SOUND & COMMUNICATIONS

Volume 35 Number 2 February 1989

TELECONFERENCING: AN A/V OVERVIEW

Most business conferences today utilize prepared audio or visual aids of some kind to enhance presentations and stimulate participant interest. What kinds of A/V media are possible in a teleconferencing system? A teleconference involves participants at remote locations utilizing anything from speaker-phones to full-motion video for the purpose of communication. Obviously, the types of A/V media which may be used are directly related to the kind of teleconferencing chosen. But whether you are using audio, still-video, or motion-video teleconferencing, there are many A/V options from which to choose. 32

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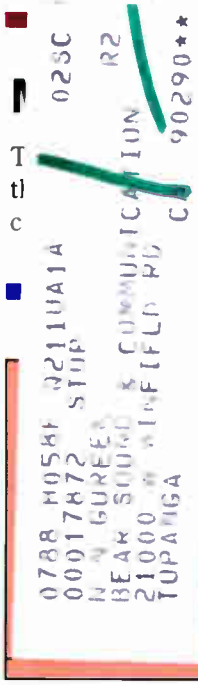
Designing a successful system — one that fulfills the user's expectations — requires a clear understanding of how the system will be required to function. 37



REPORT: A/V CONTROLS

ironments to fit the specific needs of individual clients has become
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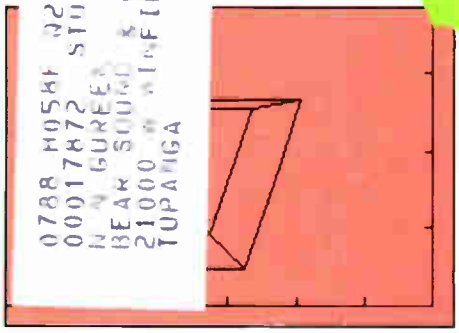

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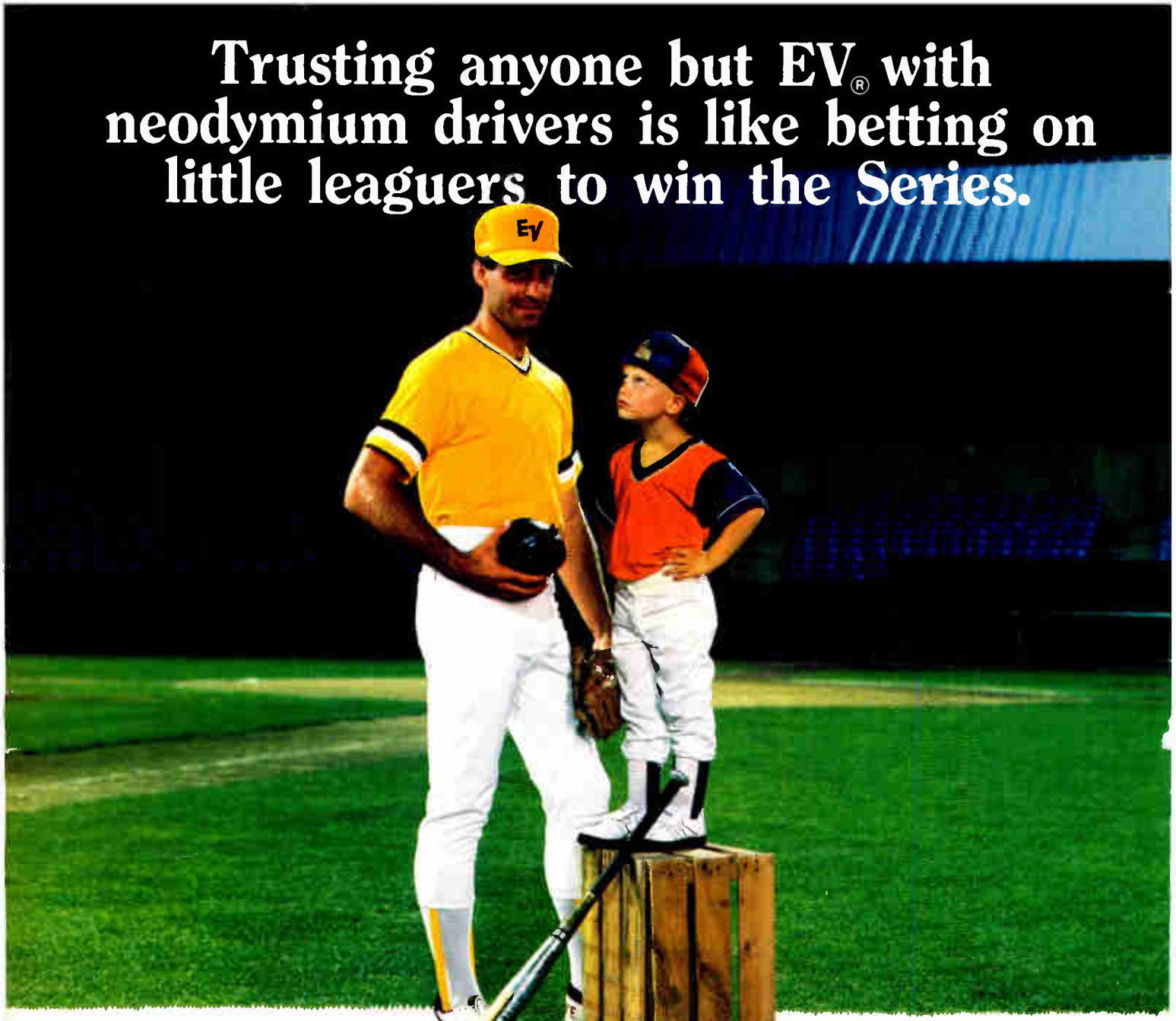

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Coming in March . . .

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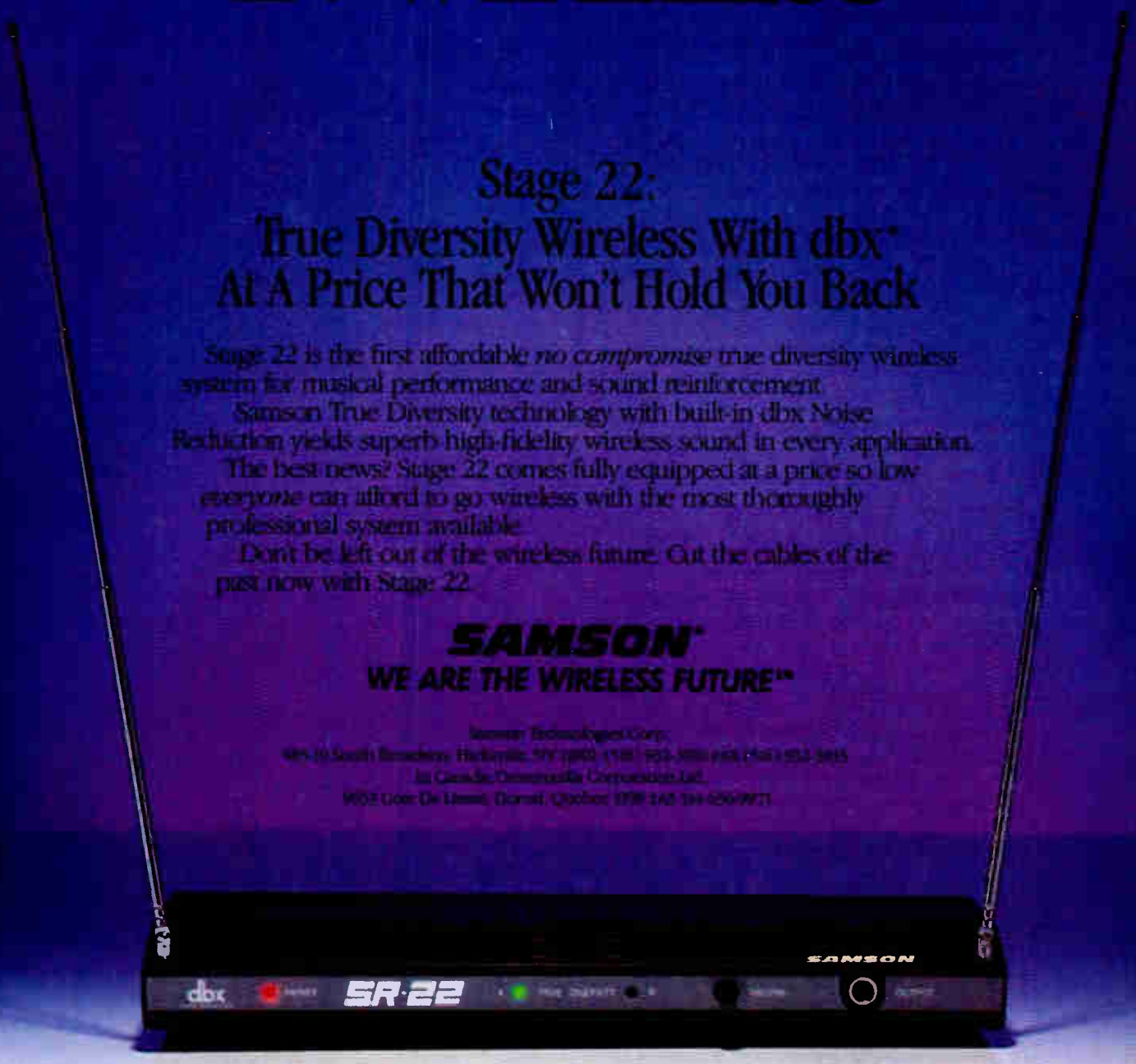

Stage 22 is available with the Electro-Voice N/Dym 757 microphone sold exclusively in wireless by Samson.

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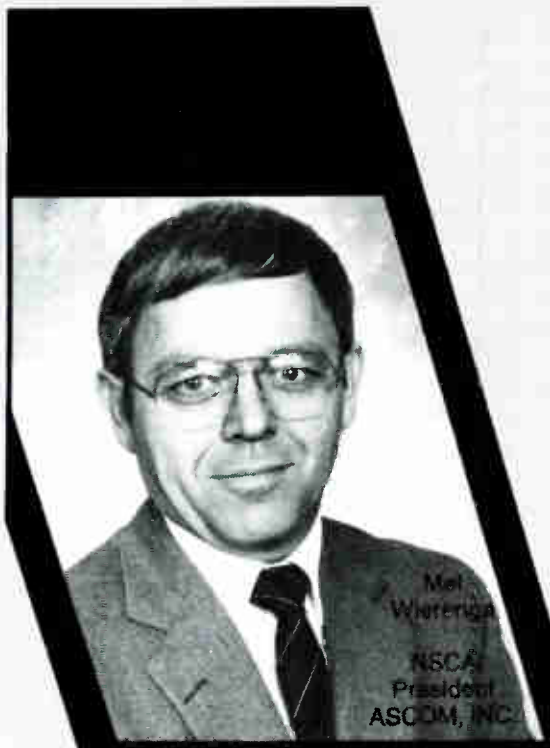

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S	M	T	W	T	F	S
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7	8	9	10	11	12	13
14	15	16	17	18	19	20
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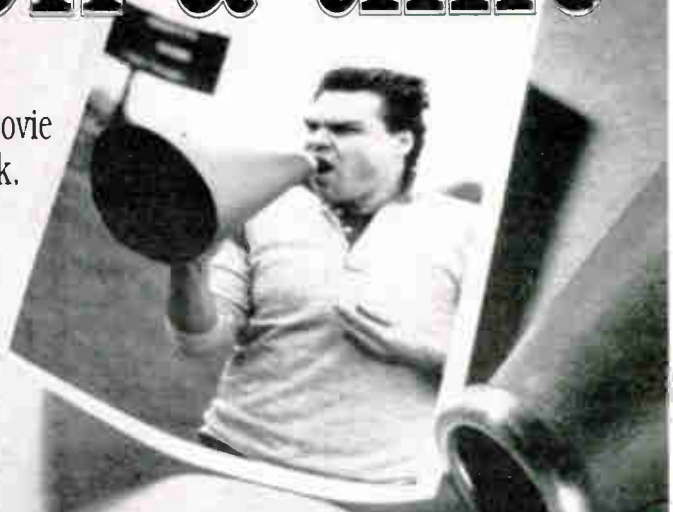
Once upon a time

This was a movie soundtrack.



And this was an amplifier

In their day, they were the state-of-the-art. The theater organ (or piano) provided all of the sonic textures required to completely involve an audience with the film on screen. The megaphone was reliable, but its limitations quickly became obvious. Its frequency response was rather limited, and its direct dependence on input level made it usable only by oral athletes.

With man's undying need to to expand his ears' horizons, the film soundtrack came to replace live accompaniment. Sound reinforcement came to span everything from audio in the home, to rock and roll in the arena. As the quality of these mediums grew, the need to surpass the limitations of existing amplification became apparent.

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NEWSLETTER

MARK IV AUDIO STRATEGY OUTLINED

Mark IV Audio is a term we'll be hearing more of, according to Robert Pabst, president of Electro-Voice. The elements, formed by acquisitions by Mark IV Industries over the past few years, add up to a hefty subsidiary population of audio-related companies. Beginning with the Gulton acquisition, which provided Electro-Voice, the Mark IV Audio companies now include E-V, Altec-Lansing, Gauss, Vega, Ivie (the last three the results of the Cetec acquisition) and University Sound (now incorporating Cetec Raymer).

In a wide ranging interview, Pabst outlined his strategy for the next several years. Central to that strategy are segmentation and share of market. All the elementary subsidiaries operate independently and will continue to do so; however, each company specializes in a different segment of the market — and will be expected to gain a 30 percent share of whatever market they are in.

The corporate philosophy directing the business is, according to Pabst, one of high-end equipment, good warranties and service, carefully chosen distribution and dealers, along with lasting relationships and dealer training. "We are interested in building relationships," Pabst said.

The objective, according to Pabst, is to have Mark IV become one of the three largest companies in the world, by sales, servicing pro audio. University Sound may well be the biggest component within five to 10 years. The six segments that the company currently attends to are: music, pro sound, commercial sound, OEM, cinema sound and broadcasting. Ivie (the former Cetec Ivie) will "maintain a staunch leadership position in audio instrumentation."

RAMSA/PANASONIC FEATURED IN MIDWEST DEALER SHOW

RAMSA/Panasonic demonstrated the RAMSA CD's and R-DATs at the Swiderski Electronics Regional Dealer Show in Elk Grove, Illinois. The booth featured the introduction of the portable SV-250 and studio SV-3500 R-DAT players and the single and multi-play CD players.

AGFA-GEVAERT OBTAINS INJUNCTION AGAINST SUNKYONG

Agfa-Gevaert AG has obtained a Consent Preliminary Injunction effective January 15, 1989, from the United States District Court for the Southern District of New York, which completely enjoins Sunkyong International, Inc., from making, using or selling in the United States certain stackable winding cores wrapped with magnetic tape used primarily in the sound duplication industry, according to Agfa. Agfa-Gevaert AG first sued Sunkyong in July 1987, charging Sunkyong with infringing Agfa-Gevaert AG's U.S. patent no. 4,081,151.

In the Federal Republic of Germany, Sunkyong has already lost an infringement suit on a companion German patent, Agfa says. Sunkyong acknowledged its patent infringement in Germany of the Agfa-Gevaert AG patent and declared it would refrain from any further patent infringing activities in that country.

COHU WINS CONTRACT

Cohu, Inc. has been awarded a multi-year contract, with an initial order of $523,000 from the U.S. Navy covering procurement of television cameras. The cameras to be supplied are ruggedized environment-resistant models for outdoor surveillance. Depending upon the Navy's requirements and approved funding levels, the contract value could total $7,800,000 over the next four years.

The contract was awarded by the Navy Electronics Systems Engineering activity (NESEA), which is responsible for the security and surveillance of U.S. Naval installations throughout the world.

NEWSLETTER

NEWS FROM DOWN UNDER: NEW DSP CHIP

The Australian firm Austek Microsystems has developed the A41102 signal processing chip, capable of performing more than 100 million mathematical operations per second, according to a report from Austrade, the Australian Trade Commission. Applications for the chip range from medical and military electronics to audio graphic equalizers, and could also include TV transmission via telephone lines.

GENTNER COMPLETES EIGHTH QUARTER OF PROFIT

Gentner Electronics Corporation has reported that its second quarter of fiscal year 1989 completes its eighth straight quarter of profitability. In Gentner's second quarter ending December 31, 1988, the corporation reported a net revenue of $1,110,200, up 47 percent over that of the comparable quarter last year. The revenue increase resulted primarily from strong sales in the newly acquired audio processing products from Texar Incorporated, according to William V. Trowbridge, chief operating officer for Gentner.

UNIVERSITY SOUND REINTROS 9000 SERIES

University Sound is reintroducing the 9000 Series of modular mixer/amplifiers originally designed and sold by Cetec Raymer. University had pulled the product and redesigned it after the company's merger with Raymer. Evaluation of the redesign is now being made by University's preferred contractor customers, with no buying commitment. Final specs have not been made available.

ORTEL INTRODUCES TVRO FIBER OPTIC LINK

Ortel Corporation has introduced the System 6000, a TVRO Fiber Optic Link. The System 6000 is used to transmit the LNB output from a satellite earth station antenna to a remote receiver or headend over distances up to 15 miles, without a repeater. The System 6000 consists of a model 6300A Fiber Optic Laser Transmitter and a model 6400A Photodiode Receiver. The system can transmit all 12 channels from a single polarization. The fiber optic link offers complete immunity to microwave interference, and insensitivity to weather conditions.

COMCAST SELECTS GENERAL INSTRUMENTS FOR WEST PALM BEACH REBUILD

General Instrument Corporation has announced that Comcast Cable Communications has selected the Jerrold Division of General Instruments to supply fiber optic and conventional cable tv electronics for its West Palm Beach, FL, rebuild. Total cost of the rebuild is expected to be $25 million, with General Instrument supplying approximately $10 million worth of equipment.

REP NEWS:

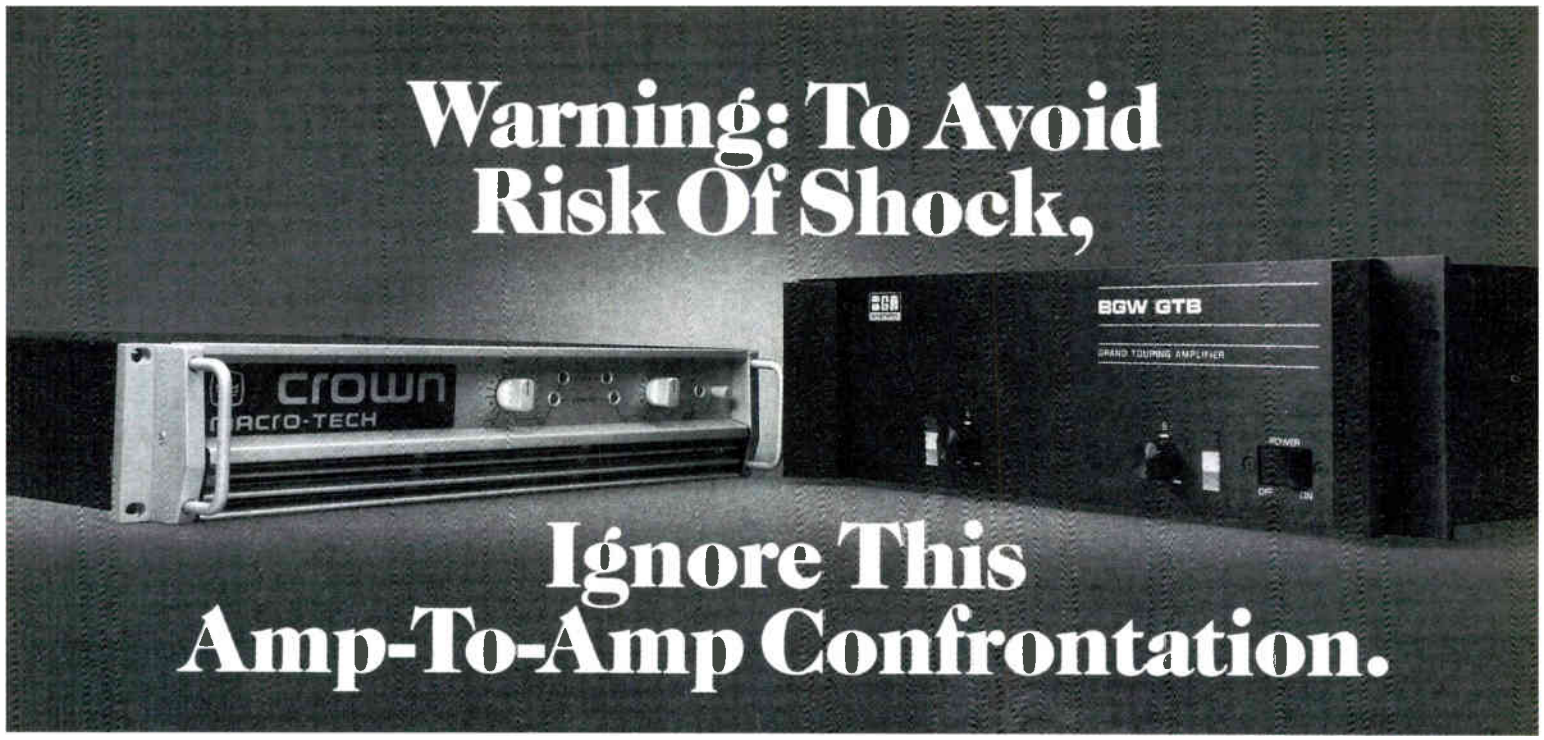
HM Electronics, Inc. (HME) has appointed four new rep firms to handle HME's line of cabled and wireless intercom systems and wireless microphones. Northshore Marketing will cover all of Washington, Alaska, Oregon, western Montana and northwestern Idaho. Northshore Marketing is located at 16 West Harrison Street, Suite 205, Seattle, Washington 98119.

Brian Trankle and Associates will cover northern California and northern Nevada for HME. Brian Trankle and Associates is located at 1504 Industrial Way #4, Belmont, California 94002.

Powerlines Marketing will cover northern Illinois and eastern Wisconsin for HME. Powerlines is located at 321 Ashland, Evanston, Illinois 60202.

R.J. Throckmorton Sales Company will cover eastern Nebraska and southern Illinois for HME. R.J. Throckmorton is located at P.O. Box 1038, 124 Manchester Road, Ballwin, Missouri 63022.

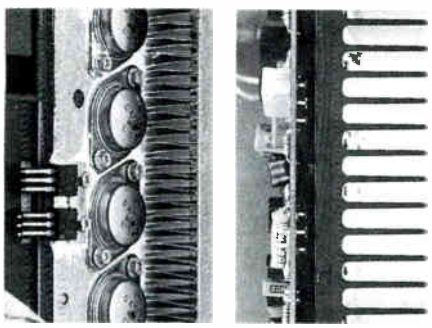
Warning: To Avoid Risk Of Shock,



Ignore This Amp-To-Amp Confrontation.

Let's be frank. We're out to change your idea of what—and who—makes a professional power amplifier. So if you just bought a Crown MacroTech, turn the page — this comparison won't be a polite one. But it will stick to the facts.

A look inside these two amps will give you a better idea of why BGW amps like the GTB Grand Touring Amplifier are built like no others in the world. And raise some questions about Crown MacroTechs.



Left: *The MacroTech uses mostly air to dissipate heat, not metal. The closely spaced fins are vulnerable to airborne dust and dirt.*

Right: *BGW uses ten pounds of aluminum to absorb thermal transients, extending power transistor life.*

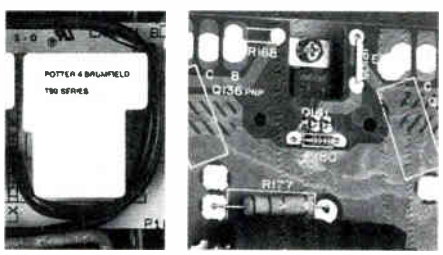
TAKING THE HEAT

If the MacroTech heat exchanger reminds you of an air conditioner, you've grasped its design. This approach works, at least until dust and dirt clog the fins. But as soon as the air flow slows or stops, temperature rises. Soon after that, the Crown shuts off — it could even fail.

The GTB uses massive extruded aluminum heat sinks with widely spaced fins. The mass of metal absorbs thermal transients without straining the fan. And without quick changes in transistor temperature. That's important: Transient musical loads put the worst kind of stress on power transistors. The effects of thermal cycling fatigue may not show up until after the warranty. but they can destroy lesser amps. Meanwhile, BGWs keep right on delivering clean, reliable power.

REAL SPEAKER PROTECTION

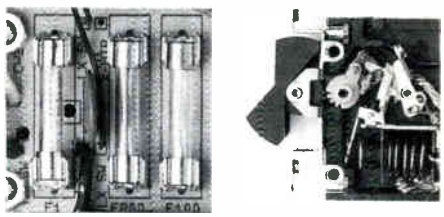
Most amps today are direct coupled, so a blown output transistor (the most common failure) connects the power supply directly to the speakers. Earlier MacroTechs had no protection against DC. Now Crown has learned their lesson — or have they? The sensing circuit and relay they now use shuts off the power transformer, but allows the filter capacitors to discharge stored DC energy directly into your drivers — risking real damage.



Left: *Crown uses a slow-acting. less reliable relay. It can allow the filter capacitors to discharge stored energy directly into your drivers.*

Right: *BGW's modular power output section protects your speakers against DC damage with an instantaneous Thyristor Crow Bar. And the module is easily replaced in the unlikely event of failure.*

BGW pioneered DC speaker protection in 1971. We stopped using relays years ago, when they no longer met our reliability standards for BGW amps. The GTB, like all BGWs over 200 Watts, uses solid-state Thyristor Crow Bars to keep DC from ever reaching your valuable speaker cones or compression drivers.



Left: *Time is money, and with Crown's MacroTech you can lose plenty of both: You have to pull it out of the rack every time a fuse blows.*

Right: *The GTB's power switch is also a rocker-actuated magnetic circuit breaker. You can reset it in a second if power lines hiccup.*

MAKE YOUR OWN COMPARISON

Before you buy or spec your next power amp, call us at **800-468-AMPS** (213-973-8090 in CA). We'll send you tech info on BGW amps and the name of your nearest dealer. He can arrange a demo of any BGW model against any amp you choose. Then you'll be able to appreciate the advantages of BGW engineering with your ears, as well as your eyes.

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HANDLING CUSTOMER COMPLAINTS

by Monroe Porter

Eventually every business services a perpetually dissatisfied customer. Fortunately, these individuals usually represent a small percentage of the customer base. There is, however, a limit to *every* customer's patience. Even the most tolerant customers may get hot under the collar and make inflexible demands if their complaints are ignored. A consumer survey report revealed that among customers who took their business to the competition, indifference to a problem caused the change of allegiance in 68 percent of the cases.

'Resolving customer complaints is an essential element in building a professional company image.'

Resolving complaints is an essential element in building a professional company image. A Wharton Business School report showed that unhappy customers are likely to tell at least fifteen people about their dissatisfaction. And 90 percent of these unhappy customers would have purchased goods or services from the offending company again had their complaints been adequately adjusted. Failing to handle complaints professionally indicates a lack of concern about building future business relationships, and leaves the customer feeling that the company has taken advantage of them. The following tips can prove helpful in handling customer complaints.

(1) Don't avoid a customer with a problem. An angry customer will tell their story to someone. Listen to the complaint and try to make the customer feel less inclined to relay it loudly to the general public.

(2) If there is a problem, make every effort to discuss it privately with the customer. Don't make a scene in front of other customers or employees.

(3) Listen attentively to the complaint. Don't interrupt, talk, argue or make comments. Just listen. Respond with sincere regrets for the inconvenience.

(4) Get the facts straight. Ask the customer to speak slowly and write down the most pertinent facts of the story. Making a list of demands limits the customer's complaint and shows your concern with the situation.

(5) Be aware that complaints may be exaggerated; probe gently until all the facts have surfaced.

(6) Ask customers what they consider to be an equitable solution to the problem. Often they are willing to settle for less than what you are prepared to give. If so, solve the problem by agreeing to their terms.

(7) Acknowledge the customers situation, show concern, but focus on the task and the solution, not the emotions involved. Use this principle to help separate the facts from the feelings.

(8) Use mirroring. Match your style to the customer's style. If they speak quickly, you speak quickly. If they speak slowly, then you speak slowly also.

(9) Keep working on the complaint until it is resolved, but don't make promises you can't keep. Be very clear in your position and stick firmly to it. Use management only as a last resort.

(10) Gear customer service policies to the "majority" of reasonable customers and not to the few who will be unhappy even if given company stock.

Dealing with customer service problems is not pleasant. With practice, however, service complaints which appear to be insurmountable obstacles can be turned into sales challenges. Long-standing relationships can be built by satisfactorily correcting a customer's problems. In this respect, handling customer complaints can be as important to the well-being of your business as offering a good product or excellent technical service.

'Relationships of long-standing can be built by correcting a customers problems satisfactorily.'

Porter is vice president of Proof Management Associates, Richmond VA.

It's Not Just A Phase We're Going Through.

The tremendous success of the Tannoy PBM series of reference monitors is by no means coincidental. Since the introduction of the world renowned NFM-8 nearfield monitor, much time and effort has been spent on discerning the needs of the mixing engineer and the applied requirements of "playback monitors". The PBM Line exemplifies this commitment to excellence in reference studio monitoring. These compact loudspeakers sport robust poly cone mid-bass transducers utilizing efficient long-throw, high power voice coils. The low frequencies are carefully controlled by optimumly tuned ports located on the rear of the loudspeakers. Hi frequencies are provided by Hi Power ferro fluid cooled polyamide dome tweeters which extend H.F. bandwidth beyond 20KHZ. The driver accompaniment is knitted together by means of a precision hardwired crossover unit, utilizing robust low loss components, and heavy-duty input terminals which will accept standard 3/4" spaced banana plugs and the majority of high quality, specialist audio cables. Transducers and crossover assemblies are neatly housed in a stylish, high density, partical wrap cabinet, specially designed to minimize unwanted cabinet resonance, and high frequency reflection. In summarizing, we have left the best feature of all for last "price versus performance."

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TELECONFERENCING: SYSTEMS INTEGRATION

by Steven J. Orfield

The design of audio and video teleconferencing systems in large rooms differs in a clear way from most other types of projects in the audio field; there are so many players on the average design and operational team that neither success nor failure in system performance is easily attributed to one design team member. An underlying reason for the problem of performance in teleconferencing is the lack of acceptable standards which can be used to control its four most crucial variables (exempting video):

Talker-listener behavior.

The in-room and remote-site audio system.

The transmission link.

The room acoustics.

The variables noted above provide a problem in addition to the lack of standardization in their use; while decisions regarding the first are usually controlled by the client, the other three variables are usually dealt with by three separate consultants or vendors, each of whom does not generally understand the issues involved with the others' disciplines. A brief look at each of these areas will suffice to introduce the complex problem of teleconferencing.

Anyone who has designed a large conference room or boardroom intended to be used for teleconferencing has probably experienced a classic initial problem of many new installations, and this is the client's broad variation in his use of the room and audio system. On the one hand, the room is generally intended to provide a space for amplified meetings which are not broadcast off-site, and this internal use can be as flexible as the room design itself.

Upon using the same room for broadcast, certain issues of sensitivity begin to emerge. What is the priority of microphone use? Is a main talker to use the room podium during a teleconference? Is a separate A/V program, such as a video tape program, to be interspersed with the meeting? Is it possible for the main talker to wander around the room during the meeting? Can listeners not seated at the boardroom table communicate with the off-site conferencee via wireless microphone? Is it appropriate if the members of the meeting seated at the table lean back and talk at some distance from their microphones? How is an "aside" comment kept out of the teleconference transmission and local audio system?

The simple and most appropriate way to reduce this problem of "user definition" is to define the room and its user in very narrow terms with respect to:

1. Meeting participant position.
2. Podium position.
3. No wireless microphone use.
4. No secondary A/V presentation use.
5. Identical use definitions and systems at both ends of the transmission chain.
6. "Filibuster control" of microphone by the first talker "on-system."
7. No participation by those not seated at the table.

While narrow definitions tend to resolve many of these problems, the client unfortunately forgets these definitions very quickly and, as with all audio systems, the system is used in any way which proves to be obvious or convenient.

While teleconferencing is often more difficult than other problems of large-scale audio design, the designer of these systems is often seduced by a "systems approach" to the problem, and he assumes that the equipment specifications are the crucial variable in the process. Typically, a system of matched microphones, preamplifiers, and associated electronics is specified, and there is little or no information supplied with these systems indicating their proper use, compatible room designs, or compatible transmission link designs.

Since these systems tend to attempt to provide echo cancellation, it is becoming more and more obvious that room acoustics may play a significant part in the function of these systems. On the other hand, while professional audio design in large rooms has recognized the problems of room acoustics and tends toward the use of more selective (or "higher Q" devices), teleconferencing has traditionally tended toward very low Q devices, such as omnidirectional loudspeakers and microphone coverage patterns exceeding 50 degrees to each side of the talker. Thus the transducers used in these systems are low selectivity devices and tend to accent rather than reduce the problem. This lack of selectivity is often compensated for by "auto sensing" circuits which gate microphones off when sound is not coming from the talker direction, but these systems are far from optimized. Thus, the question of control of these devices and their interface to an appropriate room environment are often difficult to resolve. Also and somewhat surprisingly, most of the

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designers of these systems do not realize how important equalization is, in that some systems are frequency sensitive at very narrow bands and equalization can modify gating.

It is often true that the selection of a transmission link vendor is not coordinated with the teleconferencing room design or equipment selection, and when the system and the link begin to exhibit problems, there are usually two parties pointing fingers at each other, the link vendor and the audio dealer. The audio dealer, who is often the designer, may do certain things to minimize this problem, including extending an invitation to the link vendor to participate in the design process with any information that is known about the interaction between his transmission path and equipment and the audio system in the teleconferencing room. Additionally, the audio dealer should avoid the use of extensive processing in the initial design and withhold process ing gear for later "tuning" of the system. This includes the use of compressors, de-essers, gain riding componentry, etc.

The link supplier can be very useful in defining the range of expected signal, in terms of amplitude and frequency, and further explanation of the limits of the system, in terms of minimum signal, S/N, frequency range and appropriate test methods of evaluating the link on an ongoing basis are very useful.

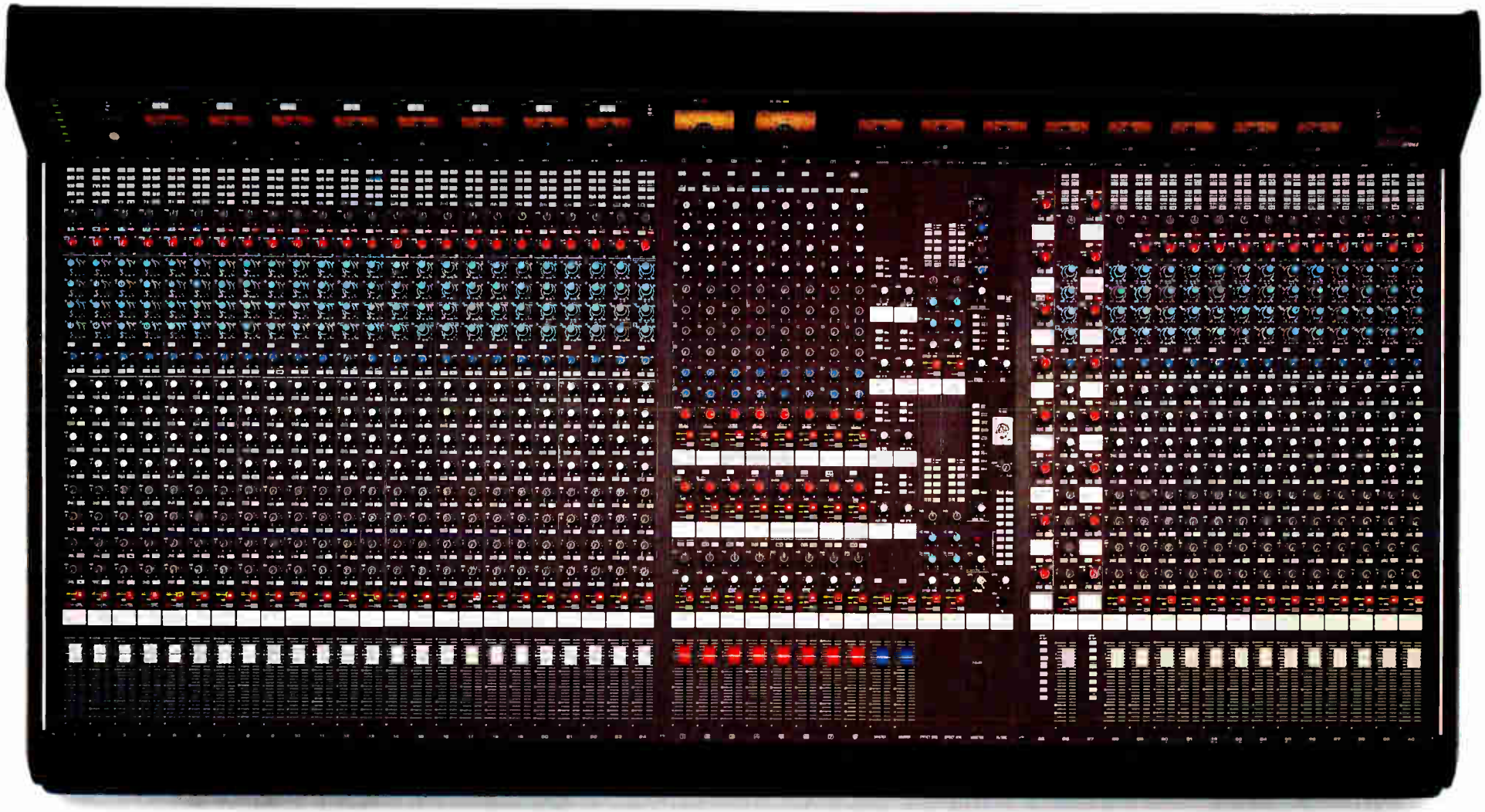
While it is now becoming more commonly accepted that room acoustics plays a critical part in teleconferencing in large and small rooms, there is far less agreement on the specific issues. The variable of reverberation is generally the first known variable in this problem, and it is often the only variable considered when acoustics is explicitly at issue. In addition to reverberation, other issues which are crucial to teleconferencing room acoustics are:

HVAC (heating and cooling) system noise.

Environmental noise (wall and door design).

Specific reflections which cause

(continued on page 62)



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MEASURING LOUDSPEAKERS WITH TEF: PART II

by Mary C. Gruszka

This month, we continue with our look at the single-driver, powered loudspeaker (the Anchor AN-1000) we began measuring in part one. Figure 1 shows the ETC of that speaker, similar to the ETC we examined last month, except that the baseline has been raised to show the arrival times of the reflections of objects next to the loudspeaker.

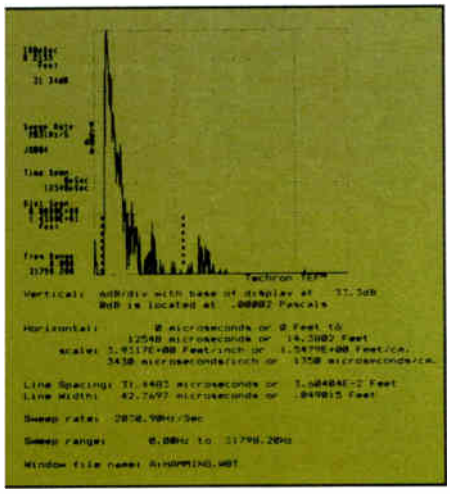

Figure 1. Energy Time Curve of speaker showing direct sound decay and room reflections.

The main reflections are those of the ceiling, and of the wall behind the speaker setup. Since I wanted to make the measurements in a setting similar to that of a small edit suite, I placed it near my VCR, not too far from wall surfaces.

The first set of reflections is about 2000 μs (or about 2.5 feet) away from the direct sound, while the second set is about 4600 μs (or about 5.2 feet) away. (The exact numbers can, of course, be read from the cursor, but if you are just given the plot, use information such as the full scale time and the time division lines to estimate the distances.)

Having identified the major sound occurrences on the ETC, I then selected the time span within which I wanted to see the frequency response. The time span chosen is indicated by the asterisk lines on figure 1. The frequency response plot, as a 3-D display, is shown in figure 2. Figure 2 plots the decay of energy within a range of frequencies (0 to 20 kHz) and within the chosen time span for direct sound only, since the first reflection, as seen in the ETC, is hidden under the baseline of the 3-D display. (The data for that reflection is not lost, and can, if needed be raised above the baseline.) However, by extending the time span to include the reflection, I was able to obtain a good balance of time and frequency resolution for the 3-D display.

The frequency resolution for this display is 770 Hz and the time resolution is 1.3 milliseconds (or about 1.5 feet). Each of the 32 energy-frequency plots is spaced at 126 μs (or about 0.144 inches) apart. This gives about a ten-to-one overlap or redundancy in the curves and allows a smooth total display. Comparing the ETC and this 3-D plot, you see that the speaker decays smoothly in frequency as well as time.

A single energy frequency plot for this same time span is shown in figure 3. This measurement was taken with a space window of 4 feet (or a time resolution of 3.5 milliseconds), giving a frequency resolution of 282 Hz. (This is the best frequency resolution you can have with this space window, as the frequency resolution is the speed of sound divided by the space window, using similar units for length.) With this space window, the peak energy as well as the decay of direct sound plus that first reflection is included in the measurement. However, that reflection is about 42 dB lower than the direct sound, and does not significantly alter the plot of direct sound only.

By widening the space window to include this reflection, I was able to obtain the frequency resolution shown, and still look at essentially the direct sound of the speaker. In this way, it was possible to obtain a virtually anechoic measurement without any special chamber (and with the loudspeaker positioned in the environment in which it will be used).

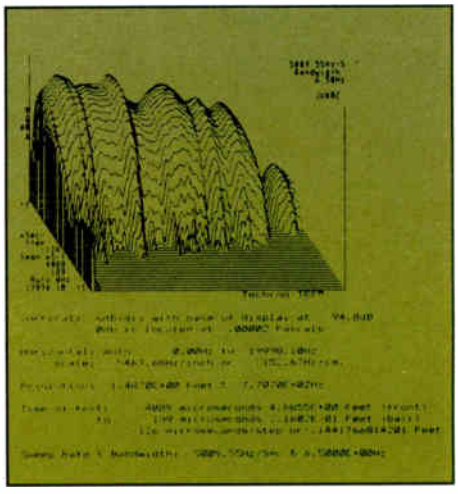

Figure 2. 3-D frequency response curve for the time span marked in figure 1.

A better anechoic measurement could have been made had I not included the reflection. But then I would have had to use a smaller space window which would have given a worse frequency resolution. (I could have moved the speaker farther away from the reflections, but I wanted to show how much information you can get

Gruszka is president of MCG Audio Consulting, Edgewater, NJ.

from "in-place" measurements.)

As shown in figure 3, the frequency response is between at least 150 Hz and 16,000 Hz plus/minus 3.7 dB. (The low-frequency response actually extends below 100 Hz. To measure that anechoically, the speaker would have to be moved farther from the reflecting surfaces, as discussed.)

Unlike the frequency response of audio electronics which are specified to within fractions of a decibel, the response of loudspeakers are generally specified over a wider range of level. This means that it is very important to see the actual measurement curves of the loudspeakers you are considering. You want to see where, and how often, that frequency response deviates from a flat curve.

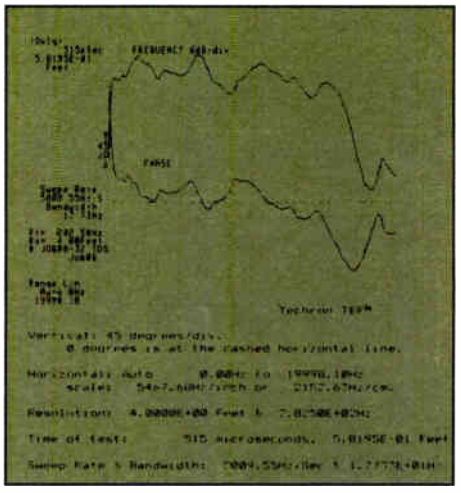

Figure 3. Single energy-frequency curve (magnitude and phase) for the direct sound of speaker.

The particular energy-frequency response for our speaker is a result of the loudspeaker driver that is used. According to John Munroe, chief engineer of Anchor, one of the design goals for this speaker was to make it an extended-range device.

To accomplish this , the driver was designed with a long-throw voice coil to extend the low-frequency response, and a light, high-compliance cone to achieve the high-frequency response. According to Munroe, the combination of these factors causes a resonance in the driver but also allows for the extension of the frequency response, as can be seen in figure 3.

Munroe added that he did extensive TEF measurements on the driver in-

(continued on page 65)

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CADP: JBL'S CENTRAL ARRAY DESIGN PROGRAM, PART TWO

BY MIKE KLASCO

Last month we reviewed the basic framework of JBL's CADP and how one started the design process by entering the physical attributes of the design space. In this installment, we will take a look at the intelligibility, mechanical design, documentation, and sound system engineering aspects of the program.

INTELLIGIBILITY ESTIMATES

If you have measured or calculated the reverberation time, or if you know or can estimate the average absorption coefficient, then this data can be entered into the Room Menu. Only reverb time or average absorption is needed, the program will automatically calculate one from the other. If you are doing a quick cost estimate, you may want to base those estimates on your past experience. Other parameters required to be entered are room volume and surface area. A full design study (after you get the job, or if your time is being paid for) should be carefully calculated to acoustically model the space with as much accuracy as possible.

The Central Array Design Program—CADP.

While the reverb time utility provided with CADP is rudimentary, there are reverb calculation utilities from other sources that are quite useful. Headware has Acoustics II, which takes care of room volume, surface area, average absorption coefficient, RT60 versus frequency and even the preferred equation for the size and character of the room. CADP accommodates Norris-Eyring and Sabine equations and Acoustics II includes these. Acoustics II is available only for the Apple II, but TPM Software offers OPTORT60. This program is helpful and easy to use, except for dealing with materials not included in its data files. New materials can be used for a specific calculation, but not saved. Altec provides a simple RT60 utility (free of charge). These programs will be compared in detail in an upcoming review. Rough determination of RT60 will require less than 30 minutes with any of these programs, but count on at least another half an hour checking on surface materials and the like with architects and interior decorators, as well as looking up absorption coefficients. A reference book that provides absorption coefficients should be kept handy as the file libraries supplied with these programs are not comprehensive.

If you have entered the acoustical data then you can view direct-to-reverb ratios for empty and full audience conditions, and estimated intelligibility for empty and full conditions.

Depending on the complexity of the job and the user's familiarity with the program, the time spent can be as little as half an hour to a half-day (on a multi-cluster, multi-tier job, including intelligibility estimates).

CADP AS A TOOL FOR SOUND SYSTEM ENGINEERING

While CADP, in the hands of an experienced user, can be an effective tool for cost estimation, sales proposals/presentations, and preliminary design studies, it has limitations for full scale engineering studies. Some failings are apparent: it does not predict gain-before-feedback; it is oblivious to obstructions (i.e. it does not provide shadowing of multi-tier seating); there is no consideration of acoustical phenomena such as flutter echo, arrival time (for setting of time delays), nor for adjustment of speed of sound in air at different temperatures; and distributed sound systems are not accommodated (although split clusters are directly supported in the latest revision).

Designers of outdoor facilities may be disturbed that there is no control of level/distance loss. Experienced engineers usually try 6 dB, 8 dB, 10 dB and even 12 dB drop with doubling of distance, to account for varying humidity effects, wind, ground/air temperature effects, and so on. Super-stadiums and civil defense/siren/voice warning systems are often too large for the program, both dimensionally and in speaker complement.

Many of these limitations are common with other sound system design programs. Some of these problems have been addressed in newer programs, but have created other problems, such as ambiguous or questionable data, or excessive processing time. Certainly, the designer is responsible for considering these problems, whether CADP or some other design aid is used, but once the computer model is created there is a tendency not to refer

Klasco is president of Menlo Scientific, Berkeley, CA.

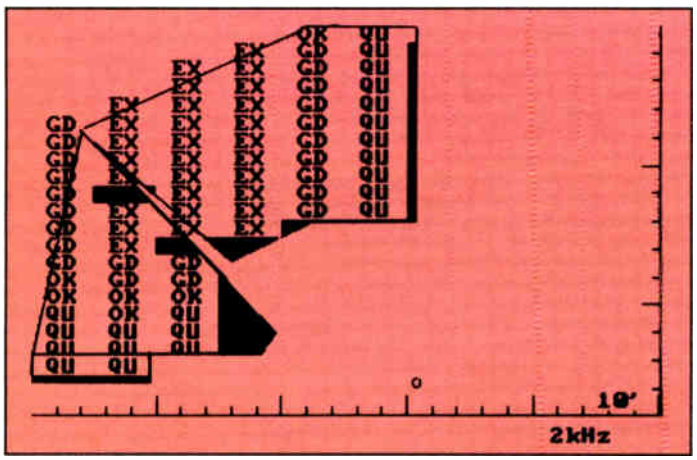


Figure 1. Estimated intelligibility (best case—a full audience; EX = excellent, GD = good, OK = acceptable, QU = questionable). These estimates must be derated, as the signal-to-noise ratio does not meet the assumptions of the prediction formula.

back to the original prints of the facility, and software can lure the unwary designer into a false sense of security.

With any of these programs "reality checks" are important, and regular visits to the job site (or at least reviews of the prints) can remind you of critical features that may have been omitted from your room model. "Due care" and good engineering practice must be exerted by the designer. CADP — like any other present-generation sound system CAD — is not fail-safe, and does not pretend to be.

GETTING HIGHER RESOLUTION FROM CADP

If the user desires to increase the resolution of data for viewing critical areas, he may divide the seating planes into smaller areas, or prepare a partial seating plane file. This allows the use of the same number of data points on a smaller area in order to "zoom-in." Additionally, all 12 corners may then be used to describe the seating plane more faithfully. In a room model with many seating planes, calling up a single plane requires deleting all the other planes. One way to avoid this is to save each critical seating plane as a separate file.

INTELLIGIBILITY

The intelligibility section has been the source of much debate. CADP uses a variation of Peutz's work that has been modified by Augsburger. Some assumptions used by CADP (from Peutz) may not be appropriate for certain sound reinforcement situations. Specifically, the intelligibility criteria assumes that the low frequency reverberation time not be 1.5 times the 2 kHz time, that the crowd noise is 25 dB below the amplified speech peak level, and that flutter echoes and early reflection acoustical problems have been eliminated. These criteria are not often met by arenas and stadiums, although movie and legitimate theaters, many contemporary churches, and most well-designed auditoriums do satisfy these specifications.

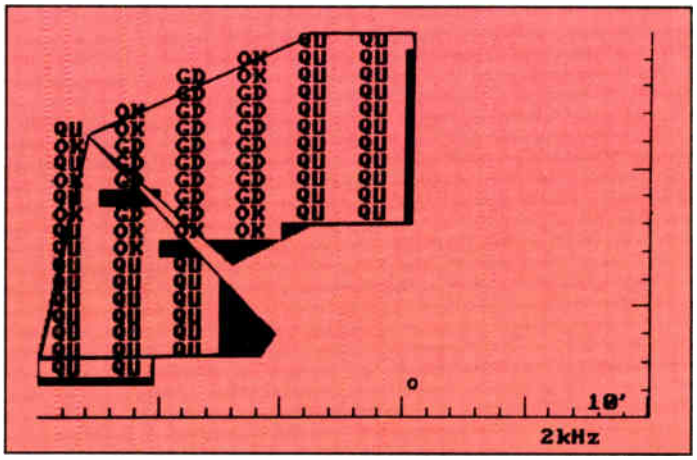


Figure 2. Estimated intelligibility (worst case—an empty space). Much of the area rates GD (good), with the peripheral areas rating QU (questionable).

I have rarely encountered an arena or stadium house sound system that is run 25 dB over the crowd noise as these spaces are not absorptive enough, most crowds are too noisy, and the threshold of pain too low. Most old churches, as well as most large arenas, suffer from reverb times that are at least 1.5 times the 2 kHz period, and flutter echos are fairly common. If the intelligibility algorithm could be modified to allow user-specified signal-to-noise and mid-band/low-frequency RT60 ratios, then accurate estimates would be possible for a wider range of applications. CADP's ratio of direct-to-reflected sound uses the inverse-square-law for direct-sound and the statistical reverberant-field for the reflected-sound. Other programs offer %ALcons, RASTI (actually a transformation of %ALcons to RASTI which is controversial), and raw direct/reverberant ratios.

MECHANICAL DESIGN

CADP provides a rudimentary 3-D mechanical design program. This program is useful for the initial planning, but has limited use in actual array construction, and drafting new horns is a

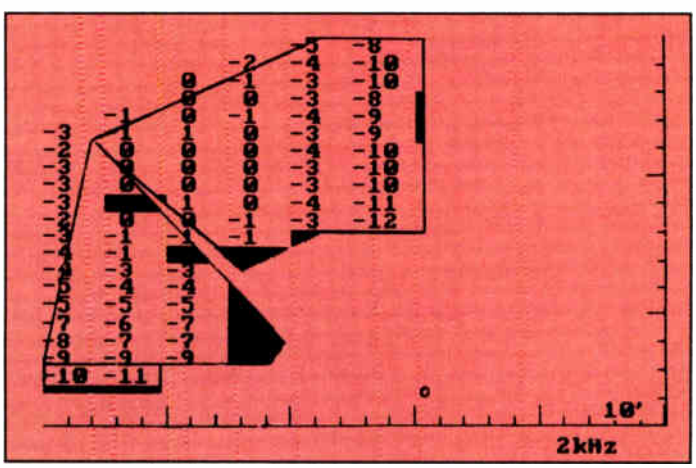
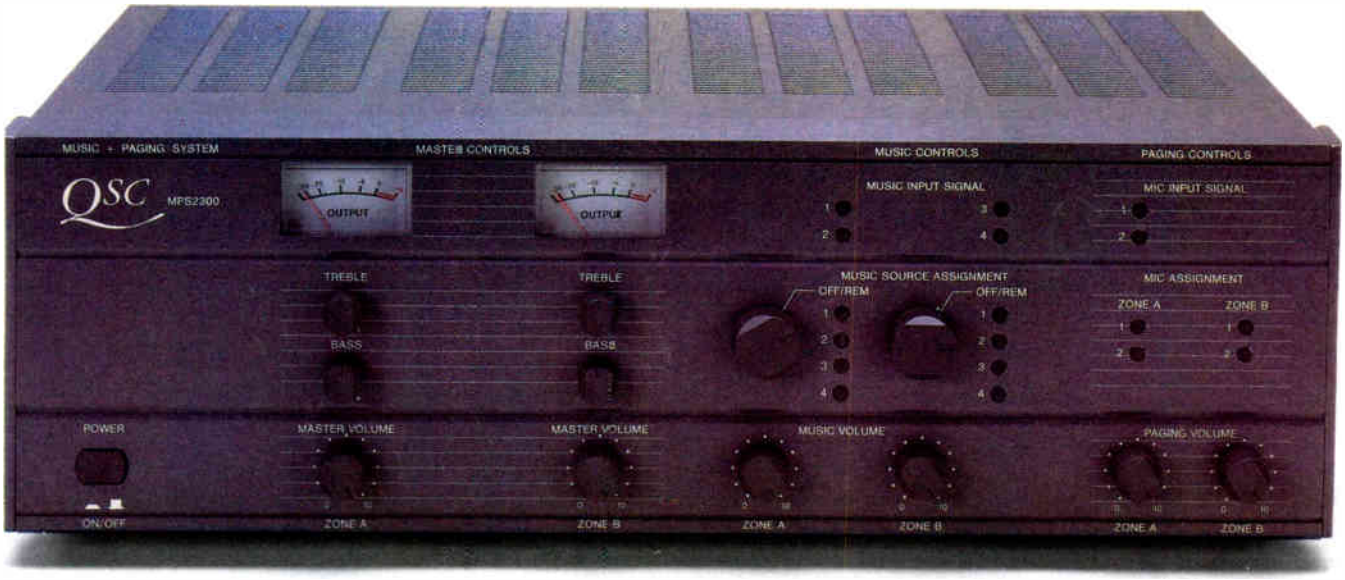


Figure 3. Direct/reverb (best case—a full audience). The direct field is equal or above the reverberent field in some areas.

When adequate is no longer good enough.

MPS 2300



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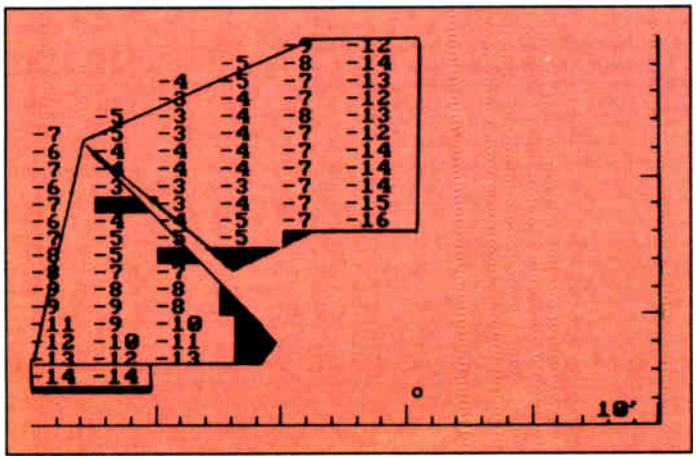


Figure 4. Direct/reverb (worst case—an empty space). The direct field is below the reverberent field in all seating locations.

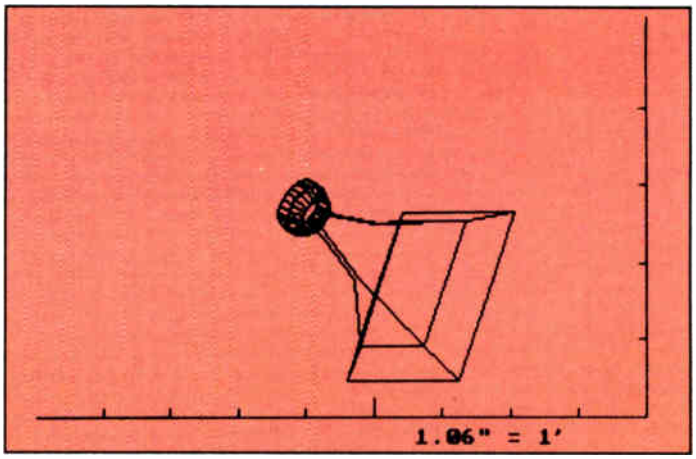


Figure 5. A 3-D view of the single horn (the EV HP 6040). Entire arrays can be shown, as can split arrays (if the scale is adjusted). Top, front, and side views are available; hidden line removal and collision detection are not.

tedious process. The mechanical design module does not remove hidden lines, so complex arrays appear visually "busy" and confusing. The program allows collisions between components, so if you are not careful you can devise impossible arrays. Although JBL's data library contains some bass boxes, the files supplied by EV and Community do not include any bass units, further limiting the usefulness of this module.

Users may find that AutoCADD or other full-scale mechanical

(continued on page 66)

AUDIO TELECONFERENCING SYSTEM REQUIREMENTS

BY JOEL A. LEWITZ, P.E.

Much has been written about the individual components which comprise the electronic systems portion of audio teleconferencing. Transducers and electronic components are only part of the total teleconferencing system concept. Successful teleconferencing depends on the quality of other systems as well; neglecting any one of these other systems can reduce the overall performance of the entire teleconferencing system. This is an overview of the key systems which influence teleconferencing, with some suggestions for maximizing the performance of each.

THE SYSTEMS APPROACH

There are five individual systems which must be integrated for successful teleconferencing:

1. The teleconference participants.
2. The electronic systems.
3. The telephone interface system.
4. The transmission system.
5. The acoustical system.

THE TELECONFERENCE PARTICIPANTS

This is the system which is most often overlooked in teleconferencing. It can make or break the success of the teleconferencing system. After all, it is the teleconferees who will ultimately judge the success or failure of the system. Evaluations by the designer or the installer, or impressive data from sophisticated instrumentation will mean little if the users are not satisfied. The user's criteria and expectations are of utmost importance.

According to the user's criteria, teleconferencing should be clear, intelligible, natural sounding, uniformly distributed throughout the listening area over a full frequency range, easy to operate, and it should meet the user's functional requirements (such as whether full or half duplex is required).

EXPECTATIONS

Most people were introduced to teleconferencing with the desk top Model 4A Speaker Phone. They have all heard the familiar complaint: "It sounds like you're talking in a barrel!"

The user's expectations strongly influence their satisfaction with the teleconferencing system. Potential users of teleconferencing systems can be divided into two groups: those who have used Speaker Phones and think that all teleconferencing systems sound as if everyone were talking inside a barrel, and those who have never used a teleconferencing system and think that all teleconferencing systems sound like normal telephone conversations using a hand set. Users from the first group will be pleasantly surprised by a well-designed teleconferencing system; users from the second group will *never* be satisfied.

Care should be taken to avoid the temptation to ask someone who is unfamiliar with teleconferencing the following question over any audio teleconferencing system: "How does it sound?"

Chances are great that the response will be discouraging.

Therefore, prepare the end-user with the expectation that the overall performance will be clear and intelligible. Inform him that the degree of clarity depends on maximizing the contributions from each of the five systems described above.

TELECONFERENCING ETIQUETTE

Most teleconferencing systems are "hands free" and operatorless. Therefore, the elements of successful system operation involve the extent to which proper "teleconferencing etiquette" is exercised by the users. If the talkers mumble or speak in a low voice, they will not be heard any better by someone on the other end of the teleconferencing line than they will be heard by someone sitting directly across the table.

Teleconferencing systems, like sound reinforcement systems, do not perform magic. The purpose of a sound reinforcement system is to bring the ears of the listener in the last row up to

TABLE 1: MATERIAL NRC

MATERIAL	NRC	CHARACTERISTIC
Gypsum board or wood	0.05	Mostly reflective, absorbs almost no sound.
Glass	0.05	Mostly reflective, absorbs almost no sound.
Carpet	0.30	Still not very absorptive.
Drapes	0.45	Mildly absorptive.
Mineral fiber ceiling tile	0.55	More absorptive than reflective.
Glass fiber ceil-tile or acoustic wall panels	0.90	Very absorptive.

Lewitz is a principal of Peoletti-Lewitz Associates, Inc., San Francisco, CA.

the front of the auditorium so that he hears as clearly with the sound system on as the listener in the front row would hear with the sound system off. The same is true of the teleconferencing system, except that the back row is another room, and the front row is directly across the table from the talker.

Another aspect of "teleconferencing etiquette" is that only one person should be talking at one time. If everyone in a room without teleconferencing is talking at once, there is a complete jumble lacking intelligibility. This cacophony is magnified in a teleconferencing system when the talkers are in different rooms. Rowdy or boisterous meetings simply do not lend themselves to audio teleconferencing. Rustling of papers, clinking of coffee cups and other extraneous noises must be kept to a minimum.

It is extremely important for the people who will participate in the teleconference to be properly prepared and briefed beforehand. Criteria, performance goals, and expectations should be discussed, and everyone should be instructed in proper "teleconferencing etiquette."

THE ELECTRONIC SYSTEM

This system can be divided into three sub groups:

1. Design.
2. Component Selection and Location.
3. Installation, Tuning, and Adjustment.

Design. Many design approaches are available and have been described in technical literature. "Package" designs range from fully integrated systems with microphones and loudspeakers in a single table top unit to "room" systems with microphones and loudspeakers concealed in the ceiling. Each of these has advantages and limitations, many of which relate to the physical limitations of the room, the acoustics, and the functional desires or needs of the users.

Some users insist on an "invisible" system, where microphones and loudspeakers are completely concealed. Other users are not inconvenienced by microphones, cables, or other components cluttering the table. Find out what the user's aesthetic and functional needs are before selecting a specific system design approach.

Package designs are sometimes better suited to existing rooms. Designs using individual components are more easily installed in new construction where interaction with the interior architect and accessibility of physical elements (such as ceilings and tables) allow more freedom to locate microphones and loudspeakers.

Some teleconferencing systems cannot utilize table-mounted components because there is no table (as in auditoriums, lecture rooms and conference rooms with individual moveable desks rather than a traditional conference table). Ceiling, wall, and/or desk mounting are possible alternatives in these cases.

Pay careful attention to the ergonomic design of the teleconferencing system. Remember that the users may not be technically sophisticated: keep the controls necessary to turn the system on and off convenient to the conference area, easy to understand, and easy to operate.

The clarity and intelligibility of the teleconferencing system will be directly proportional to the signal-to-noise ratio at the sending microphone.

We are speaking of the *acoustical* signal-to-noise ratio, not the electrical signal-to-noise ratio (which is a function of the electrical system). The signal is the direct sound which travels directly from the talker to the microphone, while the noise is unwanted sound. This is reverberant sound which reaches the microphone from the talker after bouncing off one or more surfaces. It also includes room noise such as air handling noise, noisy activities within the room, and noise intrusions from outside the room.

Increasing the signal-to-noise ratio is accomplished by increasing the signal (the numerator of the ratio) and/or decreasing the noise (the denominator). The methods of doing this are few and simple. They should be kept in mind in any teleconferencing system design as they are the most elementary and important parts of any design. If you find yourself minimizing rather than maximizing the acoustical signal-to-noise ratio, stop and think: clarity and intelligibility may suffer.

The signal may be physically increased or maximized by locating microphones closer to the talker, or by having the talker speak louder. Noise may be physically rejected or minimized by providing more sound absorption in the teleconferencing room, adequate mechanical system noise control, and adequate sound isolation from exterior noise; by using directional microphones (table mounted) oriented toward the talker; and by minimizing noisy activities in the teleconferencing room.

Component Selection and Location. Locate microphones as close as possible to the persons speaking for maximum clarity and freedom from feedback. Ceiling, wall, and recessed tabletop mounting are the most common microphone locations (ceiling- and wall-mounted microphones will typically be omnidirectional types; table-mounted microphones may be either directional or omnidirectional). Care should be taken to insure that table-mounted microphones are not located where they will be covered up by papers or books.

Other options include gooseneck, lavaliere, and desk-stand mounting. Although the latter group generally results in reduced talker-to-microphone distances, they are usually ruled out for aesthetic reasons.

Avoid locating microphones on a ceiling greater than 10 feet high. Locate ceiling microphones in "null" zones with respect to the loudspeaker locations. This is especially important in systems with electronic priorities which "sense" the talker's signal to switch on a microphone. Rejection at the microphone of sound from the loudspeaker within the room is necessary to prevent the system from confusing incoming voice signal from a loudspeaker (for which the microphone should be "off") with the live voice of a talker in a room (for which the microphone should be "on").

Provide circuitry which attenuates loudspeakers associated with open microphones to reduce the gain of potential feedback loops in full duplex systems (use condenser microphones because

of their greater sensitivity and smooth response; the smooth response will help minimize feedback).

Use the least number of open ceiling microphones necessary for uniform pick-up. When the incoming signal sounds too "reverberant", the solution may be to reduce the number of open microphones in the sending room. The use of automatic microphone mixers will minimize the number of open microphones. This is most effective with table-mounted directional microphones which are mounted close to

TABLE 2: FAVORABLE ROOM PROPORTIONS

	HEIGHT	WIDTH	LENGTH
A	1.00	1.14	1.39
B	1.00	1.28	1.54
C	1.00	1.60	2.33

the talkers. When ceiling- and wall-mounted omnidirectional microphones are used it is much more difficult for automatic microphone mixers to detect the signal from only the microphone closest to the talker.

The use of 1/3-octave band equalization will smooth the overall response of the system for natural sounding teleconferencing. Use 1/3 or narrow band equalization for feedback suppression in a closed loop full duplex teleconferencing system when the number of open microphones and physical relationships between the open microphones and loudspeakers do not change in the course of the system operation.

If automatic microphone mixing changes the number and location of open microphones it will be more difficult to use equalization for feedback suppression because the change in physical relationships between microphones and loudspeakers will change the feedback modes of the system.

Distributed ceiling-mounted loudspeakers or loudspeakers distributed around and under the lip of the conference table will maximize sound level uniformity. Use

4-inch loudspeakers because of their generally smooth frequency response. The smooth response will help minimize feedback. High quality 4-inch loudspeakers will provide sufficient low-frequency response for natural reproduction of speech frequencies. They will always exceed the frequency response of most transmission systems. The extended low-frequency response and power handling capacity of larger diameter loudspeakers is usually not necessary in teleconferencing systems.

Loudspeakers should be oriented so as to maximize the amount of sound energy on the listeners. Provide sound absorption for surfaces on which the rest of the amplified sound falls.

Installation, Tuning, and Adjustment. Teleconferencing systems are no different from other sound amplification systems with regard to the importance of a neat, tidy installation and proper tuning/adjustment. These are included because they should always be considered part of the electronic system.

TELEPHONE INTERFACE SYSTEMS

This is the area which has shown the most rapid improvement of any electronic component in teleconferencing systems. Selection of the specific component requires consideration of many factors: design, budget, and functional requirements (such as half duplex, full duplex, voice-operated switching, feedback control circuitry, echo rejection circuitry, hybrid, and bridge).

TRANSMISSION SYSTEM

The quality of the teleconferencing system will be only as good as the quality of the transmission system, whether land line, higher quality leased lines, or satellite transmission is used.

Sometimes placing a new call between two teleconferencing locations will improve the quality. Many users make the connection prior to an important teleconference, then keep the line open until the system is used to insure high-quality signal.

ACOUSTICAL SYSTEM

Acoustics are as important in the teleconferencing suite as they are in the concert hall. In fact, many of the same criteria that support good listening at the symphony apply to teleconferencing systems: control of excessive reverberation, control of background noise level, adequate isolation from noises or activities outside the room, and freedom from detrimental acoustic phenomena (such as sound focusing and echoes).

It is important to balance these criteria with the functional and performance requirements of the room, as well as the visual requirements of the room designer and the users. Fortunately, this harmony between acoustics and aesthetics is not difficult to achieve. The acoustical ele-

ments required to enjoy good sound can and have been incorporated in many visually impressive rooms. Planning and coordination are key elements to achieving good acoustics. The users, designers, and contractors need to be aware of the materials and design approaches which support good acoustics.

Reverbation Control. A sufficient amount of sound-absorbing material must be strategically placed in the room for proper reverberation control. This material comes in many forms. A rating scale called Noise Reduction Coefficient (abbreviated as NRC) is used to categorize the ability of a material to absorb sound. The scale goes from zero to one with the highest NRCs assigned to the materials which are most efficient at absorbing sound. Some examples are found in table 1.

The NRC is actually an average of the absorption coefficients at the four octave-bands of 250, 500, 1000, and 2000. NRCs are useful and quick indicators. However, together with RT60 calculations, they should be used with the understanding that the NRC number is an average of absorption from low- to high-frequencies. An excellent source for this information is the *Compendium of Materials for Noise Control*, a technical report available from the U.S. Department of Health, Education, and Welfare.

Typically in these rooms, the Sabine equation can be used to determine the reverberation; alternatively, if the RT60 can be measured, the same equation can be used to determine the room's average absorption coefficients. In either case, the simplest implementation is available in slide-rule form from both Shure and Syn-Aud-Con. Whether one can do something about the reverberation or not is not the total issue. But inasmuch that RT60s are easily obtainable, this single number will provide the installer with a guideline of the total signal-to-noise ratio and with an indicator of talker-to-microphone distances.

Background Noise Level. Mechanical system noise and vibration control is an important element of teleconferencing system acoustics. A noisy air handing system can interfere with clarity and intelligibility from the teleconferencing system. Ambient (background) noise levels are rated using the Noise Criteria (NC) level which is measured in the room using a sound level (decibel) meter and octave-band filter set. The SPL is measured in octave-bands without weighting, and the readings are plotted with the resultant curve "fit" to one of the curves in the NC table.

Rooms with higher NC levels are noisier than rooms with lower NC levels. The background noise level in teleconferencing rooms should be in the NC 25 to 30 range. However, it should also be noted that with an increase in talker-to-microphone distance, a decrease in the NC is necessary.

(continued on page 63)

TELECONFERENCING: AN A/V OVERVIEW

BY DAVID MARSH AND MARTIN HILL

The purpose of any conference is for several people to get together and *confer.* Webster's defines the word confer as follows: to compare views or take counsel. This process often involves the use of prepared audio or visual aids in one form or another. A teleconference is simply a conference which involves participants at remote locations utilizing anything from speaker phones to full-motion video for the purpose of communication. Obviously, the types of audio/visual (A/V) media which may be used are directly related to the type of teleconferencing chosen.

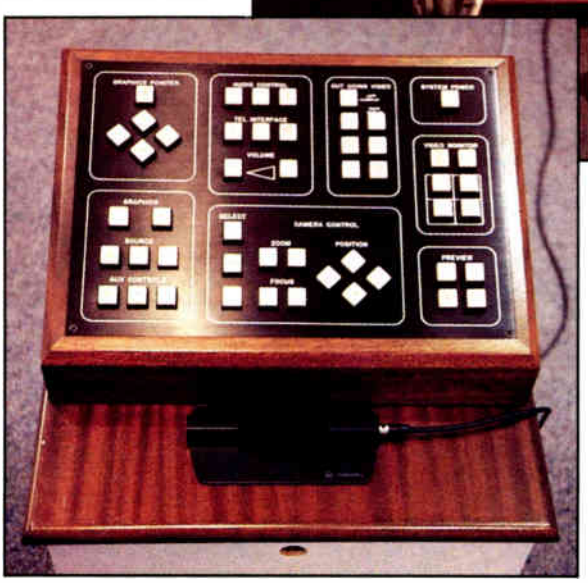
NON-VIDEO TELECONFERENCING

As previously mentioned, a simple conference call between two or more persons by telephone can legitimately be called a teleconference. In this scenario, only a few types of A/V media transmission are possible:

1. Playback of prerecorded audio material.
2. Facsimile transmission of printed material.
3. Transmission of computer files via modem.

STILL-VIDEO TELECONFERENCING

A more sophisticated form of teleconferencing involves the transmission of video images, often called videoconferencing. Video signals may be transmitted as data over standard telephone lines producing *frozen* or *still* video images rather than raster type video. Still-video teleconferencing allows many more types of visual aids to be used. Computer-generated graphics may be transmitted to another computer or a "video show" type of unit. In a dedicated videoconference room, one or more permanent video cameras might permit viewing of marker boards, flip charts, posters, and three-dimensional objects (e.g., a product being described to salesmen in different locations around the country). A ceiling mounted video camera could be used to view art work or other graphic materials positioned on the conference



ABOVE: Any boardroom or meeting room can be converted to a teleconference room with mobile units like the one pictured above. The two-camera teleconferencing console and remote control unit can be seen in the center, with the graphics console partially visible at left.

LEFT: The remote unit allows complete control of both consoles from anywhere in the room.

Marsh is senior consultant with Pelton Marsh Kinsella, Inc., Dallas, TX. Hill is an independent acoustical consultant.

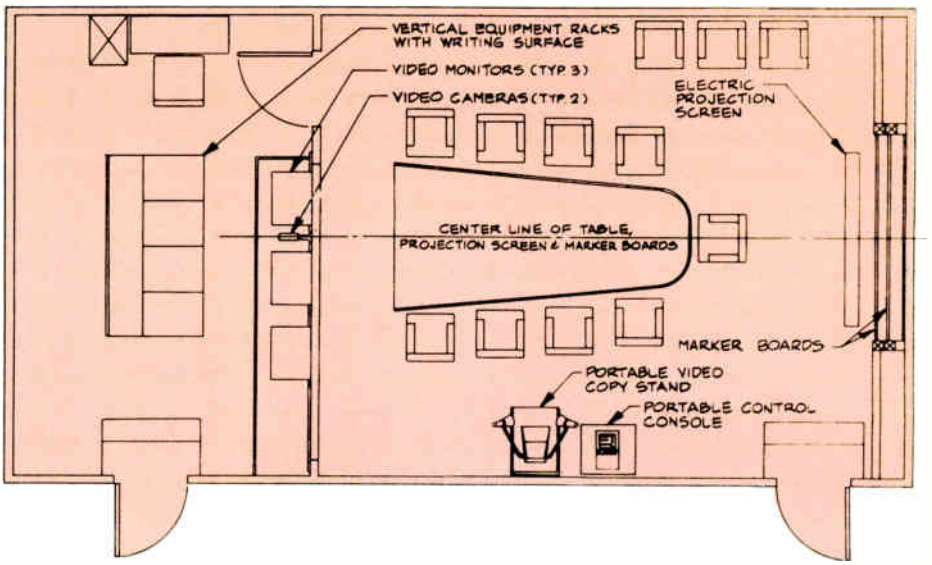


Figure 2. A typical videoconference room floor-plan.

table. However, a more common way to handle this function is through the use of a graphics console or video copy stand.

The graphics console is used to transfer art work, printed materials, sketches, overhead transparencies, or 35 mm slides to video. Figure 1 illustrates a custom graphics console design which includes a camera mounted in the top of the unit aiming down at a glass graphics table which may be illuminated from the top or bottom. A 35mm slide projector with appropriate lensing and mirrors projects an image on the glass graphics table. This type of self-contained "portable" graphics console is almost a necessity when videoconferences are conducted in non-dedicated or *shared* spaces.

The final extension of still-video teleconferencing would be transmitting video pictures of the conference participants. However, this is not generally recommended because people are expected to move (no one wants to talk to a mug shot). This brings us to the use of motion-video in teleconferencing.

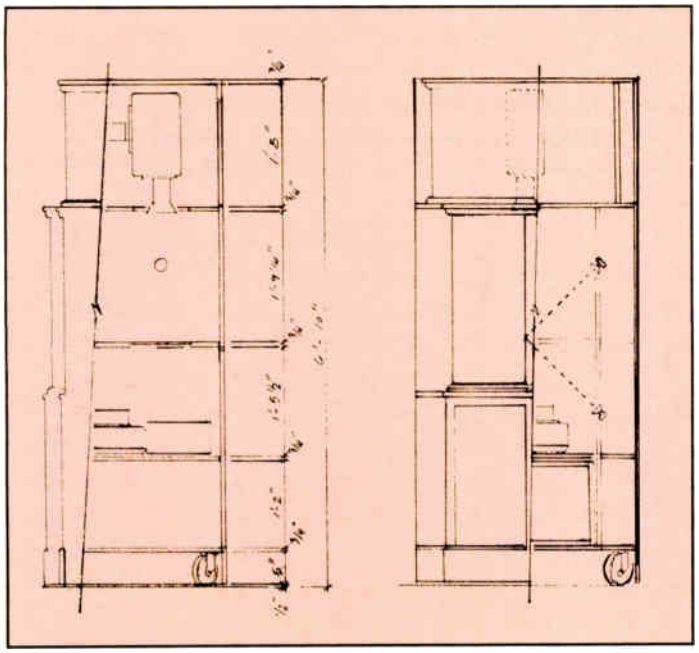


Figure 1. Side view (at left) and front view of the graphics console, showing position of overhead camera.

FIBER OPTIC HDTV

BY KEN McGORRY

Southwestern Bell Telephone (SWBT) conducted its first demonstration of fiber optic-provided high-definition television (HDTV) coverage of an event—a St. Louis Cardinals vs. the Philadelphia Phillies baseball game—late last summer. The closed-circuit telecast brought the high-definition picture to an audience of potential business customers assembled by SWBT at the Fox Theatre, almost five miles from St. Louis' Busch Stadium, via "hair-thin" fiber optic cable. SWBT hoped to create interest among its chosen audience in the future applications of an HDTV/fiber optic marriage for enhancing video conferencing and the growing area of telemedicine as well as entertainment events. And SWBT made no secret of its intention to one day "distribute" programming to the public.

Barely two weeks prior to this demonstration, the Federal Communications Commission proposed to Congress a relaxation of cable/telephone company cross-ownership restrictions. Noting that telephone companies are already positioning themselves to provide broadband services such as HDTV, and that cable services are now financially stronger and more pervasive (U.S. cable penetration is now estimated at 80 percent), the FCC proposed liberalizing the standards for affiliation between telephone and cable companies.

Previously, the government sought to prevent "anti-competitive conduct by telephone companies if permitted to provide cable service." Now, the FCC is suggesting that the once-feared telephone companies'

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A quad splitter allows previewing of all video signals on the monitor in the teleconferencing console. The graphics console at left can transmit a variety of visual materials (in this case, the x-ray visible in the lower right screen of the monitor).

MOTION-VIDEO TELECONFERENCING

Many organizations rely upon motion-video teleconferencing in order to increase the effectiveness, accuracy, and efficiency of communication. This type of teleconferencing supports all of the aforementioned A/V media types along with the advantage of motion. The obvious application is the viewing of people as they speak or move from one area to another in the room. Added visual cues that a talker may impart greatly enhance intelligibility and effectiveness by bringing the teleconference closer to face-to-face communications. In addition, video tapes, laser disc information, and multi-image presentations may be viewed.

The graphics console is used to transfer art work, printed materials, sketches, overhead transparencies, or 35mm slides (or in this case, an x-ray) to video. An overhead camera is aimed down at the glass graphics table, which may be illuminated from the top or bottom.

Motion video encompasses two types of information transmission. The first is actually a digitized form of information transferred through telephone lines or low-speed satellite transmission systems. The other is true full-motion video which requires transmission either by microwave (from one point to another) or by satellite (to many points). The former is much less expensive and provides acceptable video for all but the most demanding applications. An example of an application requiring full-motion video would be playback of a video tape with a lot of motion.

An important aspect of motion videoconferencing is the ability to approximate face-to-face communication. Each participant in a videoconference should feel as though the people on the other end of the transmission are an extension of the group; no one should feel as if they are located at some far point looking in. Achieving this feeling of participation requires attention to the following details (illustrated in figures 2 and 3):

1. Monitors used for viewing people should be located at eye level, and should be as large as possible.
2. Each video camera should be at the height of the object or person being viewed. For example, a video camera being used for viewing a marker board should be positioned at the same elevation as the marker board's horizontal center line. An exception to this rule is an overhead graphics camera mounted in the ceiling for viewing transparencies, artwork, etc. on the conference table.
3. Tables and chairs should be arranged so that all participants may be viewed by appropriate video cameras. No participant should be hidden behind equipment or another participant.
4. Remote control of video camera functions (pan, tilt, and zoom) should be provided, allowing individuals to be viewed almost as large-as-life.

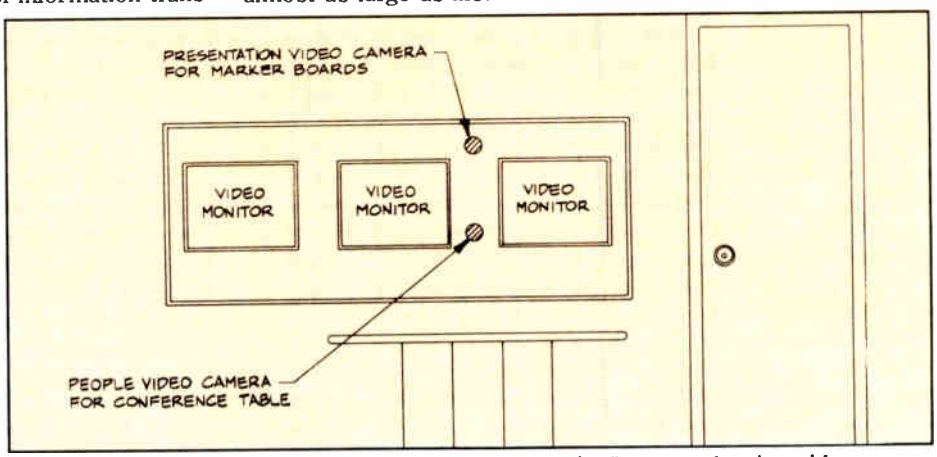

Figure 3. A look at the front wall of the room shown in figure 1, showing video camera and monitor positions.

FIBER OPTIC HDTV

(continued from page 33)

denial of rights to cable companies to use telephone poles and conduit for cable transmission may be turned around. The commission, in its official announcement, proposed "to modify its definition of affiliation to permit carriers to participate in provision of cable television service so long as [this] participation does not constitute ownership and/or control." The FCC also suggested that new rules "essentially similar to the broadcast/cable cross-ownership affiliation rules" be instituted.

At the Fox Theatre, SWBT aimed to show exactly what it could provide, and how. To demonstrate HDTV's superiority, a 28-foot-by-16-foot HDTV screen was erected aside a conventional large-format television screen which was 20 feet long and 15 feet wide, mimicking the dimensions of a typical television screen. The view of the ball game was provided by a Sony HDTV camera (which was aside an Ikegami camera supplying the conventional feed), was transmitted at the speed of light with a 90 megahertz bandwidth and was screened by an Eidophor HDTV large-screen projector.

Suggesting that the demo was a forerunner of regular HDTV/fiber optic transmission of special events to large-screen venues, SWBT spokesman Bill Motchan says, "It's not far off, we want to do it soon as we can—but we can't provide the [HDTV] equipment."

SWBT, which services Kansas, Mississippi, Oklahoma, Texas and Arkansas, envisions, at first, creating relatively small regional fiber-optic networks providing transmissions of events, corporate videoconferences and telemedicine (enhanced video of surgical procedures showing great detail).

For longer hauls, satellite transmission to a fiber optic regional downlink is foreseen. Greg Pace, SWBT area manager, application testing, calls this "the most likely scenario for telephone companies: put together a local video distribution network and tie-in to downlinks." He agrees that in the not-too-distant future, a telephone company could transmit, for instance, a championship boxing match from Alantic City to Kansas City using satellite and fiber-optic technology to instantly provide audiences with a high-definition, large-screen view of the bout.

Steps toward providing similar service

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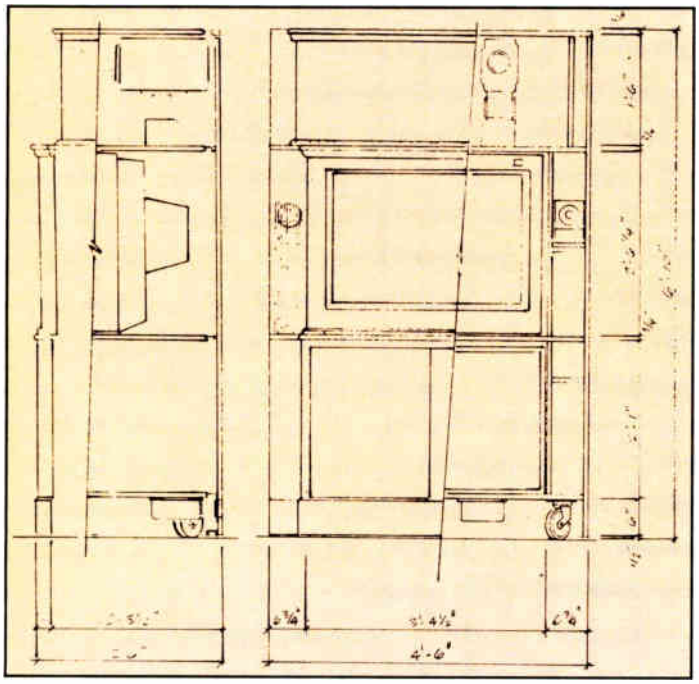

Figure 4. Side view (at left) and front view of the teleconferencing console.

In a non-dedicated room, compromises must be made. For example, a portable roll-about type teleconferencing console may be required (such as the one shown in figure 4). This unit includes two cameras in the top (rather than at eye level) and a single large video monitor. A quad splitter divides the screen into four smaller areas to allow previewing and viewing of all required video signals. The quad splitter idea may be useful in adapting an existing A/V presentation room for videoconferencing in which case the monitor is replaced by a video projector and screen.

LIGHTING

Lighting is one of the most important parts of the teleconference environment. After all, without light we would have only non-video teleconferencing. Lighting techniques used in teleconferencing are similar to those used in photography and video production, making use of front-light, back-light, and fill-light.

Contrary to what some believe, most lighting can be accomplished through the use of fluorescent light fixtures. The key to success is to use the same type of lighting (i.e., all fluorescent or all incandescent) so that video cameras can be set for proper

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TELECONFERENCING: SYSTEM SOLUTIONS

BY PAUL H. SCARBROUGH

Any professional audio designer knows that designing a good system — one that fulfills the users expectations — requires a clear understanding of how the system will be required to function. Essential components of any good designer's background are the knowledge that there is more to audio design that the selection of speakers, microphones and amplifiers, and an understanding of the role of room acoustics in good audio design. Why then are otherwise competent designers befuddled when they apply their skills to the problems of teleconferencing? To understand this, let's back up and look at the teleconferencing problem by first setting the goals for such a system. It is only when we look at the intended function and understand what *needs to happen* that we can translate the intended function into technical requirements.

Ceiling-mounted microphones and loudspeakers provide more varied room configurations and more user freedom.

FUNCTIONAL REQUIREMENTS

Conference participants must be able to speak and listen without distracting room effects.

Conference participants must be able to speak and listen without distracting echo returns.

Conference participants — at each end of the line — must be able to talk freely, interrupt if necessary, i.e. carry on a real two-way conversation.

Conference participants should be able to move freely about the room and still be able to speak and hear clearly.

Allow for flexible room configurations, permitting users to set up the room a they wish, without needing an operator to reset or rewire the system.

Make the system "user friendly," so much so that the chairman of the board can hold a late night teleconference with the Hong Kong office and not need to know much more than how to dial the phone.

TECHNICAL REQUIREMENTS

Provide good room acoustics.

Employ system designs which incorporate suitable means of echo rejection.

Design a full duplex system. Avoid half duplex, quasi duplex, gated designs.

Employ open microphones with omnidirectional pick-up.

Design a system with ceiling mounted transducers.

Design a system that is tuned and adjusted only once, at commissioning; provide simple operating controls — an on/off switch.

Sound like a tall order? Taken together, as with any problem, it all looks rather difficult, maybe even technologically impossible. But let's look at the issues in turn.

Without a doubt, the single most neglected factor in teleconferencing system designs is the issue of room acoustics. Board and conference rooms of large dimension *can* be good rooms for teleconferencing, if room acoustics are designed to support this function. Large rooms should be modeled, their reverberation, reflection and background noise characteristics tailored to teleconferencing use.

This means that a reasonably quiet environment should be provided: NC-30 is recommended for any board or conference room.

Scarbrough is director of administration for Jaffe Acoustics, Norwalk, CT.

TELEPHONE TALK

by William Lobb

Two-wire, four-wire, hybrid, repeater; what seems like jargon is actually the language of the forebears of the audio industry. *We* are the ones speaking jargon, not the telephone company. Telephone terminology is perfectly logical if you consider the history of the communications industry.

Take the word *repeater* for instance. What a quaint term for what is essentially a two-way amplifier.

The first electric communication system was the telegraph, and in the first commercial telegraph circuit, a wire was stretched from Baltimore to Washington and then to New York. After duly celebrating the transmission of the question "What hath God wrought?," the wire was pushed on toward Chicago. But somewhere along the line (probably some lonely cornfield in Ohio), the wire's resistance finally became so great that further transmission was impossible. What to do?

Simple! Build a little house in the cornfield, put in a table, a chair, and a wood stove. Bring the New York wire in one window, send the Chicago wire out the other window. Hire a telegraph operator, give him a battery, a key, a sounder, and a big switch. His job would be to listen to the New York wire and *repeat* it, word for word, into the Chicago wire, then listen to the Chicago wire and *repeat* the answer, word for word, into the New York wire.

It's fun to imagine this employee, staggering home through the cornfield at night, dizzy from the day's messages. Think of what he must have known. Did he dabble in the stock market?

The *repeater* was soon replaced by a bank of relays and later on (for the telephone), the relays were replaced by vacuum tube amplifiers, but somehow the name *repeater* has always been good enough.

The terms *two-wire*, *four-wire*, and *hybrid* are all part of a single concept. In the early days of the telegraph and telephone, there was only *one-wire*, about a #10 solid iron conductor, with a resistance of 10 Ohms per mile. The earth served as the return wire to complete the circuit. This, incidentally, is how we got the term *ground* to mean the common returning conductor.

Long before any of us were born, the phone company realized that using the earth as a return, although cheap, was otherwise not such a good idea. The earth was a good conductor all right, but it was noisy — and thus the world's first *ground loop* problem was created.

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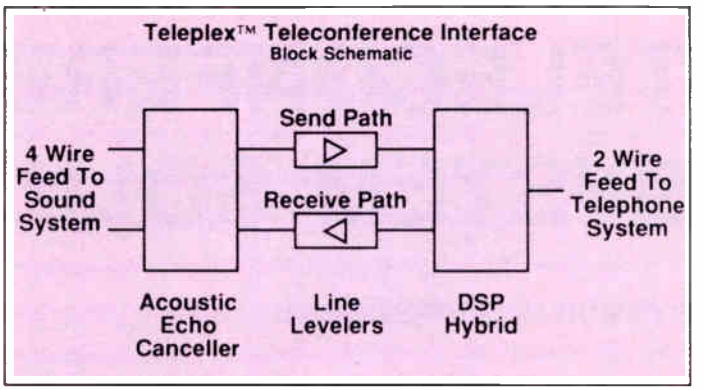

Figure 1. The Teleplex teleconference interface—a block schematic.

Mechanical systems must be designed to exclude unwanted noise from these quiet spaces. Windows, doors and walls should be detailed to exclude other sources of unwanted noise — traffic, aircraft, typewriters, copiers and the like — from the teleconferencing space.

It is also necessary to incorporate adequate amounts of absorption into the room finishes. Reflections from hard surfaced walls and floors can arrive back at a microphone with fairly high energy levels (only 3-6 dB down from the direct field) and delayed in time enough to make voices heard by participants at the far end of the teleconference sound hollow. In addition, many board and conference rooms are large enough volumetrically to make the reverberant field a concern. Carefully placed absorptive materials will control sharp reflections and cut energy in the reverberant field, sharply reducing room effects in teleconference

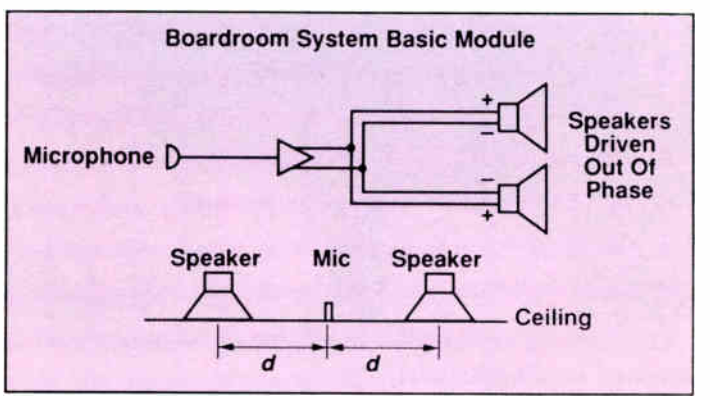

Figure 2. Basic Boardroom System microphone and loudspeaker modules.

transmissions. A variety of attractive absorptive materials can be employed to accomplish this goal.

Nothing is more distracting to a participant in a teleconference than hearing his or her own voice returning with a distinct (and long) delay. This can be the result of two conditions. In the first instance the echo is caused by the looping back of the receive signal (i.e. that coming into the room) into the send signal (i.e. that leaving the room) via the room itself. Essentially the microphones pick up the sound produced by the

Who would believe a microphone this flat...

Model AT871 UniPlate™
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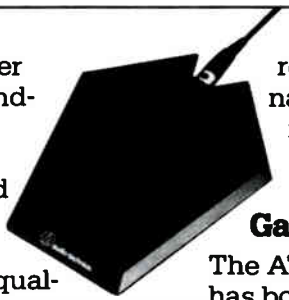
could have a curve to match!



If you've tried other hemicardioid boundary microphones, you may have been disappointed in the sound... thin, peaky, and requiring lots of equalization. If so, it's time to listen to ours: the new AT871 UniPlate Condenser Cardioid.

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Our experience pioneering UniPoint miniature condensers permitted us to take a new approach to boundary microphone design. We optimized the basic UniPoint cardioid element for boundary use, creating remarkable reach and presence, yet retaining extended high and low-frequency response so vital to natural sound reinforcement.

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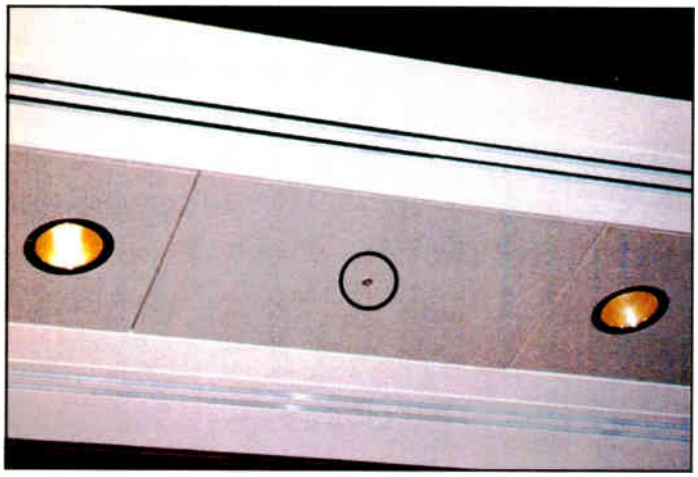

One of the ceiling-mounted mics is just barely visible in center panel.

speakers and attempt to send it back via the telephone line. In the second condition an echo returns via the telephone line itself, an indication of inadequate separation of send and receive signals by the hybrid, also known as poor trans-hybrid isolation.

Both of these problems can be reduced and in many cases eliminated through use of a product developed by Sound Control Technologies, Inc. The unit, a Teleplex teleconferencing interface, is actually composed of three distinct elements: an acoustic echo canceller, a DSP (digital signal processing) hybrid, and a pair of line levelers as shown in figure 1.

An acoustic echo canceller solves the first echo problem described above. The canceller is a DSP device which can cancel or remove echoes over a specific time period, in the case of the Teleplex unit 64 milliseconds. The canceller samples the receive

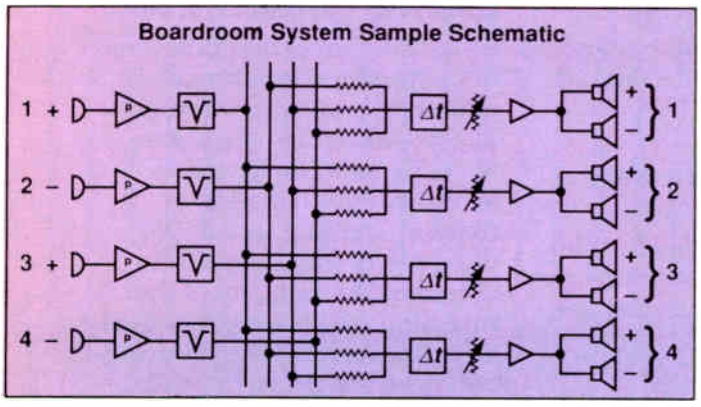

Figure 3. A sample schematic of the Boardroom System.

signal and removes from the send signal any replicas of the receive signal that fall within the time frame of the device (64 milliseconds). For this device to function best, the replicas must be at least 6 dB lower in level than the receive signal. This factor, referred to as the acoustic echo return loss (AERL), must be taken into consideration in designing the audio system for the room itself. When configured and tuned properly in a room where the acoustic treatment has been carefully designed, the canceller will consistently provide nearly 50 dB of echo rejection, more than enough to eliminate the acoustic echo condition.

A DSP hybrid is employed to correct the second echo condition. In simplest terms, a hybrid is a transformer designed to convert four-wire send and receive signals so that they can be sent over a conventional two wire telephone line. To be effective, the hybrid must maximize the passage of throughput, and simultaneously maximize the rejection of reflections, return echoes or crosstalk. In practice a hybrid must be tuned to obtain the optimum resistance and capacitance balance, resulting in maximum echo rejection or trans-hybrid isolation. In the Teleplex unit, a proprietary DSP Hybrid provides approximately 60 dB of trans-hybrid isolation, more than sufficient to obtain

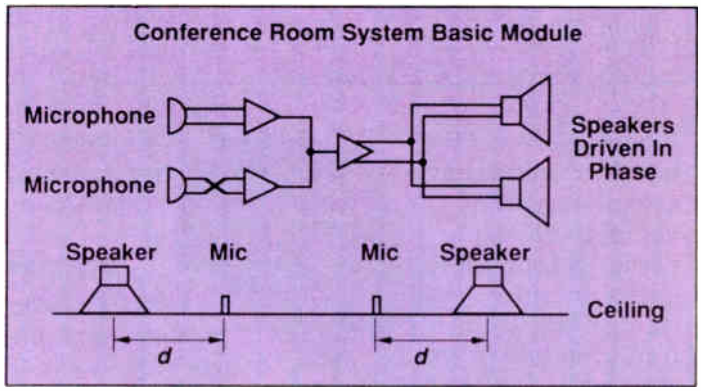

Figure 4. Basic Conference Room System microphone and loudspeaker modules.

a stable teleconferencing environment.

Between the acoustic echo canceller and DSP hybrid are a pair of line leveling devices used to normalize send and receive levels. The levelers employ a feed-forward technique to achieve a steady signal level. Changes in input levels are compensated by slewing the gain at a gradual rate. Sudden peaks are restrained independently by a feedback limiting circuit. Working inaudibly, the levelers effectively adjust for loud or soft talkers, strong or weak telephone lines.

Teleplex teleconferencing interfaces mount in standard 19-inch equipment racks (a unit takes up 3 rack spaces) and provide all of the hardware necessary to link an audio system with the telephone system. The interface provides a telephone line input jack (RJ-11) and line level input (send signal) and output (receive signal) connections.

Provide a system which permits free, two-way conversations; allows users to move freely about them room, permits varied room configurations; and is simple to operate: these final issues are grouped together because their resolution is really a function of the design of the audio system within the room. And in fact there exists a ready solution to these

(continued on page 66)

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THE JOHN T. MULLIN STORY

BY MARY C. GRUSZKA

We tend to take modern audio tape recording and editing techniques for granted. It seems difficult to believe that only around 45 years ago, tape recorders were not being used in the production of quality audio programs in this country.

The single most influential person in the introduction of audio tape recording to the radio networks (and subsequently to the record companies) is John T. (Jack) Mullin. Jack brought two AEG Magnetophon tape recorders to this country from Germany after World War II, built new electronics, and put the machines to use: at first in 16mm film production, later in the production of the Bing Crosby radio show.

Both applications of the tape recorder were the first of their kind in this country, and alone would have been enough to earn Jack the right to be called a true pioneer in the field. But he did more than that. Among his many other contributions to the widespread success of audio recording technology, he was instrumental in getting Ampex interested in tape recorder manufacturing.

At the 85th Convention of the Audio Engineering Society held recently in Los Angeles, Jack shared his love of the recording arts and sciences with those in attendance through his exhibit, "The John T. Mullin Collection: The History of Sound Recording," a display of historically significant audio recording and reproducing equipment. Jack also charmed convention-goers by participating in a special workshop, "An Afternoon with—Jack Mullin."

The collection holds many wonderful treasures, some of which are still in working order. There was an Edison Phonograph (circa 1877), an exact copy of the first tin-foil machine; a Victor Orthophonic Victrola "Credenza" model (circa 1925), the first reproducer designed by Bell Labs to match their new electrical recording system: a Capehart Record Changer, introduced in the early 1930's, used to change 78 rpm records, had a device that mechanically flipped over the records.

There were, of course, magnetic wire and tape recorders on display. Included was one of the AEG Model K-4 Magnetophon tape recorders that Jack used in recording the 1947-48 season of the Bing Crosby show on the ABC Radio Network. As part of his personally conducted tour of the exhibit, Jack played back a segment of the show that featured Jimmy Durante. Other machines shown were the Ampex Model 200 (circa 1948), and a Utah Company Military Wire Recorder (circa 1943).

A wide variety of vintage microphones were also on display. They included the Western Electric Condenser (circa 1921), RCA 4AA Condenser (circa 1926), and the RCA 44-BX Velocity (circa 1938) microphones.

In his AES workshop, Jack talked about his interest in audio and how it led him to his unique career. Here are just some of the stories that he shared.

Jack was born in 1913 in San Francisco and developed an early interest in audio. In 1932 he entered the University of Santa Clara, near San Francisco, in the electrical engineering program. Most of his courses dealt with power engineering, but one course was his favorite: radio engineering and communications.

While in college, he kept up his interest in audio by making and rebuilding phonograph amplifiers. Even his senior thesis had an audio theme—the development of a stereo disc cutter using vertical modulation for the left channel, and lateral modulation for the right channel.

Graduating in 1936, Jack immediately went to work for the Pacific Telephone Company, staying there until his induction in-

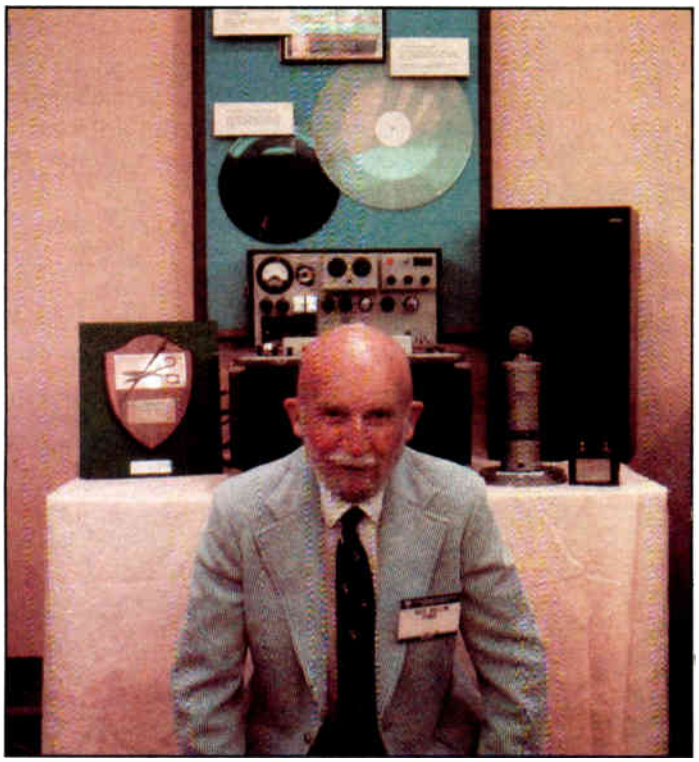
"Nipper" was on hand (with his Berliner Trade Mark *model gramophone), welcoming visitors to the Mullin exhibit at the 85th AES.*

to the Army in 1941. Despite his background in electrical engineering, he was assigned to the coast artillery.

Fortunately, the Army was discovering that it had a need for qualified communications people. Shortly after joining the service, he applied for and was accepted into a program for "radio location" training in England. While there (in 1944), working late at night solving the interference problems involved with radio location (or RADAR, as the "Yanks" called it), Jack would listen to music programs on the radio. Since the BBC's broadcast day ended early, Jack would tune the dial for other stations. He even-

Gruszka is president of MCG Audio Consultants, Edgewater, NJ.

Photography by Jesse Klapholz.



Jack Mullin, with the tools of his trade in the background: one of two Magnetophons he brought to this country, and the scissors he used in the first days of "cut and splice" tape editing.

tually discovered that the German stations had strong signals with no interference and featured orchestral music all night.

His first reaction on hearing the quality of these broadcasts was to conclude that the Germans must have employed musicians to work all night. The sound was unlike that of scratchy 78 rpm records, constantly being changed during a broadcast. Nor was it like the sound produced by any of the captured German tape recorders that he had heard up to this point. Those field tape recorders had high background noise and distortion.

It wasn't until about a year later that Jack finally discovered how the German radio stations produced such quality programming. After the Allied invasion of Europe, Jack was transferred to an Army Signal Corps group based in Paris whose function was to analyze captured German communications technology (telephone, radio, radar, field recorders, development labs, and so on). Occasionally Jack and his group would go into the field to investigate German electronic equipment, bringing back and analyzing samples, and writing reports for the Signal Corps.

On one such trip in 1945, Jack and a colleague went to Frankfurt to investigate the contents of an enclosed radio transmitting tower. They found the wooden tower mostly empty, except for two diesel powered generators. At first, their trip seemed fruitless. But there they met a British army officer, also interested in audio, who told Jack of a tape recording machine being used in a nearby radio station, a machine that produced superb sound. Jack was skeptical: he'd already had some experience with German tape recorders. Nevertheless, he decided to make the trip to Bad Nauheim (a small town outside of Frankfurt) where the radio station was located.

At that station, which by this time was operated by Armed Forces Radio, Jack was able to listen to one of the tape machines, and was surprised at the high quality of the playback. Physically, the recorders resembled the poor- quality units he had already analyzed in Paris; he wanted to know what made them sound so radically different. Jack's colleague photographed the German instruction manuals and schematics for later analysis of the circuits, and Jack took 2 or 3 rolls of recording tape to help in the investigation

Back in Paris, Jack found that the main difference between the machines he had seen earlier and the broadcast-quality Magnetophons he had heard in Bad Nauheim was that the radio station machines used high-frequency AC bias instead of DC bias. Jack later modified a DC-bias Magnetophon with circuits based on what he had seen at Bad Nauheim, and achieved audio quality equal to that of the broadcast Magnetophons. He, of course, also wrote all the necessary reports for the Army.

Jack realized the tremendous potential of the German technology. Following approved procedures of Army "war booty" regulations, Jack shipped two disassembled DC bias AEG Magnetophon K-4 transports in 18 mailbags to his home in San Francisco. By that time he had accumulated 50 rolls of 0.25-inch I.G. Farben Type L and Type C tape (which he included in the shipment). He wasn't concerned about the German electronics, since he could build new circuitry at home. However, he hand-carried the head assemblies because he didn't know enough about them and wanted to make sure they arrived intact.

The Ampex Model 200 tape recorder.

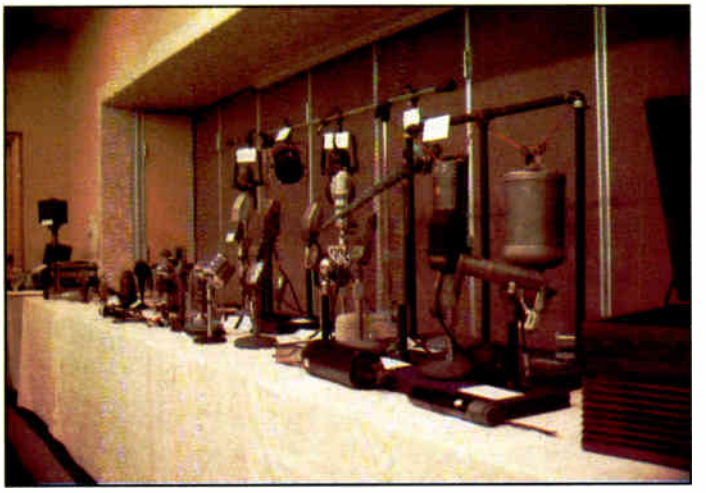
The tape was very advanced for its time: the Type L tape had the oxide impregnated in the plastic base, while the Type C tape was more like modern coated tape. (I.G. Farben was broken up after the war into its constituent companies, including BASF and Agfa). Like all magnetophons, Jack's machine ran at 30 ips with one reel of tape lasting about 22 minutes.

Once home, Jack built two sets of electronics for his transports,

An assortment of early tape recorders, including an early model Rangertone portable.

using American tubes and components. He added AC bias and pre-emphasis that later became the basis for the NAB curve. The frequency response of the German war-time broadcast machines went out to about 10 kHz, but Jack extended the frequency range to about 15 kHz.

In January 1946, Jack joined his friend Bill Palmer at W.A. Palmer Films in San Francisco. He used his tape machines to record non-sync-interlocked sound tracks for Palmer Films' 16mm productions. The good takes would be transferred to film, thus saving a lot of film. Because the takes were short, Palmer and



Of particular interest was the extensive array of microphones on display.

Mullin were able to achieve good synchronization even without an interlock system. This was the first application of magnetic recording in 16mm industrial sound film in this country.

Mullin and Palmer demonstrated the Magnetophons publicly for the first time on May 16, 1946, (a most memorable night, Jack recalled), to an IRE meeting at NBC's radio studios in San Francisco. In attendance was Harold Lindsay, future chief engineer of the then small Ampex Electric Manufacturing Company.

Ampex had been making small airborne radar motors and generators during the war, and was considering which direction to take now that the war was over. Some members of the company wanted to manufacture loudspeakers; others were interested in making disc cutting lathes or turntables.

Ampex made their decision after the October 1946 Society of Motion Picture Engineers (SMPE—now called SMPTE) convention in Los Angeles. Jack Mullin and Bill Palmer were in attendance at that meeting with one of the Magnetophons tucked away in the trunk of their car. Jack recalled that Bill's decision

Some early model RCA and Shure mics were among the treasures to be seen here.

to pack the tape recorder was made at the last minute. It proved most fortunate.

Word got around during the convention that Jack and Bill had brought their own magnetic recording machine. A lot of people expressed interest in it, so Jack and Bill showed it in a room at the old Hollywood Hotel. Alexander Poniatoff, Ampex's co-founder, was invited to one of the demonstrations. Poniatoff was impressed with what he had heard, and decided that this was the kind of product that Ampex should manufacture.

Jack wasn't able to get involved with Ampex at that time

An assortment of RCA sub-miniature omni-directional mics, circa 1975.

. . . Turn it up!

Keith Worsley
3:15 pm, Jan. 26, 1989

We have all lost someone who lived and loved this industry! We'll miss you, Keith!

A variety of historically significant gramophones were also on display, and included machines from Edison and Victor.

because he had an agreement with Colonel Richard Ranger to help develop and distribute a magnetic tape recorder that Ranger was attempting to manufacture in New Jersey. (Ranger was known for his Rangertone Chime that produced the signature tones used by the NBC Radio Network). Jack had met Ranger toward the end of the war when he described the Magnetophons to the Colonel and showed him the heads he was bringing back home from Germany. This meeting with Mullin prompted Ranger to obtain more information about the machines in Europe, and to begin manufacturing his version.

As things turned out, Ampex introduced their production recorder before Ranger. (The Colonel went on to make audio tape recorders for the film industry in the 1950's.)

After the SMPE convention, Jack's Magnetophons eventually

Well-known as an audio pioneer in his own right, George Soames was on hand and obviously enjoying his tour of the exhibit.

MARKET UPDATE: A/V CONTROLS

BY HANNAH KLAPHOLZ

When people get together to exchange ideas and present their work, many evolving forms of media and environmental settings change dynamically. These days the number of media types and aesthetic choices are increasing in number and complexity—not to mention frequency of change and combination. It is the very personal nature of communication that creates a signature of individual communication requirements. Individual needs meld into some common ground, forming a loosely-configured set of requirements for a system. These change from conception-stage through every phase of the design-specify-build process. Experience guides us through with the attempt to accommodate every whim and fancy of the client. Each design is different, and any project grows with the learning-curve of the client. Therefore, complete customizing of multi-media and multi-environments has become the key to the design of any successful meeting place in today's business world.

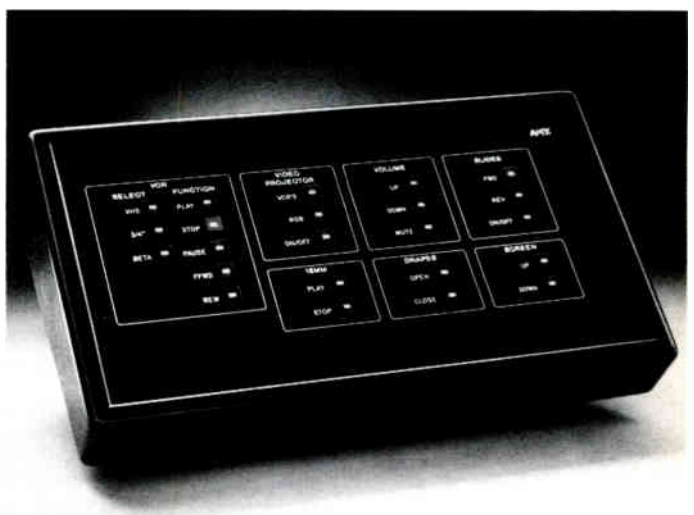
With so many different components of A/V, lighting, video, and mechanical systems the complexity and degree of control is the cornerstone. People take for granted that the push of one button can change the color, temperature, feel, and size of a room. It is our job to supply that end to a degree possible within the constraints of today's affordable technology. They want it and they want it now. In this short view, an outline of who makes what is an attempt to acquaint the perplexed designer as to what some of the companies are up to these days. With the fast-pace of computer technology integration, each company offers a constantly improving line of products.

AMX

AMX manufactures wired and wireless remote control systems for applications ranging from conference room systems encompassing audio, video, AV and environmental controls to industrial/residential automation systems. AMX systems utilize a distributed processing architecture with a high speed, differential, synchronous buss. Each interface is capable of stand alone operation or interaction with the buss to accommodate applications from simple to complex.

AMX wireless systems feature serial data transmission by radio carrier at either 303.5 or 310 MHz, providing omnidirectional operation through walls, screens, doors, and all conventional construction materials, with 150 foot range standard, that may be extended to 650 feet utilizing the optional 8X-ERA Extended Range Adapter. All AMX wireless systems utilize a triple redundancy scheme for data transmission to permit error free operation of several systems in the same area without interaction.

Wired systems utilize the SoftAire™ multiplex technique to support multiple panels in a system. The "User Interface" can be either conventional engraved buttons with LED status feedback, or interactive touch sensitive panels with Electro-Luminescent display. The EL panel features user programmable buttons and menus for easy customization of the control panel by the end user, via a password protected editor that features a pull down menu bar. In addition to text, the EL panel can also display graphic images that have been converted to a Post Script file.



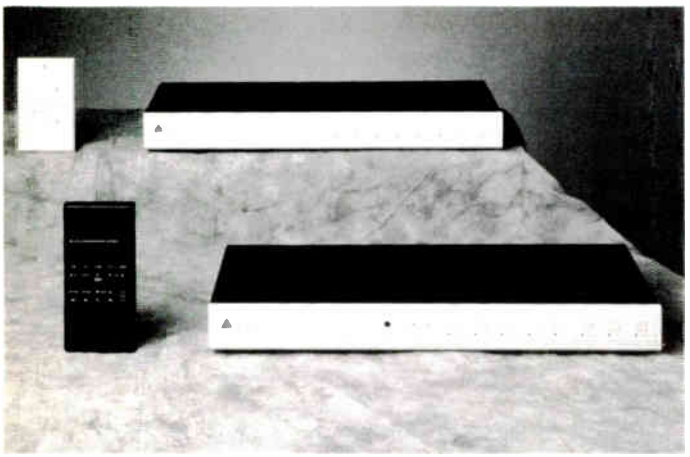
The SOFTWIRE control panel from AMX.

AMX manufactures interfaces that support contact closure, infra-red, RS-232, and other wired serial data formats, as well as specialized contact closure controlled interfaces for motors, lights, audio and video.

AUDIO ACCESS

The PX-4 Multi Room Remote Control System is based on a line-level audio-switcher with VCA that accepts commands from a wall-mounted key-pad or an infra-red transmitter. The unit includes an external signal processing loop connection. One may use the key-pad or the infra-red transmitter individually or simul-

Klapholz is a frequent contributor to this magazine.



Audio Access offers the PX-4 multi-room remote control unit.

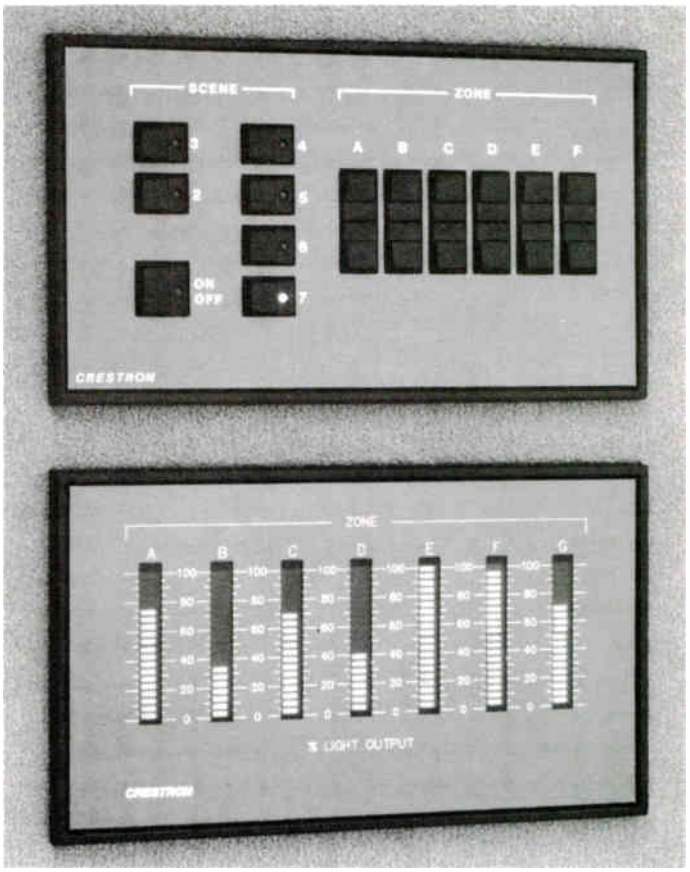
taneously. In addition to the source selection and volume functions, it includes 23 control outputs that can be connected to tuners, CD players, tape decks, etc. These outputs allow one to operate any contact-closure controllable unit. This system was originally designed for the control of consumer systems, and as such is ideally suited for CD players, tape decks, VCRs, TVs, tuners, etc. If the equipment that is to be controlled does not include remote control functions, the PX-4 interface modules can easily be added to the piece. This unit modification is simply accomplished by soldering a ribbon-cable in parallel with the front-panel control switches.

An interface module interconnects the "source equipment" and the PX-4. This is a contact relay-closure module with typically five relays. Interface modules are available with up to 14 relays. A PX-4 can have up to five modules. The system is modularly connected using AMP connectors and ribbon cable. The infrared output can be used to pass through other signals such as controls for VCR, etc. An optional RS-232 port is available for computer control of the system. The AC outlet is switched to supply power to the amplifier for the selected zone. The keypad-in and control output jacks use solderless connections to simplify installation.

The S-2 plug-in cards from AUDSCO.

AUDSCO

Flexibility and compactness are two features of the unique Audsco S2 series of plug-in cards. These solid state switching cards are available in various models, including microphone/line preamplifiers, line outputs and speaker level amplifiers. All configurations are available with voltage-controlled amplifier or digital-controlled attenuator. Microphone preamplifiers are available either transformerless or with conventional transformers. They all have limiters on the first amplifier stage, and the design of the switching stages allows them to be combined to give almost unlimited design flexibility. Computer-aided-design capabilities allow rapid customization of an existing card—often a working prototype can be produced the same day.



The Creslite System 7 lighting control unit from Crestron.

CRESTRON

Crestron manufactures the Cresnet and the Executive Control Systems. Both systems offer control from wired, radio frequency (RF), and infrared (IR) control panels and are capable of operating any type of media or environmental equipment in an audiovisual facility. The Cresnet system offers two-way wireless operation providing feedback on wireless panels.

The CTP-100 features touch sensitive super-twist LCD panel that replaces conventional push button control panels. The user

sees only the controls necessary for a presentation, eliminating the intimidating array of conventional push buttons. The control panel does not become obsolete since displays can be altered to accommodate equipment changes. It is available in self-contained wireless console.

An AV system can be organized into a series of simplified panel displays, each containing only the control capability needed for a specific application or by a particular presenter. Simply touch the desired directory listing and instantly the related controls appear. This system of simplified directories and menus allows for rapid selection of panel displays, resulting in a smoothness of operation. Even if equipment is added or removed from the system, the display simply revised without even removing the panel from its location. All information is stored in write-protected non-volatile memory. The CTP-200 is a portable wireless LCD control console for use with Cresnet or Executive control systems. When used in conjunction with the CWG-1F Gateway in Cresnet systems, the console controls up to 126 functions with feedback indication.

The Executive Series II allows both wired and wireless control panels to be used in the same system. Wired panels, available in 8 to 48 functions provide feedback of system status using two-way data communication. Panels are easily connected to the Control Decoder via four-conductor cable.

The Control Decoder, central component of all systems, provides low voltage relay closures for operation of virtually all types of AV equipment and room environmentals. Specialized control needs, such as A.C. switching, can be handled with the wide variety of interface modules available. Systems may be specified in groups of eight functions with a maximum capacity of 48. Every function is easily configured via the powerful System Smart software package.

System Smart software redefines control flexibility by providing a simple push button programming procedure to configure types of relay closures. System Smart software allows relay closure programming and system configuration via a 16-position mode switch located on the front panel of the Control Decoder. The Executive System Smart software provides more complex and varied types of functions than can be programmed with DIP switches or jumpers. In addition, it can be programmed right from the front panel of the control decoder.

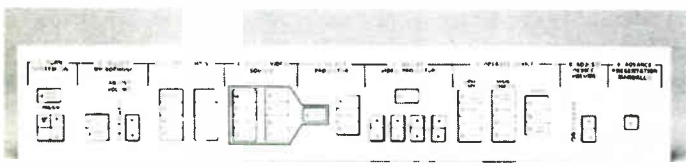
Local Area Network technology allows for a simple, uniform system interconnection by bussing all Cresnet modules to the master unit via a four-conductor cable. The network concept allows the master unit to be linked with all equipment modules and panels by a four-conductor cable. System layout is greatly

simplified since components can be interconnected in any order. Virtually every aspect of the panel design can be specified, including size and shape, resulting in a wired panel that is both user-friendly and aesthetically coordinated with the room environment.

The Creslite System 7 provides complete dimming control of fluorescent, incandescent, low voltage and cold cathode lighting sources. Push button control panels allow instant recall of up to 30 preset lighting scenes. Each scene may be programmed with a fade time up to 32 seconds, providing a smooth transition from one level to the next. Systems from 1 to 99 zones are easily configured making System 7 ideal for applications ranging from small conference rooms to multi-section hotel ballrooms.

FSR

FSR manufactures a line of gadgets that solve common problems with a modular component approach. Simple wiring is a key element in each piece, using compression screw terminals (for example, solder-type connections are used for resistor mounting). Relays and other simple switching circuits are easily fabricated using a snap-in track system which also includes power supplies. Projector interfaces (35mm slide and film), remote volume controls, video control, and auto-AC powering are some



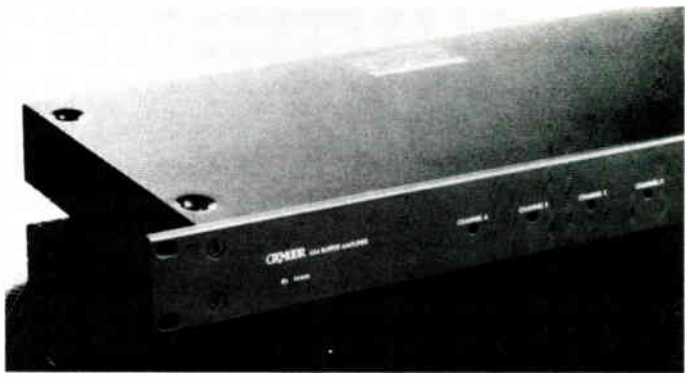
The DL-64 lectern panel from FSR.

of the smaller components that economically tie together and provide the finishing touches on systems. For larger systems, control systems are available that can remotely control entire boardroom systems from lights to audio.

The DL-64 Conference Control System is based on a remote-panel of dedicated switches that transmit to a rack-mounted unit. The system provides a link between the A/V rack and its remote panels. Up to 64 switches, three analog bar graphs, and random access with lamp feedback are transferred back and forth with four wires—two for power and two for data. The remote locations may be either consolette or lecturn panel. The rack-mount unit controls various pieces of A/V hardware including video projectors, tape decks, lighting, etc. The interface cards each have a 16-position connector strip where the DL-64 system ties into the local control system. Four of the seven interface cards are for the switch circuits to activate a control module. Other cards provide a signal for lamp feedback.

OXMOOR

Oxmoor Corporation is using a shaft encoder in the RC-16 remote control, that translates knob movements into a string of

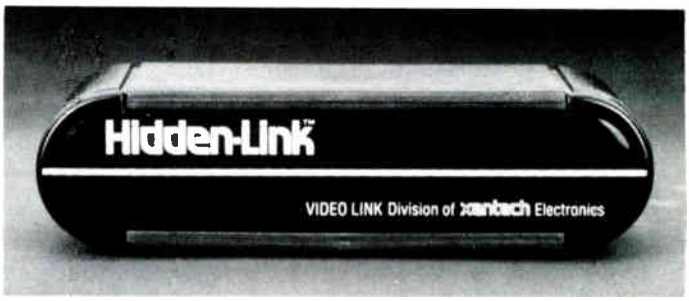


Oxmoor Corporation's 4x4 buffer amplifier.

digital pulses to precisely control audio levels—in precise 1.5 dB steps including 90 dB "off" position. LED's have replaced the pointer on the RC-16 remote control and all controls in a loop track each other. It communicates information using RJ-11 modular phone plugs on a four or six-wire daisy-chain bus. Up to four controls can be placed on an audio channel and all controls are active at once. 64 channels can be wired on a single control loop. Other features of the system include front-panel gain controls, key-switch lockout, independent preset and priority levels controls, and remotes that are ready-to-mount in standard electrical boxes.

XANTECK

Xanteck Corporation has an infra-red repeater system line, including a small scale unit called Hidden Link. Though Hidden Link can be applied in many other ways, it was specifically designed to allow remote control use of A/V equipment without that equipment being visible, such as when the equipment is installed in a cabinet with solid wood doors, or in a closet. "More and more consumers are wanting to eliminate the visible clutter of their electronic equipment by placing them in cabinets with solid doors," explained Bill Cawlfield, Director of Sales and Marketing at Xantech. "As the A/V system buyer matures he is becoming more concerned with overall room decor and installing his equipment in wall cabinets or decorator floor cabinets. The clear glass rack systems are no longer desired by this upscale consumer." The concept of Hidden Link is simple. Using



The Hidden Link from XANTECK.

the existing A/V equipment's remote control, the small Hidden Link box is mounted on top of a cabinet and aimed toward the

(continued on page 64)

U P D A T E

People

Friedman Moves To Carver; New Appointments at E-V

Three New Managers at Burle

Burle Industries, Inc. has appointed J. Scott Aemisegger passive infrared product manager. Aemisegger will be responsible for marketing Burle's motion sensing light control products under the name Security Switch. Aemisegger had been general sales manager with Aba Software, Inc. prior to joining Burle Industries.

J. Scott Aemisegger

Burle has named Larry O. Place manager of quality and reliability assurance. He will be responsible for security products quality. Place comes to Burle from General Electric where he held numerous positions including manager, production test.

Terry Crawford has been named technical marketing manager at Burle Industries. His responsibilities will include assisting government agencies in designing and using Burle products, and providing technical information about Burle products and technology for government programs and products. Prior to joining the company, Crawford was employed by Siecor Corporation and most recently, Designers and Planners.

Carver New Appointees

Carver Corporation has appointed Mark Friedman senior vice president and director of sales, marketing and product development. Friedman joins Carver after holding the position of senior vice president of sales and marketing at Onkyo U.S.A. Corporation for the past ten years. Before joining Onkyo he was national sales manager of Empire Scientific Corporation.

Carver has appointed Colleen McNaur as national sales manager, mobile audio. McNaur is responsible for expanding Carver's line of automotive audio electronics, defining new products and managing the company sales efforts in the auto sound market. For the past four years, McNaur has been Carver's engineering manager. Before coming to Carver, she was the electrical engineer for the CBS Records plants in Carrollton, Georgia.

John McCready has been appointed to the position of marketing manager, consumer products. McCready's responsibilities include product planning, advertising and marketing services administration. Over the past 15 years, McCready has held products and marketing positions with Marantz Company, Inc., Quasar Company (Division of Matsusita Electric Corporation of America), and in the retail audio sector.

EV Appoints Loudspeaker Engineer and Project Engineer

Electro-Voice has appointed Chris Stirling project engineer for the loudspeaker components group. Stirling's responsibilities include the design of new woofers and compression drivers. Prior to joining EV, Stirling worked at Martin Audio. His responsibilities included new or improved products for the professional audio market as well as initial introduction of structural form moldings.

Scott Null has been appointed project engineer in the electronics department for Electro-Voice. Null will design and develop audio products including mixers, amplifiers, and other state-of-the-art products. Null has experience in the engineering field from his prior position with the electrical systems division of the Bristol Corporation.

Winsted Appoints McDonald Rep

The Winsted Corporation has appointed Bobbi McDonald as a representative with Skip Dunn Video Sales. The firm will represent Winsted's line of professional Video Support Systems and Security Support Systems in Connecticut, New Jersey and New York.

Bobbi McDonald

Gentner Hires Product Line Specialist

Gentner Electronics Corporation has added Kelly Hannig to its product management team as a product line specialist. Hannig will specialize in both RF and audio processing products.

Hannig will be making presentations to professional groups on RF and audio processing. He will also be in charge of new product development for these lines.

Hannig has seven years of broadcast engineering experience including studio and transmitter construction. He is a Level One certified instructor. His experience includes teaching electronic communications at a Salt Lake City Technical College.

Coradian Appoints Senior Vice President of Sales

James R. Walker has been appointed senior vice president of sales at Coradian Corporation. He will have overall responsibility for new sales in all Coradian offices in the United States. Before joining Coradian, Walker was vice president of sales at Jackson ADT Communication Systems.

Three Vice President Appointments at Alpha

Alpha Wire Corporation has appointed Grant McLennan vice president marketing. His responsibilities will include all marketing activities: strategic planning, new product development, inventory management and developing new markets. McLennan was previously vice president marketing for the Grow Group, a manufacturer of professional and household products.

Edward H. Gowett has been appointed vice president of sales for Alpha. His responsibilities include national pricing, supervising both the inside sales representatives and a field sales team and directing the overall sales activity of the corporation. Before joining Alpha, Gowett was a vice president and officer with the Houston Wire and Cable Company.

Larry G. Myers, appointed vice president of national accounts at Alpha, will oversee the marketing and sales activities of all Alpha Wire national accounts. He will coordinate the Alpha sales team efforts throughout North America as well. Myers rejoined Alpha after spending a year as national sales manager for power and electrical products at Pirelli Corporation.

Micro-Coax Names Decker Manager of Engineering

Micro-Coax Components, Inc. has appointed Frank Decker vice president, manager of engineering. Decker will be responsible for the continued technical advancement of Micro-Coax's line of microwave transmission line components. Decker has over 16 years of experience in the microwave field. He came to Micro-

Frank Decker

Coax from American Electronics Laboratories, Inc. where he was most recently microwave division director and manager of the microwave program management office.

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James R. Walker has been appointed senior vice president of sales at Coradian Corporation. He will have overall responsibility for new sales in all Coradian offices in the United States. Before joining Coradian, Walker was vice president of sales at Jackson ADT Communication Systems.

EIA Elects Quam's Little

The Electronic Industries Association has elected William G. Little, president of Quam-Nichols Company, Inc., as EIA's chairman. Little has been with the company for 18 years, and has gone from distributor sales manager to vice president in 1976 to president in 1981. During this period, he expanded the company's manufacturing scope from exclusively loudspeakers to a diversified comprehensive line of commercial and industrial sound products.

William G. Little

Prior to joining Quam-Nichols, Little spent seven years as a sales executive with the south bend lathe division of Amsted Industries. Among his leadership positions, Little has served as chairman of the distributor products division of the Electronic Industry Association and as an officer and director of the Electronic Industry Show Corporation. He was instrumental in the formation of the National Sound and Communications Association.

Jesse Klapholz Named Announcement Control System Consultant

Jesse Klapholz, consultant in electroacoustics, has been appointed announcement control system consultant for the international terminal under construction at the Philadelphia Airport. Klapholz (technical editor of this magazine) is a specialist in commercial and performance-space acoustics noise and vibration and sound system design.

Digital Sound Adds to Senior Management Staff

Digital Sound Corporation has appointed David Brahm vice president of quality and administration. Brahm will be responsible for corporate-wide quality of products, processes and human resources, according to Bryan Grummon, president and CEO of Digital Sound. Brahm has been with Digital Sound for four years and had previously been vice president of engineering. Prior to Digital Sound, he worked at AT&T Bell Laboratories for 13 years.

Peter Woon has been named vice president of engineering for Digital Sound. Woon will be responsible for the company's engineering programs, according to Grummon. Woon came to Digital Sound from IBM where he worked for 22 years and held a variety of technical management positions in research and development in the U.S. and Japan. ■

Contracting Close-up

Night Club Sound Systems Installed; Reports From Stockdale Commercial, TSI

Diversified Concepts Installs in School and Museum

Diversified Concepts, Inc. of Marcellus, New York has installed sound systems in the Munson-Williams-Proctor Institute, a museum and educational establishment devoted to fine arts in Utica, New York and the Cortland High School auditorium in Cortland, New York.

The sound system for Cortland Auditorium includes facilities for sound reinforcement, sound reproduction, foldback and live audio for video and audio post-production. The school has a cable station and the system had to be interfaced with the existing video system, according to Tom Zorn, general manager of Diversified Concepts. The sound system was finished in late September 1988.

The main speech reinforcement system includes an Altec Lansing 231A console, 1674C automatic microphone mixer, 1692A mixer/amplifiers, 1698 monitor panel, 1712A compressor/limiter, 1631A dividing network, 2204A incremental power amplifier, 1269 power amplifiers, MRII564A and MRII594A mantaray horns, 299-8A H.F. drivers, 816 L.F. horns and 515-8G L.F. drivers plus an Industrial Research Products DG4021 transversal equalizer.

The sound reproduction system in the auditorium includes a Crown PS400 amplifier, Bose 802W loudspeakers (wall-mounted) and Bose 802C controller equalizer. A complete theatrical intercom system was all ClearCom products.

The stage monitoring system includes a Crown PS400 amplifier and

a JBL 4602 stage monitor. Outboard processing equipment for the sound system includes a DBX 166X dual-channel compressor/limiter and an Aphex aural exciter.

The auditorium sound system for the Munson-Williams-Proctor Institute, completed in October 1988, provides facilities for speech and music reinforcement and recording.

"It was a challenge — they were very picky about the aesthetics," Zorn said. " We built a custom box to get the speaker to blend into the aesthetics." The custom box hangs at the proscenium level.

The system includes Altec Lansing 1674C automatic microphone mixers, 1700 mixer/preamplifiers, 1698 monitor panels, MRII594A mantaray horns, 299-8A H.F. drivers and 3127 L.F. loudspeakers as well as an IRP DG4021 transversal equalizer, a Yamaha MC1204 mixing console, a Crown PS200 power amplifier and Electro-Voice XEQII dividing network.

Stockdale Commercial Sound Goes to School

Stockdale Commercial Sound of Bakersfield, CA, designed and engineered individual single source sound systems for nine multi-purpose rooms for the Panama/Buena Vista Union School District. Four of the systems will involve remodels and five will have new systems. Six out of the nine installations were completed by Stockdale, with the others done by Serban Sound Systems and Tec Time Communications, also of Bakersfield.

"[The systems are] fairly elaborate for schools," said William Roland, supervisor at Stockdale. "They are very good systems when typically [schools] have small systems. The district wanted excellent systems, they've had bad luck with sound systems."

The nine schools will take a total of two years to finish, according to Roland. "We just finished a junior high school [in November] — it was the most involved of all — biggest cluster and most equipment," Roland said.

Stockdale used the following equipment for the school's sound systems: Altec Lansing mixer/power amplifier, mixers, dividing networks, power amplifiers, incremental main frames, progammable equalizers, ceiling loudspeakers, compression drivers, monitor speaker systems, speaker systems, Mantaray horns, H.F. horn/driver, Mantaray horn, feedback suppressor, and microphones; Yamaha cassette decks; FSR switching equipment; Soundolier racks and panels; Telex wireless systems; West Penn wire; Signal wire; Shure microphones: and Atlas/Soundolier horns.

Stockdale will also install sound systems in four court rooms for the Kern County Juvenile Justice Center, located north of Los Angeles. The job is estimated to start in January, according to Roland. Wilfred Malmund is the sound system consultant for the center.

Altec Lansing power amplifiers and Industrial Research Products modular mixers will be used for the systems in the court rooms, according to Roland.

DDA Reports New Installations

DDA's Mixing consoles are better known in recording studio and audio post production circles, but their 'S' series consoles are making an impact in the live sound reinforcement market with recent installations by Long Communications of Winston Salem, NC, at the River Oaks Church in Danville, VA, and the Koger Center For The Performing Arts in Columbia, SC.

Lewis Feldman Audio and TSI Go Into the Clubs

Lewis Feldman Audio in Manhattan has completed sound systems for the Red Zone Club in Manhattan and The Strand in Rehoboth Beach, Delaware. TSI in Mineola, New York installed the video system in the Red Zone Club.

The sound systems in the Red Zone Club and The Strand are very similar with the Red Zone Club having "double the sound system at The Strand, [with both clubs needing] extensive acoustical modifications," according to Lew Feldman, president of Lewis Feldman Audio. The Red Zone Club has two complete sound systems, upstairs and downstairs, plus one independent peripheral system.

"The Red Zone Club is the best sound system in a discotheque anywhere in the country. It's awesome, clean, clear, absolutely gorgeous," Feldman said.

The video system in the Red Zone Club, installed by TSI, consists of a multi-image slide system with 24 projectors and ten screens, according to Chris Maione, vice president of TSI. The Arion Pro 16 Dissolve Controller, used in the video system, can be programmed to project certain images. The information in the controller is saved on standard cassette and can be recreated at a later time. Two slide projectors are underneath each screen, shooting to the screen across the room to project a moving image such as a car moving from one screen to another.

The sound systems at the Red Zone Club and the Strand consist of Technics 1200 turntables, RG Dynamic Range expander, a custom designed crossover by Feldman with Urei electronics inside and modifications to his specifications, Furman meter panels and power panels, JBL 2225 cone transducers, 2445 compression drivers, Urei 1620 microphone mixer, 525 electronic crossovers, and 539 1/3 octave room equalizers. The Red Zone Club has 16 custom built sub-base

enclosures and six tweeter arrays with JBL bullets while the Strand has eight custom built sub-base enclosures and four tweeter arrays with JBL bullets.

The Red Zone Club also used 23 Crown amplifiers with a power output of 30,000 watts in its main system and nine Crown amps in its auxiliary sound system. JBL speakers were used for both systems. ■

Products

New Handset Intercom From Aiphone; Renkus-Heinz Introduces New Loudspeakers

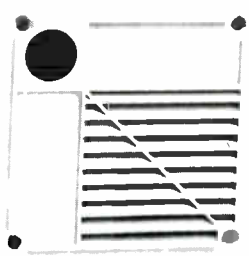
Atlas/Soundolier Prods

Atlas/Soundolier is expanding with a complete selection of modular consoles, turret assemblies, racks and accessories designed to protect CCTV surveillance and security control equipment. The modular enclosures will accommodate camera control, video monitor and/or command centers in a professionally integrated housing compatible with the electronics of all major manufacturers, the company said.

Atlas/Soundolier's five surface or recessed-mounting outdoor loudspeakers provide call-in or annunciator capability and vandal-resistant and weatherproof communications within their local area of installation, according to the company.

The water sealed, die cast, compression driver loudspeakers are designed for hands-free intercommunication and application in demanding environments such as parking garages, transportation terminals, guard stations, controlled access and drive-in service facilities, the company says. The loudspeakers are offered in a choice of two watt or fifteen watt power handling with 25 V. or 70 V. line transformer options, and include a pre-mounted call origination switch protected by a rubber boot.

Circle 1 on Reader Response Card



Electro-Voice Mixer and Microphone

Electro-Voice's PL68 pro-line microphones feature high-level output with smooth frequency response and gain-before-feedback characteristics. It comes in three versions: PL68, PL68S and PL68SH. The PL68 and PL68S are low impedance. The PL68SH is a high-impedance microphone for guitar amp and DJ-mixer inputs.

Electro-Voice's powermix 61PM is a

portable 200-watt, six channel powered mixer, designed specifically for the MI market, according to Jim Long, EV director of marketing. The MOSFET power amplifier offers sonic quality while the anti-clip circuitry eliminates clipping and distortion and protects the speakers.

Circle 2 on Reader Response Card

AKG Audio Processor and Condenser Mic

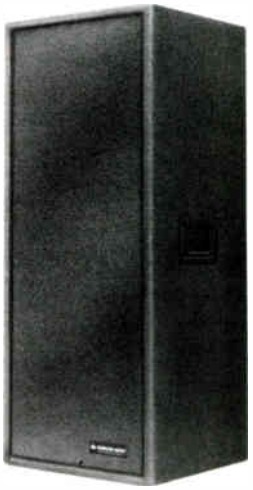
AKG has introduced the CAP 340 M digital audio processor, a freely programmable, modular system complete with comprehensive software. The CAP 340 M can be used in live and studio recording as well as for acoustics research and computer simulation.

AKG's C426 B comb stereo condenser microphone allows any required polar pattern (cardioid, omnidirectional, figure-eight, and six intermediate positions) to be selected — for each system separately — without affecting the microphone's sensitivity and also without inducing noise, according to the company.

Circle 3 on Reader Response Card

Renkus-Heinz Intros New Prods

Renkus-Heinz's COAX60 and COAX90 provide coverage at mid and high frequencies from a relatively small source, according to the company. Mounting the h.f. horn and driver coaxially in the mouth of the mid-frequency horn, creates a powerful point source with pattern control from 250 Hz to 17 kHz. The co-ax package consists of the Renkus-Heinz SSD 5600 mid driver and an SSD 3301 high frequency driver mounted on Renkus-Heinz constant beamwidth horns.



COAX60 and COAX90 provide 60 and 90 degree coverage angles, respectively. Both the COAX60 and the COAX90 have a suggested retail price of $2900.

Renkus-Heinz's SUB-152 bandpass subwoofer system is designed to be used as a sub-bass support for full-range speaker systems such as the Renkus-Heinz FRS Dyna-Gard series. By restricting bandwidth, the bandpass design increases efficiency to 106 dB (1w,1m), the company says. Two high

efficiency 15-inch woofers in a specially tuned, six cubic foot enclosure give low frequency response down to 45 Hz. The SUB-152 has a suggested retail price of $1,700.

Renkus-Heinz's RH-23 dyna-gard processor is a two channel (stereo) processor designed to be used with the Renkus-Heinz dyna-gard FRS and SMS series speaker systems, as well as with many other two way passive crossover speakers. The processor provides equalization and protection for both the low frequency and high frequency driver, and includes switchable stereo or mono sub frequency outputs.

Circle 4 on Reader Response Card

IED Power Amplifier Card

Innovative Electronic Designs, Inc. has added the model 6208 eight ohm power amplifier card to its 6000 series power amplifier system. The card consists of a complete high performance single channel 200W switchmode (class XD') power amplifier. It delivers full power into an eight ohm load without the use of an output transformer.

Circle 5 on Reader Response Card

Bogen Wall-Mounting Modular Amps

Bogen Communications, Inc. has added two wall-mounting models to its line of modular amplifiers. Models WMA-80 and WMA-160 have continuous output power ratings of 80 watts and 160 watts, respectively, the company says. They are suitable for auditoriums, schools, banquet rooms, gymnasiums and other locations where permanent, inconspicuous, tamper-resistant installation is desired.

Each amplifier provides eight input channels, including a built-in low-impedance microphone input, a projector input for audio-visual applications, and six module ports which accept any combination of Bogen's plug-in input and control modules.

Circle 6 on Reader Response Card

A Closer Look

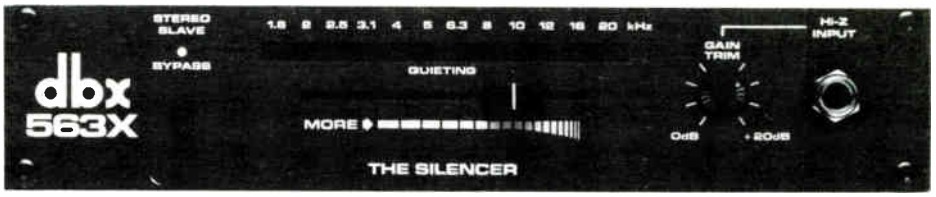
The dbx 563X 'Silencer'

by Gary D. Davis

The dbx 563X, dubbed "The Silencer," is a half-rack sized, self-contained, single-ended noise reduction system. Unlike the widely known dbx tape noise reduction system, the 563X does not require that the signal be encoded prior to recording or transmission and complementarily decoded upon reception or playback. Such encode/decode systems are really noise avoidance systems; they do not remove noise from a given program signal, they merely reduce any noise which might be added by the transmission or storage medium. Instead, the 563X removes noise from any signal.

The 563X is based on prior dbx technology — indeed, based on designs that are decades old. It is a class of signal processor known as a "sliding horizontal filter." That is, it includes a low pass filter whose cutoff frequency is automatically adjusted based on the content of the program material. A sensor circuit intelligently determines whether and where high frequencies are present in the program, and then commands the voltage-controlled state-variable filter's cutoff frequency to slide up or down as needed. If all that is present is a predominantly low-frequency male speaking voice, the filter cutoff will slide down in frequency. Since hiss is predominantly high-frequency noise, the hiss will be reduced. If a wide-range musical program is present, the filter will slide up in frequency to allow the harmonics to pass through the device. While hiss may continue to be present, the theory is that the music will mask the hiss (which it generally does).

The 563X front panel is the model of simplicity. There is an input gain trim control with an associated High-Z unbalanced phone jack input. A push-button switch places the unit in bypass mode (not hardwired, so average gain remains consistent with or without filter action), and an LED to indicate whether the unit is in stereo slaved mode. The primary control and display consists of a horizontal slider labeled "Quieting," and a 12-segment LED display to show the cutoff frequency of the filter (from 1.6 to 20 kHz). Adjustment of the Quieting slider will change the way the detector commands the cutoff to slide with a given program source (i.e., you can use it to make your own trade-off between hiss removal and removal of too much of the upper end of the program material).



The rear panel includes unbalanced phone jacks for input and output. There are two outputs, high level (0 dBv) and low level (−20 dBv). There is also a stereo strapping jack and associated master/slave switch so that two 563X units can be linked to process a stereo program (this assures that the filters will track on both channels). A recessed slide switch enables the power supply to be set for 120 or 240V AC mains.

The unit is specified to have a frequency response of 20 Hz to 20 kHz +/−1.5 dB (pink noise), 0.06 percent THD, 0.1 percent IMD (SMPTE method), 391 kohm input impedance, and outputs capable of driving 600 ohms (at 0 dBv) or 10 kohms (at −20 dBv). Maximum input and output level is listed at +18 dBv, and equivalent input noise at −82 dBv.

There are a few ambiguities in the materials sent to us by dbx. In the block diagram, the High-Z Gain control appears to control the level for both the front-panel High-Z input and the rear panel Line input. Is this the case? (The input Z spec suggests it is.) If so, it seems the High-Z Gain control is mislabeled. If not, then the block diagram is in error.

We also wonder why there is no warning label on the rear panel regarding the potential damage caused by inserting a tip/sleeve phone plug into the Stereo Strapping jack. While the information is in the manual, let's face it — not everyone studies the manual prior to hookup. We also question why the input impedance for the rear-panel line input is a very high 391 kohm. This would be fine for a direct guitar input, but it seems to us that it is underterminated for the average line level source, and possibly an invitation to RFI, etc. We queried dbx on these items, but received no reply.

dbx does not intend the 563X to remove hum, ticks or pops, or to track modulating or changing hiss, nor to

Gary D. Davis, of Topanga, CA, has been a technical writer and audio consultant since 1974. Along with his associate, Ralph Jones, he authored the Yamaha Sound Reinforcement Handbook.

quiet noisy program material that has been dynamically processed. It is for cleanup of program which has a continuous and unchanging hiss "floor." Within this definition, they claim the 563X will be useful for complex MIDI setups, studios, duplication facilities, theaters, broadcasters, and PA systems.

The same basic function is also available in a modular package for insertion in a dbx signal-processing rack frame. This incarnation is labeled the Model 929.

In order to make a device like the 563X, dbx has almost certainly used level detection and filter technology which they have developed over the last 18 or so years. And decades before that, other companies built sliding horizontal filters with vacuum tube circuitry. If the 563X is to be truly useful, it will have to operate with minimum audible artifacts — without causing background hiss modulation that is objectionable and without muffling or modulation of program harmonics. Since we have not auditioned the unit, it will be up to you to take a Closer Look. ■

Literature

Full-Line Catalog Available From Alpha

Alpha Full-Line Catalog Accesses Technical and Ordering Info

Alpha's catalog "W-10" provides access to technical and ordering information about more than 7,000 wire, cable, tubing, connector and harness assembly products. The 350- page, full-line catalog is divided into ten sections, each containing introductory pages and a sub-index.

Dialight Guide to Indicator Lights

Dialight Corporation is offering a

190-page guide to indicator lights, which provides detailed information on NVIS and Secure lighting. The Secure lighting section covers indicator lights designed to meet the requirements of MIL-L-3661B. The section in the guide on NVIS lighting is for indicators that conform to MIL-L-85762A.

Heinemann Revised Quick Guide to Overcurrent Protection

Heinemann Electric Company's revised edition of the "Quick Guide to Overcurrent Protection" is now available. It covers 14 different series of circuit protectors and circuit breakers ranging from 0.01 to 700 amperes. New to the 14-page design aid is a pictorial guide to circuit breaker internal circuits.

Wesflex Flex-Con Cable-In-Conduit Product Bulletin

Wesflex, Inc., a unit of Utilitech Services Corporation, has released its Flex-Con cable-in-conduit product bulletin number CIC-01. The bulletin describes the complete Flex-Con family of thick-walled polyethylene conduit for direct-buried or aerial distribution and drop cables.

CALENDAR

Upcoming Events

MARCH

VOICE '89: Santa Clara, CA. Contact: (800) 888-2188. March 6-8.

30th ERA Management and Marketing Conference: Maui, HI. Contact: 312-649-1333. March 12-18.

National Association of Business & Educational Radio (NABER): New Orleans, LA. Contact: 703-739-0300. March 15-17.

Communciations Expo '89: Las Vegas, NV. Contact: 303-220-0600. March 29-31.

APRIL

National Relay Conference: Stillwater, OK. Contact: 219-264-9421. April 17-19.

ISC Conference: Anaheim, CA. Contact: 312-299-9311. April 25-27.

NAB: Las Vegas, NV. Contact: 202-429-5300. April 29 - May 2.

MAY

EDS: Las Vegas, NV. Contact: 312-648-1140. May 9-11.

National Fire Protection Conference: Washington, DC. Contact: 617-770-3000. May 15-16.

National Council of Acoustical Consultants (NCAC): Toronto, Canada. Contact: 201-379-1100. May 20-22.

National Sound and Communications Association Expo and Conference '89: Nashville, TN. Contact: 312-593-8360. May 25-27.

JUNE

National Presentation Expo: New York City. Contact: Barbara Stockwell, Ass. V.P., Knowledge Industry Publications, 800-328-5474, in New York State, 914-328-9157. June 6-8.

National Association of Music Merchants (NAMM): Chicago, IL. Contact: 619-438-8001. June 17-20.

American Society of Mechanical Engineers (ASME): Pittsburgh, PA. Contact: 212-705-7732. June 18-22.

International Security Conference/Central (ISC). Chicago, IL. June 27-29.

JULY

Electronics Technician Association (ETA): Boise, ID. July 20-22.

International Association of Auditorium Managers (IAAM): Reno, NV. Contact: 914-683-1000. July 23-August 1.

CONSULTANT'S COMMENTS

(continued from page 16)

feedback or echoes or tend to falsely gate microphones.

Specific absorption or attenuation at microphone and loudspeaker positions to change the directional characteristics of these systems.

It is unfortunate that the dual uses of many of these rooms cause competing needs; if the rooms are optimized for natural reinforcement of speech (as they should be in large meeting room use), they are often more reverberant than is ideal for teleconferencing. Therefore, some priority of teleconferencing to other uses should be established or at least discussed with the client.

> 'The system is often used in any way which proves to be obvious or convenient.'

It is clear from this brief introduction to the problems of systems integration in large teleconferencing facilities that there is an obvious need for standardization both of successful approaches to solving these problems and for testing formats to determine which parts of a system are operating on a successful basis.

This need for formal systems testing and for quantification of individual performance of each of the variables in question suggests the need for a joint industry/consultant effort to look at the overall process. With this in mind, Orfield Associates has been contacting manufacturers and vendors within this field to attempt to organize a cooperative effort in the beginning resolution of some of these problems. We would be pleased to hear from others involved in this field regarding their experiences and knowledge, and it is hoped that later this year we will be providing a two part article on the theory and application of teleconferencing calibration standards with an exposition of our initial findings and those with whom we have had contact and useful input. Your participation is invited.

AUDIO TELECONFERENCING

(continued from page 31)

Sound Isolation. Nothing ruins a teleconferencing system more than intrusions of sounds and noises from outside the room. Outside noises (such as aircraft flyovers and traffic noise) and noise from interior adjacent spaces must be kept isolated from the room.

In locations with high exterior noise levels, windows should be avoided. If present, they should incorporate double glass, with a 2-inch to 4-inch air space between the panes.

The wall construction of the room should consist of at least two layers of gypsum board on each side of a metal stud, with full batt insulation between the studs. The wall should go full height, from floor slab to ceiling deck. The wall perimeter and all wall penetrations (such as conduit, wire-ways and mechanical system ducts) should be fully sealed and caulked.

Adequate sound isolation should also be provided between the teleconferencing room and noisy projection equipment (if front- or rear-projection rooms are in use). Table-mounted overhead projectors and ceiling-mounted video projectors are other potential noise sources: equipment fans of units that are intended for use in meeting rooms are a lot noisier to the microphone than one would think.

> 'Planning and coordination are the key elements in achieving good acoustics.'

Detrimental Reflections. Avoid concave surfaces and hard, reflective parallel wall surfaces; these can lead to problems with sound focusing and echoes. Hard surfaces are avoided in maintaining low reverberation. But, in smaller capacity situations the room may have been designed for acoustic voice reinforcement, relying heavily on early coherent reflections. These early reflections may cross-over a point in time (becoming distinguishable echoes). Similarly, a hard ceiling may interact with a large hard-surfaced boardroom table.

In these situations, a sound reinforcement system may be used, allowing the elimination of hard echo/reverberating-surfaces (even though this may not have been requested by the client). Once a sound system is in place, it may be easily adapted to teleconferencing.

While the details of room acoustic design fill many technical volumes, there is one rough guideline which requires very little calculation — room proportion ratios. There has been a considerable amount published concerning various ratios which consider the multi-dimensional modes of various proportioned rooms. Ludwig Sepmeyer's work (*Computed Frequency and Angular Distribution of the Normal Modes of Vibration in Rectangular Rooms*, JASA, 37:3, March 1965.) offers the ratios shown in table 2. These points and guidelines should only be used as an indication if an existing room is within practical and manageable limits, or if a more detailed and exhaustive study is necessary.

SOUNDS GREAT

The quality and control of all aspects of the teleconferencing system are the keys to receiving this positive response to the *Great Audio Teleconferencing Question*: "Sounds like you're right next to me!"

(continued from page 50)
user's position. As the box receives the infra-red signal, it is transferred via normal speaker wire terminating in two small infra-red LEDs placed inside the front section of the cabinet. The solid doors remain closed, hiding the equipment, but the user retains full remote control functions. The entire Hidden Link unit is smaller than the size of a cigarette pack, measuring only ¾-inch high and 3-inches wide. It is easily installed in five minutes requiring no tools.

YORK

The York Controline Series provides virtually every function required for any media or environmental installation. It provides a single remote control system which can be completely user-programmable, installs quickly and may be expanded by adding additional Control Decoders. The Control Programmer has an 80 character display which allows complex system programming.)

York's Controline series features the CP-1 control panel.

The Control Programmer permits user-programming of virtually any required function, including timed sequences. A backlighted LCD display provides feedback during programming, test or review. Simplified programming for all functions includes complex simultaneous or conditional commands. There is quick and easy editing of any commands. Software supervision prevents invalid or conflicting entries. Automatic non-volatile memory update prevents loss of programmed information. The protected mode prevents accidental modification of the system, by non-authorized personnel. RS-232C Computer Interface is provided for programming and control via direct connection to computer or modem. This system may be programmed using only the programmer or with remote panel and decoder push buttons. Modular telephone cable connects the programmer to system decoders and accessories over the Local Area Network. A wireless input eliminates the need for separate adapter when used with multiplex wired panels. The Control Programmer is available in table top or rack-mount and requires only 1¾-inches of rack space.

The 1-Way Multiplex (Wired) Control Panels have 3-wire digital multiplex with any number of remote control locations and up to 120 channels on 3 wires. Features include simplex (transmit only) digital transmission and York standard or custom designed panels and portable consoles.

The 2-Way Multiplex (Wired) Control Panels have 3-wire digital multiplex with any number of remote control locations with up to 120 channels on just 3 wires (240 channels on 4 wires.) Features include full duplex (simultaneous) digital transmission with feedback status on every channel, compact remote processors which may be used with any type or design of remote control panels, York standard or custom designed panels and portable consoles, and remote panel push buttons with adjustable dual level lamps.

The Control Decoders come in 6, 12, 18, or 24 channel output models. Features include: full size lighted push buttons which can easily be engraved and permit full local control without the need for an additional panel, a user-selectable push button status indication for either feedback or relay status, a front panel date LED provides indication of valid multiplex or wireless data as well as fault conditions. All user-programming switches are externally accessible. The plug-in power supply meets UL requirements. Regulated 24VDC power output provides for customer equipment or external relays. The units connect together and to certain accessories on Local Area Network using modular telephone cable. Plug-in "captive wire" terminal strips are provided for relay outputs and feed-back inputs. All relay outputs are 3 Amp Form C (SPDT). Relays may be user-programmed via externally accessible DIP switches for any combination of momentary, latching or interlocking outputs. RS-232C Computer interface is available as an option on any model. Remote feedback inputs are available on 6 and 12 channel models. The Control Decoder is available in table top or rack-mount and requires only 1¾-inches of rack space. The wireless input on all models eliminates the need for separate adapter when used with multiplex wired panels. The remotely mounted wireless receiver permits multiple receiver locations for use in difficult or extremely large reception areas. These wireless receivers feature exclusive gating circuit to ensure interference free reception and require no field tuning.

The York Controls GCP-1 is a video graphics control panel which may be programmed or reconfigured for a variety of remote control applications. The graphic control buttons and legends appear on a liquid crystal display which uses "supertwist" technology for high contrast and brightness. Control through the GCP-1 is accomplished by a 0.50-inch grid, clear membrane, touch screen overlay. The 0.50-inch inch grid allows up to 108 touch sensitive areas which can be created and used as control buttons. Feedback or status to the panel is indicated by inverting the image in any button are addressed. An adjustable "click" level provides actual tactile feel to the finger whenever a button area is pressed. An entire York Controline system may be controlled from a single screen on the GCP-1 or up to 64 separate "Control Screens" may be created for more complex control systems or when the system must be reconfigured for different users or applications.

SUMMARY

Today smart-system may mean that diode-logic precludes one event from overriding another. Tomorrow the push-button simply will not be adequate for the boardroom of the future. Artificial intelligence and speech recognition technologies will play crucial roles in meeting the needs of tomorrow's boardrooms. Mandates calling to replace the operator and button with direct commands taken from a talker's dialogue are certainly in the foreseeable future. It is the computer-oriented systems that will be capable of incorporating these input modules, working in tandem—or even replacing—today's state-of-the-art LCD touch-panels. ■

THEORY & APPLICATIONS

(continued from page 21)

stalled in different enclosures to see what effect this would have on total system response. He found that the performance of the driver dominated the performance of the whole system, regardless of the enclosure used. He also noted that other driver designs, while better at damping the resonances, did not provide the extended frequency characteristics Anchor was seeking.

The measurements presented here should give you an idea of what to look for when reviewing measurement results for other loudspeakers. Note the time and frequency responses. With some speakers, the energy at different frequencies decays at different rates and times. This shows up readily on a 3-D display. Unlike figure 2, you would see some bands of frequency decaying longer than others.

My thanks to John Munroe for the information he provided about the speaker, and to Farrell Becker of Audio Artistry for his version of the TEF 2.0A software used to produce figure 3. ■

FIBER OPTIC HDTV

(continued from page 35)

have already commenced in Japan, which is not heavily cable-penetrated. Pace suggests that domestic motion picture companies can use such technology to provide theatres with crystal-clear showings of films without ever making—or distributing—copies of the reels.

Both Pace and Motchan stress that SWBT hopes to act only as a distributor and the day that consumers own the necessary equipment to receive fiber optic transmissions of HDTV could easily be 20 years off.

One provider of films and sporting events that is closely monitoring these developments is Home Box Office (HBO). HBO's parent company is Time, Inc., which also owns cable multiple system operators (MSOs) that are now experimenting with transmission of HDTV over existing cable lines. How well HDTV stands up to satellite transmission is another question the cable service is scrutinizing. These test transmissions have not yet been seen by the public, but HBO, like SWBT, wants to be there when the public (and the technology) is ready to receive. HBO is interested in covering more sporting events (it recently has had a lock on championship boxing) but its first priority is film.

HDTV's dimensions are perfect for restoring the aspect ratio of film for those who (eventually) have a screen to watch it on. "There's no need for frame compression," says Alan Levy, New York City-based HBO corporate spokesman. "HDTV is [for now] a big-screen phenomenon," he continues, "and a high-def projection system has the *look* of a movie."

Levy's own projection is that high-def for the home will come first to the high-end user in the form of HDTV VCR/monitors which will play films with super high quality. "We do motion pictures," says Levy, "and when HDTV gets in the home — HBO wants to be in the position of providing it. It's an evolutionary process. Now we transfer 35mm film to videotape, soon we'll do film to high-def tape. Cable companies are already running [their own] fiber optics in some new markets, too.

"There's no question that the federal government is looking at phone companies as a provider of TV transmissions. But it's yet to be seen if phone companies will provide [cable] with competition. It used to be 'How much for the use of the pole?' Now cable works with phone companies on processing pay-per-view orders. Maybe we'll work more closely together than we ever thought."

SWBT's Pace sums up his view this way: "When people are exposed to viewing an event on HDTV large-screen with quality audio, they will accept it and there will be a change in entertainment patterns. Quality will sell." ■

McGorry is associate editor of Post *magazine.*

A/V OVERVIEW

(continued from page 36)

white balancing. If fluorescent light fixtures are used, they should be positioned at an angle or use directing vanes to light the faces of participants from an elevation angle of 45 degrees or less. Back-lighting should be of equal intensity to front-lighting in order to give depth to the room and to the people being viewed. Fill-lighting is typically provided by overhead fluorescent fixtures adjacent to the key-lights and back-lights (as well as from light reflecting off of walls).

In general, earth tones should be used on all finished materials including table surfaces in order to provide natural looking flesh tones. It is especially important that table surfaces are not finished in a color that will make faces look unusual (e.g., green or yellow). Walls should be illuminated at about 60 percent the intensity of the frontal-light. This will allow some definition in the walls, but not draw attention to these areas. An exception to this is on marker boards, charts, or other drawing surfaces. Light levels on these areas should be the same as the key-light. In general, lighting levels should be determined by the lighting needs of the camera. However, front light of 60 f.c. to 80 f.c. should be sufficient with modern CCD type cameras.

CONTROLS

With such a variety of equipment available, teleconference participants should have the ability to remotely control as many functions as possible. This avoids unnecessary moving around the room to operate individual pieces of equipment. Such a control system typically controls video input/output switching, camera movement, and preview audio functions. Other functions to be controlled might include audio volume, system power up/down sequences, an electric projection screen, or special functions of the CODEC or satellite.

The control system/user interface is usually comprised of a single custom built console utilizing an arrangement of buttons and graphics to meet the needs of a specific conference situation. The buttons on this console norm ally operate remotely located relays which actually do the work of controlling equipment. Possible alternatives to a button type console are a user defined LCD panel (now offered by several A/V control system manufacturers) or a PC which is programmed to provide the control functions.

SUMMARY

As one can see, a great variety of A/V media may be successfully employed in a teleconference. The type of teleconferencing (non-video, still video, or motion video) determines what A/V technologies are available and the type of room (dedicated or shared space) partially determines what A/V technologies are practical. After those decisions are made, the effectiveness of A/V usage may be enhanced by proper implementation. ■

JBL'S CADP

(continued from page 26)

design programs are called for when doing cluster design. A file interchange utility between CADP and AutoCADD has been developed by a third party, and should be of interest to CADP users who use AutoCADD. AudCadd, from VDP is an ancillary program of pre-drawn components that is used with AutoCadd, and can be used to generate cluster designs.

CADP generates a report on the coordinates of the seating plane and loudspeakers, but these will require additional explanation for others to understand. I provide the prints that were marked up when the job was prepared for the data entry for the work sheets. The loudspeaker report denotes the coordinates, aiming, model numbers, and relative levels of each of the speakers in the cluster. Center of gravity of the cluster is also calculated. These reports can serve as the basis of the bill of materials and rigging information.

CADP does not provide any utilities for generating system flow charts. Various flow charting programs are available; one of the most complete and efficient programs I have come across is Flow Charting II+ by Patton and Patton (cost is $200).

CONCLUSIONS

CADP was a labor of love by the people of JBL (Ron Means, Keele, Albertz, Eargle, and others). The program was instrumental in popularizing computer-aided sound system design. Many of the limitations that I have commented on in this review, such as medium resolution CGA graphics, the very basic room modeling, and the rudimentary mechanical design, are all really criticisms of the hardware and software limitations imposed by technology circa 1983. Only some of the programming weaknesses have been resolved in updated releases, but this is because JBL faced a difficult decision: should they expend the energy needed to completely revise CADP, or should they concentrate on developing their new generation of software design tools. Their decision was to tidy up CADP, but to put most of their effort into the new program.

CADP was certainly worth the $600 JBL charged for the program. Considering that JBL will allow a credit for a trade-in of CADP for their next-generation program, users will certainly have gotten more than their money's worth. ■

SYSTEM SOLUTIONS

(continued from page 40)

issues in the form of two patented sound systems developed by Jaffe Acoustics and now manufactured by Sound Control Technologies, Inc. These systems, called Voice-lift* by the manufacturer, use ceiling-mounted microphones and speakers and employ acoustic and electronic nulling techniques to achieve stable voice reinforcement or full-duplex teleconferencing.

To understand how these systems provide high quality teleconferencing capability, it is helpful to look at their theory of operation.

In the first system, the Boardroom System*, physical and electrical symmetry are employed to provide maximum rejection of loudspeaker output by the microphones. Specifically, one microphone is placed on the center line between two loudspeakers. The loudspeakers are driven out of phase with respect to each other creating an acoustic null at the point of the microphone. This null typically exceeds 20 dB (and is fully three times higher than the minimum acoustic echo return loss required by the Teleplex). Figure 2 illustrates one of these speaker/microphone modules. A system typically consists of an even number of modules, enabling a second level of electrical symmetry to further enhance cancellation and thus improve system gain. The polarity of the signal from alternate microphones is reversed, resulting in further electrical cancellation of loudspeaker sound picked up by the microphones.

A sample schematic of a complete system is illustrated in figure 3. Note that in addition to the cancellation techniques, notch filters are employed to reject remaining feedback modes, and signal delays are inserted to take advantage of the Haas effect, to help maintain source localization by the listener. Finally, the system is zoned such that each microphone feeds all loudspeaker pairs except the pair adjacent to it. Gain of a particular microphone signal is proportionally increased from module to module so that the loudspeakers farthest from a microphone receive the highest level from it.

In the second system, the Conference Room System*, or "Hot Room," cancellation is achieved through the use of paired modules in which each module has one microphone and one loudspeaker. In every module the distance between the speaker and microphone is identical. In this system the microphones are summed out of phase and the speakers are driven in phase as shown in figure 4. The two modules may be separated by any desired distance, and an entire room may be covered by employing numerous modules, the only limitation

(continued on page 67)

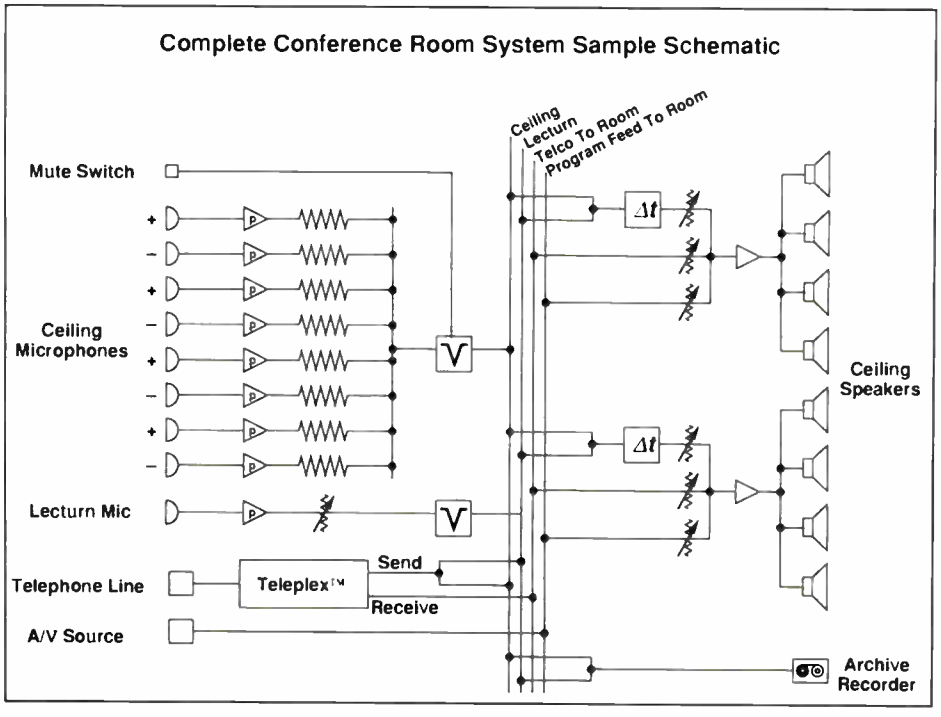


Figure 5. Complete sample schematic of the Conference Room System.

SYSTEM SOLUTIONS

(continued from page 66)

being that the total number of modules must be an even number. As in the Boardroom System, this system achieves a null of approximately 20 dB making it fully compatible with the Teleplex interface.

Both systems can be configured to allow audio/visual equipment (VCR, Film Projection, etc.) to use the ceiling speakers for program audio. Also, the systems can provide line level outputs to allow archival recording of meetings or to provide monitoring capability to the control room. Figure 5 illustrates a sample schematic of the conference room system with interfaces for teleconferencing and program audio.

The self-rejecting nature of these two systems promotes their use in teleconferencing applications. Used in conjunction with the Teleplex teleconferencing interface, these systems provide high quality, stable teleconferencing while simultaneously allowing for varied room configurations and freedom of movement within the room. Two similarly equipped rooms in the same building or continents apart can communicate as efficiently and effectively as if the participants were in the same room.

Voicelift and/or Teleplex systems have been successfully installed, or are soon to be completed in the NASA Boardroom at the Johnson Space Center in Houston, the US Trust Bank Boardroom in Boston, the Compaq Corporation Boardroom in Houston, and the Peoples Bank Boardroom in Bridgeport, CT. ■

The Boardroom System *is the patented development of Jaffe Acoustics, Inc. of Norwalk, CT. The patent #3,992,586 issued on November 16, 1976 and is licensed exclusively to Sound Control Technologies, Inc. of Norwalk, CT. The* Conference Room System *is a proprietary development of Jaffe Acoustics, Inc. of Norwalk, CT. A patent application incorporating this concept has been allowed by the U.S. Patent Office and a patent will shortly issue. Upon issue this patent shall be licensed exclusively to Sound Control Technologies, Inc. of Norwalk, CT.*

TELEPHONE TALK

(continued from page 38)

With the advent of copper wire and cable it became feasible to include a second wire for the return and not rely upon the earth, and so the *two-wire* circuit was born. This was also proudly known as a *metallic circuit* because no dirt was involved.

The two-wire circuit (with its resistance of 10 or 20 Ohms per mile) could certainly be made to work between New York and Chicago, but not very well. Amplification is needed, so let's return to the cornfield in Ohio and cut the two-wire circuit — voila, *four wires*!

The task of separating the two-wire circuit into a four-wire circuit (two for New York, two for Chicago) is carried out by the *hybrid*. *Hybrid* literally means the combining of two things to make one and indeed, when used backwards, the *hybrid* will also turn a four-wire circuit into a two-wire circuit.

The *hybrid* accomplishes this feat by a neat little trick which we now know as phase cancellation. If the original two-wire circuit contains New York plus Chicago, the *hybrid* derives a minus New York and a minus Chicago signal and produces, on its four-wire ports, New York plus Chicago minus New York (equals Chicago), as well

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AD INDEX

TELEPHONE TALK

(continued from page 67)

as New York plus Chicago minus Chicago (equals New York). At its two-wire port the *hybrid* of course produces New York plus Chicago.

A *hybrid* can be made with transformers, op-amps or DSP chips, anything that will produce controlled phase cancellation, but the principle is always the same: two-wire to four-wire, or four-wire to two-wire.■

MULLIN

(continued from page 46)

caught the interest of Murdo MacKenzie, the technical producer for Bing Crosby. MacKenzie was looking to improve the quality of the recording process they were using for the "Bing Crosby Philco Radio Time" show.

To put together the show, Bing Crosby and his guests were recorded during their performance (in front of a live audience) on 78 rpm 16-inch lacquer disks. Musical numbers were also pre-recorded on the same medium. The show was then tediously edited by re-recording from disk to disk, often creating fourth-generation recordings for broadcast. The quality of the final product was so poor that the Crosby show was losing its audience share.

Jack proved that his tape system offered higher audio quality and was easier to edit than the disks. In fact, using the editing technique he had already developed at Palmer Films, he was able to make cut-and-splice edits (with tape and a pair of scissors) in only 3 minutes, edits that had previously taken days using the disk system.

Jack moved to Los Angeles and started working on the 1947-48 season of the Crosby show. Until Ampex came out with their Model 200 audio tape recorder and 3M came out with 112 tape, Jack used the same 50 rolls of I.G. Farben tape that he had brought back from Germany on the Magnetophons. Each show used seven or eight rolls of tape, which were then very tightly edited and finally transferred to lacquers for broadcast. They couldn't risk playing back a tape that had numerous splices over the air, but they made sure the disk playback was identical to the tape playback.

After each broadcast, the show was transferred to disk. Jack did not simply bulk-erase the spliced tape reel and start over. He disassembled the reel first, then sorted out the pieces of tape by thickness.

In the beginning, jack used scissors and regular Scotch™ cellophane tape to make his edits (there was no special splicing tape available). The sticky tape had a problem: the adhesive had a tendency to bleed out and stick to the next layer of tape. To get around this, Jack rubbed all of his splices with a little talcum powder, rewound the tape, and then played the tape back. If the tape had not been replayed for a few days, he would have to repeat the talcum powder process all over again. (3M later introduced a special white splicing tape which Jack gratefully used. This splicing tape was very similar to the tape used today.)

In April 1948, Ampex delivered serial numbers one and two of the Model 200 to Jack to record the Crosby show. About the same time, 3M introduced the 112 tape, a coated acetate tape which Jack used on the Ampex machines.

Bing Crosby Enterprises became the sole distributor worldwide for the Ampex audio tape recorders. ABC became the first customer (for the Crosby show), followed by NBC, CBS, Mutual, Capitol Records, Columbia Records, RCA Victor, and Decca. In 1949, Ampex introduced the Model 300 which remained the standard audio tape recorder in the broadcast and recording industries for the next decade.

Jack worked on the Crosby show until 1950. He then developed the world's first working prototype of a magnetic videotape recorder. He also built wideband instrumentation recorders. When the Electronics Division of Bing Crosby Enterprises was sold to 3M, Jack went to 3M to continue the development of instrumentation recorders and Mincom audio tape recorders.

Jack's many accomplishments demonstrate that he is truly an innovator who has advanced the state of the recording arts and sciences. Jack is continuing his support of the industry through his efforts in the assembling of his collection.

Unfortunately, there is as yet no permanent home for the Mullin exhibit. A number of people, including media historians Peter Hammar and Shelley Herman, are looking for a safe warehouse in the Los Angeles area while the search for a permanent location goes on.

For further information about the Mullin Collection and future exhibits you can call 415-941-0295 or 213-849-4136. ■

The author would like to thank Peter Hammar for his assistance in the preparation of this article.

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Living In A Digital World

Over and over again we have been blasted with the buzzword digital. Everything is digital this and digital that. It is to the point that the issue has become so clouded that we can't see the forest for the trees. Digital technology is essential to everything we do. In fact, thinking that there is anything we can do better in analog is not quite true anymore.

For the first time since the CD was introduced, compact discs outsold the vinyl long-playing record in the first half of 1988. The RIAA keeps track of all these figures and just recently announced some rather important news. These figures are based on the first six months shipments, and are compared to the same period of 1987. CDs were up 64 percent (to 70.4 million units from 43 million units in 87); LP shipments were down 22.4 percent (to 43.5 million units from 56 million units). During this first half of 1988, digital music aficionados spent $1 billion for CDs. With consumer acceptance and spending as an indicator, digital audio has reached a new milestone.

Digital audio has several impacts on the state-of-audio. First of all it is clear that a majority of the serious music listening public now own CD players. Many radio stations are playing more CDs, and a growing number are exclusively CD—especially in the classical genre. Therefore, now more than ever, the public's awareness of the quality of audio is increasing dramatically. Furthermore, their tolerance of poor audio is decreasing steadily—it has to sound better in a pro system than on their home hi-fi. This raises more concern for the designers of acoustical spaces. It is rather difficult for physical acoustics to compete with a barrage of MIDI'd and SMPTE'd digital software.

And D/A converter costs are rapidly becoming more economical. Surface-mount chips are readily available in many flavors and at attractive prices. This arena of circuit economics is inarguably well under hand. The computing aspect is another front whose war is gallantly being waged by international chip manufacturers. New hybrid designs are making DSP and A/D conversion better, less complicated, and cheaper. Computer memory, while technically advancing very strongly, seems to be economically stagnating—at least for right now.

Yet another aspect of the technically-digital marketplace is telecommunications (including fiber-optics). This "sleeping giant" of an arena is not really sleeping at all: the giant is napping, ready for the introduction of yet another generation of technical impact. With the speed, complexity, and density of communications systems being built, analog can simply no longer survive in many situations. These growing areas are supplying economically and technologically advanced systems for the transmission and manipulation of data.

Aside from the point-of-no-return digital audio cross-roads at which we now stand, we also see the onslaught of digital control. The days of complicated relay matrices and diode logic are approaching the point of pricing themselves out of the market. Consumers are demanding more performance per dollar spent than ever. When they see the declining prices of yesterday's computer power, they expect the same from any other technical system. After all why should John Doe consumer pay more today for yesterday's technical system from John Doe dealer, when he can buy a more advanced system from Jane Doe dealer for less money!

Digital data—whether it is a representation of an audio event, information, or a switch closure—can all be simultaneously handled within one technology. It is the price and power of this technology that is for the first time out-performing analog. Many systems that were previously the exclusive domain of the analog world are now becoming part of the digital world we live in today.

Jesse Klapholz
Technical Editor

Coming in March...

We focus on Residential Intercommunications: find out what's new in home intercom systems and A/V entertainment installations. And we continue our series reviewing CAD programs for sound system design with a look at the Bose Modeler program.

And look for articles on these topics:

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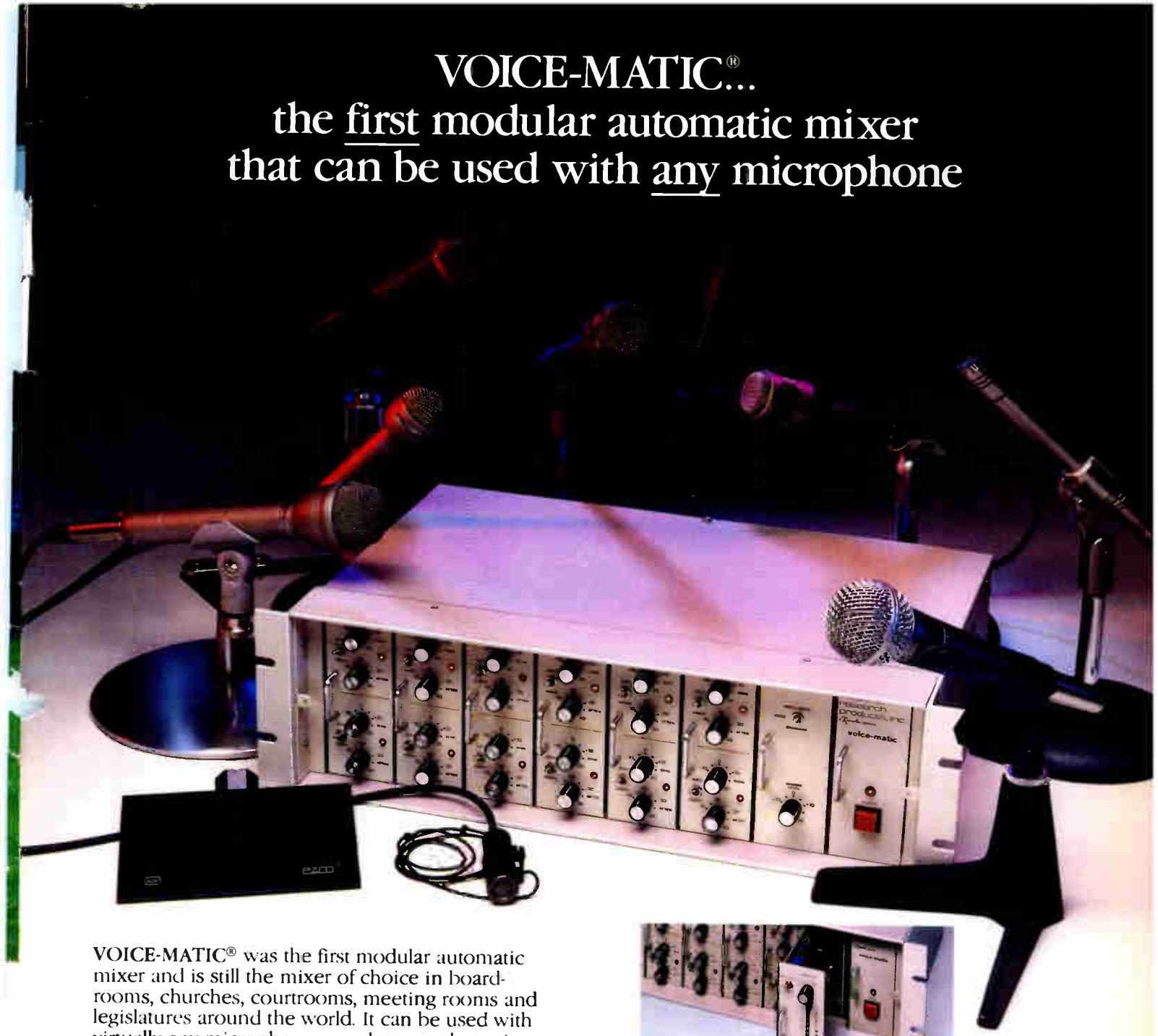

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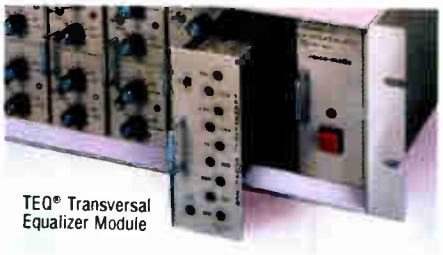
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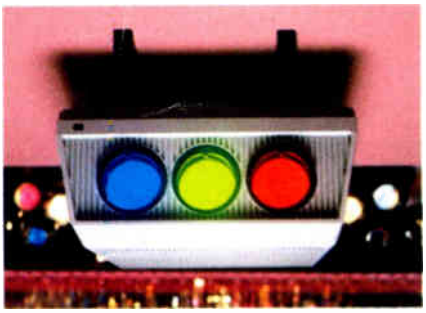

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