

SOUND & COMMUNICATIONS

COVERING TELECOMMUNICATIONS
AND ELECTRO-ACOUSTICS

MAY 1985

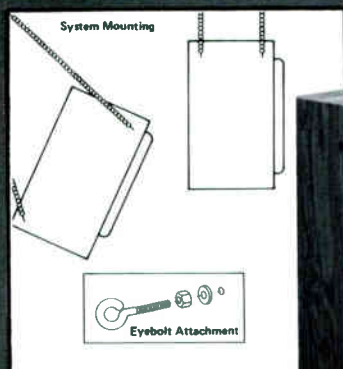
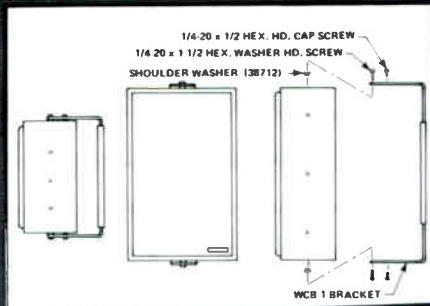
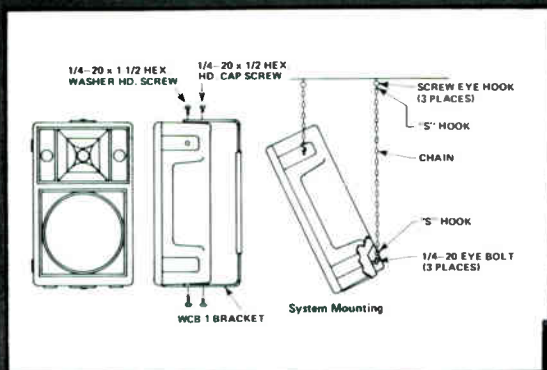


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AIRPORT TERMINAL INSTALLATIONS

LAB TEST REPORT: THE PRAVEY DECA 700

PAY PHONE DEREGULATION: WILL IT PAY OFF?



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World Radio History

SOUND & COMMUNICATIONS

MAY 1985

Volume 31 #5

FEATURES

AIRPORT SOUND, SAFETY & SECURITY

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Recently the Los Angeles International Airport underwent a major sound, life/safety, and security refurbishment. The enormous job, which had to be done in time for the 1984 Olympic Games, is discussed by Bill Schiefer of Acromedia, the contractor, and by Richard Negus of Purcell Noppe, the consultant.

PAY PHONE DEREGULATION: WILL IT PAY OFF?

25

On June 15, 1984, the Federal Communications Commission (FCC) deregulated pay phones, allowing for the private ownership and manufacturing of the units. It has been assessed that by the end of 1985, one out of four pay phones will be purchased or leased from a private company. And *The Wall Street Journal* estimated the pay phone business at four-billion dollars a year. But will pay phones pay off for you?

TELECOMMUNICATIONS AND TELECONFERENCING

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Editorial Director Chris Foreman recently attended AT&T's Global Teleconferencing Symposium and the Tri-State Telecommunications Exhibition in Pittsburgh, PA. He talks about the shows and the nature of teleconferencing in particular.

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What would have happened if Edison's cylindrical phonograph record was standardized? Are we standardizing too early?

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Jim Brown of Sound Engineering Associates explains impedance matching and terminations which he calls "two of the most widely misunderstood concepts in audio."

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Jerome Brookman discusses in depth the return of the two-track (duplex) system of communication and particularly the markets in which it is thriving.

COMPUTERS & DIGITAL AUDIO

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The column focuses on the announcement control system, the I.E.D. 500AC, that is used at the Los Angeles International Airport. It particularly examines the hardware and its usage.

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ON THE COVER

The cover photograph on the May issue of *Sound & Communications* is an inside view of the Los Angeles International Airport and its newly refurbished sound system. The airport, which is the third busiest in the U.S., receives 94,000 visitors daily.

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SETTING IT IN STONE

We all want standards—or at least we *think* we want them. But, are standards always a good idea? Probably not, in my opinion, at least not until a new industry has some time to mature.

Consider what would have happened if a committee of some standards organization had decided to standardize Edison's phonographic cylinder. The cylinder had some advantages from a technical, playback point of view. It had a constant diameter so that playing speed was the same from start to finish. It used a vertical recording cut technique which allowed reasonably consistent playback quality as the needle wore down. It used a linear tracking arm and had no tracking error problems.

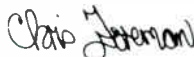
Sound like a pretty good system, why not standardize right away? A uniform standard would make competition work by giving consumers the option to buy equipment from any manufacturer conforming to the standard, knowing that any recording conforming to the standard would play on it. Quality, features, service, and price would become the selling points and consumer confusion would be minimized.

But, then look at what else would have happened. Recordings would have been limited to maybe two or three minutes in length unless additional standard speeds were allowed. This would have limited the medium to popular songs and other short musical pieces, no symphonies or concert albums. The cylinders would have been difficult to mass produce, making each record a costly investment. The playback equipment would have required a lot of precise gearing and such and might also have been expensive. Fortunately, no such standard was developed and the "technically inferior" *disk* format with lateral recording cut won out primarily because of market forces. As a result, we have long-playing, low-cost recordings that can play on relatively low-cost turntables. A standard too early in the game would have hurt rather than helped.

It is possible that we made such a mistake in the sampling rate standard for digital audio. At the existing 44 kHz standard, anti-alias filters have to be very steep to allow a 20 kHz response. The audibility of those filters is the subject of a lot of technical controversy right now. Double the sampling frequency, however, and the anti-aliasing filters could have been moved up in frequency and their slope rate could have been decreased. Why wasn't this done? The higher sampling rate was too costly for existing technology, although future technology will likely lead to a more cost-effective method.

Some standards make a lot of sense. The AES standard for specifying component loudspeakers used in professional sound reinforcement is an example. The best standards are probably those that were first accepted by the marketplace and then adopted by one or more standards organizations. The Phillips cassette and Compact Disk standards are examples. Some standards are enforced by marketing prowess alone. The IBM PC standard has not yet been adopted by any standards organization yet it is a "de facto" standard that is adhered to as rigidly as if it were a governmental regulation. The marketplace won't always impose its own standards. Look at the mess stereo AM broadcasting was in. This is one case where a technological standard, imposed from without, could have been very useful.

I believe in standards. The limits imposed by a standard set us free to market our products (or to buy products) unencumbered by compatibility concerns or worries about technological obsolescence. Yet, strict standards that are imposed too early can hinder technological development. Thus, whenever a marketplace standard seems likely, it's probably best to let the various competitors fight it out and to let a de-facto market standard develop before making it official and setting it in stone.



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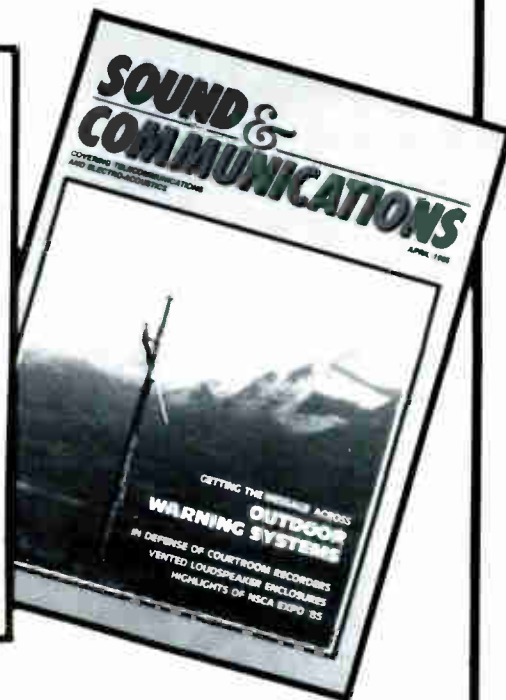
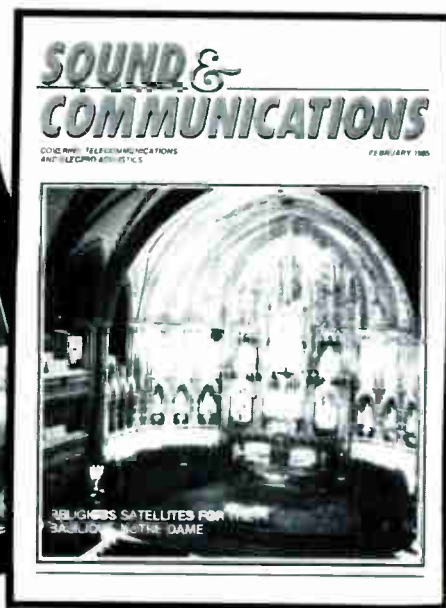
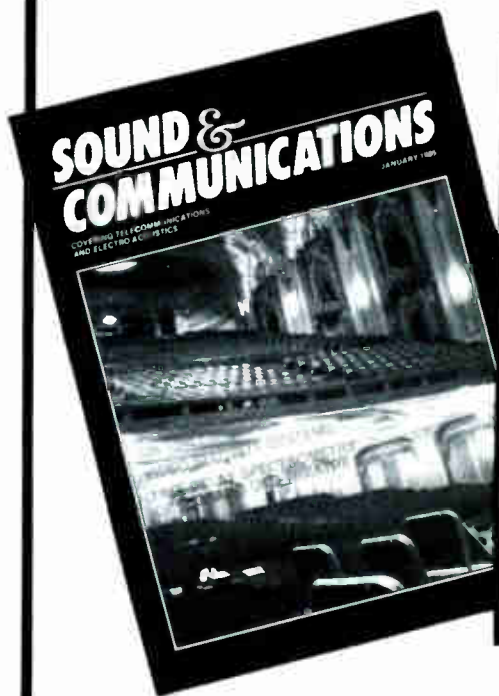
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JBL PRO DIVISION NOW INDEPENDENT

In response to JBL Incorporated's continued market growth, a new company has been formed from JBL's professional products division, according to Ron Means, its newly-elected president.

The new company, JBL Professional, is one of four units recently created due to the overall growth of JBL. The consumer division is now known as Harman-America. JBL's exporting group is now JBL International, and the manufacturing arm is now Harman-Manufacturing.

JBL Professional will operate its own finance and credit departments, purchase products from the manufacturing groups, and maintain its own inventory.

The restructuring has brought personnel promotions. Mark Gander, formerly product manager, has been promoted to vice president-marketing of JBL Professional. Former national sales manager, Ken Lopez, has been named vice president-sales. Two new positions have been created within the marketing department at JBL Professional; one to concentrate on the sound contracting, broadcasting and theatre markets; the other to focus on the MI, pro audio and studio/recording markets.

BOSE ENGINEER ANNOUNCES NEW DISCOVERY ON SPEAKER DIRECTIVITY

Bose Corporation engineers claim to have shown that speech intelligibility does not have a direct relationship to loudspeaker directivity. They believe that other methods of predicting intelligibility that are more accurate exist.

The announcement of finding was made by Kenneth Jacob, a research engineer for Bose, in a presentation at the Audio Engineering Society's Convention in Anaheim, CA. earlier this month.

AUDISAR ANNOUNCES THE APPOINTMENT OF FOUR NEW REP FIRMS

Bob Munger, owner of Audisar, has announced the appointment of four new rep firms. Gemini Electronics Marketing, Edmonds, WA (Dean Nordquist at (206) 776-3121) will handle the Audisar loudspeaker and transformer products in the Pacific Northwest. The Southern California area is covered by Allwest Electronics, Camarillo, CA (Larry Lupo at (805) 388-1789). Audisar has appointed Shirley Munger of St. Petersburg, FL (813) 345-6716, to cover the Southeastern portion. And the Midwest is now covered by Marketing Insights, Glenview, IL (Frank Lupino at (312) 729-2047).

PASO SOUND PRODUCTS APPOINTS NEW SALES REP FIRM

David Moore, sales manager for Paso Sound Products, Pelham, has announced the appointment of Lichtenauer Associates as their sales representative for northern California and northern Nevada.

Lichtenauer Associates will be responsible for Paso's engineered sound, packaged sound, public address and Elvox intercom products.

CROWN INTERNATIONAL EXPANDS PRODUCTION FACILITIES AND SERVICE

Responding to the ever-evolving demands of its customers, Crown International, Inc., the Elkhart, IN. based audio electronic company, has had a busy past year and a half

expanding its facility to meet the needs that come with growth. A more aggressive marketing philosophy, increased sales, and the introduction of several new products has resulted in the need for more room.

The summer of '84 saw the completion of a 36,000-square-foot addition to the manufacturing facility expanding Crown's square footage by 85 percent. The new facility houses fabrication, etching, incoming inspection, shipping and receiving, stockroom, operations and maintenance and a new paint area. This addition not only increased efficiency in handling raw materials and finished goods but allowed the Engineering and Service departments to expand.

The Engineering Department recently increased their square footage by over 25 percent and is looking at another 12,000 square feet to be added soon. In line with the Engineering Department, Crown's Service Department just completed a 1,200-square-foot addition and reorganization in preparation to match the company's growth.

NEW PICTURE TELEPHONE SERVICE DEBUTS ON NBC'S TODAY SHOW

The first video-conference service available by dialing a telephone number over a regular telephone line debuted before a national television audience March 22 in a feature interview on The Today Show.

The new service, called Videocall, is an offering of Argo Communications Corp. of New Rochelle, NY. Argo operates a fully digital transmission network that carries the video and audio signals. Widcom, Inc. of Campbell, CA. manufactures the display terminals that display the video image.

The demonstration featured a coast-to-coast live conversation between Today Show host Jane Pauley in New York and two executives of the sponsoring companies, Widcom president Robert Widergren and James Shields, vice president-sales of Argo Communications, who were located at Argo facilities in Sherman Oaks, CA.

JAFFE AND HOWLAND FORM ARTS MANAGEMENT SERVICES

Christopher Jaffe, president of Jaffe Acoustics, Inc. of Norwalk, CT, has announced that he and James Howland have organized a new firm, Jaffe/Howland Arts Management Services. The company will offer consulting and management services for performing arts facilities worldwide.

"My association with Christopher Jaffe came about as a result of our working together at the Kentucky Center for the Arts and our contact in personal and professional circles over a 15-year span," said Howland. "We both recognized that the combination of Jaffe's extensive theater design experience and my varied arts management background would create a powerful resource for municipalities and arts organizations alike.

"The recognition led to the formation of Jaffe/Howland Arts Management Services." In addition, Jaffe has announced the expansion of Jaffe Acoustics, which has moved to a new headquarters at 114A Washington St., Norwalk, CT (203) 838-4167.

TELECOMMUNICATIONS SUPPLIERS GROUP LAUNCHES PUBLIC TELEPHONE COUNCIL

The United States Telecommunications Suppliers Association has announced the formation of a subgroup that would represent the interests of pay telephone manufacturers and distributors. The subgroup's (Public Telephone Council) goals include meeting with The National Association of Regulatory Utility Commissioners and Bell Operating Companies to discuss matters of mutual concern and monitor state payphone proceedings.

IMPEDANCE MATCHING

by Jim Brown

Impedance matching and termination are two of the most widely misunderstood concepts in audio. Many of us in the field got here by way of radio, television, or related technologies where one rule dominates; terminate everything. Transmission line and network theory and the maximum power transfer theorem make this generally excellent practice for rf and video systems, but not often good practice for audio.

The maximum power transfer theorem, show here in a derivation supplied by Mike Pratts of NBC, is a basic theorem of linear circuit theory. It states that for a linear circuit, the maximum power will be removed from a generator of constant voltage or constant current and having a fixed source impedance when the load impedance (the variable) is made equal to the source and their reactive components of opposite sign.

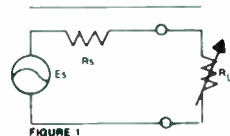


FIGURE 1

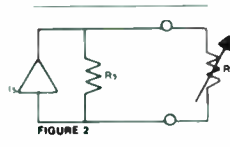


FIGURE 2

In **Figure 1** (a constant voltage source) and **Figure 2** (a constant current source), R_s is the load impedance (the variable), R_L is the output (source) impedance of the output stage E_s or I_s . Thus, a 600-ohm source would provide maximum power output to a 600-ohm load. Of course, if the source impedance were made the variable, more power could be supplied by reducing the output impedance of the voltage source or raising the output impedance of a current source.

Unfortunately, modern solid state and even vacuum-tube amplifiers do not fit into the conditions described by the maximum power transfer theorem. Solid-state output stages generally have an output impedance much lower than the loads they are meant to drive (generally 20 to 100 times lower). When these amplifiers are loaded by impedances lower than intended (thus attempting to absorb more power and more current than the amplifier is designed to supply), the amplifier becomes non-linear and its gain drops. In other words, the mathematical model (the amplifier's equivalent circuit with a generator and an internal impedance) is no longer valid. Because it is no longer valid, the maximum power transfer theorem no longer applies. The equivalent circuit (on which the maximum power transfer theorem is based) falls apart. In fact, the actual electrical circuit falls apart as an amplifier, producing clipping, increased distortion, reduced headroom, and reduced output. Naturally, it may also be more likely to fail.

What then is the practical meaning of the actual output and input impedance of amplifiers? What is impedance matching in audio? Well, from the above discussion it should be obvious that there are optimum loads for most amplifiers (or systems) and these are specified by the designer (manufacturer or systems engineer).

The thing that drives power amplifier manufacturers crazy is the reactive component of the load impedance. Although rarely specified on data sheets, many popular speakers and matching transformers can look almost like a short circuit (capacitive or inductive) at crossover, resonance frequencies, or at very high or very low frequencies.

Line level devices are gener-

ally specified for 600-ohm loads. This does not mean that they must see a 600-ohm load but merely that they have enough power output capability to supply full-rated output voltage into a 600-ohm load. They will generally have slightly more headroom and somewhat less distortion into a higher impedance load since that load does not absorb as much power.

OUTPUT IMPEDANCE OF AN AMPLIFIER

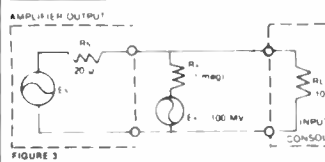


FIGURE 3

Why then do we care about the output impedance of an amplifier? First consider a signal path in an electrically noisy environment. (**Figure 3.**) An amplifier having an output (source) impedance of 20 ohms is driving a console at another location which has a 10 k ohm input impedance (R_L). R_L is then said to be "bridging" the line since it is more than 10 times higher than the 600-ohm rated output load impedance of the amplifier. Let's represent our noise source by a generator $E_x = 100$ mv through a source $R_x = 1$ Megohm (the noise is induced by electromagnetic coupling in the wiring between the two amplifiers). **Figure 3** can be redrawn to **Figure 4**.

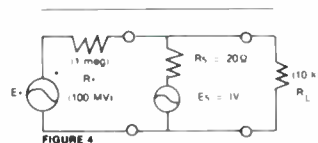


FIGURE 4

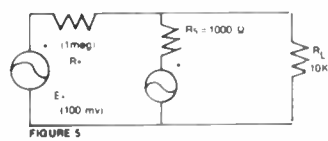


FIGURE 5

Since $R_s = 20$ ohms, the noise source is attenuated by the voltage divider ratio R_s over $(R_x + R_s)$ before showing up at R_L . The desired signal E_s sees no such loss and appears at full strength in R_L . Thus, in the example $E_N = 100$ mv \times 20 ohms over 10^6 ohms = 2 uv. We could say that the 20 ohms source impedance has attenuated the induced voltage by $20 \log R_s$ over $R_X = \text{neg } 94$ dB and the signal-to-noise ratio is $20 \log E_s$ over $E_N = 114$ dB.

If the output amplifier were replaced by a device having an output impedance of 1,000 ohms and designed to work into a 10 k ohm load, the modified circuit of **Figure 5** applies. For this new circuit, $E_N = 100$ mv \times 1k over 1 Meg = 100 uv, for a signal-to-noise ratio of $20 \log E_s$ over $E_N = 80$ db. Note that this second "high impedance" circuit is 34 dB poorer with respect to noise immunity than the first "low impedance" circuit simply by virtue of its output impedance.

The same characteristic can often eliminate the need for distribution amplifiers in many applications. If all loads are bridging (10 times higher than the rated load impedance), then by basic circuit theory (Kirchoff's law) 10 such loads can be connected on the circuit without overloading and moderate noise levels swamped by the low output impedance.

The first example of impedance matching in audio is the passive network such as a resistive pad, passive equalizer, or passive crossover. These passive networks are combinations of resistors, inductors, and capacitors designed to be driven from a specified source impedance and loaded by a specified load impedance (or the termination). The correct network performance, whether frequency response, crossover slopes, or pad loss, depends on the proper driving source and load impedances. If these im-

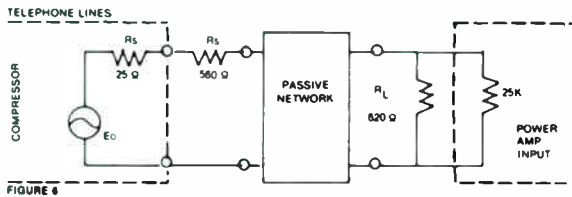


FIGURE 6

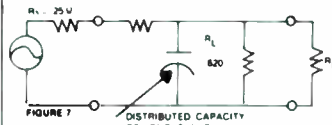
pedances are not correct (within about 10 percent), the equalizers and crossovers can exhibit ringing, incorrect slopes, and otherwise poor response, and the pads would not provide the correct loss or isolation.

In the example show in **Figure 6**, a passive network designed for 600-ohm input and output impedances needs to be driven by a compressor having an output impedance of 25 ohms and will feed a power amplifier having an input of 25 k ohms. It is necessary to add a resistor R_s (or "build-out" resistor) in series with the input of the equalizer, making the source impedance as close as possible to 600 ohms. A standard value of 560 ohms is usually chosen and is certainly close enough for audio work. A load resistance (R_L) of 620 ohms (standard value) would be required on the output.

Next, consider the telephone line, which are transmission lines and follow classic transmission line theory. Although they nominally have a characteristic impedance of 600 ohms, in practice they rarely get close to that value. This happens because the characteristic impedance of transmission lines depends on its physical construction and is governed by such parameters as wire diameter, spacing, insulation, inductance, and capacity. If a transmission line is terminated by its correct characteristic impedance, you may look into the opposite end and see that value of impedance. If it is not, however, the value of impedance will vary with distance along the line and can vary as widely either side of the characteristic impedance as

the degree of mismatch of the load (and the degree to which the characteristic impedance is not 600 ohms due to different wire/line dimensions).

It is no wonder then that, as Harrison Klein found in his measurements on a number of telephone lines at a Chicago-broadcast facility, the impedance of telephone lines can vary widely. In his measurements he found variations from 200 to 2,000 ohms to be quite common.



How then do we deal with telephone lines in audio systems? Well, if we have ordered an equalized line from a telephone company, it has, by standard practice, been equalized flat for a driving source impedance of 600 ohms and a load impedance of 600 ohms. In other words, the telephone company supplying the line has provided passive equalization for the circuit which assumes 600 ohms on each end. It is necessary to treat it just like the passive network described above, terminating and driving with 600 ohms.

If the line is not equalized, it may work better without the build-out resistor. A "short" line (about a mile) could act like a large capacitor in parallel with the output. The build-out resistor working into the line becomes an R-C high-frequency response.

Another set of misconceptions surrounds the use of

transformers in audio, and the common ways we label and specify them by impedance ratios reinforce these errors. For all practical purposes, a good audio transformer will have no impedance of its own but will simply multiply the impedance connected to its opposite winding by the square of the turns ratio. If nothing is connected to the secondary winding of the transformer, the impedance Z_1 (looking into the primary) will be infinite (assuming a perfect transformer). Consider **Figure 8**, the ideal transformer.

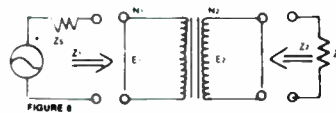


FIGURE 8

$$\text{that is } \frac{Z_1}{Z_2} = \left(\frac{N_1}{N_2} \right)^2$$

$$\text{or } Z_1 = \left(\frac{N_1}{N_2} \right)^2 Z_L$$

$$\text{and } Z_2 = \left(\frac{N_2}{N_1} \right)^2 Z_s$$

The voltage is transformed by the turns ratio itself: E_1 over $E_2 = N_1$ over $N_2 = \text{sq root of } Z_1$ over Z_2 .

In other words, we say that the voltage is proportional to the square root of the impedance ratio. A 600:15K ohm transformer has an impedance transformation ratio of 1:25 and a turns ratio of 1:5. It is designed to be loaded (on its secondary) by 15 k ohms but if it is loaded by 30 k ohms instead, the impedance Z_1 (looking into the primary terminals) will be 1,200 ohms. Notice also that if the primary is driven by a typical 30-ohm input stage, the impedance Z_2 (looking back into the secondary terminals from the load) will be 750 ohms.

All of the relationships are simplified for ideal transformers. To modify them for real life, consider the following imperfections and losses of real

transformers. Wire resistance, iron, and insulation losses show up as resistance in series with the windings. Imperfections in the magnetic and coil structure show up primarily as resistance and capacitance as shown in **Figure 9**.

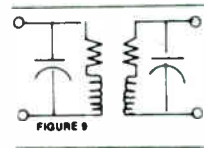


FIGURE 9

Transformers designed to be used as the output transformers in line level devices are normally designed to be driven by the low (10 to 50 ohm) impedance stages of modern audio gear and are designed to be loaded by impedances from 600 ohms to 50 k ohms or higher. They may have turns ratios of 1:1 or even as high as 1:2 to improve output headroom from relatively low-voltage power supplies. In other words, the transformer designer understands the design limitations of the audio circuit designer and comes up with a transformer design to fit those parameters. He understands that the amplifier will probably work best without termination but must also work well with it, and he designs a transformer that will perform well under both circumstances.

Just as line level audio circuits are not normally terminated, mic input circuits are almost never terminated. A mic input labeled 150 ohms is meant to be driven by a 150-ohm mic but it is nearly always bridging to that mic. I do not know of any modern mic-input stages having an input impedance of less than 800 ohms and most are much higher. Mic input transformers have the additional design limitation of needing to optimize signal to noise ratio so that shielding and turns ratio will be determined by these factors.

(continued on page 15)

ON THE REBOUND

by Jerome Brookman

As the old established markets for intercom systems, duplex and simplex, reawakened and newer markets arose, the vertical approach to sales revived.

This is especially true of old-line intercom makers who've watched their product sales increase 15 to 20 percent ahead of the last six quarterly-reporting periods.

Who's buying? Just witness the impact of the burgeoning heavy industrial manufacturing industry and the petrochemical industry needing explosion-proof intercom systems, with and without paging facilities.

Also, the growth of the fast-food drive-in industry has absorbed an inordinate amount of intercom ordering systems.

The largest buyer of intercom systems has been the supermarkets, according to one intercom manufacturer who has been building a simple master to remote station systems with the paging facility at the master station only.

One needed a second talkpath—usually the intercom station—to accomplish the internal path to information for the caller on the interconnect line!

Nothing is unusual about the intercom system, save its price, its reliability, and its convenience. Storecasting of sale items has been used sparingly.

Warehouses for dry goods have been a particularly healthy market for closed intercom systems. They function as the right arm of the warehouse superintendent who is respon-

sible for keeping inventory records, directing a small staff of workers, riding aisle-carts filling orders for daily shipment.

The healthcare industry which employs a number of intercom systems, seems to have been whittled down to about three or four suppliers. The suppliers devised quirks and perks within their circuit to satisfy the screechiest head nurse. There are as many variations of nurse-patient product/system mix, as there are applications, all answered by "standard" gear: pocket-pagers, LED readouts of bed/patient status, computer assisted record keeping of patients medication. Although a less complicated system, the resident/nursing home market uses a similar system.

According to some sales managers, price usually isn't a determining factor, in the private sector. However, within the semi-public and public areas (government) bidding is still required, specifications are not too clearly spelled out, and payment can take as long as six to eight months.

Much of the simplex intercom systems sales seems to remain constant, one product manager said. He found his sales...and it could be typical of this entire product area...by staying about a footstep ahead of inflation. Meaning, that sales were riding along at about a 5 to 8 percent annual increase. With little new product introduction in this sector, except for one or two suppliers, domestic and off-shore, there is little expectation among sales managers for a windfall year.

There is yet another market that is hard to follow, the institutional market. The common understanding of the institutional market covers education (secular and laity), local, state, and federal government prisons, veterans administrations, libraries, public works,

museums, and recreation centers.

While the common carrier supplies a local area network stitching these locations to a central switch (within a city hall), there are intercom systems functioning at some locations. One supplier has been "packaging" a simple master to remote station system. While other prime suppliers have concentrated system design and operation for special applications, to wit: a duplex system for the prison market only! Another is focusing on nurse/patient systems market, forsaking everything else. Still another manufacturer has forsaken the common intercom market demands to specialize in private systems for off-shore drilling rigs, oil tank farms and refineries!

The old two-track system is coming into common practice, once again. Earlier, interconnection stymied, then almost stalled completely, the sale of the complementary talk channel working along side of the phone system connected to the national telephone network. The sellers of interconnection sold the "package" of essential—and ego-features such as automatic dialing, station message recording, paging and intercom. What they did not tell the buyer was that once the phone was on intercom, interconnection was out of service!

One needed a second talkpath—usually the intercom station—to accomplish the internal path to information for the caller on the interconnect line!

It has been established, repeatedly, that almost 80 percent of the talk that goes on within any establishment's four walls, is intercommunication between persons, departments, buildings. Interconnection has its place within the scheme of an organization; but the two-track system is more than just a convenience, it is economical to own and use. It frees up the out-

side phone to receive calls.

Meanwhile, the Simplex System has been injected with increasing sales to the local banking business, credit organizations, finance, and loan companies, and particularly, the housing industry.

New construction of hi-rise buildings has been moving ahead through the Sun Belt and other areas of the nation. These buildings have been calling for intercom systems between the lobby and apartment, between apartment and parking area, and between apartment and the convenience store just off the lobby.

Additionally, the retro fit market for intercom systems has witnessed a strong comeback. Local municipalities especially older ones, have been promulgating local laws relating to intercom for protection of property, for the safety of tenants at the moment of fire or other emergencies. In New York City the current law requires that all buildings of eight or more apartments provide non-failing intercom systems for the safety of the building and the tenants.

Mail boxes have come in for their share of replacement. The federal government, earlier, had mandated a new type of mailbox and exercised control over its purchase and installation. But a hue and cry by the makers of these products, induced the government to forsake its efforts in this area. According to one large supplier of apartment house intercom/mailbox facilities, there has never been a dropping off of retro fit business in all of the metropolitan areas.

Withall, the two-track system has rebounded with a splash. To ascribe it to just the economy is to overlook the impact of interconnection. Interconnection brought variety to a staid 48-volt circuit, educating the communication systems buyer to a new world of features, some newer equipment, and the magic of the microcomputer.



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COMPUTERIZED PAGING

edited by Chris Foreman

The sound and communication systems at the new Tom Bradley International Terminal at Los Angeles Airport (LAX) are controlled by a micro-processor "brain" supplied by Innovative Electronic Design of Louisville, KY.

The LAX system controls are based around I.E.D.'s Model 500AC Announcement Control System which is described as a "multi-function professional announce system whose operations and digital processing are controlled by micro-processors." The 500AC design stresses micro-processor control of microphone station queing, and distribution of emergency messages, background music, life/safety systems, and recording announcements.

The LAX system operates very much like any conventional-zone paging system except that things like which zones can be accessed by any given microphone and which microphones have priorities are set up by software, not by hard-wire patch bays. Thus, these features can be re-programmed when needed.

In effect, this is a system whose diagram is software-controlled. All the programming for a system like LAX is contained in non-volatile bubble or E-PROM memory. If a power outage occurs, the system reprograms itself.

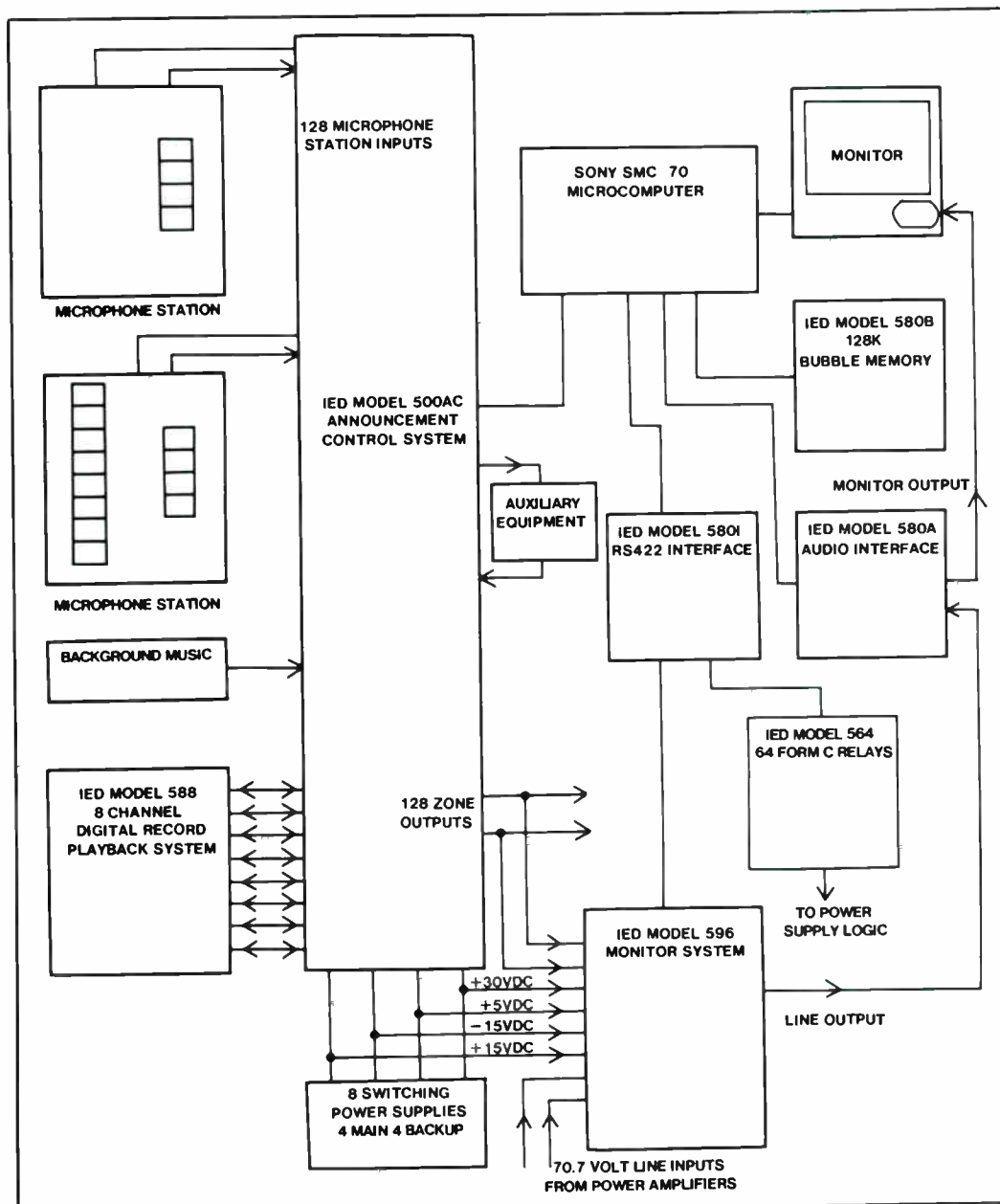
Another significant feature of the LAX system is bubble-memory storage and playback of digitally recorded audio announcements. The LAX system can store up to eight 30-second announcements

and "que" them according to priorities and according to a first-come, first-served basis. This makes it possible for an operator to make an announcement at any time, even when the system is in use for another announce-

ment. The operator's announcement will simply be recorded and will then wait its turn to be played back into whatever zone(s) the originating station had access to.

The I.E.D. system uses a

Sony SMC-70 micro-computer for its control functions. Part of the Sony's assignments include real-time fault detection and automatic switch-over to back-up systems in the event of a failure.



The diagram is representative of a typical IED 500AC system but is not necessarily accurate for the LAX system. For more information on the 500AC system contact IED at 9701 Taylorsville Road, Louisville, KY 40299; (502) 267-7436.

THEORY & APPLICATION

(continued from page 11)

In the case of active devices (amplifiers, output stages, etc.), load impedance is specified only as a means of pinning down minimum level of performance for the equipment in a standardized set of operating conditions which are generally accepted to be worst case. In

most cases, the equipment will perform better (less distortion, more headroom, etc.) without the termination. Hence, these rules:

- (1) Avoid terminating active devices (amplifiers, compressors, d.a.'s, etc.).
- (2) Terminate and build-out all passive networks, passive equalizers, and telephone lines.
- (3) Termination will

sometimes aid in the solution of interference problems (both rf and noise), and ringing in transformers.

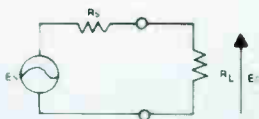
In a well-designed transformer and within the specified impedance ranges for the transformer, the loss and stray components will be small enough to ignore.

In a good line or mic level transformer, $P_{in} = P_{out}$ within

one or two dB so that the voltage ratios will be approximately as described above. As the impedance gets very far away from the design impedance of the transformer, though, the reactive components can easily take over and cause bumps in the frequency response curves or ringing in the square wave response.

APPENDIX

Maximum Power Transfer Theorem by Mike Pratts; notes by Jim Brown



In the circuit, R_L is the output load and it is desired to pick a value for R_L such that the power taken by it from the generator E_s having output resistance R_s is maximum.

Writing the equation for the

voltage across R_L :

$$E_o = E_s \times \frac{R_L}{(R_s + R_L)}$$

And the power in the load (P_o):

$$P = E_o^2 = E_s \times \frac{R_L}{R_s + R_L} \times 1 = \frac{E_s^2 \times R_L}{R_L (R_s + R_L)^2}$$

$$\frac{E_s^2 \times R_L^2}{R_L (R_s + R_L)^2}$$

$$P_o = E_s^2 \times \frac{R_L}{(R_s + R_L)^2}$$

To find the maximum power, we take the first derivative of P_o with respect to R_L and set it equal to zero. (E_s

and R_s are constants.)

$$\frac{dP_o}{dR_L} = E_s^2 \times \frac{(R_s + R_L)^2 - 2R_L(R_s + R_L)}{(R_s + R_L)^4}$$

$$R_L \times 2(R_s + R_L) = 0$$

$$E_s^2 \times (R_s + R_L) - 2R_L(R_s + R_L) = 0$$

$$R_s - R_L = 0$$

$R_s = R_L$ for maximum power output and

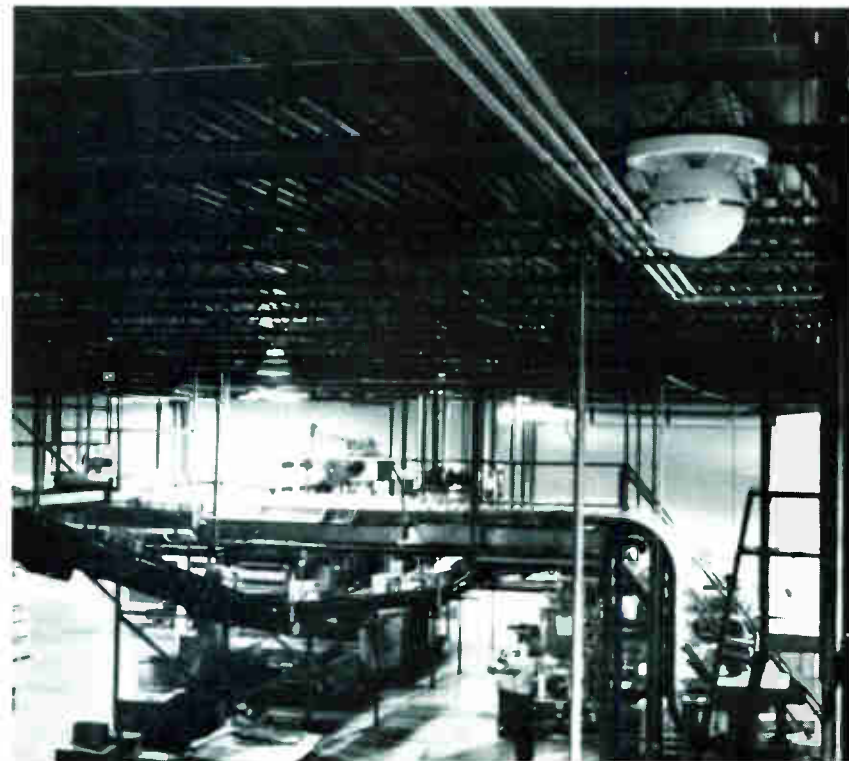
$$P_o = E_s^2 \times \frac{R_L}{(2R_L)^2} = \frac{E_s^2}{4R_L}$$

Note that an equal power is lost in R_s and that half the voltage (6 dB) of the generator

is lost in R_s (its own source impedance). This is not a particularly healthy situation in amplifiers since that R_s is mostly inside the transformer or integrated circuit and the dissipation of more audio power there is not desirable.

Note also that the 6-dB loss from $R_s = R_L$ will happen as well with passive circuits when matched and terminated. It is not uncommon to lose 6 to 12 dB in a passive equalizer or telephone line in addition to the cutting action of the filters. This is an important reason for providing for 20 dB of additional gain on amplifier inputs.

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“Everyone realized that the International Terminal was going to be the gateway to which tens-of-thousands of foreign Olympic visitors entered Los Angeles.”



A key element in Los Angeles' 1984 Olympic Program was the expansion of the Los Angeles International Airport (LAX). Over 700 million dollars was spent on the LAX airport expansion program with one absolute requirement, that it be done in time for the 1984 Olympics. The cornerstone of the airport expansion program was the addition of a new international terminal which by anyone's standard is big: a half mile long stretch of concourse going north and south from the main seven story building; six-million cubic feet of internal space designed to efficiently accommodate 19,000 passengers per day.

Los Angeles International Airport is the third busiest airport in the world, averaging over 94,000 passengers per day (34 million passengers in 1984) moving through the airport complex. Altogether LAX has eight domestic terminals and the Tom Bradley International Terminal, thus giving LAX over 100 airport gate positions, a mere 27,000 parking spaces (over 10 million cars parked at LAX in 1984) and LAX is a port of call to 70 domestic and international airlines.

Bill Schiefer, project manager with Acromedia Corporation, the Los Angeles-based contractor that installed the international terminal sound, life/safety, and security systems said, "It's officially 'The Tom Bradley International Terminal' (named after the mayor of Los Angeles), and it's big enough to handle the loading and unloading of up to eleven 747's simultaneously."

"I have seen up to four 747's unload within minutes of each other and suddenly there can be up to 1,500 people standing in line to check through customs. With a custom facility that alone contains over 125,000 square feet of room space, and having 70 Customs Examination Stations, and eight baggage claim belt systems, the U.S. Customs people have the ability to handle up to 2,600 passengers per hour. The customs facility contains the latest in security and detection facilities and since most of the visitors are from foreign countries, both the flight information display system and the sound system are designed to give information in multiple languages," Schiefer said.

*by Richard Negus, Purcell Noppe and Bill Schiefer, Acromedia
Written and Edited by Dave Bryan*



Bill Schiefer (left) talks with Tom Kinley (right) of L.A.'s Fire Department.

Richard Negus of Purcell Noppe, the consultant who designed the sound system said, "The terminal is big. The main building alone is large enough to contain three football fields laid out side by side."

Both men agree the sound system for the terminal paging is entirely different from any of their other projects. According to Negus, "The architect was Pereira, Sworsky, Sinclair, and Williams, who specified the sound system had to be a quality system, sound reasonably natural, and they wanted to keep the number of loudspeakers to a minimum. They didn't hold us to a number, they just wanted us to try to minimize the quantity and specify only what we believed to be necessary. I think the assemblies we used resulted in about *half* the number of loudspeakers that would have otherwise been necessary."

The design used constant directivity horns, pointed straight down to flood the departure level of the main building's public areas. In the concourses and other low-ceiling areas, custom assemblies of "woofertweeter" speakers are employed to achieve the frequency response and the wide-angular coverage required.

In the main building, the vertical horns are JBL model 2365 with model 2445 drivers. In the lower ceiling concourses, arrival halls, and baggage areas, the loudspeaker assemblies are a combination of a four-inch transducer, JBL model 8110, together with the model 034 tweeter. The tweeters have one-inch domes for wide-angular coverage. Each pair, the domed tweeter with its companion four-inch loudspeaker, is mounted in a custom Acromedia enclosure in which both elements are acoustically separate; a crossover network and transformer for the 70-volt drive complete the package.

Negus explained, "The combination in the custom housing gives at least 120 degrees of coverage (that's 60 degrees off the transducer axis) to the six dB down contour, from 100 Hz to 6,000 Hz. We needed the overall frequency response to handle the consonants, particularly the sounds of c, s, and t. They're essential for intelligibility. We needed the wide-angle dispersion in low ceiling areas to minimize the quantity of loudspeakers used, and to maximize the spacing between them. At the lower frequencies the four-inch loudspeaker does the

work, but at around 3,000 Hz its pattern narrows down to about 100 degrees necessitating a crossover to the one-inch domed tweeter which maintains the polar response out to 6 kHz so that it's no more than six dB at 120 degrees."

"The pair in the box are acoustically separate. The low frequency speaker is a port loaded system in combination with a tweeter, but I've never seen such a combination used before in a distributed airport sound system application.

"I specified standard off-the-shelf components in a rather unusual application. I don't know of anyone in the sound reinforcement business who has used one-inch domed tweeters for the radiation of high frequency sound in a distributed system like we have here. The components are expensive, but since only half as many were used as compared to more conventional systems, one method isn't more expensive than the other, and there was a labor savings too, aside from the higher quality sound that resulted," Schiefer said.

The vertical horns in the main building are uniformly 40 feet above the floor, and give a frequency response from 300 to 6,000 Hz, with a well-defined sound "foot print" of 25 by 40 feet at the five-foot ear plane. Each horn is enclosed in a 64-cubic-foot enclosure painted to match the interior design and suspended by two-inch diameter steel tubes. Why such a rugged suspension system? California is earthquake country, and each horn assembly is estimated to weigh about 150 pounds.

According to Negus, "There are 117 horns in the main building, plus something like 2,000 of the four-inch loudspeaker and domed tweeter assemblies in the rest of the structure. As a person walks along under the horns, the sound pressure level variation is only three or four decibels, and that's comfortably within normal limits of acceptability. It sounds constant regardless of whether a listener is under a horn or midway between two horns. For the loudspeaker-tweeter assemblies, there's about an eight dB variation in the perceived sound pressure level as someone walks along under them. This variation is certainly perceptible, but again acceptable for the specified usage.

Visitors looking around inside the main building or even the concourses,

are struck by the amount of window glass, the terrazzo floor, and the vast size of it all. Asked about the reverberation time, Negus replied, "It was designed to be three seconds maximum above 250 Hz. Jack Purcell was in charge of the building's acoustical design and we cooperated on it. Naturally, if we could have reduced reverberation time to one-and-one-half to two seconds, it would have been better, but that has tremendous implications in that finished specified by the architect would have had to be changed.

"However, there were aspects of the sound system that were of considerable help to us. Automatic level control of each microphone maintains the loudness level of each announcement more or less constant and comfortably above the ambient noise level. And as we weren't concerned with music reproduction, the long reverberation time at low frequencies (below 250 Hz) caused minimal problems. Outside jet engine noise was largely eliminated by the acoustical design of the building: there aren't any windows that open directly to where the jet engine noise would be high. The windows open into shielded areas such as to sides away from the aircraft. Actually, most of the noise is generated by people inside the building."

Negus prides himself on writing complete specifications. He speaks of the various bidders for the job. "All bids from qualified firms were given serious consideration, and they were qualified by having installed somewhat similar projects in the past. Acromedia's bid wasn't the lowest, but it was about right, considering what they had going into the project, plus they had outstanding experience in constructing complex airport sound systems throughout the world."

The design of the positioning of the horns and loudspeakers was "mostly a lot of simple things," said Negus. "I worked out the problems for various ceiling heights, specified standard components, and that was about it." Concerning wall reflections and resulting interference, Negus said, "Those reflections and the resulting interference with direct radiation is a fact of life."

"Interference of this kind in audio from 20 to 20,000 Hz exists over very narrow regions, of limited bandwidths, so it doesn't appreciably affect intelligibility in speech systems."

In reference to the use of wall loudspeakers, Negus said, "A wall speaker would act like an *active* reflection, there would be all sorts of additive and destructive combinations resulting—like the output of a comb filter. So I have to ignore wall reflections because there's really nothing I can do about them. Naturally, if I had a choice, I'd make the wall more sound absorbent for lots of reasons, but..."

Were the components tested prior to the overall design work? "No, there wasn't any need. Everything was standard theory, the components were stock items, and afterwards everything did check out as we expected," Negus said.

The brains of the control in the sound system is the model 500 processor built by Innovative Electronics Devices (I.E.D.) of Louisville, KY. Amazingly, when Negus specified the performance of the processor, he didn't actually know if anyone had manufactured such a unit. According to Negus, there wasn't anything difficult about it. It solved a lot of problems peculiar to large airport sound systems.

He was right on both counts about

I.E.D.'s model 500, it was the first of this type they had made and to date there have not been any major problems.

"The processor is a routing, storage, and call transmission device; it also reports on the status of individual calls and on the performance of components in the system—with the exception of the power amplifiers," Negus explained. "There's a computer in the processor controlling everything, and its programmable by authorized people who know the system well."

The processor functions whenever a call is made, the signal from the microphone preamplifier/limiter is sampled at about 16,000 Hz, digitized into bits which are stored in a bubble memory—a type of RAM. Eight speech calls of up to 40 seconds each can be stored. If a person picks up a microphone and starts to make a call when the processor has already stored eight calls, he or she will see a busy light on their microphone's panel. "But that hasn't happened yet in normal operation that I know of," Negus said.

After the caller has said the message, he can push a "send" button to direct



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the processor to transmit the message. This involves retrieving the digitized speech samples and converting them back into an audio signal, if the "send" button is not pressed or if a decision is made automatically to change the message, the message is automatically erased from memory after about five-seconds. If someone picks up a microphone, pushes the push-to-talk button, but then holds the microphone while doing something else, the call is cancelled.

Demonstrating paging at the airport Schiefer put through an announcement, then waited for the processor to broadcast it. First, there was a three-note musical chime signal, then came the message after a few seconds. The chime precedes the message to alert people to listen—unless, there had been another message broadcasted seconds before.

When things get busy—the situation when many of the 64 microphones are in use at about the same time—up to eight messages are stored and later presented in the original calling sequence. It is a normal queuing operation that customers calling for reservations on the telephone run into all the time.

Although the call-directing functions of the processor can be changed by authorized personnel, or by those who know the password needed for computer entry, the present program limits the coverage of some microphones only to certain areas. For instance, baggage type information is limited to loudspeakers in the baggage areas. Other microphones are universal and their output is broadcasted everywhere. The microphones in the main lobby, and those at the information booths, broadcast everywhere. They also can be used by the Los Angeles Fire Department in an emergency.

Processor displays on a color television screen, the status of calls, reports on defective equipment.

Conventional magnetic tape recorders weren't used to record and store paging calls because, according to Negus, tapes and tape recorders tend to wear out and break down, but the sample-digitize-store in RAM type memory, retrieve, reconstruct, and play back processor has no memory parts and consequently has practically unlimited life by comparison. Although more expensive, the processor will earn its higher price by re-

quiring far less maintenance.

The life/safety system is autonomous from the sound system. "The life/safety system is complex by anyone's standards. For example, there are almost 500 initiating circuits with devices, such as heat, smoke, water pressure, manual fire stations, door access detectors, etc. All of this input data are transmitted to several control stations where a battery of computers notify and log all events around the clock," Schiefer said. The only problem Negus had was finding a high quality microphone that is sufficiently rugged for general use at the airport.

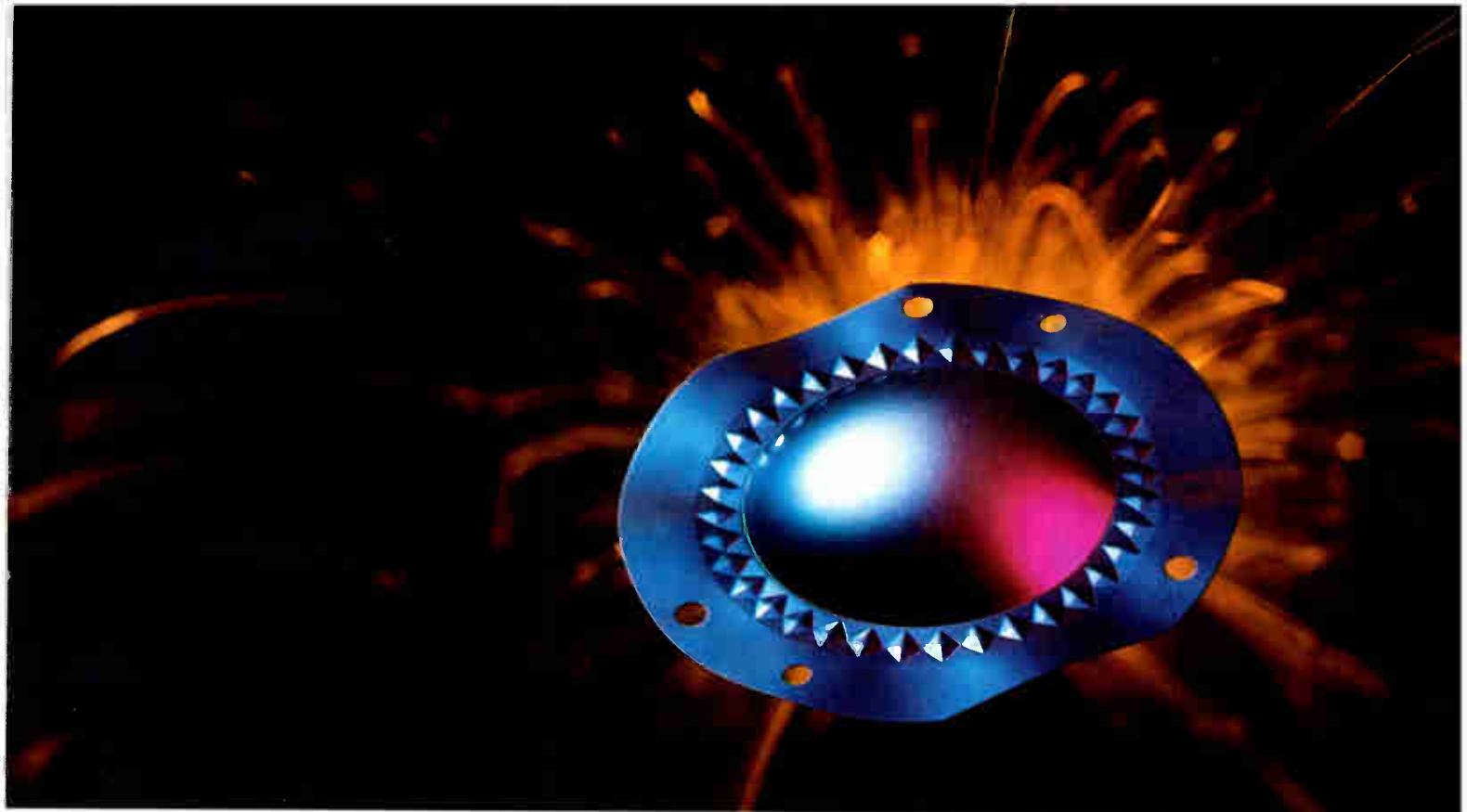
Each paging station has a keyboard, an address module, a speech compressor, and a driver to feed the remote processor. The compressor keeps the signal output constant so that listeners always hear the same sound level regardless of how loudly or softly the person speaks into his microphone.

In addition to the microphone station compressor's function, there are other variable gain control devices located in the equipment room. These adjust the average gain of a microphone channel according to the noise level in the area covered. This helps to maintain a constant signal-to-noise ratio at all times within an ambient noise range of 12 dB. A greater range would have required additional

(continued on page 22)



I.E.D.'s Announcement System



JBL's unique titanium diaphragm and "Diamond Surround" bring new purity and consistency to high frequency response

IT TOOK JBL SCIENCE, A NITROGEN EXPLOSION, AND PURE TITANIUM TO GIVE YOU PERFECTED HIGH FREQUENCY SOUND.

High frequency sound has always fought with the technology that brings it to the ear. The driver diaphragm has been most vulnerable, pushed to the breaking point, unable to hold uniform frequency response.

JBL scientists decided to fight back. They exploded nitrogen into a remarkable metal, pure titanium, encircling their unique diaphragm with a vibration-absorbing "Diamond Surround," so revolutionary it warranted its own patent.

The result? A diaphragm that delivers and sustains a power and purity to high frequency response never before approached in the industry.

Perfecting titanium technology is just one of innumerable ways in which JBL science is re-shaping the quality of sound. From small clubs to auditoriums to the largest arenas, JBL speaker systems deliver your sound to every listener with outstanding force and clarity. To find out which system is designed to meet your specific requirements, contact your authorized JBL professional products dealer today.



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JBL, harman international JBL INCORPORATED 1984

Reader Service #210

Airport Sound

(continued from page 20)

audio power than was considered practical. "That circuit is our 'resident engineer,'" said Schiefer, "and it's entirely automatic." During busy times in the day, the terminal building is crowded with thousands of people, while in the morning hours the place is almost deserted. "These changing crowds alter the noise in here," Schiefer said "so the gain is changed to help out."

Negus said the system includes extra features that were added by Acromedia and Innovative Electronics Devices. It's always a pleasure to work with understanding professionals. "A lot of people were involved, but primarily Andrew Ferreghy directed the engineering team, and Robert Myers directed the shop and field operation team. A special tip of the old construction hard-hat must be given to Bob Patrick, Stan Ames, Don Davis, and Roberto Lucha who did a magnificent job of engineering/commissioning, and to Jim Fanning and Nick Taylor and their teams for their dedication in get-

ting it built on schedule.

"We are providing around-the-clock service for the first year, naturally, and after that we expect that LAX will want us to continue to maintain the systems for them," Schiefer said.

A roomful of seven-foot-high electronic racks—26 in all—accommodate the life-safety system equipment. Each rack is loaded with equipment both front and rear—the equivalent of 52 racks of equipment. Special care was given to the ventilation and cooling of life/safety electronics due to the concentration of equipment. In another room, directly below are 20 additional racks in which are located the sound system power amplifiers, processor, and one-third octave equalizers. "If any of the life/safety or most of the sound system equipment fails, a signal is instantly sent to a LAX manned control room," Schiefer said. "They call for maintenance service or the fire department, or both depending."

Each loudspeaker or horn line is driven by two power amplifiers in electrical parallel through an isolation circuit (Altec's Sequor), so that if either fails it won't load the other amplifier—

which will continue to drive the loudspeakers and horns but at a reduced level of six dB. The redundant system provides enough power in either amplifier that listeners can easily hear the call. For the same reason, the system operates with two independent processors; either one can function on its own if the other fails.

The sound system amplifiers, each capable of putting out 100 or 200 watts per channel are made by B.G.W. in Hawthorne, CA. Twenty-five dual 100 watt and 16 dual 200 watt per channel amplifiers were used for a total sound system output power capability of 11,400 watts (RMS).

Each amplifier drives a group of horns or loudspeakers through twisted pair inside metallic conduits, with the longest run being one-quarter mile. Separate metallic conduits are used for page station lines and amplifier outputs. The sound and life/safety systems required Acromedia technicians to install over two million feet of cable, which is more than the distance from Los Angeles to San Francisco.

White Instruments manufactured the third-octave equalizers, 29 units were used, all of which are passive type; UREI, now a division of JBL, provided the automatic level controllers—18 units.

The life/safety system comprises 180 output circuits and utilizes 110 individual power amplifiers. The life/safety system equipment was manufactured by the Edwards Company.

"We fabricated and tested all systems in our shop facilities in a manner which duplicated field conditions, so there weren't any major problems," Schiefer said. "I've been in this business 30 years and considering the complexity and the time schedule of the project, I have never seen anything like it.

"Actually the only major problem was that the terminal building was one of those unusual structures which really didn't fit under the existing life/safety codes. The building was designed and approved under one series of codes, but as the construction progressed the Los Angeles Fire Department requested an upgrading to the most stringent of the most current life/safety codes. As a result, six months before the building was due to be completed, we had to add many additional smoke detectors, fire alarm stations, thousands of additional Atlas Model VT-Series (U.L. approved)

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The job of a good lavalier microphone is to be heard and not seen. So we're introducing the new MKE 2 micro-miniature electret lavalier mic—our smallest ever. It comes with a variety of clothing attachments and can even be taped to the wearer's skin. So whether your talent is fully costumed for an epic or scantily clad, they'll hardly know it's there.

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Reader Service #211

life/safety speakers, and generally reconstruct the complete life/safety system. Once again the bottom line was that these changes must be done on time for the '84 Olympics. We had to work a two-shift operation, but when the project was done everyone at Acromedia had felt that they contributed to the success of the '84 games at Los Angeles," Schiefer said.

"A lot of companies and good people were involved in this project, but we managed it all very neatly by simply communicating with each other, Schiefer added. "Our continual series of 6 a.m. working-breakfast meetings for two years paid dividends. I have never seen such a high degree of cooperative effort before. "Maybe it was the Olympic spirit, but working with professionals like Jim Manning, director of construction for William L. Pereira & Associates, and Bill Wind, project manager for Warner Electric, Inc., made the difference. Those breakfast meetings and the daily site coordination meetings eliminated the bulk of the problems before they had a chance to get complicated. Everyone realized that the International Terminal was going to be the gateway to which tens of thousands of foreign Olympic visitors entered Los Angeles. It may sound hokey, but everyone in Acromedia has a great deal of pride in giving to Los Angeles and the '84 Olympics an international terminal building which represented the best in American construction."

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If you have an opinion or idea about anything in the electro-acoustic or telecommunication industry, write to us and let us know. We would be glad to publish as many letters as we can, in our Letters & Opinions column.

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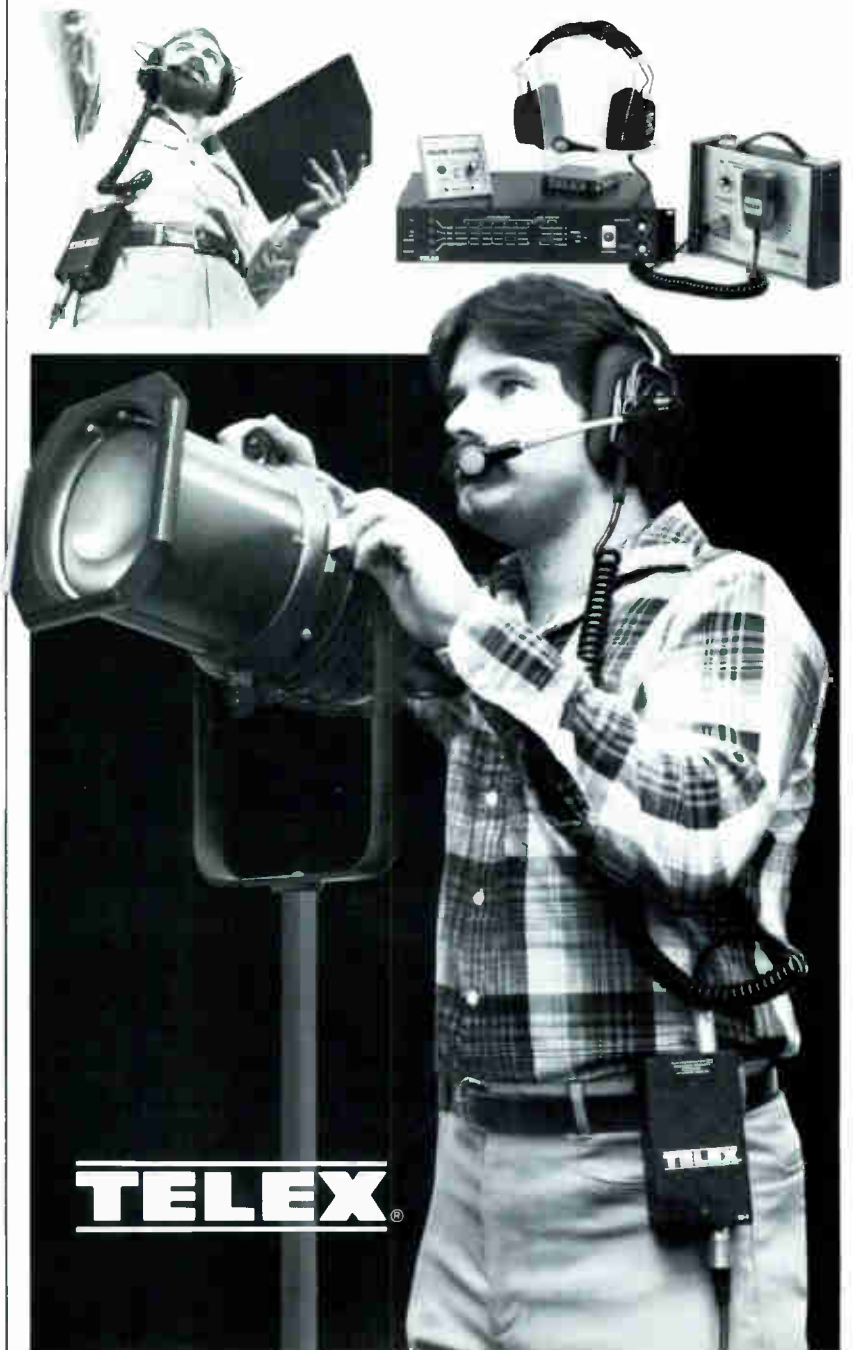
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Reader Service #213



Pay Phone Deregulation

WILL IT PAY OFF?

by Nancy Peterson

On June 15, 1984, the Federal Communications Commission (FCC) gave permission for the private sale and ownership of pay telephone equipment, with the requirement that each state establish its own rules and guidelines for the operation and service of the pay phones.

So far, approximately 12 states, including New York, Minnesota, and Pennsylvania, have set those rules, about 30 more states' rulings are pending. Some pay phone manufacturers have forecasted that within one year, almost all of the 50 states will have finalized their guidelines. And with good reason—there is money to be made.

Last year, AT&T earned an estimated \$890 million in revenues from the over 1.5-million pay phone stations in the U.S., an average of \$565 per phone. This is significant since it is predicted that many of the privately owned and operated pay phones will be replacing many of the AT&T phones. Industry analysts have also predicted that by the end of 1985, one out of four pay phones will be privately owned or leased.

The Wall Street Journal estimated the pay phone industry at \$4 billion. Two months prior to the FCC ruling, a Washington-based management consulting firm, The Partridge Group said in *The New York Times* (3/27/84),

that pay telephones will be "the most promising investment opportunity in the telecommunications field for the next decade...pay telephones will become what juke boxes were in the '60s and video arcades were in the '70s."

So, where do you sign up?

First, you're probably not going to make your fortune by owning or leasing pay phones, but you will earn upwards of 20 percent more than what AT&T has to offer. AT&T pays about 4 to 6 percent profit to anyone who lets them install and operate an AT&T phone on their property. But that's after the first \$75, it's called "cap" under the AT&T system or the mini-

imum amount required before a percentage can be taken. Most private companies offer 20 to 25 percent in a vend (location lease) situation, with the option to buy the phone on-time, or you can buy the phone outright.

The pay phones cost anywhere from \$1,000 to \$3,000, depending on the unit. At present, there are three types of pay phones available; post-pay, pre-pay, and pre-pay with answer suppression.

Post-pay phones require the caller to deposit coins *after* the call is answered. When the time is up, a tone sounds, there is no operator. Also, there is no refund if no one answers or if there is a busy signal and the caller deposited the money prior to dialing.

With the pre-pay phone, the coin is deposited *before* the number is dialed and there is a button to push for the caller to start talking.

Many post-pay and pre-pay phones are incapable of calculating the cost of a call and will accept the 25 cents deposited and put the caller through to the next town, across the state, or across the country. And the owner of the phone ends up paying for the remaining cost of the call.



Tele-Rand™ Pay Phone

The pre-pay phone with answer suppression, although the most expensive unit, can calculate the cost of the call, which will probably pay-off in the long run. With this unit, the caller deposits the money before dialing. If the proper amount is not deposited by the caller, the second party will not be able to hear the caller's voice.

Many of the states' Public Utility Commissions (PUC) are requiring pay

phone companies to manufacture phones which resemble those used by AT&T. Therefore, many of the companies are improving the units to look and function like a pay telephone manufactured by Northwestern Electric, the company that makes AT&T's pay phones. One such company is Rand of Phoenix, AZ. According to Neil McQueen, Rand's advertising and marketing coordinator, the Rand pay phone "functions like a Bell pay phone, the pay phone you've been using for years."

Rand's "comprehensive" pre-pay phone features such items as synthesized voice, from an on-board computer that generates a female voice to give calling instructions.

"A synthesized voice unit, which is inside each of the phones, sounds like a real operator and tells the caller how much money is needed to make the call," McQueen said.

The Rand phone also accepts nickels, dimes, and quarters, which is required by many states' PUC. The phone, by use of special computerized circuitry, can also function independently of a Bell operator, and has full-coin return if a call is not answered or if the line is busy.

Until recently, the focus of Rand of Phoenix had been the production of coin-operated air, water, and vacuum systems. With the break-up of the Bell system and the subsequent deregulation of local phone companies, Rand recognized the tremendous potential of the privately-owned pay phone industry. Focusing their interests on the need for an independently functional, coin-operated telephone, Rand developed and manufactured the Tele-Rand,™ which has since become the emphasis of the company.

Rand offers a comprehensive in-service program for all distributor and dealer outlets. The program is to aid the vendors with marketing and service standards for the merchandising of the Tele-Rand.™

Centcomm Communications of Farmingdale, NY, distributor of the Rand pay phone, sells the unit for \$2,995. Centcomm, like many private pay phone distributors, also offers various purchasing plans. And they will sell the units at a discounted price, if bought in bulk.

"You can buy the phone right out, or buy it on time, over a three-year period," Leisa Singer, national marketing director at Centcomm, said.

Start making cents...

The amount you receive for every dollar that the pay phone takes in; with an AT&T-owned pay phone, a vend/lease, and if you own the phone.



MA BELL

YOU

.02¢



VEND

.20¢



OWN

.36¢

**based on a 1983 FCC survey*

"Or we will just lease space from you, which is called a 'vend', and pay you a commission which is larger than that paid by Bell."

Centcomm also offers courses on service and maintenance of the pay phones.

Gladwin Telephones of Oakwood, GA, manufactures three variations of a post-pay phone; local measured and coinless long distance (long distance must be credit card, collect, or third party), local measured only, and local and long distance measured which is

compatible with OCC and PBX systems.

Gladwin's Carefree™ coin telephone is said to incrementally time telephone calls and apply selectable rates. And the electronic coin totalizer can be read remotely via a DTMF digit analyzer. The Gladwin phone can also be programmed to allow or deny incoming calls.

Gladwin also makes an emergency coinless telephone which is equipped with a single number autodialer that

(continued on page 30)

Charge-it!

The deregulation of pay phones, which opened-up the pay telephone market, also opened the market for credit-card telephones.

National Pay Telephone of Los Angeles, CA, has already started to infiltrate the market which accumulates most of its dollars from long distance calls.

Naitonal Pay Telephone markets and distributes credit-card telephones that don't require the caller to punch in "time-consuming" credit-card numbers and then punch-in the phone number. With a National Pay telephone, the caller just has to run his national credit card, such as Visa, American Express, or MasterCard, through a magnetic strip and the phone automatically registers the credit-card number. The caller later is billed for the calls on his regular monthly credit-card bill.

The company plans to locate their phones in truck stops, airports, and select hotels and restaurants across the country, anyplace in which you would find a large number of business travelers, according to Sandy Eddy of National Pay Telephone.

Founded in 1983, National Pay Telephone is the first publicly-held independent pay telephone services company. The company installed their first long-distance credit-card telephone system in Nevada in December 1984.

The system, which was installed in Nevada, is a computerized, activated system which is identical to that which was introduced by Pacific Bell for the 1984 Olympic Games.

The system permits the user to charge phone calls on five major credit

cards (American Express, Carte Blanche, Diner's Club, MasterCard, and Visa) and can handle up to 150 phones at multiple locations. It can also be expanded, with additional hardware, to serve up to 1,000 phones.

The system differs substantially from AT&T's card-calling system in that it is not necessary to dial any digits. The caller runs a credit card through a magnetic strip and the computers and switches in the company's facility automatically allows one to dial anywhere in the world. The system handles the billing, sending the calls out into the telephone network.

The system also assists the caller in five languages and allows direct dialing without the use of numeral "1" or any other access number in order to dial.

According to National Pay Telephone, the pay telephone industry is probably one of the few industries that has emerged in the last decade whose potential is almost unlimited.

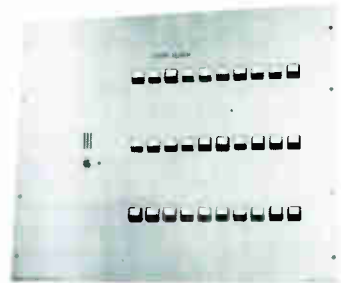
Installations of National Pay telephones include the MGM Grand Hotel, the Blue Diamond Truck Stop, the California Club, Castaways, Circus Circus, Showboat, Landmark, and Hughes Air Terminal in Nevada.

Recently, the company has expanded its office to locations in Chicago, IL, south Florida, and New York.

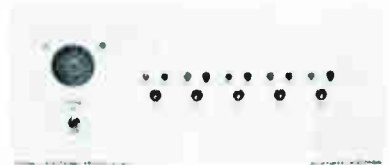
The company's president, Ross B. Scheer, has an extensive background in telephone, vending, and gaming machine experience, having served 12 years as director of marketing for Bally manufacturing.

The company sees the continuing deregulation of pay telephone service as an opportunity to aggressively market new but existing telephone technology to a vast existing market, as well as to new markets.

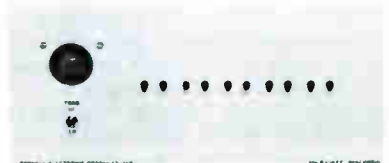
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Start with the basics. Six input channels, not four like most "portable studios." And any input can be routed to any tape track. Record in compatible stereo at normal speed. Or on any combination of 1 to 4 tracks (from any other combination when dubbing) at double speed. With Dolby* B or C noise reduction. And punch-in/punch-out on any track. Even vary



speed $\pm 15\%$ to match instrument pitch exactly.

All of the above and more makes the AT-RMX64 a very impressive cassette recorder. But the mixer section is even more remarkable...not only as an input to the tape, but as a free-standing mixer on its own. Every input accepts balanced or unbalanced mike or line signals with 60 dB of available attenuation,

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Grow with it!



frequencies.

Or select a high pass filter for the bass and shelving of the highs up or down. That's truly impressive flexibility. And send any input to any sub output and/or tape channel. Add signal processing from two return channels. Pan between channels 1 and 2 if desired. Or monitor any combination of channels with the solo bus. Create both a PA mix and a monitor mix and also record the output...all at once.

The AT-RMX64 feeds amps at +4 dBm, not -10 dBm like the "little" mixer/tape recorders. With up to +18 dBm before clipping so

that all the power

in the amps is available.

In short, every basic feature needed for the corporate, institutional, and performance markets. Yet the AT-RMX64 is so easy to use even a beginner can benefit from its almost intuitive design.

And as mixing and recording talent becomes more sophisticated, the AT-RMX64 design grows with the user. Both as a "live" mixer and a full-feature recorder. Indeed, the more you know, the more the AT-RMX64 has to offer.

Specify the recorder/mixer that takes your clients all the way to the top! Ask your A-T rep to show you the AT-RMX64, or write or call for more information today.



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Reader Service #215

Teleconferencing and Telecommunications

Recently, Sound & Communication's editorial director, Chris Foreman, attended two of the telecommunication industry's smaller shows, the Tri-State Telecommunication Exhibition in Pittsburgh, PA, and the Global Teleconferencing Symposium, sponsored by AT&T. Foreman tells his impressions of the shows, the products exhibited at the shows, and of trade shows in general.

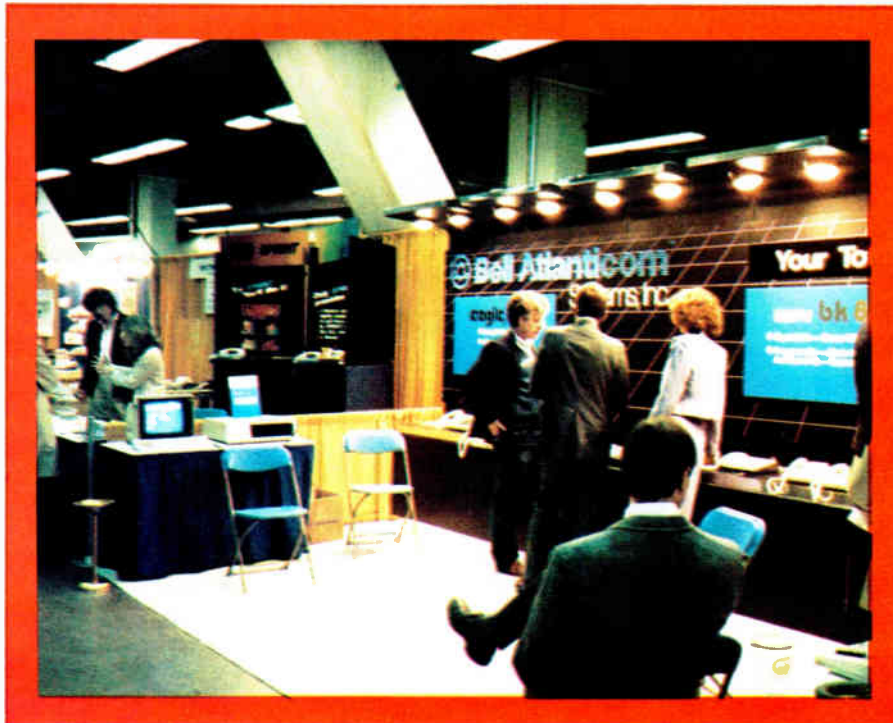
Tri-State Telecommunication Exhibition

Sponsored by the Pittsburgh-based Tri-State Telecommunications Managers' Association, the show is a regional get-together from western Pennsylvania, eastern Ohio, and northern West Virginia.

The Tri-State show is the best kept secret in Pittsburgh. But, at the recent exhibition, very few buyers showed up. The vendor turn-out, on the other hand, was great. All but a couple of booths were filled and the exhibition was as large as some national shows.

The exhibition was well planned by a show management group, Shea Management. There were several manufacturer-sponsored educational seminars and a lot of free-prize drawings. The show was held in Pittsburgh's Civic Arena, a fairly central site with reasonable access either by car or on foot from downtown Pittsburgh.

So what was the problem? Almost no advertising! I talked with the president of the association who told me that the advertising budget was only about \$5,500.



“The Tri-State show is one of the best kept secrets in Pittsburgh. . . . all but a couple of booths were filled and the show was as large as some national shows.”



Bell Atlanticom (p. 32) is displaying its various phone systems to prospective dealers.

Muzak (top, right), known for its background music services, makes a showing with its telecommunication products.

MCI (middle, right), one of the fastest growing telecommunication companies in the industry (rated 21 in Venture magazine's top 100 entrepreneurial companies) is among the most successful with a 29 percent increase in sales in 1984.

Omnifax (bottom, right) exhibiting its latest in teleconferencing products at the Tri-State show.



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Telex PH Series marries these two advantages to exceed even the toughest industrial requirements!

- Dynamic receivers resist mechanical shock, moisture and temperature extremes.
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- Soft polyurethane cushion covers are resistant to temperature and ultra-violet extremes.
- Long-life superflex cable with strain relief.
- Vinyl covered, stainless steel split headband.
- Stainless steel adjustable yoke assemblies.
- Field replaceable dynamic mike and earphone elements save time and money.

Tough PH Series designed for user comfort

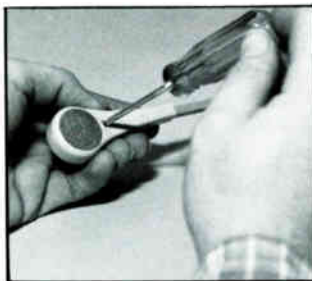
- Perfect clamping pressure for day-long use.
- Soft foam pads on headband and earcups.
- Washable nylon earphone socks.
- Headband has air vents to keep head cool.
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- Mike boom rotates for right or left side useage.

Ask about our wide variety of models

- Dual/single sided.
- Dynamic/carbon mikes.
- Binaural/monaural earphones.
- With/without in-line push-to-talk switch.



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Anybody who's ever tried to place prime-time radio spots or put ads in the business section of a major metropolitan newspaper knows that \$5,500 won't buy much exposure.

In addition, I guess I am sold on the whole idea of trade show marketing. Done right, trade shows are one of the most effective forms of lead generation and client contact. There's nothing like sitting in one place and having a large group of qualified prospects walk right up to you. In addition, I believe in the idea of regional trade shows like the one in Pittsburgh.

Yet, my experience in Pittsburgh, shows how important show management is to the success of these ventures. As a vendor, I learned a lesson. Don't just ask how much booth space costs or what other vendors will be there. Find out who's managing the show, what kinds of tugs (like seminars) will be used to pull in buyers, what the attendance was like last year and what type and amount of advertising will be done this year.

Global Teleconferencing

For the second year, the Global Teleconferencing Symposium was held in Washington, D.C. It was a small show, teleconferencing is a small business, and all the exhibitors were almost all teleconferencing manufacturers with a few system integrators.

"System integrator" is a term borrowed from the computer business that refers to a contractor who designs and installs teleconference systems.

One of the most interest-generating items at the teleconferencing symposium was the video "motion codecs". A motion codec is a rack full of complex electronics that digitizes a moving picture from a video camera and then compresses the resulting digital data so that it can be transmitted over a limited data rate transmission line. GEC McMichael and NEC America showed their current 1.5 megabit ("T1") codecs and Widcom, a fairly new California company, showed its 56 kilobit motion codec. Widcom's codec is the one that will make real "picturephone" service possible as soon as AT&T's switched 56 service is a reality.

Colorado Video showed its freeze-frame system which transmits still video "snapshots" over conventional telephone lines. They now have one which plugs into an IBM PC for storage and menu-driven selections.

Several PC-based graphic systems

were also exhibited. Most PC graphic packages are stand-alone and are made for fun or for drafting or some other in-house application. The packages at the Global show were designed for communication. They are communicating electronic blackboards, in a sense, and use PC graphics to enhance human-to-human communications at a distance.

Teleconferencing Systems International showed its Teletek Wireless Speakerphone. Several companies showed telephone bridges. Darome had a booth to sell its bridge and its bridging service. A telephone bridge is a device that enables conference calling (multi-site hookups). A bridging service is a private company that offers the same kind of operator-assisted conference calls you would get by calling the AT&T operator.

The Global show was about twice as big this year as last. That still makes it small. About a third the floor space of NSCA, if you were in Orlando, FL. Yet the customer base keeps growing, more people have decided teleconferencing really does pay off.

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The DM 1900 is available at select Numark Professional Products Division Dealers. **Suggested retail \$615.00.**

For more information about the DM 1900 or Numark's complete line of professional products, please write or call Paul Friedman, National Sales Manager.

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THE PEAVEY DECA 700 DIGITAL POWER AMP

By Farrell Becker

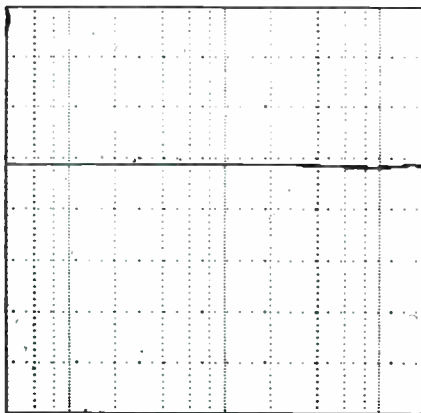
When I was asked to review a new "digital" amplifier, I thought to myself, "Here we go with another digital gimmick." After all, why convert an analog signal to a digital format for the sole purpose of amplification, only to convert it back to analog again? After talking with Skip Taylor at Peavey, I found that the DECA 700 power amplifier is actually an attempt by Peavey to create a more efficient amplifier.

DECA stands for Digital Energy Conversion Amplifier. The amplifier operates by sampling the incoming audio signal (at a respectable rate of 500 kHz). The digitized levels are then used to control a digital output stage. This stage is digital in the sense that the output devices are always either fully-on or fully-off. The output stage supplies current pulses from the power supply, the width of which are a function of the digitized audio level. Out-

put filtering completes the digital to analog process. The point of all of this is an output stage that is said to be 90 percent efficient, with reduced power-dissipation and cooler operation.

The two-channel amplifier occupies 3.5 inches of rack space with a depth of 13.5 inches and a weight of 26 pounds. An input attenuator for each channel is available on the front panel along with the power switch. Front-panel indicators for each channel in-

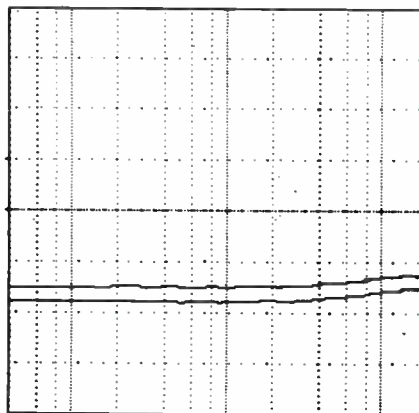
Figure 1



Log Frequency

Vertical: 3 dB/div with base of display at 48.1 dB; 0 dB is located at 8 ohm
Horizontal: Auto 0.00 Hz to 19998.10 Hz; Log freq axis (2.7 decades)
Resolution: 1.5987E+02 feet and 7.0684E+00 Hz
Time of test: 0 microseconds, 0.0000E+00 feet
Sweep Rate and Bandwidth: 49.96 Hz/Sec and 7.0684E+00 Hz
Input configuration: Channel 1 non-inverting with 24 dB of input gain and 15 dB of IF gain
Remarks: CHANNEL A... Un-balanced Input

Mag. vs Hz (EFC) of Input Impedance
Figure 2

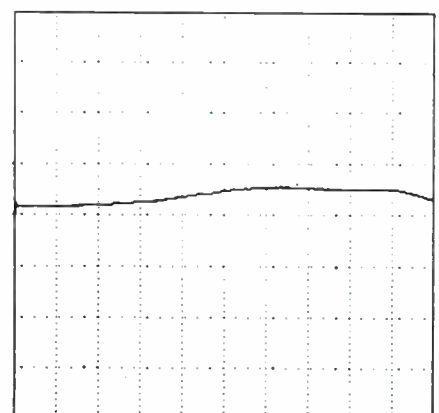


Log Frequency

Vertical: 6 dB/div; Differenced data
Horizontal: Auto 0.00 Hz to 19998.10 Hz Log freq axis (2.7 decades)
Resolution: 1.5987E+02 feet and 7.0684E+00 Hz
Time of test: 0 microseconds; 0.0000E+00 feet
Sweep Rate & Bandwidth: 49.96 Hz/sec and 7.0684E+00 Hz
Input configuration: Channel 1 balanced with 42 dB of input gain and 12 dB of IF gain
Remarks: CHANNEL A... Balanced Input

Mag. vs Hz (EFC)

Figure 3



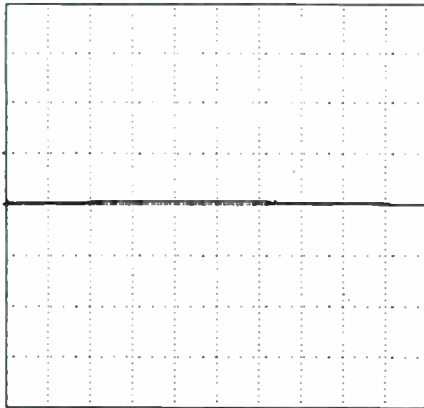
Frequency

Vertical: 3 dB/div with base of display at 16.4 dB; 0 dB is located at 1 V
Horizontal: Auto 0.00 Hz to 31699.70 Hz; scale: 8867.02 Hz/inch or 3412.21 Hz/cm
Resolution: 1.3036E+01 feet and 8.6687E+01 Hz
Time of test: 10 microseconds; 0.1130E-01 feet
Sweep Rate & Bandwidth: 7514.33 Hz/sec and 8.6687E+01 Hz
Input configuration: Channel 1 balanced with 30 dB of input gain and 9 dB of IF gain
Remarks: CHANNEL A... 1 V input... 4 ohm load



Phase vs Hz (EFC)

Figure 4



Frequency

Vertical: 45 degrees/div.; 0 degrees is at the dashed horizontal line

Horizontal: Auto 0.00 Hz to 31699.70 Hz; scale: 8667.02 Hz/inch or 3412.21 Hz/cm

Resolution: 1.3036E+01 feet and 8.6687E+01 Hz

Time of test: 10 microseconds; 0.1130E-01 feet

Sweep Rate & Bandwidth: 7514.33 Hz/sec and 8.6687E+01 Hz

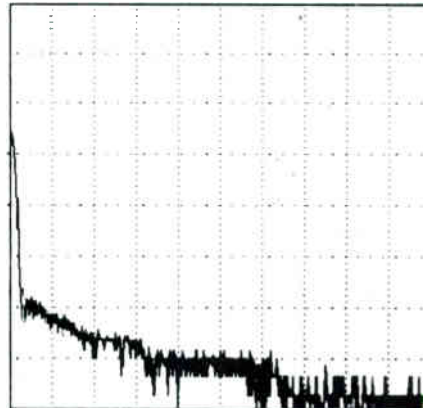
Input configuration: Channel 1 Balanced with 30 dB of input gain and 9 dB of IF gain

Remarks: CHANNEL A...1 V input...4 ohm load

clude a 10-segment LED output level indicator, a "Line Fault" LED that indicates when the protection circuit has activated, a "Thermal Fault" LED that indicates thermal shutdown, and a "DDT Active" LED. DDT, Peavey's patented compression circuit, keeps the input signal from driving the amplifier into clipping. The rear panel of the amplifier provides balanced (XLR) and unbalanced one-quarter-inch phone jacks for each channel's output. A switch selects either stereo or bridged mono operation, and individual switches are provided for each

Amplitude ETC

Figure 5



Time

Vertical: 12 dB/div with base of display at -34.6 dB; 0 dB is located at 1 V

Horizontal: 0 microseconds or 0 feet to 3149 microseconds or 3.55814 feet; scale: 9.7281E-01 feet/inch or 3.8300E-01 feet/cm; 860 microseconds/inch or 338 microseconds/cm

Line Spacing: 7.89159 microseconds or 8.91749E-3 feet

Line Width: 10.7326 microseconds or 1.21278E-2 feet

Sweep rate: 1977.45 Hz/Sec

Sweep range: 20.35 Hz to 31699.70 Hz

Window file name: A: HAMMING. W8ST

Input configuration: Channel 1 balanced with 36 dB of input gain and 9 dB of IF gain

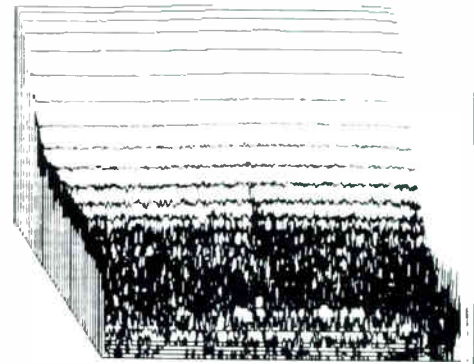
Remarks: CHANNEL A...8 ohm load

channel to either enable or disable the DDT circuitry.

Figure 1 is an impedance-versus-frequency plot for the unbalanced input. The 1 kHz value is 11 K ohms. The input attenuator had no effect on this measurement. **Figure 2** shows the impedance of the balanced input. Here, the upper curve was taken with the input sensitivity control set at the 0

3-D of PEAVEY DECA-700

Figure 6



Frequency

Vertical: 12 dB/div with base of display at -16.6 dB 0 dB is located at 1 V

Horizontal: Auto 0.00 Hz to 31699.70 Hz; scale: 8667.02 Hz/inch or 3412.21 Hz/cm

Resolution: 1.3036E+01 feet and 8.6687E+01 Hz

Time of test: 12,595 microseconds 1.4232E+01 feet (front); 0 microseconds 0.0000E+00 feet (back); -406 microseconds/step or -.4591070677923 feet

Sweep Rate & Bandwidth: 7514.33 Hz/sec and 8.6687E+01 Hz

Input configuration: Channel 1 balanced with 30 dB of input gain and 9 dB of IF gain

Remarks: CHANNEL A...1 V input...4 ohm load

dBV (clockwise) position and the lower curve was taken with the sensitivity set at the infinite (counter-clockwise) position. The lighter line across the center of the plot is a 51 K ohm reference. The value of the input impedance is read in dB below the reference. The 1 kHz impedance with the input sensitivity at 0 dBV is 18 K ohms and 14.6K ohms with the sensitivity at infinity. The output impedance measured .059 ohms at 20

Hz, .056 ohms at 2 kHz and rose to .194 ohms at 20 kHz.

Input sensitivity is specified at 1 V for 350 W output. With the input sensitivity control set fully clockwise and 1 V applied to the input, the test unit delivered 207.8 W into a 4 ohm load. An input of 1.3 V was required to obtain an output of 350 W. Rated output power is 450 W into a 4 ohm load. The test unit delivered 455.8 W with an input of 1.49 V. The unweighted hum and noise was 87.5 dB below full output into 4 ohms.

The specified frequency response (3 dB down) is 5 Hz to 40 kHz. **Figure 3** shows log amplitude versus frequency on a linear scale from 0 to 31.7 kHz with a 1 V input and a 4 ohm load. Relative to 1 kHz, the response rises 1.2 dB down at 31.7 kHz. **Figure 4** shows phase versus frequency with the propagation delay through the unit of 10 microseconds compensated for. The phase response is within 1.2 degrees across the audio band. It should be noted that the 10 micro-

second delay does not necessarily have anything to do with digital aspects of this amplifier. All electronic devices have some delay. Here the delay is the equivalent of moving the loudspeaker back about one-eighth inch.

The time response of the amplifier is shown in **Figures 5** and **6**. **Figure 5** is an Energy Time Curve taken with an 8 ohm load. The peak of the energy response is visible just to the right of the left edge of the plot. This is due to the 10 microsecond propagation delay. Following the amplitude peak, the energy initially decays quickly and then follows a slower decay out to the right side of the plot. This slow decay is composed entirely of low frequencies as may be seen in **Figure 6**, which is a three-dimensional view of the amplifier's characteristics. Here, the vertical dimension is log amplitude, the horizontal dimension is linear frequency and the front-to-back dimension is time with later time at the front. The slower decay rate for the lower frequencies is due to the nature of low

frequencies themselves. It takes time to see (hear) them. In this case, the full scale time is 12,595 microseconds. This is approximately equal to one period of 80 Hz.

The amplifier performed well during the testing procedure. There are a few peculiarities that the user should be aware of. The sensitivity of the DECA 700, for 350 W of output, is 1.3 V, not the 1 V specified, a 2.3 dB difference. The output level indicator should not be used as a clipping indicator. The 100 percent LED comes on 22.7 dB before clipping. Also, the markings on the input attenuators were seen to be anywhere between 0 and 3 dB in error depending upon position. If you need to make precise adjustments, use a good meter. The DDT circuit is a compressor with a ratio of about 4:1. The circuit activates at an input of 1.51 V, .5 dB below clipping. The output protection circuit responds quickly to a short but chatters during a continuous short on the output line. The amplifier tended to "sing" rather noticeably during testing.

The DECA 700's thermal characteristics are somewhat interesting. After idling for a couple of hours, the unit became quite warm. After running at full power for a while, the unit was actually cooler than it was when idling. Peavey says this is due to the nature of the output filtering circuitry. The amplifier has no cooling fan (and does not need one); however Peavey recommends one rack space be left blank between each amplifier in a stack. This increases the effective height of the unit to 5.25 inches and somewhat negates the size advantage.

Peavey's specifications say that the amplifier draws 800 W from the A.C. line at 700 W (bridged mode) of output power. This is an overall efficiency of 87.5 percent. As mentioned earlier, Peavey claims 90 percent efficiency for the output stage only. Still, 87.5 percent for the entire unit is not bad.

The DECA-700 is certainly a very interesting design. In a listening test, no audible difference could be detected between the DECA-700 and a "conventional" amplifier. Peavey has accomplished their design goals and the unit should perform well in professional installations.

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Reader Service #219

PRODUCTS IN REVIEW



PASO INTRODUCES WEATHERPROOF SPEAKER

Paso Sound Products introduced a full range weatherproof loudspeaker, the C 51/AT. The computer designed enclosure used in tandem with a full range loudspeaker is designed to result in extended frequency response and efficiency, nearing that of a reflex horn.

The C 51/AT comes with a 25/70 volt line transformer and can handle 20 watts RMS. The stainless steel bracket provided allows mounting on walls, posts, shelves, trees, etc. The C 51/AT is directional, and it is constructed so that sound may be directed at an area by rotating the speaker in its bracket. The system can also be used for paging or background/foreground music applications.

□ For further information contact: Paso Sound Products, 14 First St., Pelham, NY 10803; (914) 738-4800.

Reader Service #1

JBL'S NEW SOUND REINFORCEMENT SYSTEM

Providing flat power response at low frequencies and requiring less equalization than traditional horn-loaded low-frequency systems, the new JBL 46710K Sound Reinforcement System is specifically designed for smaller halls and theaters.

A two-way direct radiator system, the 46710K delivers smooth response throughout the entire listening environment, low distortion, tight transient response, uniform coverage and natural uncolored sound quality.

System components include the 2225H 15-inch (380 mm) low frequen-

cy loudspeaker, the 2425J high frequency compression driver, the 2370 flat-front bi-radial horn for constant horizontal coverage from 500 Hz to 16 kHz and the 3110A frequency dividing network with a crossover point of 800 Hz.

The 46710K system has a frequency range of 35 Hz to 20 kHz, power capacity of 150 watts pink noise to 300 watts continuous program material, a sensitivity level of 97 dB SPL, a crossover frequency of 800 Hz, horizontal beamwidth of 90 degrees and a nominal impedance of eight ohms.

□ For more information, contact: JBL Professional, 8500 Balboa Blvd., Northridge, CA 91329; (818) 893-8411.

Reader Service #2



UHER INTRODUCES 6000 REPORT UNIVERSAL

Uher of America, Inc., has introduced the Uher 6000 Report Universal open-reel tape recorder.

With five-inch tape reels and utilizing the slowest of its four tape speeds, the Uher 6000 can record for up to 16 continuous hours on one tape.

The Uher 6000 features 3-3/4, 1-7/8, 15/16, and 15/32 ips tape speeds. The slow speed can be used for long-term monitoring, court reporting, and surveillance work.

The Uher 6000 can also be used for monitoring recorder because of the built-in Akustomat (voice activated) recording control. The Uher 6000 can be programmed to begin recording when activated acoustically. Acoustic level sensitivity and spacing time controls are also included.

The 6000 also features full logic control, electronic tape tension control, and four motors for constant tape speed and low wow and flutter. Additional features on the 6000 include

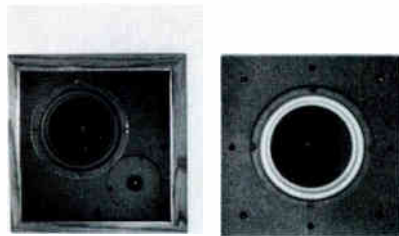
built-in DNR noise reduction, mark and find cueing on both rewind and fast-forward, switchable automatic level control and solenoid operated function controls. For extra motor life, all motors, including the capstan motor, on the 6000 cease to operate when the machine is in the stop mode. The 6000 also has a die cast chassis as well as a die cast carrier for magnetic heads, adding to its ruggedness and stability.

The 6000 is completely remote controlled by a foot switch or Uher M-600 microphone—a desirable feature for dictating and transcribing. It also has a built-in switchable loudspeaker, mechanical tape counter and an AV input jack for use with sync sound and film work. A tape-end switch that shuts off the machine when the tape ends or breaks, plus a LED to visually signal such functions and tape or source monitoring are also standard.

The retail price for the Uher 6000 Report Universal is \$1,749.

□ For additional information, contact: Uher of America, 7067 Vineland Ave., North Hollywood, CA 91605; (818) 764-1120.

Reader Service #3



NEW DROP CEILING MONITORS BY ENVIRONMENTAL SOUND

Environmental Sound has introduced two new speakers to the already established Pro Drop Ceiling Monitor Series. Two versions are available: ES-602 which houses a 6.5-inch, low frequency driver and a 3/4-inch dome tweeter; and the ES-801 which houses an eight-inch, full range driver. Both speakers can be mounted in the wall or the ceiling.

□ For more information, contact: Environmental Sound, 31220 La Baya Dr. #110, Westlake Village, CA 91362; (818) 706-0228.

Reader Service #4



FURMAN PL-8 A.C. POWER CONDITIONER AND LIGHT

Furman Sound has manufactured the PL-8 A.C. power conditioner and light module. The module is said to provide filtered power to sophisticated signal processing equipment, and illumination for the control of the same equipment in dim light and harsh shadows encountered on dark stages and in studios.

When mounted in the top of a rack, the PL-8's eight outlets provide switched power (up to 10 amps total) and its two slide-out light fixtures provide illumination for all the effects in the rack. In addition, the PL-8 provides double action A.C. power conditioning, offering protection against both high voltage surges and high fre-

quency noise/radio frequency interference.

Equipment is further protected by a resettable circuit breaker. Both lights and power may be switched independently from the front panel. The lamps pull out and also swivel, so that they can be aimed. Bulbs are standard four or seven watt sizes, and may be replaced by unscrewing the caps in front without removing the unit from its rack.

For further information, contact: Diane Poole at Furman Sound, 30 Rich St., Greenbrae, CA 94904; (415) 927-1225.

Reader Service #5

UNITED TECHNOLOGIES' DIGITIZED VOICE SAVER

United Technologies Com Dev has announced the Voice Saver™ telephone receptionist help-mate, a novel application of solid state voice storage technology. This device will store a receptionist's telephone greeting and,

at the touch of a button, play the greeting back to incoming callers with reproduction quality said to be so good, most callers can't tell it from the real receptionist. The Voice Saver help-mate will assure that callers receive a consistently clear and pleasant greeting, time after time, regardless of how busy the receptionist is or how difficult the company name is. It is especially beneficial in applications where seasonal or novelty greetings are used.

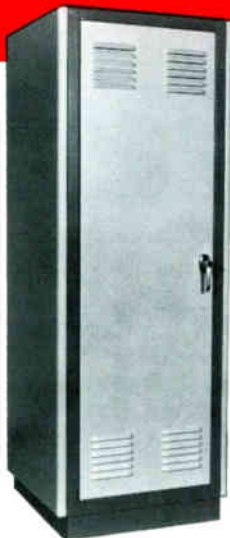
The unit connects between the PBX/Key System Console and the headset/handset, and it's totally transparent to the telephone system. Available in two models, a two-prong plug and a modular plug, the Voice Saver help-mate is compatible with most telephone switches.

For more information, contact: United Technologies Com Dev, 2006 Whitfield Industrial Way, Sarasota, FL 33580; (813) 753-6411.

Reader Service #6



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ILP INTRODUCES USER-SERVICEABLE AMPLIFIERS

ILP Electronics, a supplier of high fidelity power amplifiers and toroidal power transformers, has introduced the Professional Series of power amplifiers for commercial, industrial, and professional sound applications. Both models are available factory assembled or in kit forms.

Model RB54 (four ohm) and RB58 (eight ohm) provide 180 watts per channel and feature a twin power supply using a special toroidal transformer with electrostatic shielding. The models are light weight (21 pounds) due to the use of toroids and the amplifier heatsink design.

Model RB44 (four ohm) and RB48 (eight ohm) provide 120 watts per channel and total weight is only 15 pounds.

(continued on page 42)

PRODUCTS IN

a closer look

by gary davis



HME'S WIRELESS NEW MIC

HM Electronics, Inc. has introduced a new top-of-the line, professional portable wireless microphone system for broadcast, ENG, EFP, and film production. The System 820 is said to offer audio quality indistinguishable from a hard-wired microphone.

The use of HME's Dynamic Expansion II allows a dynamic range in excess of 115 dB and full frequency response. The reduced noise floor makes the system useful for film applications.

Up to 20 systems can be used compatibly due to the RF shielding and filtering. An Auto-Lok discriminator tracks the transmitted RF signal to minimize audio distortion.

Comment: A few months ago we examined a low-cost wireless mic system from Nady (Model 49) which operated in the 49 MHz band and was intended for home and low-budget industrial video production—wherever it is necessary to obtain a clean, location soundtrack without trailing wires or using costly "shotgun" mics. The HME system 820 is the high-end professional counterpart of that system. According to John Kenyon of HME the system operates in the VHF high band (150-216 MHz), has a 2:1 logarithmic compander capable of a 115 dB transmit-receive dynamic range, and has 50 Hz to 15 kHz (± 1 dB) frequency response. Typical operating range is said to be 1,500 to 2,000 feet (line-of-sight).

The transmitter will accept any low-Z dynamic or electret mic (fitted with

a Switchcraft mini TA4F connector), and operates six to eight hours on a 9 V alkaline battery. The receiver utilizes four of these batteries to deliver eight hours operation, and will also accept an external 12 to 30 V DC input (car, camera pack, etc) or an AC adapter. Audio output appears at a transformer isolated XLR, switchable for mic or line level.

Because of the special pre-emphasis and companding, the transmitter and receiver cannot be intermixed with other brands of wireless equipment. Like all VHF high band wireless mics, the System 820 utilizes "inactive" TV broadcast station frequencies, so the equipment must be ordered with crystals that do not interfere with local broadcasters. While the system is provided with a travel case, plan ahead if you intend to travel—crystals are not field changeable, so check your itinerary with HME to make sure the frequencies will be useable in all cities.

□ For further information contact: HM Electronics, 9675 Business Park Ave., San Diego, CA 92131; (619) 578-8300.

Reader Service #7



SHURE SM91 AND SM90 MICS

Shure Brothers Incorporated now offers both the SM91 unidirectional condenser microphone and the SM90 omnidirectional condenser microphone—two complementary surface-mount products.

Like the "pressure zone" microphones, the SM91 and SM90 take advantage of the acoustic principle of boundary effect. Because of this principle, placing either a SM91 or SM90 microphone close to a barrier or boundary (e.g., wall, floor, ceiling, table, piano lid) will cause it to perform with as much as six dB higher sensitivity and approximately three dB greater rejection of random back-

ground noise.

Advantages of the SM91 include minimized low-frequency noise and rumble, less tendency toward feedback, and avoidance of phase cancellation. In addition, the half-cardioid pickup pattern of a surface-mounted SM91 permits the microphone to operate with much less reverberation.

The SM91 and SM90 applications include sound reinforcement and/or recording microphones; and for broadcast or film productions.

Comment: The relatively flat, surface mount packaging of these mics somewhat resembles the Crown PZM packages, and, to the extent that they are "boundary effect" mics, there is a similarity. However, the technology is different. We'll focus on the SM91 because it has a nearly classic cardioid unidirectional pattern.

Speaking with Elaine Shinbrot at Shure, we learned there is a 12 dB/octave HP filter switch to roll off bottom end, a slight rising response with a three dB hump at about eight kHz, and the mic is down about two dB at 20 kHz. For an electret, the environmental range is superb: zero to 135 degrees F, and from zero to 95 percent relative humidity.

A 25-foot detachable cable joins the mic to its battery-powered preamp (2x9 V alkaline for 300 hours, or simplex). If the unit is being phantom powered and that power fails, the internal batteries automatically take over—a nice "security blanket". The preamp output is a balanced XLR with 150 ohms source impedance—69 dBV nominal, and 0 dBV maximum level operating into a recommended 800 ohm or higher load impedance. Maximum sound pressure level at the mic is 144 dB, with a 121 dB dynamic range—plenty for most applications.

The Model 90 is very similar in appearance and performance except it is unidirectional, has no HP filter, and can handle three dB less maximum level (141 is still a lot).

□ For more information, contact: Shure, 222 Hartley Ave., Evanston, IL 60204; (312) 866-2573.

Reader Service #8

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(continued from page 40)

The series features ILP modular amplifiers in a 19-inch rack size, combined with ILP-wound toroidal power transformers. The amplifiers are totally user-serviceable, and repair, if required, consists of replacing a module with a few solder connections. The integrated heatsink ensures long-term cool operation. Utilizing bipolar circuitry, the modules have short-term circuit protection, current limiting output protection, and will operate safely down to half rated output impedance.

ILP Toroidal Power Transformers operate with reduced noise compared to normal transformers. They are also smaller in size and weight, and operate with greater efficiency at lower temperature.

The RM54/58 retails for \$485 assembled and \$385 kit. The RB44/48 retails for \$349 assembled and \$269 kit.

□ For further information, Ken Koster, Gladstone Electronics, 1585 Kenmore Ave., Buffalo, NY 14217; (716) 874-5510.

Reader Service #9

LINEAR COMPUTERIZED SECURITY SYSTEMS

Linear Corporation has announced a major new system emphasis to serve the security industry's central alarm station marketplace.

The new design, manufacturing, and marketing capabilities are said to enable the company to offer complete, high technology integrated wired and wireless security systems, consisting of digital alarm transmitters, long range radio transmitters and relays, computerized central station monitoring systems, and advanced diagnostic/reporting systems.

New products and system capabilities were added through company and product line acquisitions, licensing agreements, and internal product development.

Linear now offers, for the first time, all the parts of a security system—wired and short range wireless event transmitters, infrared sensors, supervised wireless home control consoles, long range multiple zone radio

transmitters and automatic receivers for wireless central monitor stations, sophisticated wired equipment for central monitor stations, and state-of-the-art computer systems for control, diagnostic and reporting functions. All the elements have been engineered to work together, and are supported by testing equipment and a trained field service organization.

□ For more information, contact: Linear Corporation, 2055 Corte Del Nogal, P.O. Box 9003, Carlsbad, CA 92008; (619) 438-7000.

Reader Service #10



AEGIS IDENTIFONE'S NEW METAL KEYPAD

Aegis Technologies has introduced the Identifone, a visitor entry phone for use in apartments, condominiums, and office buildings.

Identifone works over the existing telephone lines eliminating the need to rewire. The Identifone allows the resident, after identifying their visitor, to open a locked lobby door or to open an elevator door by merely pressing or dialing the number "7" on their regular telephone.

The Identifone features models with a built-in directory, such as the model pictured, or models which do not have directories. All models have a standard built-in postal lock for postal carriers, metal keypad, and a multi-code digital lock feature called "Identikey." Outside telephone numbers, such as fire, police, paramedic, and management companies, can be programmed into the Identifone. Different Identifone models can accommodate anywhere from one to 1,000 residents.

□ For more information, contact: Aegis Technologies, Inc., P.O. Box 1716, San Marcos, CA 92069; (619) 471-0469.

Reader Service #11

**THE
AUGUST
1985
SOUND
&
COMMUNI-
CATIONS
BLUE
BOOK
IS COMING**



COMMUNICATION PRODUCTS UNVEILS POWERHOUSE

Communication Products has introduced a product called the Powerhouse, a stand-by power supply for loudspeaker systems, primarily in commercial sound.

The unit provides 117 V AC during power failures and is energized by a 12 V gel cell battery. It will provide 500 watts of power, which is enough for most small sound systems either tube type or solid state for approximately one half hour.

The Powerhouse is made for 19-inch rack mounting and all instructions for its operation are on the front panel.

Installation is simple, just plug the amplifier system into the Powerhouse and plug the Powerhouse into the wall outlet and you are "on".

□ For more information, contact: Communication Products, 1892 Broad St., Hartford, CT 06114; (203) 522-9117.

Reader Service #12



NEW PAC-TALK TELE-CONFERENCE MAINFRAME

Millbank Electronics has unveiled its LDE-300 Teleconference Mainframe that interfaces audio systems with the telephone network. Capable of operation in transmit or receive only or full duplex mode, the system may be used on either a two or four wire circuit. It may be operated in a shout-down mode in which the loudest talker has control; ducking mode, in which the receiving party is still heard at a reduced level; or in full duplex.

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Reader Service #228

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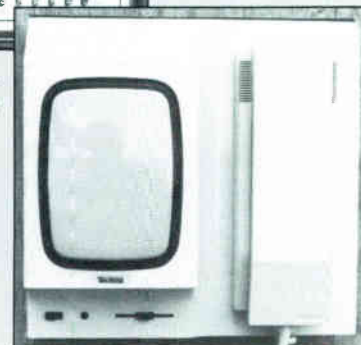


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Reader Service #221



Preset front panel controls allow for adjustment of side tone rejection, high frequency lift and receive gain. An internal control provides for adjustment of transmit gain. The mainframe provides for three inputs from the PAC-System range of preamplifiers and may be infinitely expanded by the addition of mixer or amplifier mainframes.

□ For information, contact: The TCE Group, P.O. Box 506, Lewiston, NY 14092-0506; (716) 754-4378.

Reader Service #13

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Atlas Sound has expanded the functional capabilities of its UL-listed loudspeakers by adding the option of visual signalling facilities.

The dual mode units, providing simultaneous light and sound annunciation, are recommended for high density occupancy and large size locations where maximum attention-getting alert is desirable. Additionally,

the combined audio-visual features accommodate the special needs of the physically impaired.

The VTL Series include a high intensity, low power consumption, 24 VDC xenon strobe integrated with each reflex type loudspeaker and is designed for life safety signalling in the public places.



□ For more information, contact: Atlas Sound, 10 Pomeroy Road, Parsippany, NJ 07054; (201) 887-7800.

Reader Service #14

SHURE ADDS CONDENSER LAVALIER MIC TO LINE

Shure Brothers Inc., has introduced the Model 838 Electret Condenser Lavalier Microphone. Designed with many of the performance features of the SM83, the omnidirectional 838 is used for general-purpose sound reinforcement (churches, schools, hotels, etc.); miking of musical instruments; and broadcast, film, and video productions where budgetary concerns are a priority.

The 838's design features a side-exit cable rather than the standard bottom exit. This arrangement makes the low-profile cable unobtrusive by eliminating the distracting cable loop visible below most lavalier microphones, because the cable can be concealed by the tie bar. In addition, the side-exit cable minimizes unwanted noise.

□ For further information, contact: Shure Brothers Inc., Customer Services Department, 222 Hartrey Ave., Evanston, IL 60204; (312) 866-2573.

Reader Service #15



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multi-code digital lock for residents to enter the building without a key and also off-premise phone dialing to call numbers such as police, fire, paramedics, rental recordings, real estate sales offices, and property management companies. Models range from 50 to 1000 unit resident capacity.

For more information on how Identifone makes you more than competitive, call or write: **Aegis Technologies, Inc.** P.O. Box 1716, 1709 La Costa Meadows Drive, San Marcos, CA 92069 (619) 471-0469

IDENTIFONE

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Reader Service #223

FACES AND PLACES

Executone Inc. Appoints Silverman New President

Continental Telecom Inc. (Contel), has announced that Ronald H. Silverman has been named president of Executone Inc., a wholly-owned subsidiary of Contel.

Silverman joined Executone in 1980 as senior vice president of finance and was promoted to executive vice president in 1983. Silverman replaces John R. Jester, who has accepted an appointment as president of Interline Communications Services, Inc.



RONALD SILVERMAN



GREGORY GREEN

dbx Appoints Green Sales Manager For Pro Products

Gregory A. Green has been named North American sales manager for the professional products division of dbx Inc., the high technology audio electronics and signal processing firm. The announcement was made by Scott Berdell, director of dbx's professional products division.

Prior to joining dbx, Green spent four years as director of sales and marketing at Ashly Audio in Rochester, NY, where he was responsible for all foreign and domestic sales as well as for setting up the firm's financial control and sales tracking systems. His diverse background includes training as a musician and experience in retail sales.

Shure Announces DeGenova As New PR Coordinator

Shure Brothers Incorporated, Evanston, IL, has announced the appointment of Al DeGenova as public relations coordinator.

DeGenova is primarily responsible for Shure public relations activities involving the press and artist/endorsers and an extensive involvement with the company's direct-mail advertising.

Most recently, DeGenova was managing editor of *Up Beat* magazine (a music industry trade publication) holding that position since 1981. He received his B.A. degree in 1979 from Roosevelt University, Chicago, IL.



AL DEGENOVA



ROBERT BOATMAN

EV Names Boatman Director of Advertising and Promotion

Robert R. Boatman, former head of retail advertising at Heath Company, has been named director of advertising and promotion for Electro-Voice, Inc., a supplier of high-technology microphones, speakers, and electronics to professional and consumer markets worldwide.

According to vice president of marketing Paul McGuire, Boatman will direct an expanded department "in which all advertising, promotional, and public relations services, including creative and production, have been consolidated."

NTCA Elects Anderson 1985 President in Dallas

Sam O. Anderson, manager of the Twin Lakes Telephone Cooperative Corporation, in Gainesboro, TN., has been elected president of the National Telephone Cooperative Association (NTCA). Anderson, who has served on the NTCA Board of Directors since 1980, assumed office during the association's 1985 annual meeting, held February 16-22 in Dallas, TX.

Anderson identified several priorities for NTCA in 1985, including intensive efforts on Capitol Hill to stop a proposed phase-out of the Rural Electrification Administration (REA) telephone programs. The programs provide needed financing and support services, for small and rural telephone systems.

In related NTCA news Joseph M.

Flanigan, manager of engineering, has been elected to the T1 Committee of the Exchange Carrier Standards Association (ECSA). The T1 Committee provides an industry forum to set interconnection standards for the national telecommunications network.

Augat Names Davison, General Manager, Interconnection

John A. Braun, group vice president of Augat's interconnection systems group announced the promotion of George W. Davison to general manager.

Davison will be responsible for all functional aspects of the interconnection systems division including operations, sales/marketing, product engineering, and quality assurance.

Previous positions at Augat included manufacturing manager and business manager. Prior to Augat he was factory manager for Hersey Products Inc. in Dedham, MA.

Davison holds an A.S.M.E. and B.S. in industrial technology from Northeastern University.



GEORGE DAVISON



STAN DAVIS

Ring of North America Names Davis Assistant VP-Intercom

Ring Group of North America has promoted Stan Davis to assistant vice president-intercom, responsible for corporate account development in Ring's Internal Communications Division.

Davis, who previously was national sales manager of the Internal Communications Division, has played a large role in Ring's securing a pre-eminent position in the financial, banking, and institutional markets for internal communication systems.

In his new position, Davis has responsibility for continued growth and expansion in these primary markets and will be working directly with Ron Stone, Ring's president.

BUCHANAN

plug-in printed circuit board connector



This new series of Buchanan plug-in printed circuit board connectors are designed to provide a secure, reliable connection between a printed circuit board and a connector. The plug-in design allows for easy installation and removal, and the multiple pins provide a high density of connections. The new PCB connector is available in two versions, one for vertical plug-in and one for parallel plug-in.



Amerace Corporation Publishes New Four-Page Bulletin

A four-page bulletin SSB402 describing two new configurations of miniaturized Buchanan® SSB4/5R,V printed circuit board connectors, one of which plugs in vertically, the other providing plug-in mating parallel to the p.c. board surface, has been issued by Amerace Corporation.

Over 15 photographs, drawings, tables, and diagrams illustrate detailed specifications and application suggestions that explain how the new PCB connectors can conserve board space and permit increased circuit density.

From: Amerace Corporation, Newburgh Road, Hackettstown, NJ 07840; (201) 488-4529.



Catalog of Rental Test Equipment From Leasametric

A variety of electronic test equipment for rent is listed in the first catalog published by Leasametric's recently formed Instrument Rental Division.

The 224-page illustrated catalog has short technical descriptions to assist equipment selection from over 500 manufacturers. More than 5,000 different products worth more than \$150 million are featured. All equipment is calibrated to specifications set by the National Bureau of Standards. Products range from analyzers, amplifiers, oscilloscopes, power supplies, and calibrators to logic analyzers and programmers.

Leasametric has rental options covering terms from one-month to five years including the purchase of use equipment.

From: Leasametric Inc., 1164 Triton Dr., Foster City, CA, 94404; (800) 227-1817.



Pamphlet by Anchor Automation Takes Mystery Out of Modems

Anchor Automation, Inc., manufacturer of a wide range of low-cost, smart modems, has announced the availability of a *Guide to Modems*, an eight-page pamphlet that defines basic modem technology, its applications, and provides suggestions for product selection.

The pamphlet clarifies modem operation and its benefit to the user in uncomplicated terminology. Common modem terms are explained, and the various modem types are described and compared. Tips regarding the amount of communications capability most likely needed by the user, and its relative cost, are revealed, along with advice on software, installation, and troubleshooting techniques.

The pamphlet is offered at no charge by Anchor Automation representatives, distributors, dealers, and retailers.

From: Anchor Automation, Inc., 6913 Valjean Ave., Van Nuys, California 91406; (714)995-1650.

NATA Publishes International Telecommunications Export Guide

The North American Telecommunications Association (NATA) has

published *The Telecommunications Export Guide*, a comprehensive reference tool designed to aid American telecommunications firms sell their products and services overseas.

The 134-page directory provides market profiles of 134 countries, plus lists of export resources available to suppliers, in foreign countries and in the U.S.

NATA is selling its *Telecommunications Export Guide* for \$85 for NATA members, \$115 for non-members. Bulk discounts available.

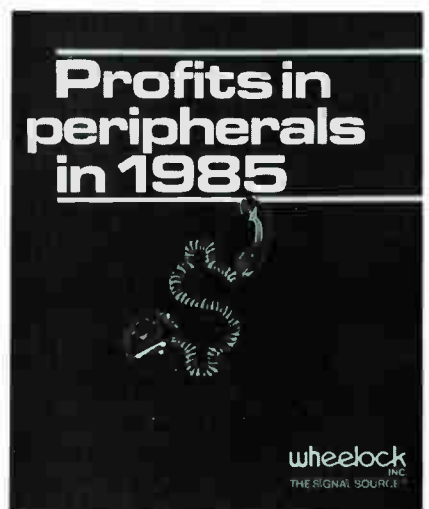
From: NATA Publications, 2000 M St., N.W., Suite 550, Washington, D.C. 20036; (202)296-9800.

Literature Explains Telephone Extension Alerts

A 20-page application guide and installation brief that explains the many needs and hook-ups of telephone extension alerts with PBX and electronic key systems has been introduced by Wheelock Inc. Called the *Profits in Peripherals - 1985*, the brochure describes the many phone signalling problems found in many commercial environments with profit-making tips on solving them. An extensive section is devoted to practical installation guidelines for telephone and intercom systems, and simplified wiring diagrams are included.

Featured in the brochure is a signal selection guide, a chart showing recommended spacing between signals, and a graph of typical ambient noise levels.

From: Customer Service, Wheelock Inc., 273 Branchport Ave., Long Branch, NJ 07740; (201)222-6880.



BOOK REVIEW

by Ted Uzzle

Making Rooms for Music

Beranek, L.L., *Music, Acoustics, and Architecture*, Robert E. Krieger Publishing Co., 1981 (originally published by Wiley, 1962).

Talaska, Richard H., Ewart Wetherill, William Cavanaugh, *Halls for Music Performance: Two Decades of Experience, 1962-1982*, American Institute of Physics, 1982.

Some books are so good they define their subject. One of these is the modern classic on concert hall design, *Music, Acoustics, and Architecture*, by Leo Beranek. Some years ago the original publisher allowed this book to go out of print, but Krieger Publishing Company is now offering a reprint edition.

Beranek begins with the obligatory pages showing vibrating strings, logabels and decirithms, and the rest, but is to be credited for keeping this tuning up to a minimum and plunging right into the overture by defining in musical terms the hearing characteristics that make music possible.

The heart of the book is the portfolio of 54 concert halls, new and old, good and not-so-good. They are grouped by country with photographs and plans, technical and architectural measurements, and subjective descriptions of the halls by musicians and music critics. The reader is endlessly surprised at the few basic concepts there are of orchestra and opera hall design, and how many variations, combinations, and permutations have been built. Some halls are instantly familiar, with the iconology shared by almost all places of public assembly, while others are exotic in use of space and very difficult to understand even with photographs and plans.

This portfolio would be enough to make the book useful, but Beranek collected his concert hall data for a practical purpose: to make generalizations about the measureable characteristics that can be shown to correlate with the subjective opinions of the professional listeners, the musicians, and the critics. For example, what measureable quality is shared by those halls which also share reputations for intimacy and liveness? What are the

results of the same measurements in halls regarded as lacking in intimacy and liveness?

The appendix explains an oddity in the history of architectural acoustics. When Wallace Clement Sabine consulted on the design of Symphony Hall in Boston, his prediction of the reverberation time was substantially wrong. The nature of his error, an incorrect use of absorption for audience seating areas, is explained at the end of the book. Although this part was originally published 25 years ago, many elementary books on acoustics still continue the mistake.

For the twentieth anniversary of *Music, Acoustics, and Architecture*, in 1982 the Acoustical Society of America sponsored another book, *Halls for Music Performance: Two Decades of Experience*. The second book devotes two pages each to eighty-five halls constructed or renovated from 1962 to 1982. In the same way that Beranek gave photographs, plans and tabular data on each of his fifty-four halls, the concert halls in the second book are described in a similar manner.

If you have ever worked on some aspect of concert hall design, whether architectural acoustics or sound systems, you will appreciate *Halls for Music Performance*. It is a casebook of practically everything going on in the world of music performance buildings.

The book groups buildings in the U.S. by state, and international buildings by country. The international projects are fascinating, especially those with acoustical or architectural traditions unfamiliar to the ones found in English-language journals.

Music, Acoustics, and Architecture and *Halls for Music Performance* are good companions, not because they agree or disagree about specifics, but because they permit you to turn instantly from one concert hall to another thousands of miles away.

Most bookstores can order *Music, Acoustics, and Architecture* for you, but *Halls for Music Performance* can only be bought from the Acoustical Society of America, 335 E. 45th St., New York, NY 10017.

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Reader Service #224

DATE	EVENT/COMMENT	LOCATION	CONTACT
May 13-16	9th Annual Conference on Teleconferencing and Interactive Media	University of Wisconsin Extension, Madison, WI	Pat Greenwood International Teleconferencing Association 1299 Woodside Dr., Suite 101 McLean, VA 22102 (703) 556-6115
June 6-7	International Communications Industries Association's Symposium for Chief Executives	The Westchester Hotel White Plains, NY	ICIA/Terri Campbell 3150 Spring St. Fairfax, VA 22031-2399 (703) 273-7200
June 17-21	Communications Week '85; Successful Strategies for Data and Voice Communications	McGraw-Hill World Headquarters, New York, NY	Datapro Research Corporation 1805 Underwood Blvd. Delran, NJ 08075 1-800-257-9406 in NJ, (609) 764-0100
June 24-26	Telecon East: International Conference and Exhibit	The Sheraton Center New York, NY	Applied Business Telecommunications Box 5106 San Ramon, CA (415) 829-7235
July 7-10	Conference on Opportunities For Investing In Telecommunications	Princess Hotel Hamilton, Bermuda	IGI Consulting, Inc. 214 Harvard Ave. Suite 200 Boston, MA 02134 (617) 738-8088
July 7-12	International Communications Industries Association Institute for Professional Development, "Sales Training for the Communications Industry"	Bloomington Campus Indiana University, IN	Terri Campbell ICIA 3150 Spring St. Fairfax, VA 22031-2399 (703) 273-7200
August 4-7	International Background Music Association's Meeting and Conference	Westin Bayshore Hotel Vancouver, Canada	Roger Van Brackel (419) 782-2741 Bruno Fulde (604) 682-3141

FUTURE DATES

September 26-28	Electronics Industry Association's Mobile Communications Show	Washington Convention Center Washington, DC	Jack Wayman EIA, Sr. Vice President (202) 457-8765
November 4-8	110th Meeting of the National Council of Acoustic Consultants/Acoustical Society of America	Nashville, TN	NCAC 66 Morris Ave. P.O. Box 359 Springfield, NJ 07081 (201) 379-1100



ELECTROVERT'S NEW, ONE-PIECE NYLON WIRING DUCT

A one-piece round design wiring duct which requires no covers and can be bent to fit corner's without the need for cutting has been introduced by Electrovert Inc.

Molded of polyamid nylon for temperatures to 212 degrees F (100 degrees C), the VK-Flex series makes rewiring easy, and lends itself to an efficient use of space. Wires are conveniently fed into the duct because of a circular overlap finger design. Open slots allow for complete air circulation, lead-offs, and insertion or removal of wires with terminals remaining attached.

Contact: Electrovert Inc., 399 Executive Blvd., Elmsford, NY 10523; 914/592-7322. Telex: 646-186.

Reader Service #16



N.A. SOAR'S MODEL 1700 DIGITAL LEVEL METER

North American Soar Corp. has announced its Model 1700 digital level meter, a new concept in surface level measurements. Model 1700 is designed to assist the professional engineer or craftsman in making finite level or angular measurements.

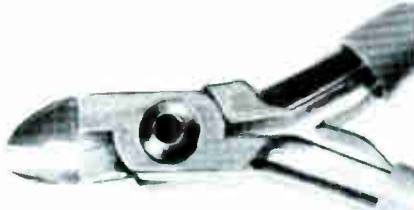
The machine is small and compact, sizes (6.25-inch x 3.75-inch x 1.25-inch) for easy transport. The Model 1700 has two 3.5 digit LCD readouts with annunciators enabling the operator to observe the slope angle

in degrees, the slope direction plus slope height in meters per meter from either the side or top. A buzzer can be activated to give an audible tone alarm when 0 degree (level) is attained. The meter also contains a switchable LCD light for reading in dark areas.

The Model 1700 retails at \$99.95.

Contact: Lys Grebla, Operations Manager, North American Soar Corp., 126 Cornell Ave., Cherry Hill, NJ 08002; (609) 488-1060.

Reader Service #17



E.T.M. INTRODUCES 18-DEGREE DIAGONAL CUTTERS

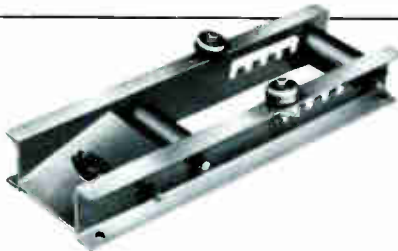
The new model 1014S miniature cutter and model 1014L standard diagonal cutter with narrow 18 degree angle jaws by E.T.M. Corporation are designed for electronics and other small cutting applications.

The cutting tips have hi-speed tool steel inserts for harder, sharper, and longer lasting cutting edges. Both cutters can cut up to .032 (miniature 22 AWG) and smaller wire and both cutters are available in flush or semi-flush cut.

Polished stainless steel construction provides longer life and easy clean-up, durable vinyl grips offers operator comfort.

Contact: ETM Corp., P.O. Box 888, Monrovia, CA 91016; (818) 359-8102.

Reader Service #18



PORTABLE REEL HANDLING DEVICE FEATURES SMALL SIZE

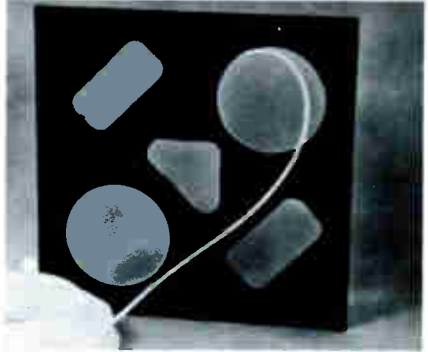
Roll-A-Reel Company, the manufacturer of an original device for payout or take-up of anything put on reels, is now offering a space saving model in

the product line. Known as the Style C, the new model is load rated per CEMA standards at 3,000 pounds and features complete portability and maximum versatility in accommodating reels of any width.

The Style C Roll-A-Reel consists of two frames or platforms fabricated from four-inch structural steel. Each platform is arranged with two heavy duty ball bearing roller assemblies. The front roller assembly is permanently mounted while the rear roller assembly is adjustable to any one of six self-locating positions.

Contact: Roll-A-Reel Company, 7881 Reading Rd., Cincinnati, OH 45222; (513) 761-8500.

Reader Service #19



PANDUIT ANNOUNCES CONTINUOUS GROMMET EDGING

A new line of continuous grommet edging supplied in 100-foot rolls has been announced by the Panduit Corp. The grommet edging eliminates abrasion of wire insulation passing through holes cut in metal panels. It can snap into place, even in irregularly shaped holes, and the profile grips the panel firmly.

Panduit® continuous grommet edging comes in four sizes for panel thicknesses from .02 inches to .144 inches. The 100-foot rolls can be cut to any desired length and are packaged in dispenser boxes.

Material is either polyethylene which provides flexibility or natural nylon which provides abrasion resistance. The nylon edging is available with solid walls or slotted walls. Polyethylene is available in solid wall only.

Contact: Panduit Corp., 17301 Ridgeland Ave., Tinley Park, IL 60477-0981; 1-(312) 532-1800.

Reader Service #20

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Cetec Vega wireless equipment plays a prominent role in the sound production of the famous musical, CATS.* Jess Heimlich, sound engineer for the touring company, says, "Cetec Vega wireless systems are work-horses. They make my job a lot easier, and, more importantly, give me a feeling of security. They are subjected to the most unimaginable workout I have ever seen."

Cetec Vega wireless microphones have helped CATS in the winning of seven Tony Awards (including Best Musical, 1983) and the Outer Critics' Circle Award—Best Musical (1983).

The road company of CATS uses 14 Cetec Vega Model R-42 dual-diversity wireless receivers with Model 77/DII bodypack transmitters. The system features DYNEX™II, Cetec Vega's new standard in audio processing. Jess also has two backup Vega systems on standby. "These 16 sys-

tems have been on the road for over a year now, providing about 95% reliability. When you put your reputation on the line eight times a week, you want equipment that'll back you up. Vega's do. And, more importantly, when there is a problem, you want a company and its representatives to provide you with immediate service. Vega has given me both. Typically, repair turnaround time has been 36 hours!"

The road company's stage managers also use the Cetec Vega "Q" System full-duplex wireless intercom system, which interfaces to their Clear-Com wired intercom system.

In all, between 15 and 17 wireless microphone and intercom systems are used simultaneously on stage, without a trace of interference between systems.

Cetec Vega wireless systems are also in use at the newly opened

CATS productions in Los Angeles, Toronto, and Chicago, and on Broadway. Jess says, "In the last three years, I have used more than 30 Vega systems on four different Broadway Productions. The plain and simple truth is: they work...MORE RELIABLY, MORE CONSISTENTLY, AND MORE OFTEN than any other wireless I've ever used."

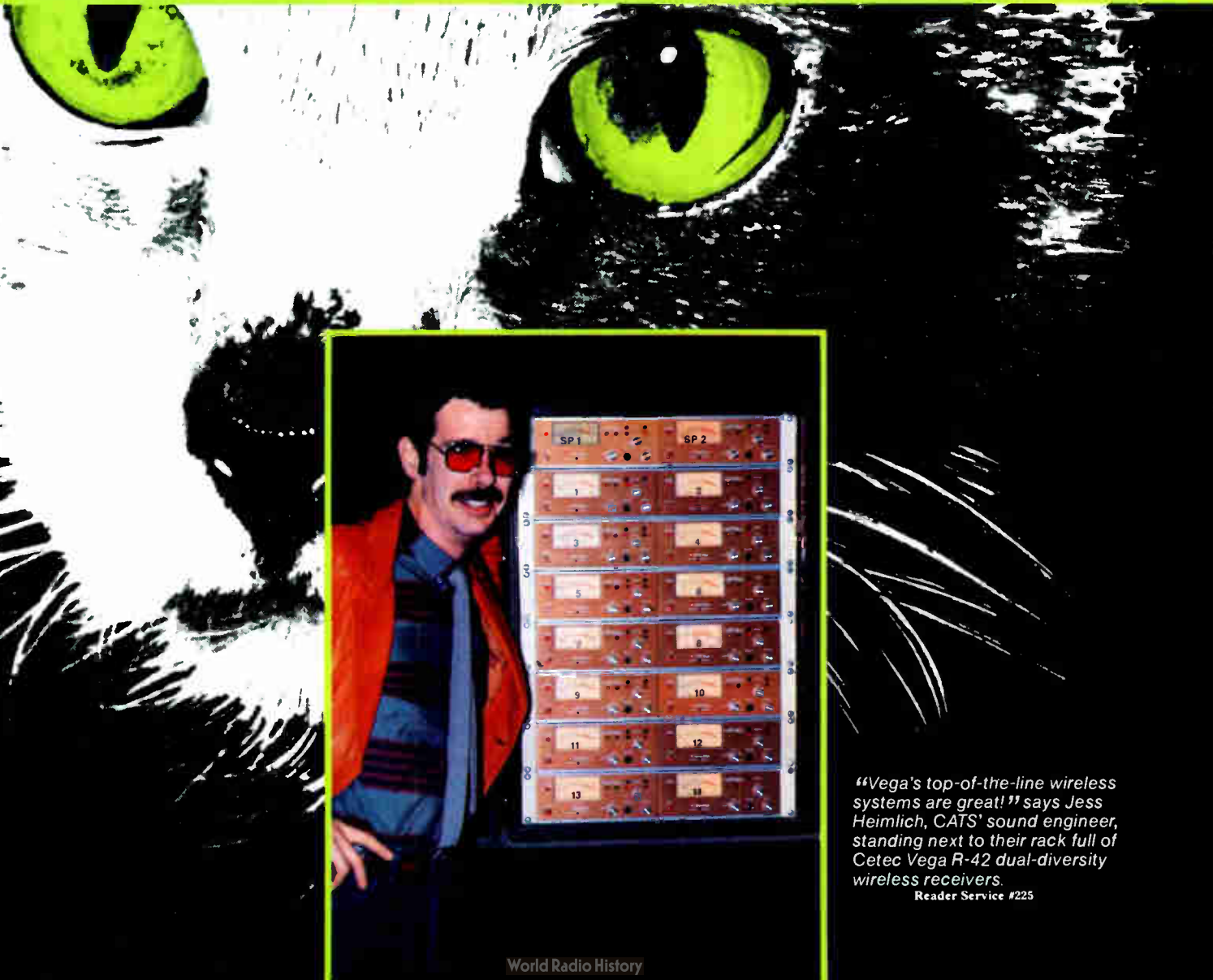
If you must equip your performers with the most dependable, highest quality wireless microphones, remember the words of CATS' Jess Heimlich: "Cetec Vega wireless are the best I have ever used."

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*CATS is a registered trademark of THE REALLY USEFUL COMPANY, Ltd



"Vega's top-of-the-line wireless systems are great!" says Jess Heimlich, CATS' sound engineer, standing next to their rack full of Cetec Vega R-42 dual-diversity wireless receivers.

Reader Service #225

The world's first unidirectional surface- mounted condenser mic. Clean and simple.



No carpet strips or plastic baffles needed. Until now, all surface-mounted mics have been omnidirectional. Trying to add directionality has required a lot of busy work. The new SM91 brings the big advantages of unidirectionality to boundary effect microphones by incorporating a condenser cartridge with a half-cardioid pattern that isolates the speaker from surrounding noises.

The new smoothie. The sleek SM91 delivers wide-band, smooth response throughout the audio spectrum, while greatly reducing the problems of feedback, low-frequency noise and phase cancellation.

Low visibility, high versatility. The SM91 is an excellent mic for meetings and conference rooms. It also does a great job of isolating a vocalist or instrument

in musical applications. And it's the ideal mic for live theater.

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