout the United States. FCC rules require that the owner of any proposed or existing antenna structure must register the structure with the FCC if it is used by an FCC licensee and if it requires notice of proposed construction to the Federal Aviation Administration (FAA).

The FCC intends to use information from NIMA to improve the accuracy of its ASR database and to monitor ASR compliance. The information will be made publicly available through agency databases, and may be particularly valuable to licensees interested in collocating facilities.

Additions to the NIMA database will now be compared to ASR every three months. If the FCC finds that a site referred to it by NIMA is not in compliance with FCC rules, the FCC will issue a Notice of Potential Violation letter asking the site owner to bring its tower structure into compliance with FCC rules within a

specified time period. If the site owner does not comply, the FCC will issue a Notice of Violation, which may lead to a fine and other penalties.

The FCC is not hesitant when it comes to levying fines for tower-related violations, including failures to register towers. The likelihood that the Commission might identify any particular unregistered tower has, however, been somewhat limited, largely because of the limited resources available to the Commission. The Memorandum of Understanding gives the FCC a new and accurate source of information concerning potential violations.

FCC localism road trips begin

As part of its effort to blunt Congressional and public criticism of the broadcast multiple ownership rules adopted in June, the FCC has begun a series of regional hearings to ascertain information and opinions about localism and its value in the broadcast regulatory scheme.

The first hearing, attended by Commissioners Copps and Adelstein and FCC Chairman Powell, was held in Charlotte, NC, in October. Large media companies such as Infinity Broadcasting and NBC plus smaller commercial and non-commercial broadcasters made presentations. Two North Carolina congressmen also made presentations, as did members of the public.

It was emphasized in the hearing that members of the public could file petitions to deny the license renewal applications of North and South Carolina radio stations that they see as being deficient in meeting local needs. The deadline for such petitions against radio renewals in those states was Nov. 1, shortly after the hearing.

The next hearing will be in San Antonio in January. The San Antonio hearing may prove interesting because San Antonio is the corporate headquarters of Clear Channel Communications, a company whose success in consolidating radio stations across the country has caused much of the localism clamor.

Martin is an attorney with Fletcher, Heald & Hildreth, PLC., Arlington, VA. E-mail martin@fhhlaw.com.

Dateline:

April 1 is the deadline for filing license renewal applications for radio stations in Indiana, Kentucky and Tennessee. Biennial ownership reports must be filed with these renewals even though stations in Indiana, Kentucky and Tennessee filed such reports in 2003.

Also on April 1, biennial ownership reports must be filed, and annual EEO reports must be placed in the public files of stations in the following additional states: Texas, Delaware and Pennsylvania.

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The perfect Pickup

By Chriss Scherer, editor

Select a mic for its overall sound and suitability, and avoid the tendency to settle for an old standard.

The process of selecting the right equipment for the station often involves careful research into the needs of the users, and then matching these needs to the available choices. The available budget also figures into this equation, but it can sometimes have some flexibility based on the features.

It's amazing how often this process is ignored when it comes to selecting a microphone. It's easy to think that a mic is a mic. They all pick up sound. They all cover the audio spectrum. In general this is true, but the same careful consideration given to an audio processor can be applied to a microphone. Just as an audio processor has its own nuances and feel, so does a microphone.

For studio use, these nuances and the general specifications are the key aspects to consider. The studio mic sees as much regular use as any other piece of equipment, so a minor price difference should not be a limiting factor.

As a review, there are two general categories that can describe any mic. One category covers the mic's electrical operation. The other details its pickup pattern.

For the electrical aspect, all mics can be categorized as either dynamic or active (usually condensers). Dynamic mics are

purely passive devices. Sound resonates a diaphragm that creates a signal voltage. Ribbon mics, while not as common in regular use, are also categorized as dynamic mics, but because of their low output level and fragile construction, are not typically found in regular use for radio.

The other electrical type of mic is the condenser. In condenser mics, the pickup diaphragm affects a capacitor with an electrical charge on it. As sound waves move the diaphragm the capacitance changes, thereby causing changes to the electrical charge, which results in an output signal.

Both types are practical for use in a studio. Dynamic mics require no external power, so they do not require any special installation. Most condenser mics operate on phantom power—a power supply that is carried over the balanced audio path. Most current console designs and mic preamps can provide phantom power. Some condenser mics use batteries or require an external power supply.

Evaluating the sound quality of a dynamic or condenser mic is a subjective test. In general, condenser mics tend to cost more than dynamics. Some feel that condenser mics have a crisper, more present sound. While either is suitable for use

Resource Guide

An overview of available mics for the studio



The Studio Projects C1 is a cardioid condenser microphone with a 1.06" capsule, low-noise FET amplifier and balanced, transformerless output circuitry. It features a switchable 10dB pad and a 6dB at 150Hz high-pass filter. It includes a shock-mounted elastic suspension, foam wind screen and a hard-side carrying case. The mic's frequency response is from 20Hz to 20kHz with a maximum input of 142dB. The output impedance is less than 200Ω. It operates on phantom power.

www.studioprojectsusa.com

The Audio-Technica AT3060 is a large-diaphragm, side-address, cardioid condenser element with a tube output. It does not require a dedicated power supply or special cable because it operates exclusively on 48Vdc phantom power. The hand-selected tubes are individually tested and aged to maintain peak performance. The tubes are shock-mounted to dampen mechanically-coupled vibrations. Large coupling transformer improves the low-frequency linearity. It features a 50Hz to 16kHz frequency response, 400Ω output impedance, a 117dB dynamic range and a maximum input level of 134dB. It includes a shock mount and protective pouch.



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The perfect Pickup

in a studio, dynamic mics are usually preferred for field use because they do not need batteries or a phantom power supply, which few portable devices can provide.

The second general categorization of mics deals with the pickup pattern. In most radio applications an omnidirectional or cardioid pattern is

used. There are other directional patterns, including super-cardioid, hyper-cardioid and figure eight or bidirectional, but they are not as commonly used in on-air applications. Some studio mics offer switchable patterns. This is a convenient feature in some applications, but is usually not necessary for the single-function use of a mic in a studio.

All cardioid mics exhibit proximity effect. This is an increase in bass response as the signal source gets closer to the mic. Some mic designs acoustically reduce this effect, which can prevent a

mic's sound from becoming boomy when used closely. Also, many cardioid mics have a bass roll-off switch to tailor the low-end response. Announcers love proximity effect because of the richness it adds to the sound of their voices.

In a studio, either pattern will work, but most engineers prefer a cardioid pickup. The cardioid pattern by nature reduces the level of sounds from the side and rear of the microphone. This is particularly useful in a studio with more than one mic in use.

For field use, a cardioid mic is best when used only by one person. The reduction in unwanted sound is a benefit. However, if the mic will be used for interviews where the mic is shared, an omnidirectional pickup would ensure that all voices are heard equally.

The tonal quality of a mic is just as important as its application. As the first link in the audio chain, take the time to fully evaluate your next mic choice. You may be surprised at what you hear.



The **Rode Broadcaster** is an end-address, cardioid mic with a 20Hz to 20kHz frequency response and an output impedance of 40Ω. This large-diaphragm condenser mic includes a unique on-air indicator LED that can be connected to a studio's warning light. It has an internal shock-mounted capsule to reduce structure-borne noise and a fine mesh pop shield to eliminate plosives. It is housed in a rugged stainless-steel body and features a voice-tailored low-cut filter. It includes the BM1 microphone holder and a zip pouch.

www.rodemicrophones.com

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The Electro-Voice RE27 N/D is a large-diaphragm dynamic mic featuring the Electro-Voice Variable-D design to reduce the significant increase in bass response from the proximity effect of the cardioid pickup. The N/DYM element design provides a 6dB increase in sensitivity compared to other dynamic mic designs. The integral wind and blast filter reduces breath noise and plosive transients. Frequency response is from 45Hz to 20kHz. The output impedance is 150Ω. It has three selectable filters (bass roll-off, low-mid cut and high-frequency roll-off) to tailor the frequency response. The mic includes a stand adapter, carrying pouch and hard-shell case.

www.electrovoice.com



The Sennheiser MD 421 II continues the tradition of the MD 421, which has been one of Sennheiser's most popular dynamic mics for more than 35 years. The large-diaphragm, cardioid dynamic element handles high sound-pressure levels. The mic features a five-position bass control switch to tailor the bass response. The frequency response is from 30Hz to 17kHz. The Nominal output impedance is 200Ω. To celebrate the 90th birthday of the company's founder, Fritz Sennheiser, a special-edition MD 421 SE with gold-plated hardware, a wooden case and a signed certificate was issued.

www.sennheiserusa.com



A hyper-cardioid condenser mic, the Lawson Air features an original capsule design using a variant of the company's L47 capsule. The mic is a 48V phantom-powered, 1" large-diaphragm cardioid condenser mic with a six-micron gold-sputtered diaphragm. The capsule diaphragms have been edge-connected for more warmth, robust articulation and more resonant proximity effects. The mic features the Lawson Quick Change capsule system. The mic's solid-state circuit features a Neutrik transformer, hand-soldered all-discrete components and a gold-plated XLR connector. It features 20Hz to 20kHz frequency response and 150Ω output impedance. It includes a shock-proof carrying case and swivel mic holder.

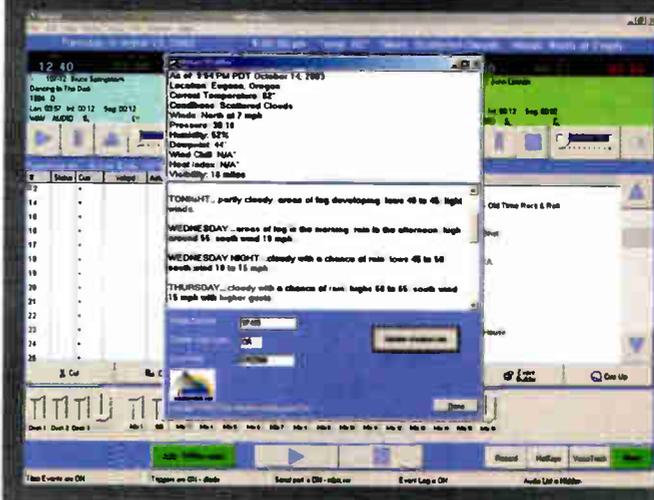
www.lawsonmicrophones.com

Simian 1.6 is the result of input from numerous BSI users. Thanks to their input, Simian now includes an on-screen weather display that updates from the internet.

The new Simian also includes sophisticated new Voice-Tracking functionality allowing Voice-Tracking days in advance, even from remote studios, and an improved ability to verify logs before air play.

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The perfect Pickup

The AKG Acoustics C 4500B-BC is a cardioid, condenser microphone with transformerless output. Its all-metal housing and double-screening of all acoustically open sections of the microphone provide shielding capability. The C 4500B-BC offers a front-end firing capsule position, electro-magnetic screening and internal pop-filter. A 120Hz roll-off filter is integrated into the C 4500B-BC, while a 20dB pad allows users to replace dynamic microphones without changing the adjusted gain structure on associated equipment. The low self-noise and high overload point of the AKG C 4500B-BC offer a dynamic range of more than 135dB. The output impedance is 200Ω and frequency response is 20Hz to 20kHz.

www.akgusa.com



Built by Audio-Technica and based on the A-T 40 Series, the Sound Performance Lab Nugget condenser mic uses a 1" diaphragm and transformerless circuitry for accurate, musical reproduction with a maximum input of 145dB SPL. It features a switchable 50Hz high-pass filter and 10dB pad. The mic was designed for vocal and instrumental recording applications. A high-quality shock mount is included. The cardioid pattern has a 20Hz to 20kHz frequency response, a 129dB dynamic range, 50Ω output impedance and a 78dB S/N. It includes a suspension shock mount.

www.spl-usa.com



The Shure KSM27 is a side-address condenser microphone with a cardioid polar pattern. It has an externally biased, 1" gold-layered diaphragm, low self-noise, a 20Hz to 20kHz frequency response and a Class A, discrete, transformerless preamplifier. It features a subsonic filter to eliminate rumble from mechanical vibration below 17Hz, a switchable 15dB pad, a three-position switchable low-frequency roll-off filter, an integrated three-stage pop protection grille and an internal shock mount. It can handle an input level of 137dB. It includes a protective pouch.

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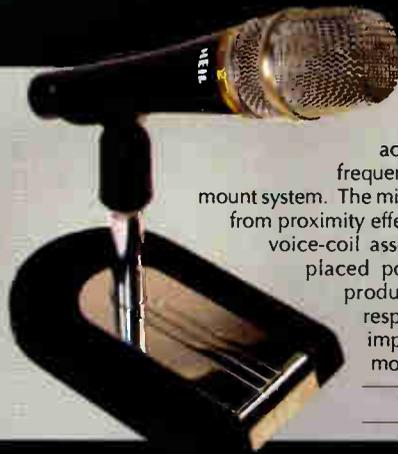
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NEW!



The Neumann TLM 103 large-diaphragm, cardioid condenser microphone uses the transformerless circuit found in numerous Neumann microphones and features low self-noise and high sound pressure level capability. The mic is available in satin nickel and matte black finishes. The mic provides flat frequency response to 5kHz with a 4dB presence boost in higher frequencies. It is capable of handling sound pressure levels up to 138dB. The K 103 large diaphragm capsule is based on the K 87, well known from the U 67/U 87 microphones.

www.neumannusa.com



The Heil Sound Goldline Pro dynamic mic achieves a low handling noise by mounting the wide frequency, dynamic element into a sorbothane shock-mount system. The mic has also been engineered to reduce the bass boost from proximity effect. It features a large aluminum 1.125" low-mass voice-coil assembly. The phasing plug assembly has equally placed ports that sense audio from behind the mic to produce a linear cardioid pattern. The frequency response is from 40Hz to 18kHz. It has a 600Ω output impedance. It includes a wooden case. A shock mount is also available.

www.hellsound.com

The SE Electronics Z-2200 features discrete Class A FET electronics with a transformer-coupled balanced output. The mic's frequency response is from 20Hz to 20kHz and can handle a maximum input of 125dB. The audio response has a slight rise towards the high end. Its output impedance is less than 200Ω. Features include a 100Hz bass roll-off switch and a 10dB pad. The pickup pattern is a fixed cardioid. The mic's gold-sputtered diaphragm measures 1.07". The mic has a 3dB to 6dB lower self-noise than the company's previous models.

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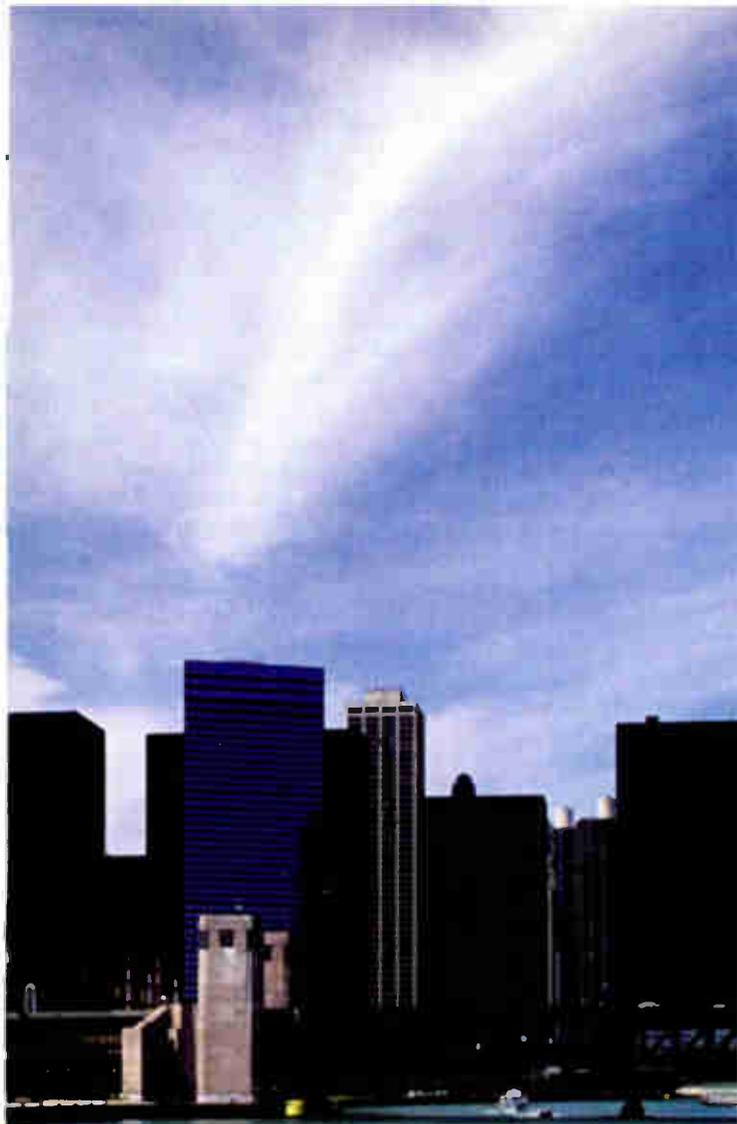
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AN UPGRADE PATH
for the future

By Tim Wright, CPBE



Inside the all-digital facility of Clear Channel Chicago

In the summer of 2002, a facility consolidation came to the Chicago market of Clear Channel communications. The facilities for the six stations (WLIT-FM, WNUA-FM, WKSC-FM, WVAZ-FM, WGCI-FM and WGCI-AM) were spread around five locations in the downtown area of Chicago. Several of the facilities were rather long in the tooth, and two of the three had their studio leases due to expire.

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“This is not your ordinary, average microphone.”

*Joe Walsh - guitarist for
The Eagles & just an
ordinary average guy*



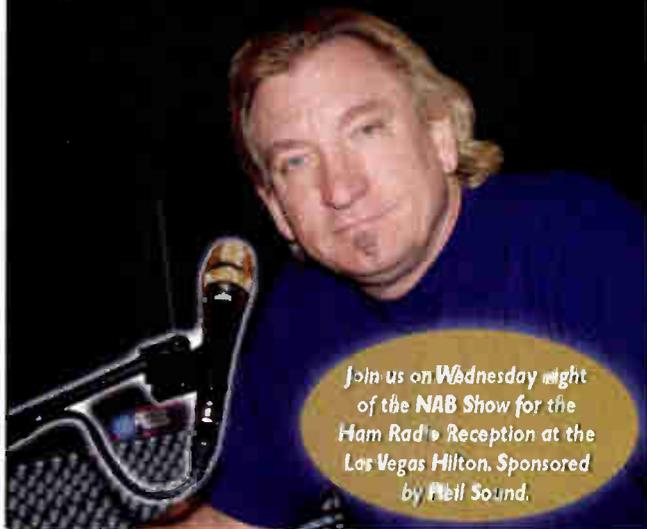
Bob Heil, pioneer innovator of live sound reinforcement systems for such greats as The Who, The Grateful Dead, Joe Walsh, Peter Frampton, and countless others has been carefully listening to broadcast engineers, industry professionals and talented performers for many years. Bob has now allied his vast knowledge and 37 years of experience into his new line of high quality microphones and audio hardware.

The introduction of this new product line marks the birth of the new PROLINE division at Heil Sound, Ltd. It is documented in recent product reviews that the new Heil dynamic microphone element has raised the bar for dynamic microphone technology.

This latest Heil technology captures every note and feeling with brilliant, natural articulation. Clean, clear, condenser-like sound produces an exceptional rich, warm sound. The most beautiful and affordable microphone ever. The new Heil GOLDLINE PRO.



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With this in mind, a search began for a suitable location that could house the six stations plus a seventh future station (WRLI-AM 1690), which has since been brought online. In addition, space was



All the studios have low equipment sight lines for better interactivity. Some monitors are mounted on booms to place them in better viewing positions.

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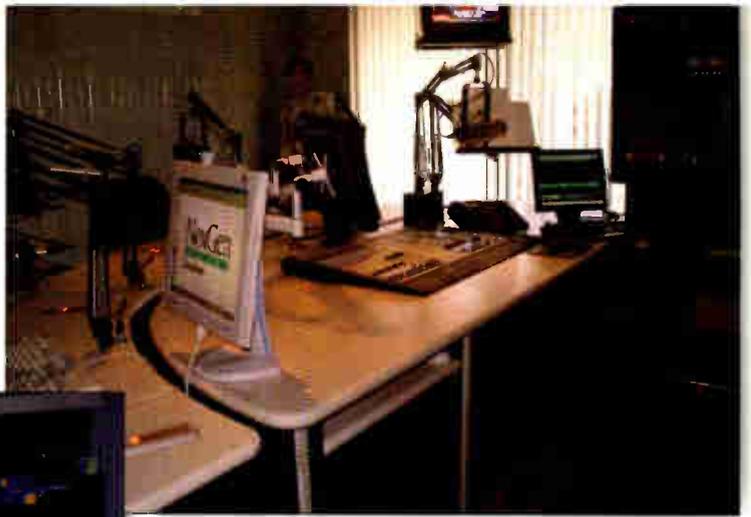
needed for the Entertainment, Premiere, Katz Media and Hispanic divisions of Clear Channel. The total square footage required was figured to be at least 75,000. Several properties were considered and rejected by the corporate team that handles real estate for Clear Channel before a lease was signed for the 27th and 28th floors of the building at 233 North Michigan Avenue in downtown Chicago.

This space was formerly occupied by an Internet hosting service that died a quick death when the dot-com bubble burst. The defunct company left the space with a large debt owed and an office infrastructure just waiting for another high-tech client. We decided to proceed. The 27th floor was the former technical operations center, and all the IT, telephone, HVAC and electrical distribution was in place and originating from that floor. As it turned out, extensive modifications were required on 27, such as adding the studio complex, but the 28th floor remained mostly intact because it was already developed as office space.

The studio facilities are designed around the pod concept, with each station having an air studio (12'x18'), a main production room (12'x18'), a voice tracking room (10'x12') and a fourth room (10'x12') that serves as an auxiliary production room, a voice-track room or a jock-prep area. A shared performance studio (12'x18') complete with Steinway piano replaces the main production room of one of the stations, and a shared talk studio replaces the main production room of another. All together there are 28 studios. A 3,300 square-foot, centrally located technical operations center (TOC) houses the common facilities for all studios, plus the IT infrastructure, an engineering lab, studio related mechanicals and the engineering offices.

Selection of the technical equipment began concurrently with selection of the

The studios use similar room layouts. Shown here are the air studios for WRLL (right) and WLIT.



office location. Outside of the hard drive-based delivery system selection (the Prophet Nexgen), local engineering management was given a major say in the other parts of the facility infrastructure. It was decided early on that the facility would need to meet several criteria:

- All-digital as much as was practical
- Based on a router concept
- Expandable
- Flexible
- Easy for the talent to use
- Cost effective

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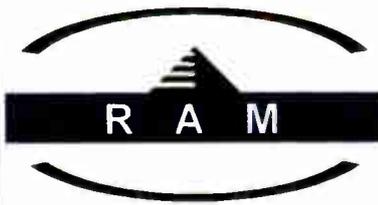
A typical voice-tracking studio has the basic necessary equipment.



One portion of the rack room is visible through this window from the hallway, which makes an impressive stop on a facility tour.

Several manufacturers were approached and asked to submit a unified solution that would meet our criteria. After careful consideration, one system stood out above all the rest for us: the Vadis by Klotz Digital. Once initial reservations of having a console managed by a PC running a Microsoft OS were answered to the satisfaction of all, we saw the possibilities of a software-defined facility.

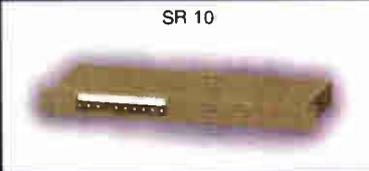
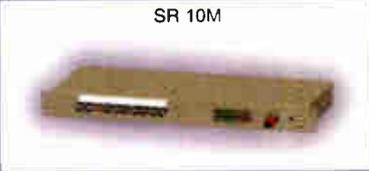
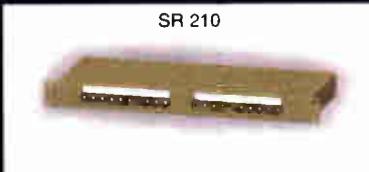
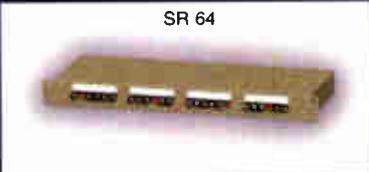
Because several facility leases were due to expire, a fixed timetable was a major consideration. As much construction as possible was handled by third parties. The general contractor was Turner Construction of Chicago, the studio furniture was designed and built by Harris, the Vadis wiring



AUDIO SWITCHERS

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SR 10	SR 10M
	
10 x 1 STEREO SWITCHER	10 x 1 STEREO SWITCHER WITH METERING AND MONITORING
SR 210	SR 64
	
10 x 2 STEREO SWITCHER	6 x 4 STEREO SWITCHER
SR 201	SR 61M
	
20 x 1 STEREO SWITCHER WITH PARALLEL REMOTE CONTROL	6 x 1 STEREO SWITCHER WITH METERING AND MONITORING

The technical operations center houses many racks. Shown here are the routing engines for the Klotz system (top), the servers for the Prophet automation system (middle) and the streaming servers and in-house cable system (bottom).



and system integration was handled by a Klotz contractor Joe Corollo, the Prophet Nexgen wiring was handled by Prophet Systems Innovations and the miles of CAT-5E and fiber were installed by the local IBEW union contractors. Daily supervision of the project was handled by Bob Fukuda, market director of engineering, who dedicated a year and a half to the cause. The balance of the Chicago engineering staff was busy maintaining the five existing facilities, and helping out with construction where possible. Enough of the facility was completed by November 2002 so the first station, WLIT-FM, was able to move in as it launched a 24-hour Christmas music

format. A month later WVAZ-FM followed and the remaining stations went live at four-week intervals after that. By mid-summer 2003 all the stations had moved in.

Items of note

1. There is totally integrated AES and analog routing with the Vadis system. All wiring was pulled as 110Ω AES cable and CAT-5E. Termination for the AES cable is the Krone block system, and for the CAT-5 cable, 110 blocks and RJ-45 connectors. Touchscreen-based GUI are used throughout the TOC for monitoring and metering purposes.

2. Integration of mass caller choked lines into a PRI delivery to the Telos 2101 studio phone system. After years of saying it could not be done, the local phone company said yes, and a special protocol was developed to allow just that.

3. Jock skimming direct to CD. A bank of eight Tascam CD recorders, located in a semi-public area of the TOC, allow the jocks to burn a CD track every time they open a microphone. Blank CDs are now cheaper than cassettes. Everybody has a way of playing them back at home or in the car. An added benefit is that as far as the PDs are

Product Showcase



Model AFS-3 Audio Failsafe

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AN UPGRADE PATH for the future



The view looking West from the 27th floor is impressive.

concerned, jocks cannot cheat on air checks and re-record a bad break like they could with a cassette.

4. The local cable TV company wanted \$50 per drop per month for basic cable service. Instead, we installed a bank of DSS receivers that feed another bank of cable TV modulators purchased on the surplus market for \$25 each. So for a fraction of the monthly cost, anyone in the facility can have in-house cable, complete with our own "public" access channel.

Wright is a senior studio engineer for the Clear Channel stations in Chicago.

Equipment List

Adobe Audition
Air Tools 6100 profanity delay
APC UPS 100kW UPS
Aphex Compellor
ATI modular Sys10K
Audio Metrics DA
Audion Labs Voxpro
Burk ARC-16
Comrex Matrix
Crown D-150 monitor amps
JBL Control 5 monitors
Crown D-45 monitor amps
DBX 166XL
DBX DDP
Denon DN-M991R minidisc
Denon 961FA CD players
EAScriber Pro
Electro-voice RE27
Eventide Ultra Harmonizer
Gepeco 110ohm AES cable
Hafler TRM6.1 monitors
Harris Intraplex T1 STL/TSL/WAN
Harris custom furniture
Henry Matchbox
ICOM PCR-1000 PC-based scanner
Sound Tube FP633 focused speaker
Imedialogger
JBL 4412 monitors
Klotz Vadis routing system
Marti CR10
Middle Atlantic equipment racks
Moseley PCL 606
O.C. White mic booms
Omnia FM processor
Omnimount speaker mounts
Optimod 8100 processor
Pro Tools
Prophet NexGen
Radio Systems B.O.B.
Rolls RS79B tuners
Sage Endec
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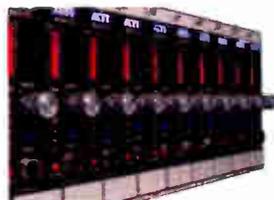


HD provides a clear migration path to an all-digital air chain and is ideal for diverse broadcast audio applications from a single STL to a multi-location wide area program audio distribution network. Multiple locations can share talent and administrative resources with STL HD deployed as a wide-area audio and data transport network over all types of T1 circuits—private, public leased (Telco) circuit, microwave and spread spectrum radio or T1 subcarrier over video microwave.

www.broadcast.harris.com
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ATI SYS10K

The modular SYS10K accepts up to 10 microphone/line/distribution modules to provide up to 60 channels of audio distribution and amplification in a 3RU space. The interchangeable modules can be used in any combination in the same rack frame. The SYS10K is powered by two alarmed, hot-swappable power supplies. Separate fusing and regulation in each module minimize localized heat build-up and yield the highest system reliability. Barrier blocks with fanning strips or Phoenix/Euroblock-style rear connectors make installation a snap. All modules have front-panel output level adjustments and headphone jack, can provide transformer or active-balanced outputs and are available with or without metering. Microphone modules can provide phantom power. AVCA option is available for remote gain control. RF-protected inputs and outputs ensure clean, quiet performance.



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As a 15kHz POTS codec, the Matrix can connect with all Comrex POTS codecs, and with the optional ISDN module, the Matrix is compatible with most ISDN standards. When the remote site has no phone line, the optional GSM module allows the Matrix to transmit 7kHz audio with an internal GSM wireless phone. Along with the full line of Comrex codecs and telephone hybrids, the Matrix will help your station broadcast great-sounding audio from anywhere.

www.comrex.com
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Danagger Audio Works Plan B

By Don Danko, CBRE CBNT

ead air. It's a program director's worst nightmare, and no station is immune from it. As engineers, we only have control over technical failures that cause dead air such as STLs, consoles and overnight automation through good old preventative maintenance. Although necessary, preventative maintenance and diligence will only eliminate some failures. Eventually technical failures that are out of our control will happen, something that could never have

isolated status inputs, mute control, three N.O. auxiliary relay contacts and a grounding stud complete the back panel layout.

The unit is designed so all necessary adjustments are made from the front panel. The silkscreen labels are easy to understand and read. Recessed adjustment pots are mounted for main audio and compact disc levels, as well as one for the silence delay. A built-in speaker, a headphone jack and a volume control are also provided. Front panel buttons include an enable, test, activate, reset memory, bypass, restore, mute, disc random and disc resume.

Additionally, a full set of compact disc control buttons are front and center under the CD door. The Plan B also comes with indicator LEDs so you never have to guess what it's doing. LEDs

included are for main audio, digital link, remote link, disc playing, not ready, backup on-air and memory fail.



Performance at a glance

- Well designed, built and manufactured
- Methods for setup and testing without putting backup audio on air
- Limited five-year warranty
- External power supply
- Backup audio source and silence sensor

Technical

The documentation included in the manual includes easy-to-follow schematics for the main board and one other circuit board manufactured by Danagger. Those circuit boards are well made, components are clearly labeled and all ICs are socketed. Two additional circuit boards associated with the Toshiba CD player are manufactured by Toshiba and do not have documentation or socketed ICs. The audio outputs are passively switched using gold-contact relays.

Basic installation

The logical place for this unit is the transmitter site. Pick a mounting location that is as clean and climate controlled as possible. Insert this unit in the audio chain just before the last piece of equipment that takes AES or discrete left and right audio. This may be just before the STL, processor or, better yet, the exciter. Doing this will eliminate as many points of failure as possible. Remember that if you insert the Plan B after the processor but before the exciter, any issues with processing can be overcome by burning a CD with processed audio. Once the unit is mounted you'll have to interrupt the audio to physically insert the Plan B into the audio chain and make the connections.

After it's connected and audio is running through it you will want to set levels and the silence delay. Set the main audio level first to standard programming. This level is the threshold used for silence detection, and the adjustment is aided with the use of a front panel LED. The disc level

been foreseen, let alone planned for. Sooner or later it will hit your station.

The newest tool to fight the dreaded dead air problem is the Plan B Silence Eliminator from Danagger Audio Works. Designed and built to be simple, flexible and convenient for any station, the basic principle is that this unit will detect silence and start playback of a CD on the built-in CD player. That's it; but this unit is far from basic.

The Plan B is built into a rugged aluminum two-rack unit case. It accommodates digital or analog inputs/outputs on standard three pin XLR connectors. The back panel also has a five-pin DIN connector to power the box with the included dc power supply, a fused and surge-protected telco connector for remote control via a touch-tone telephone. A connector for optically

Flushing Away Your Audio Quality

Swishing and swirling audio is the sad result of bit rate reduction combined with the wrong processing. Unless all sources, storage media and transmission systems are linear the audio will be bit rate reduced at least once, probably several times. Each pass generates more artifacts. Lower quality processing, multiband compression, limiting and clipping can make those artifacts even more apparent. But level control is still essential.

Introducing the new Compellor® 320D - the world standard AGC is now available with both digital and analog i/o. For almost two decades the Compellor has sustained its unrivaled reputation for 'invisible' operation. The same cleanliness of circuitry and intelligence of processing algorithms that make it 'invisible' also make it perfect for processing in the digital domain. The Compellor will not 'unmask' the masking from upstream reductions and it will feed a signal that will sail through downstream reductions.

The 320D fits any plant from all digital to all analog and anywhere in between. Perfect for all HD applications, the Compellor 320D will help keep your great audio great at a price that won't wipe you out.



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The rear panel connections.

adjustment is then set by ear. This is easily set because the CD audio and the program audio can both be listened to, adjusted and compared without interrupting the actual on air programming through an ingenious method designed into the unit. Next, set the delay for the maximum time period of silence you would like the unit to ignore. This can range from two seconds to 10 minutes. The manufacturer has even designed and included a test mode to test the silence sensor without putting CD audio on the air. As always, you will want to perform a final test and actually cut programming from the source before the unit. That's the basic installation, but if you stop there, you'll be missing out on some really nice features of the Plan B.

The unit has touch-tone remote control features. Access to a telephone circuit at the point of installation is necessary, but worth the extra work. If you already have a remote control using the transmitter telephone line you will have to install another line or try a distinctive ring router like a SR3 by Multi-Link in Lexington, KY. Your telephone company should be able to provide a second number for the same line using distinctive ringing for only a couple dollars per month. The Plan B has the capability to report alarm conditions to up to three emergency phone numbers. With a touch-tone phone you can program various functions, listen to incoming audio or CD audio if it's playing, activate the three auxiliary relays individually, read the state of any one of three status inputs and restore, activate or bypass the unit.

With the extra set of contacts for an audio failure alarm, this unit can also be connected to an existing remote control or alarm device. One nice aspect is its internal EEPROM. With this, information such as passwords, playback mode, three emergency phone numbers to report alarms and a few other setup parameters are safe whenever power is interrupted. Of course, an uninterruptible power supply is highly recommended.

The Plan B can play MP3 encoded discs as well as conventional CDs. Remember to adhere to all copyright laws when doing this.

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Field test

I tested this unit by installing it at the transmitter site. I connected the AES digital output of a RFSTL to the digital input of the Plan B, then the digital out of the Plan B to the exciter digital input. Because our main programming is classical music, which can have quiet passages, the delay was set for four minutes. During my test I was able to kill programming (in the overnight hours, of course) and let the Plan B take over. It did so flawlessly, switching to the backup CD I created that is indistinguishable from normal program audio.

I found the telephone remote control easy to get used to. It was similar to maneuvering around a voice mail system with a list of options and corresponding commands. The power supply is an external heavy-duty multi-voltage supply with a six-pin DIN connector. I prefer internal power supplies, but this is not a big problem.

Because the backup source is a CD, a mechanical device, it can be prone to the problems associated with anything mechanical. Likewise, if the transmitter is particularly dusty, keeping the optics clean might be a problem. I would like to see a unit with a Compact Flash card or similar solid-state media. Also keep in mind that if you already use a telephone line for the transmitter remote control you will need an interface or a second line to access the Plan B.

Simple installation and setup takes only minutes. Even when using more of the features and relays it will only take about 90 minutes to install, program and test. With all this and a five-year warranty, I believe the Plan B is a good investment. 

Danko is VP of engineering and operations for WGUC-FM, Cincinnati.

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These reports are performed by the industry, for the industry. Manufacturer support is limited to providing loan equipment and to aiding the author if requested.

It is the responsibility of Radio magazine to publish the results of any device tested, positive or negative. No report should be considered an endorsement or disapproval by Radio magazine.

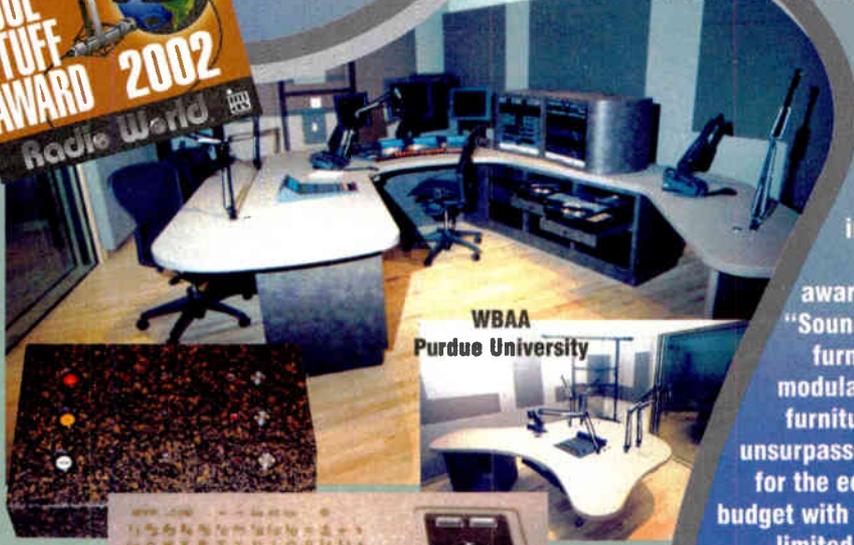


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Mooretronix Stereo Tracer

By Tom Atkins

When Bob Moore of Mooretronix contacted me about his latest product for testing analog audio lines called Stereo Tracer, my first thought was that everything we need to check analog audio pairs has already been manufactured. Quickly, I was put back on track and started to realize the power of this device.

Stereo Tracer is a device that connects to a dual-trace, 10MHz (or better) oscilloscope with an external trigger input and will verify amplitude, phase, and channel position of balanced audio lines by the

connectors to the cable pairs under test. The other end of the cable pairs are then connected to the female XLR connectors, which are the return input to the Stereo Tracer. The correctness of the stereo audio path can be viewed on the oscilloscope. The hardest part of using this unit is getting used to the signature waveforms. Realistically, it took about 60 seconds to get used to them.

Ready for action

It was time to put the product to a real world test. We first started simple. We found a couple of XLR microphone cables about 10 feet long buried in a box of junk. Stereo Tracer quickly verified that one cable was in phase while the other was not. On removal of the XLR connector's covers, we found one cable was wired with pin 2 hot while the other was wired with pin 3 hot. Not bad for the first test, but I was insistent on finding the true power of this testing device. So we connected the unit in the terminal room and decided to check the integrity of the connection to and from the audio console in the production room with the audio console in circuit. My victim to test was the 8x2 stereo selector switch on the console. Testing was going smoothly until we got to input number six. Stereo tracer detected that left channel audio was appearing on the left and right console outputs while the right channel audio being sent to the console was not detected. While investigating of the mechanical switcher in the audio console, we noticed that when a repair was made the right channel cable pair to the switcher input was not connected and a solder bridge was

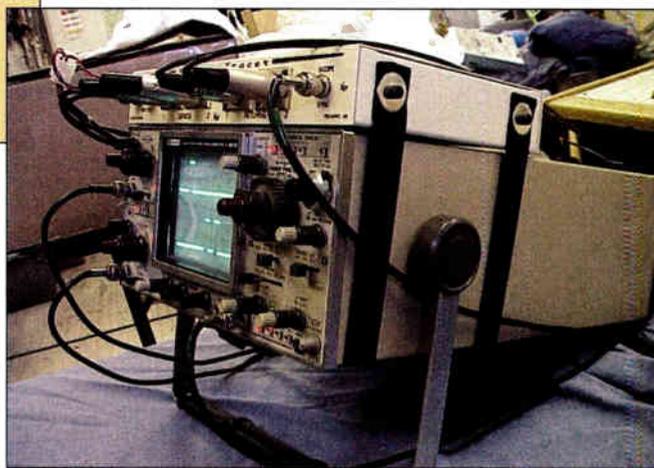


Performance at a glance

- 20Hz to 100kHz frequency response
- 4dB output on the send connectors
- Detects several configuration errors
- Displays audio path quality
- XLR to BNC interface for oscilloscope

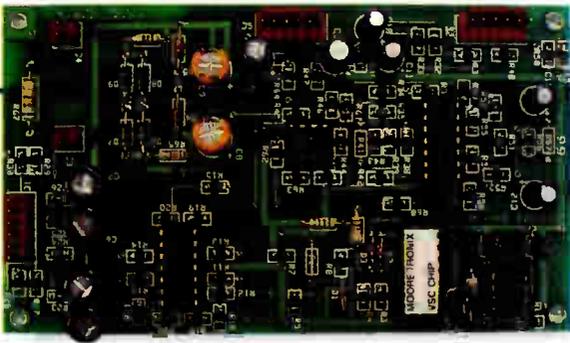
video signature waveforms on the oscilloscope.

Operation is quite simple. Connect the oscilloscope inputs and external trigger to stereo tracer's front panel BNC connectors, plug in the wall wart power supply, set the scope to display both traces, adjust the inputs of the scope to measure 2V peak per division and set the sweep to 1ms and use the external trigger function of the scope. You are now ready to test balanced audio cable via the front panel mounted XLR connectors. A 4dB signal is sent to the male XLR



The unit attached to an oscilloscope and ready for use.

causing the left channel input to appear on the left and right channel output. In my endeavor to test things to their limit, I decided to try and test CAT5 UTP. After making the appropriate RJ-45 to XLR conversion connectors, we



The circuit board that drives the Stereo Tracer.

connected the device to some of the runs in the building. This unit verified the connections flawlessly. One other use we accidentally stumbled across is that the Stereo Tracer will balance the inputs of the oscilloscope. We found this arrangement useful when trying to test pieces of equipment that do not test well with an unbalanced input.

Built in a rugged metal enclosure, the unit can be rack-mounted with optional rack ears or can be secured to the top of most oscilloscopes by the optional nylon straps. The send outputs are rated at 700ohms balanced while the inputs are a 40kohm bridging. Frequency response is within ± 0.5 dB from 20Hz to 100kHz. To me, the unit is well worth the investment to turn an oscilloscope into a powerful audio cable-pair testing tool.

Atkins is vice president/director of engineering of Backyard Broadcasting, Baltimore, MD.

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New Products

By Kari Taylor, associate editor

www.beradio.com

Interactive listener messaging IVP New Media

Cybershout: This Internet messaging system allows show hosts and radio listeners to interact. Comments sent in by listeners



can be viewed in real time or stored for future use and review. This product also allows the end user to view all statistics as well as user e-mail addresses so that the information can later be used

by the radio station as a marketing tool. Features include one window to view all messages, the ability to save messages and the built-in ability to search text. Messages can be screened and forwarded to the air talent as needed, while message senders can be categorized or blocked if necessary. The system works on all browsers, operating systems and platforms and can be individually branded for the station.

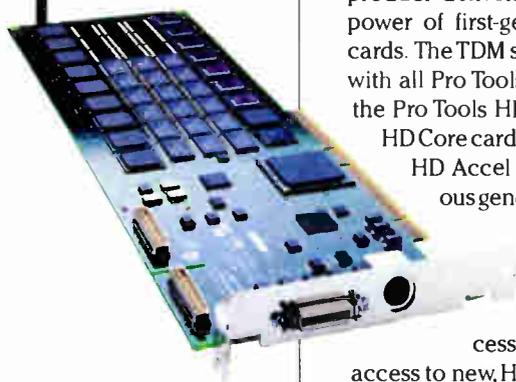
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PCI Card/editing software Digidesign

Pro Tools HD Accel and 6.2 Software: A PCI card for Pro Tools HD systems, this product delivers nearly twice the DSP power of first-generation Pro Tools HD cards. The TDM software is now included with all Pro Tools HD systems to support the Pro Tools HD Accel cards. While the HD Core card remains unchanged, the HD Accel card replaces the previous generation HD Process cards,

and may be added to any Pro Tools HD system to supercharge its processing power and provide access to new, HD Accel-optimized plugins and features. The use of HD Accel cards results in 50 percent higher voice counts across all sample rates (44.1 to 192kHz).

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Audio CAT-5 multiplexer ATI

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Power tube resource

CPI Eimac

Care & Feeding of Power Grid Tubes: This new, 5th edition includes most of the original material, but updates the book with some presently available technology, including added sections on Inductive Output Tubes. This handbook analyzes the operation of EIMAC power grid tubes and provides design and application information to assist the user of these tubes to achieve long tube life, maximum operating efficiency and circuit stability consistent with the full tube capacity.

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Software Sadie

Version 5.2: This software is designed for the Series 5 range of digital audio workstations. The software introduces features and options including fully integrated support for the Advanced Authoring Format (AAF) file interchange standard for multimedia, a normalize function, the reintroduction of speech edit for automatic silence removal, plus a range of further enhancements to playlist editing.

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**Effects processor
Carvin**



FX2: This 24-bit dual engine stereo effects processor offers quality sounds in an easy-to-use unit. Effects parameters are adjusted using real knobs instead of complicated interfaces that require scrolling through endless patches. Available effects include reverb, echo, chorus and flange. Adjustable parameters include time, decay and depth. The unit includes dual stereo engines for two independent stereo effects, a built-in power supply (no wall-wart), true stereo in/out, a link switch, the ability to link effects 1 and 2 for parallel operation, a foot switch jack and an optional footswitch.

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Upgrades and Updates

Burk Offers VRC1000, VRC2000 Trade-In Program

The program allows customers who purchase a new GSC3000 or VRC2500 to send their existing VRC1000 or VRC2000 units to the factory to receive \$400 back on their upgrade. The offer runs until Feb. 27, 2004, and is available on orders through all of Burk's distributors.

www.burk.com/trade-in

Tascam to Distribute Kamesan Mixers

Kamesan has more than a 90 percent share of the ENG/EFP mixer market in Japan. Three of the more popular models are the KST-2000 and KS-342 mixers and the Monicough. The KST-2000 is a compact three-channel mixer. The KS-342 has a pair of expansion modules, four mic inputs, comprehensive monitoring and a compact design. The Monicough is a stand-alone microphone preamp, talkback/headphone monitor system and mute switch for commentary applications.

www.tascam.com

HD Radio Software Receives CES Award

HD Radio, the IBOC technology under development by Ibiquity Digital, has been recognized as an honoree in the Innovations 2004 Design and Engineering Showcase to be held in conjunction with the International Consumer Electronics Show. The annual Innovations Awards are selected by a panel of independent industry designers, engineers and journalists to evaluate the year's most technologically advanced consumer electronics products based on the several criteria: user value, aesthetics, contributions to the quality of life, and innovative design and qualities. HD Radio was honored in the Software/Embedded Technologies category.

www.ibiquity.com

Susquehanna Orders Sixth BE IBOC Transmitter

Susquehanna ordered the Broadcast Electronics FMI-703 HD Radio transmitter on Dec. 17 for WWVQ-FM in Atlanta, along with BE's FXE 60 exciter and HD Radio signal generator.

The other Susquehanna stations with Broadcast Electronics equipment are WFMS-FM, WGLD-FM and WGRL-FM in Indianapolis, WARM-FM in York, PA, and WRRM-FM in Cincinnati.

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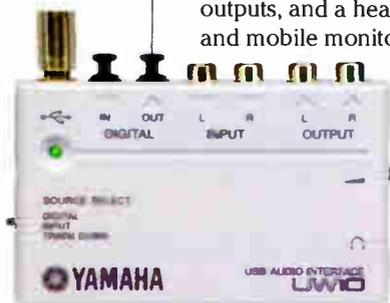
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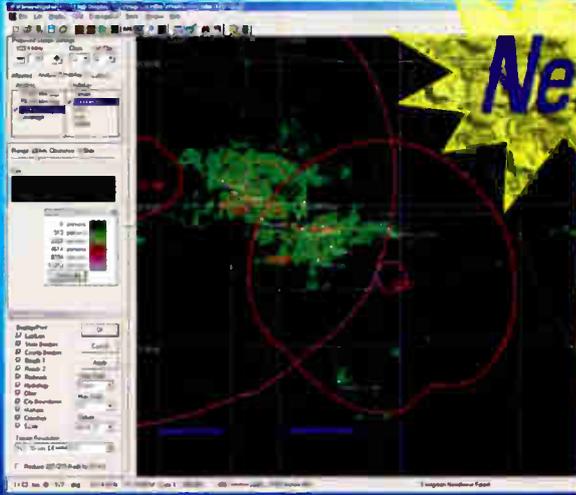
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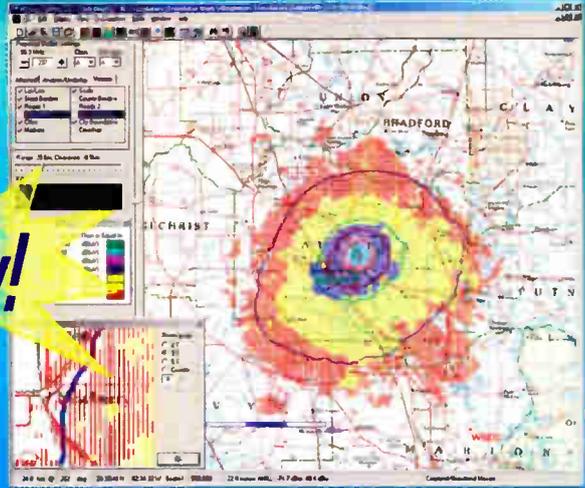
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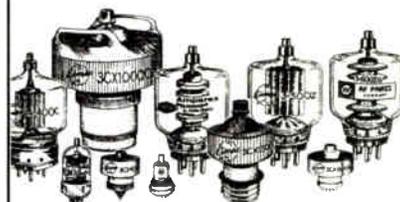
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	1	2	3	STORAGE	STORAGE
E	SOLETC	MANUAL	COMPARE	DISPLAY	COMPARE
	GROUP	FUNCTION	HEADER	HEADER	HEADER
A	4	5	6		
	NAME	SELECT	RECORD	PLAY	DISPLAY
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S	CLEAR	LIST		↑	ENTER
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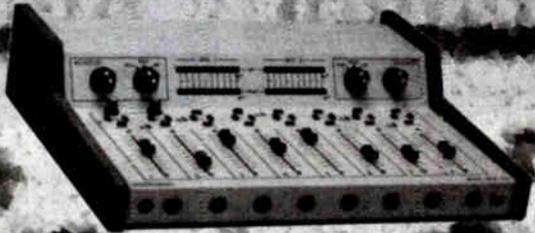
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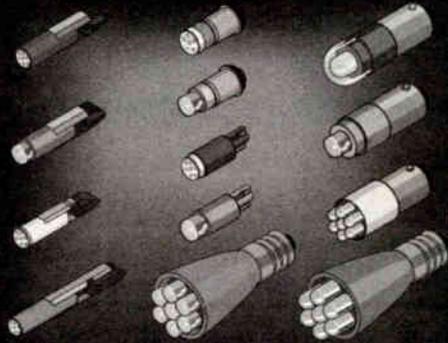
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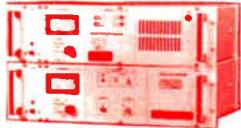


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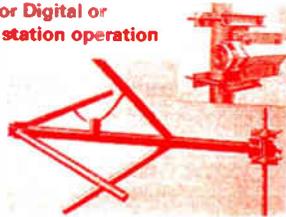
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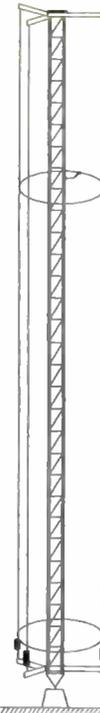
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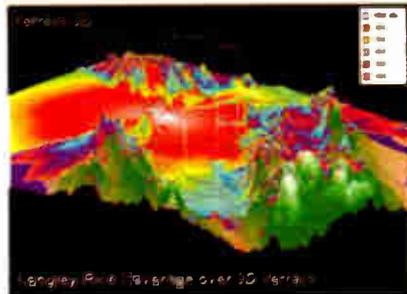
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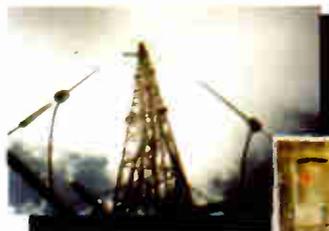
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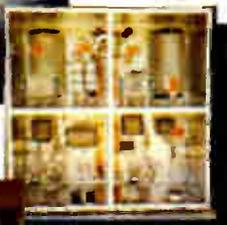


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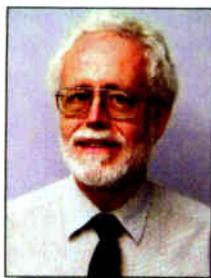
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Contributor Pro-file

Meet the professionals who write for *Radio*.
This month: **Facility Showcase**, page 22.



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Wright has more than 24 years experience in broadcast engineering, including 10 years

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He has designed, built or maintained AM and FM studio and transmitter facilities for many stations in his career. He also has experience in two-way communications and computer networking.



Written by radio professionals
Written for radio professionals

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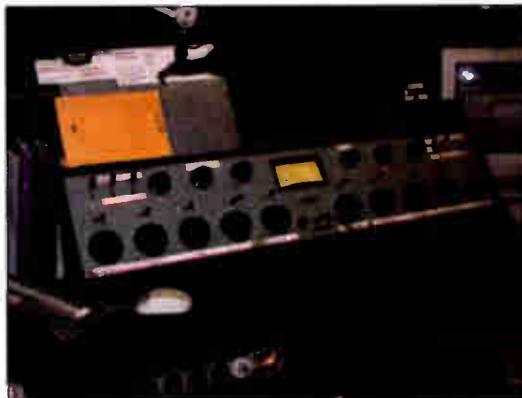
Shaping radio today and tomorrow

By Kari Taylor, associate editor

Then and now

While searching for the oldest transmitter still in daily use, the *Radio* magazine staff received a response about the oldest console still in use. This 1960 Collins 212G console is located at WJMS, 590 AM, in Ironwood, MI. It was installed in the station in December of 1960.

Designed for medium-sized radio stations, the console provides nine to 13 inputs. The VU meter is centered on the

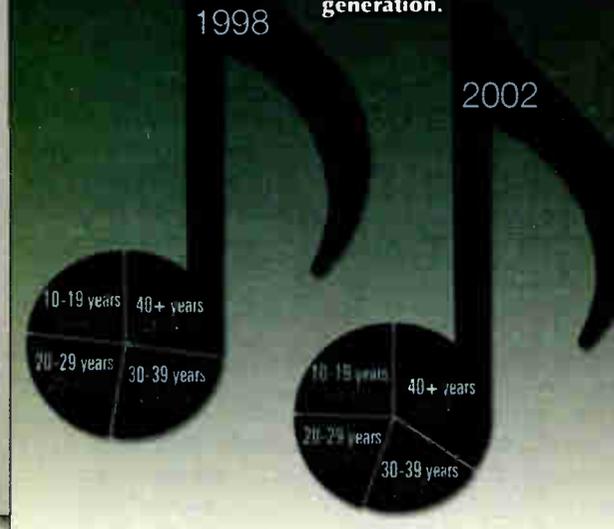


panel. The lights are external to the meter and can be replaced without removing the meter face. The top of the console is hinged and provides room to service components while the panel remains in position and the unit is operating. The level controls were stepped attenuators.

Only two types of tubes are used in this console: 5879 and 6V6. Slots in the bottom, back and top provide adequate ventilation for low operating temperatures. The console features plugable line amplifier modules.

Sample and Hold The trends shaping radio

Buyers over 40 now account for more than 1/3 of all music purchases, an increase stemming from Internet piracy problems and the strong spending power of the baby boomer generation.



Source: Recording Industry Association of America
Note: Numbers may not add up due to rounding.

Do You Remember?

In 1985, Tandberg's TCD 900 series of professional cassette decks were built around an eight-bit microprocessor with 32K of EPROM memory. According to a Tandberg ad, the cassette decks were designed "as an alternative to the practice of using inferior home tape decks for professional applications."



The TCD 910 was intended to replace reel-to-reel and cartridge machines in many applications. Touting its high specs, the deck was "capable of producing tapes at sound and silence levels beyond that required by broadcast and studio requirements." It offered a real-time counter and auto-locator functions.

Features of the 910 included four-motor tape transport with direct load; a built-in azimuth adjustment was combined with Active Phase Correction circuitry; auto stop and rewind after cut; front panel bias and record current adjustment, with built-in oscillators; and an optional RS 232 computer interface, infrared wireless hard wire remote with fader start.

WHEATSTONE D-4000

DIGITAL AUDIO CONSOLE

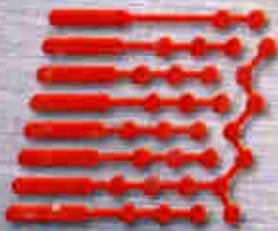


Based on the technical architecture of our popular D-5000, this new D-Series console is totally modular, offering features to satisfy the most demanding engineers—but at a lower price point than its predecessors.

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- Six pointer-style true VU meters
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- 24 bit A-to-D conversion on analog inputs
- A/B source switching with fully independent logic and machine control
- Mode selection on stereo inputs
- Low profile drop-through counter design
- Multiple studio outputs with talkback interrupt

*Wheatstone has more digital audio experience than most of our competition combined. The D-4000 is a truly high performance, reliable console that will make your transition to digital a pleasure. Benefit from our expertise—**CHOOSE WHEATSTONE**—the Digital Audio Leaders!*

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