Outdoor Sound Reinforcement

# SOUND & COMMUNICATIONS

FOR CONTRACTORS, SYSTEM MANAGERS AND SPECIFIERS

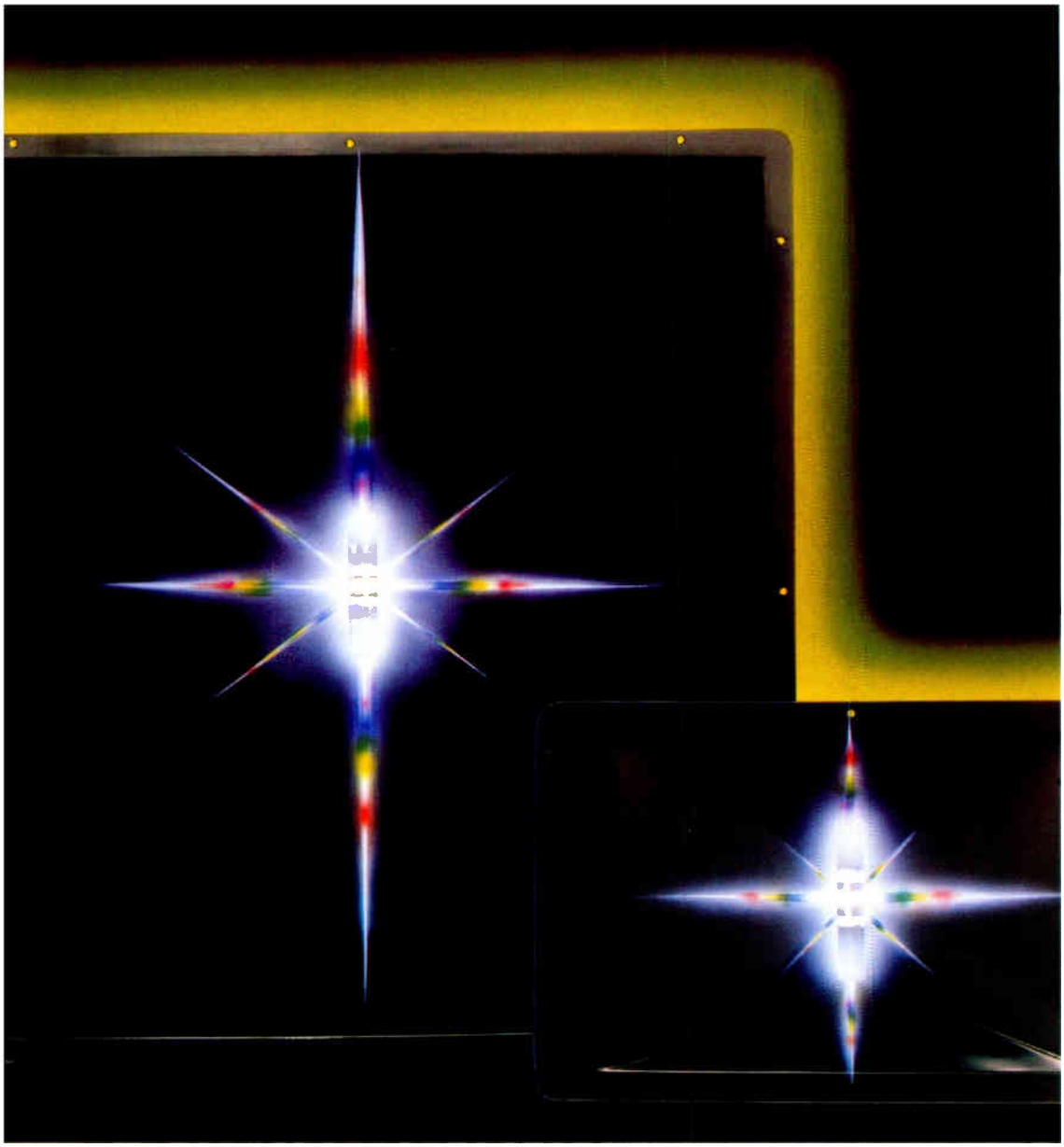
APRIL 1987


## Installation Profile: The St. Thomas Hospital Learning Center's Complex Audio and Video Systems

## Production Intercoms

## A Trivial History of the Telephone

## Sales Compensation Methods



# *When the Competition Beams, We Just Smile*

One problem with ordinary high-frequency horns is that they **beam** above 10,000 Hz. Their coverage angle narrows, so what you hear depends on where you sit.

But **HP horns** are far from ordinary. Every **H**orn **P**erfect model contains **beamwidth control vanes** that eliminate high-frequency beaming and restore full coverage to 20,000 Hz.

DH1A

These vanes, together with TransPlanar™ design and the precision of directivity-optimized size, deliver **the best directivity control in the industry.** Nobody does it better. Only EV, the company that invented the constant-directivity horn, brings you an advanced, second-generation design.

And only EV offers the finest 500-Hz-crossover driver on the market. Coupled to an HP horn, our new DH1A provides more high-frequency output than any other 500-Hz driver. More musical depth. More articulate, natural voice quality. And better transient attack than anyone ever imagined from a compression driver.

The HP horn and the DH1A driver. An unbeatable combination from Electro-Voice. We'll have you smiling too.

For more information, write Pro Sound, Electro-Voice, Inc., 600 Cecil Street, Buchanan, MI 49107.

Electro-Voice® SOUND IN ACTION™

*Circle 201 on Reader Response Card*

# SOUND & COMMUNICATIONS

Volume 33 #4
April 1987


40

## DEPARTMENTS



**ON THE COVER**
Inside the St. Thomas Hospital Learning Center and on the bottom, the RTS TWI intercom and 800 Series.

## FEATURES



## COLUMNS




combining **SOUND MERCHANDISING & MODERN COMMUNICATIONS** FOUNDED 1955 copyright © 1987 **SOUND & COMMUNICATIONS PUBLISHING, INC.,** Reprint of any part of contents without permission forbidden. Titles Registered in the U.S. Patent Office. Sound & Communications (U.S. P.S. 943-140) is published monthly by Sound & Communications Publications, Inc., 220 Westbury Ave., Carle Place, N.Y. 11514. 516-334-7880. President, Vincent P. Testa. Subscription rates: U.S.—3 years $37.50, 1 year $15.00. Canada and Mexico—3 years $48.00, 1 year $18.00. Foreign and South America—1 year $25.00. Second-class postage paid at Carle Place, NY and at additional mailing office. POSTMASTER: Send address changes to Sound & Communications, P.O. Box 159, Carle Place, NY 11514.

# What sound does a loudspeaker make when it's on backorder?

## No sound at all, obviously. But you may hear loud noise from customers whose requirements can't wait.

At Quam, we don't like backorders any more than you do... in fact, we won't tolerate them! To give you total protection from backorders, we keep 60,000 speakers in stock at the factory, so we can always ship, within 24 hours of your order, any standard item, including line matching transformers and ceiling grills or speaker/transformer/baffle assemblies. So when you deal with Quam, your work schedule won't be delayed because the speakers you need are missing from your shelf. Nor will you have to tie up cost in inactive inventory to guard against shortages. Nor will you ever have to worry about a speaker causing a call-back. At Quam, we believe in allowing sound contractors the peace of mind that comes from having a totally reliable source for speakers.

Doesn't that sound good to you?

**Quam: The Sound Decision**

QUAM NICHOLS COMPANY
234 EAST MARQUETTE ROAD
CHICAGO, ILLINOIS 60637
(312) 488-5800

## SOUND & COMMUNICATIONS

Editorial Director/Publisher
**Vincent P. Testa**

Managing Editor
**Debra A. Pagan**

Technical Editor
**Jesse Klapholz**

Senior Editor
**Elliot Luber**

Assistant Editor
**Fran Avnet**

Contributing Editors
**Marc Beningson, Gary D. Davis, Ted Uzzle**

Consulting Editors
**Jerome J. Brookman, Chris Foremen**

Technical Council
Dr. Mort Altshuler, *Professor Audiology, Hahneman University, Chief of Audiology, V.A. Hospital, Phila, PA;* Mike Biegel, *EPD Technology Corporation;* C. Leroy James, *Rees Associates, Inc.;* Richard N. Jamieson, *Jamieson and Associates, Inc.; Russell Johnson, Artec Consultants, Inc.; Brian Murphy, The Wilke Organization;* Richard Negus, *Purcell Noppe Associates, Inc.;* William Parry, *Maryland Sound Industries, Inc.;* Daniel Queen, *Daniel Queen Associates;* Jon Sank, *Cross Country Consultants; William R. Thornton, Phd, PE*

Art Director
**Andrew Elias**

Assistant Art Director
**Karen Waibel**

Production
**Bill-Lee Ithier**

Typesetting
**George Proper, David Schmidt**

Circulation Director
**Deborah A. Droge**

National Advertising Director
**Clifford Capone**

Advertising Sales
**Thomas Soevyn**

Vice President/Editorial
**Judith Morrison**

Editorial and Sales Office
**Sound & Communications**
**220 Westbury Avenue**
**Carle Place, New York 11514**
**(516) 334-7880**

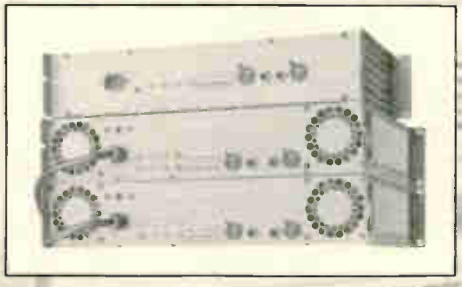
Circulation audited by
Verified Audit Circulation Corp.

VERIFIED AUDIT CIRCULATION

TESTA COMMUNICATIONS Inc

Sound & Communications • Music & Sound Output
The Music & Sound Buyer's Guide • Post
NSCA-TV News • NAMM-TV News • CES-TV News
The Music & Sound Retailer
Home Entertainment

# introducing the DX300, DX800 and DX1500 power amplifiers



The DX300, DX800 and DX1500 amplifiers all feature balanced XLR inputs, balanced and unbalanced ¼" inputs, banana outputs, ground lift switch and a terminal block with access to all inputs and outputs.

**DX300 output power:** **200** watts into 8Ω (per channel, both channels driven, 20Hz - 20kHz, -0.5dB) **400** watts into 8Ω, **450** watts into 4Ω (burst power*) **distortion** (250mW to rated power at 8Ω): IMD SMPTE: < 0.01%. THD (1kHz): < 0.01%. THD (20kHz DIN): < 0.02% **size:** 2 rack spaces, 8½" behind front panel **weight:** 7Kgs, 16 lbs. **cooling:** 2 passive heatsinks.

**DX800 output power:** **250** watts into 8Ω, **400** watts into 4Ω (per channel, both channels driven, 20Hz - 20kHz, -0.5dB), **800** watts into 8Ω (bridged mono), **800** watts into 4Ω, **900** watts into 2Ω (burst power*) **distortion** (250mW to rated power at 8Ω): IMD SMPTE: < 0.01%. THD (1kHz): < 0.01%. THD (20Hz-20kHz DIN): < 0.02% **size:** 2 rack spaces, 13" behind front panel **weight:** 13Kgs, 29 lbs. **cooling:** 1 servo controlled DC fan.

**DX1500 output power:** **300** watts into 8Ω, **500** watts into 4Ω, **750** watts into 2Ω (per channel, both channels driven, 20Hz - 20kHz, -0.5dB), **1000** watts into 8Ω, **1500** watts into 4Ω (bridged mono) **1500** watts into 2Ω, **1600** watts into 1Ω (burst power*) **distortion** (250mW to rated power at 8Ω): IMD SMPTE: < 0.01%. THD (1kHz): < 0.01%. THD (20Hz-20kHz DIN): < 0.02% **size:** 2 rack spaces, 13" behind front panel **weight:** 15Kgs, 34 lbs. **cooling:** 2 servo controlled DC fans.

*Burst power is a 1kHz tone for 10ms every 100ms, single channel (an indication of the amplifiers ability to handle music transients and tolerate deviations in nominal speaker impedance)

## Total Audio Transparency

**Manufactured in the UK:**
Hill Audio Ltd., Hollingbourne House, Hollingbourne, Kent ME17 1QJ England
Tel: (062 780) 555/6/7 Tlx: 966641 HILL

**U.S. Sales Office:**
Hill Audio Inc., 5002B N. Royal Atlanta Dr., Tucker, GA 30084 USA
Tel: (404) 934-1851 Tlx: 293827 HLAD

**Hill Audio**

**EDS EXCITEMENT BUILDS AS EXHIBIT HALLS FILL UP**

Planning for the future and nostalgia for the past are bringing about another sold-out EDS, said David L. Fisher, executive vice president of the Electronic Industry Show Corporation, in announcing that 250 companies have already signed up to exhibit. All available exhibit space will be sold by showtime, May 13. With the overall numbers ahead of last year's, Fisher said, a miniboom has developed for the salon, a popular new format which debuted last year. The number of manufacturers signing up for these enclosed conference booths on the exhibit floor, directly adjacent to their displays, has more than doubled compared to last years EDS. There has also been a surge in conference rooms, large facilities adjacent to the exhibit floor where manufacturers combine displays with multiple conferences.

**JBL REORGANIZES ITS SALES REPRESENTATIVE NETWORK**

JBL Professional has reorganized its sales representative network. As JBL expands its JBL loudspeaker and UREI electronic product lines, develps new product categories and handles the distribution of Soundcraft tape machines and mixing consoles in the U.S. and Mexico, the need for representatives that have expertise in all these markets is paramount, according to the company. Ken Lopez, vice president, sales, said, "Our representative network enjoys a very high level of stability and professionalism. The addition of Soundcraft and Professional Video Products necessitated changes in some territories; we added only those representative companies capable of living up to the highest professional standards. The new factory team is now in place and is aggressively taking our expanded product roster to the marketplace."

**ALTEC LANSING CONTRACTOR OPENS KENTUCKY OFFICE**

Altec Lansing Corporation has announced Esco of Kentucky as its authorized Industrial/Professional sound contractor in Louisville, KY. Esco of Kentucky is a branch of Electrical Systems Company, Indianapolis IN, a full service sound contractor.

**61 SENATORS SUPPORT ICIA-BACKED PROMPT PAY BILL**

The U.S. Senate is working on legislation to stop federal agencies from paying their bills late. The legislation is one of the top goals of the International Communications Association (ICIA), the trade group for video, computer and audio-visual firms.

When introducing the bill, Senator James Sasser (D-TN) credited a national business coalition led by ICIA for leading support for his bill, S.328, the Prompt Payment Amendments Act of 1987. Sasser is teaming with Senator Paul Trible (R-VA) and a bipartisan group of 61 cosponsors to hold hearings before the Senate Governmental Affairs Committee.

**BELDEN WIRE AND CABLE FORMS NEW OPERATION**

To increase total services and capabilities to original equipment manufacturers, electrical and electronic distributors and other users and specifiers of wire and cable, the former Belden Electrical Wire Products Division has been organizationally integrated into the Belden Electronic Wire and Cable division. Under the new heading, Belden Wire and Cable, the unit will be headquartered in Richmond, IN.

**MUSIC & SOUND DESIGN PROVIDES MUSIC TO ALLIED STORES**

The Music & Sound Design Studio has provided music to Allied Stores Marketing Corporation for their point of sale videotapes that will play as "continuous loops" in stores owned by the retailing store. All voice recording for the projects was also handled by Music & Sound Design. The music was selected from the production mu-

sic library at Music & Sound Design. All of the chosen selections were made available from the studio's collection of compact discs.

**FROST & SULLIVAN REPORTS ON THE KEY TELEPHONE SYSTEMS MARKET**

Frost & Sullivan describes today's competitive scene for manufacturers/suppliers of key telephone systems (KTS) in a 229 page report entitled "Key Telephone Systems (#1659). For the next five year period (1987-91), Frost & Sullivan sees total shipments, new systems together with replacements of older equipment, hovering around a level of 700,000 systems per year. Total dollar value will be about $1.3 billion annually. However the report points out good possibilities in such areas as services, accessories and components—including possibilities for the smaller players in the market. The price of report #1659 is $1,950.

**CETEC CORPORATION DECLARES $.05 QUARTERLY CASH DIVIDEND**

Robert A. Nelson, president and chief executive officer of Cetec Corporation, announced that the company's board of directors has declared a regular quarterly cash dividend $.05 per common share, payable May 22, 1987 to shareholders of record May 8, 1987.

**PEIRCE—PHELPS GETS INVOLVED WITH SEVERAL TELECONFERENCING PROJECTS**

Peirce-Phelps, Inc. has reported it is completing work on several teleconferencing projects throughout the United States. This includes three systems employing the recently introduced PicTel C-2000 Codec designed for public switched 56 kilobit-per-second networks. Peirce-Phelps is also providing system integration and supplying and installing equipment for a two-location and eventual, multi-point full motion teleconferencing system linking two Bell Atlantic operating companies—New Jersey Bell at Newark, NJ, and Chesapeake and Potomac Telephone in Arlington, VA.

The U.S. Defense Intelligence Agency awarded Peirce-Phelps a contract for a full motion teleconferencing system that includes rooms at the Pentagon and Bolling Air Force Base, Washington, D.C. Peirce-Phelps has also designed and will equip and install an audio and video teleconferencing system linking the Pennsylvania State University's University Park, PA, campus with its Behrend College campus at Erie, PA. Teleconferencing systems using the PicTel codec are being completed by Peirce-Phelps for two undisclosed "Fortune 500" companies.

**LEAR SIEGLER ANNOUNCES PLANS TO SELL SUBSIDIARY BUSINESS**

Lear Siegler Holding Corp., which recently completed its $2.1 billion leveraged buy-out of Lear Siegler, Inc., announced plans to sell several subsidiary business aquired in that buy-out as part of its corporate restructuring plans. These plans will not affect the sound and communications industry.

**MTN SERVICES ANNOUNCES NEW DISTRIBUTION PACTS WITH HITACHI AND OTHERS**

MTN Services, Inc., a member of the Marmon Group of Companies, has entered into a series of distribution arrangements with manufacturers of advanced telecommunications systems, according to Don Akerberg, president of MTN. They include: An arrangement with Hitachi America, LTD., under which MTN Services will become a distributor of the DX Series Communication Systems, a Telecommunications Facility Management (TFM) agreement with Northern Telecom enabling MTN Services to distribute the Meridian SL-1 PBX and related equipment under shared tenant and revenue sharing arrangements, and an agreement with Xiox Corporation, a maker of IBM-PC based telecommunications software, to distribute telephone management and call accounting software.

# In Memorium

Richard C. Heyser, an engineer with the Jet Propulsion Laboratories of the California Institute of Technology for 27 years and who pioneered such fields as audio measurement, ultrasound diagnosis and spacecraft-mounted television systems, died on March 14 following a lengthy illness. He was 55.

Heyser, friend and mentor to an entire generation of audio engineers and consultants, will be best remembered for his willingness to give of his time to help other audio specialists. But industry figures feel his work on the Heyser Transform Theory and Time Delay Spectrometry will not reach their full potential of application until well into the next century.

Heyser was born in Chicago in 1931. He attended the University of Arizona where he obtained a B.S. in Electrical Engineering. At that time, he worked for an Arizona television station as a station engineer. He then attended the California Institute of Technology in Pasadena, California, obtaining an M.S. degree in Electrical Engineering.

Heyser joined the jet propulsion laboratory (JPL) of the California Institute of Technology in 1955. He was involved in some capacity with all of JPL's spacecraft TV systems for over 20 years from the simple analog cameras of the 60's to the advanced digital systems of the 80's.

His development of a system to measure the response of loudspeakers was published in a set of papers in the Journal of The Audio Engineering Society in the 1960's, which combined fundamental science and engineering with a practical measuring technique. He named this system Time Delay Spectrometry and was still working on advanced aspects of this technique when he died. The method was patented in 1969 and several other patents on related theoretical and practical aspects were issued later. As time passed, Time Delay Spectrometry has become a recognized measurement technique and three instruments using this methodology have recently become available commercially.

In 1971, Heyser collaborated with a colleague at JPL to begin work on applying his methods to ultrasound imaging in the human body. This work led to a number of grants and contracts to JPL which continued up to 1987. A new type of body imager based on this concept is now being developed commercially.

Heyser was married twice. He had two daughters by his first marriage. His second wife, Amy, survives him.

# ANNOUNCING THE BIGGEST IDEA IN THE HISTORY OF WIRELESS


## *Samson incorporates dbx* noise reduction to achieve a new standard of wireless performance.*

Samson Concert TD Series is the first true diversity VHF wireless system with dbx noise reduction. We've been setting new standards of sound and reliability in wireless over the years, but we're always refining our technology to make it even better. That's why we chose world-class dbx technology to solve the biggest problem in wireless — noise.

dbx noise reduction makes the Concert TD Series incredibly quiet. It also expands frequency response to deliver the best possible sound for vocals and instruments. And you won't hear it working because dbx circuitry eliminates the pumping and breathing that plagued wireless sound in the past.

Breaking new ground with our Concert TD Series, Samson engineering excellence now takes a quantum leap forward in its ongoing search for the highest standard of wireless performance. We are the first to incorporate dbx noise reduction because we want to guarantee the best possible audio quality available in wireless today. Now there's every reason you can think of to enjoy the unlimited freedom promised by wireless.

First we took the worry out of wireless with reliable no-dropout performance, now we're taking the noise out of wireless with dbx.

**SAMSON®**

***WE TOOK THE WORRY OUT OF WIRELESS®***

Samson Products Corporation, 124 Fulton Avenue, Hempstead, New York 11550
(516) 489-2203 TLX 284696 SAM UR FAX (516) 489-2418
In Canada: Omnimedia Corporation Ltd., 9653 Cote de Liesse, Dorval, Quebec H9P 1A3 514 636-9971


*Mic Capsules Available: Electro-Voice N/D 757 element offered exclusively in wireless by Samson.*
*Also available. BK-1, SM 58, SM 85, SM 87*

*dbx is a registered trademark of BSR North America Ltd.

**Circle 211 on Reader Response Card**

by Bill Sharer

# SALES COMPENSATION METHODS

*Part I of this article focused on sales compensation, sales environment, sales personality and changing business goals. In this installment, we will take an in-depth look at sales compensation methods.*

No one can tell you how to structure your company's compensation or how much to pay. That's for you to decide. Even if someone did tell you how to do it today, it might need to be changed tomorrow. What we can do is establish criteria for a good system, explain your alternatives, evaluate the relative merits of each, and show a process for deriving a good plan.

***"There are really only three basic or pure forms of compensation: Salary, bonus, and commission."***

**What characterizes a good system?**

To be a "good" compensation plan, yours must first and foremost, be *fair.* And it must be *perceived* as fair by the rep. Although this is difficult to determine, it should be your number one goal. How you get there will vary.

Secondly, it must be understandable to the reps. Each of them must clearly know *how* they are paid and for *what* they are paid. Obvious as this may seem it often *isn't* clear. Avoid gamesmanship and gimmicks in your basic plan. This is a deadly serious matter to your reps and your company. Confine "cutesy" or frivolous contests or programs to the periphery or short-term incentive portion of your plan, not to the core of it.

Thirdly, construct your plan to emphasize and pay for the kind of performance you really want. If you want high levels of account service and maintenance, significant new account or market penetration, emphasis on new product launch, or exceptionally good records and reports, pay for it. Don't tell a rep that you want volume and profit above all and then penalize for poor records or "cherry-picking" accounts and /or products.

Fourth, a good plan is one that is under constant *review*. That isn't to say one that is under constant *change*, because sudden, frequent, or dramatic change confuses and discourages good sales effort. But do watch it to see that it continues to meet your corporate needs.

Finally, some incentive to achieve *superior* results should be offered. We'll say more about that later. But be sure that every rep can enjoy the rewards of over-performance—or you will foster mediocre results and attract mediocre people.

**Your Choices of Methods.**

There are really only three basic or pure forms of compensation: Salary, bonus, and commission. However, because most systems combine certain of these elements in their total plan—and also include special contests or incentives, value-added benefits, and/or non-financial factors, the possible permutations are many. Let's look at the characteristics, the frequency of use, and the relative merits of the more common methods.

**Straight salary.** Not many companies pay sales reps a straight salary alone anymore. Fewer than 20 percent of manufacturers, 25 percent of service companies, and eight percent of dealers or distributors use it. And of those companies, at least half of the sales managers with straight salary programs are not happy about it. Clearly it is neither common, nor popular, nor satisfactory in most cases.

Still, it has *some* merit in some settings. Where high levels of "missionary" selling, account service, or team selling is required, the salary approach may work. It may be suitable for trainees, too, for awhile. Certainly it simplifies compensation administration, relieves sales rep uncertainty, and encourages non-selling activity—whether that's good or bad. Where it fails is in giving sales reps any incentive to overproduce. It fosters mediocrity, and removes some of management's clout in emphasizing certain products, programs, or targets.

**Straight commission or draw against commission.** In this form, reps are paid only on the basis of what they produce. It's usually calculated on the basis of some percentage of something: gross volume, profit, or market share. More dealers and distributors use this method than do manufacturers or service companies (40 percent of dealers, only 15 percent of manufacturers and 25 percent service companies) and managers are generally more satisfied with it than with salary methods—as many as four or five who use it, like it.

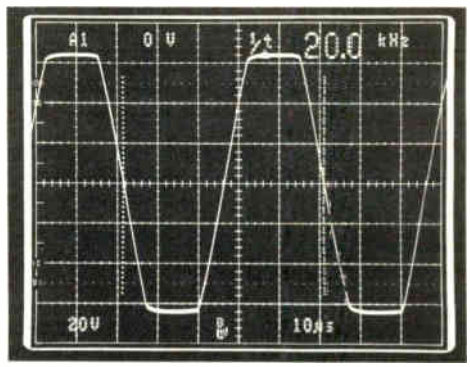
With this method, reps have maximum incentive to produce, with most of their income representing a predictable—if variable—cost to you. Reps, of course, tend to perform *only* those activities which pay off for them, often neglecting non-sales tasks, profit (unless it's your bases), and long-term account development—preferring the quick and easy sale. It may also be difficult to get them to devote time and effort to training. On straight commission, reps are essentially self-employed.

**Bonus.** Though a separate and distinct form of compensation, it's impossible to use alone except in rare, isolated, or unique situations. You should think of it as an adjunct or incentive feature of some other system—not in a vacuum. Bonuses are add-ons by definition. They may be tied objectively to specific performance, discretionary, and/or subjective.

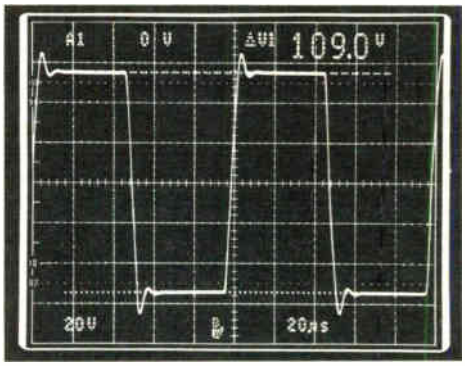
Regardless of your feelings or experience about each of these forms of compensation, it's important to note that all of them are used by someone—and often quite successfully. But

# Knowledge is Power.

The more you know about RAMSA power amps, the better they look. Designed for stability and reliability,* they reflect our knowledge of the most demanding applications. And their graceful overload characteristics dramatically improve apparent headroom. To learn more, see your RAMSA dealer, or write to 6550 Katella Avenue, Cypress, CA 90630.




The WP-9920 exhibits gentle overload characteristics even when overdriven 3dB into 4Ω Load at 20 kHz (643 Watts).



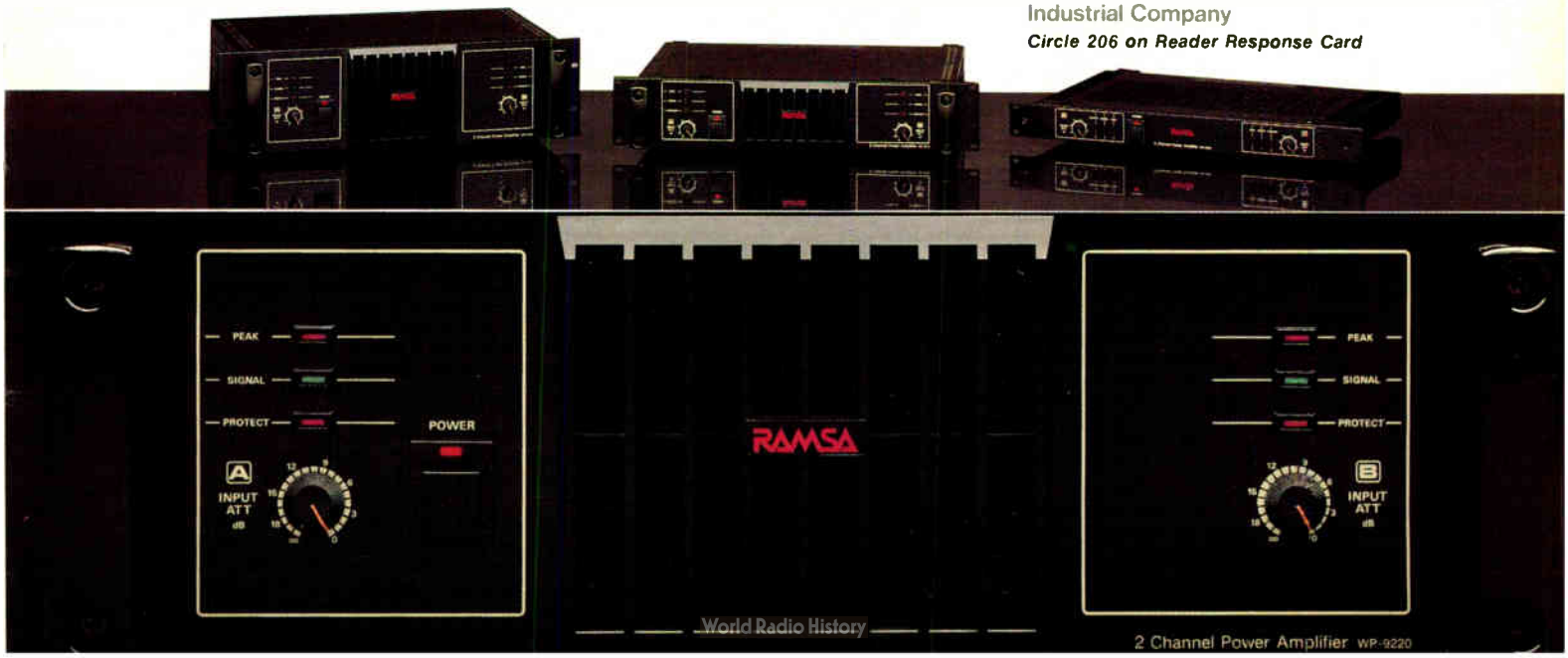

The WP-9220 exhibits minimum ringing even with extremely reactive loads. (8Ω, 1μF; 10 kHz square wave input.)

*Ramsa amplifiers carry a 5-year limited warranty.

RAMSA

Panasonic
Industrial Company

*Circle 206 on Reader Response Card*



because each has limitations as well as merits, most companies today use combination plans. The theory is sound: optimize the advantages of each form, minimize the disadvantages by using the best features of each. It would be nice if that were as easy in practice as it is in theory. It's not.

**Combination forms.** The most popular methods of compensation are those which use more than one form. This is true of industry in general. The actual mix of methods and the relative proportion each represents vary tremendously. Although they complicate administration and are generally more complex, the advantages seem to outweigh the disadvantages.

Most commonly, sales reps receive some fixed salary amount. In our industry, the range is from 0 to 100 percent of income paid in salary. But 40 percent to 66 percent is probably the mid-range of the salary portion of the typical sales rep's total income—if he or she is paid on a combination plan. The remainder is in bonus, commission, or sometimes both.

It seems reasonable that perhaps two-thirds of a sales reps income be fixed and known (i.e. salary) with the remaining third somehow variable (i.e. commission or bonus or special incentive). The emphatic disclaimer must be made, though, that this system is *not* universally best, nor always successful. What it *does* do is give you the following advantages:

(1) Two-thirds of your selling costs known, and therefore, more easily projected and budgeted.
(2) Significant (though not total) control of a sales rep's time, effort, and activity.
(3) Ability to recognize and reward superior performance.
(4) Enough flexibility to attract and keep good reps.
(5) Freedom to change emphasis or objectives within a band narrow enough to sustain the rep's effort.

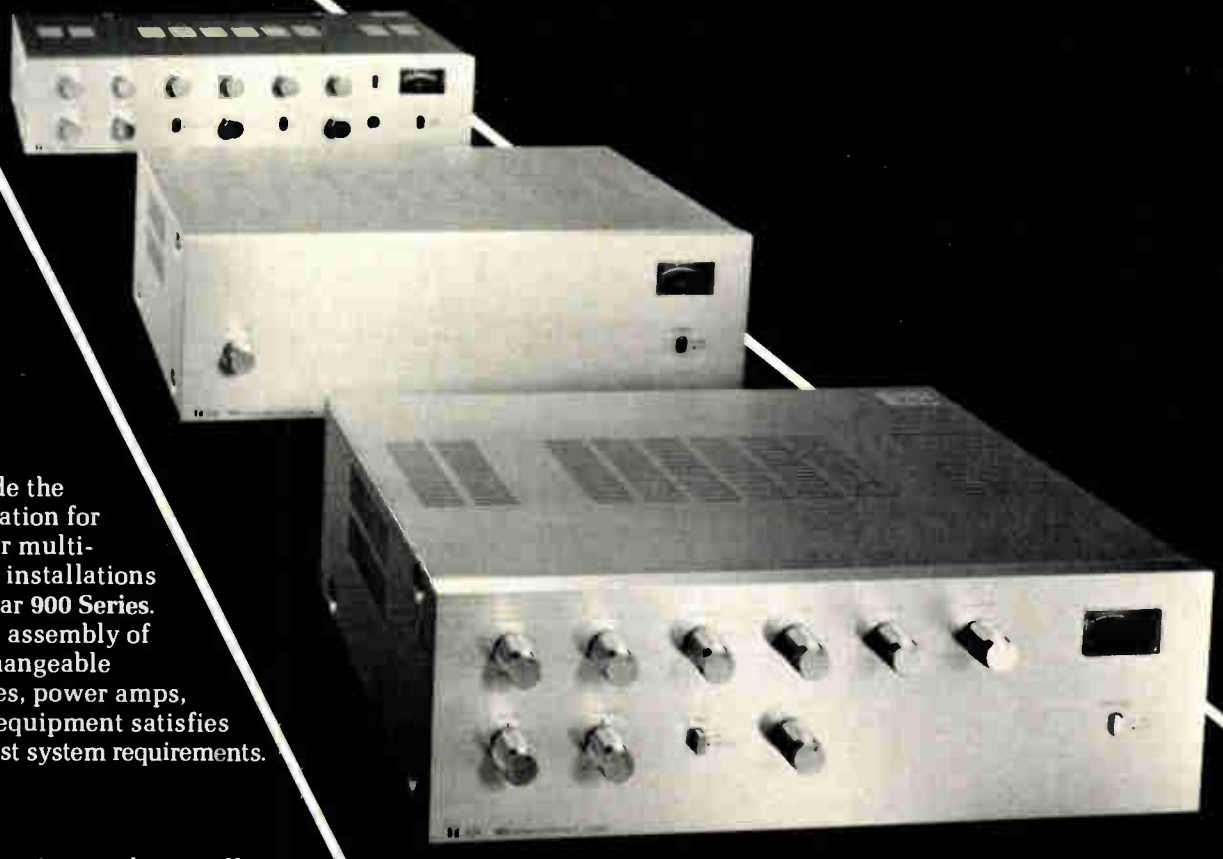
The salary (fixed) component is usually based upon the experience level of the rep, his or her tenure, previous general levels of performance, previous earnings, and competitive figures for "similar" jobs. It may require job or salary grade classifications, and it should certainly include clear job descriptions and systematic goal setting.

The incentive component (commission and /or bonus) is based on goal achievement, using any or all of several bases. Most frequent are gross volume, gross margin or profit, product mix, increased account or market penetration, and, often, non-selling activities. Commissions usually represent some percentage of sales productivity or results, bonuses usually represent some percentage of the base salary and/or the commission.

Incentive components generally work best when they start to pay off immediately as interim goals are reached. However, sometimes not at the full *rate*. If they are paid at too low a level of goal attainment, it becomes too easy to "earn" them, which may discourage "all-year" effort. At too high a starting point, they may appear unattainable, and therefore discourage a rep or fail to take advantage of their reinforcement value as results are achieved. One theory holds that if two-thirds of a

*(continued on page 57)*

# Install Confidence.



Provide the foundation for expanding your multi-purpose sound installations with the modular **900 Series**. Toa's extensive assembly of mixers, interchangeable plug-in modules, power amps, and accessory equipment satisfies even the toughest system requirements.

The 900 Series' clear, well-defined sound will impress the most demanding clients. Adapting or expanding the system for their future needs is convenient and easy.

The reliable 900 Series is backed by Toa's 50 years' experience in commercial sound. Join the many professionals who already benefit from the 900 Series' flexibility and profit power.

TOA

Toa Electronics, Inc.
Commercial/Engineered Sound Division

480 Carlton Court
South San Francisco
California 94080
(415) 588-2538

Toa Canada: (403) 489-5511 Edmonton, or (416) 624-2317 Toronto ■ Toa U.K.: (0277) 233882 Essex ■ Toa Europe: (040) 811127 Hamburg

*Circle 207 on Reader Response Card*

# CONSULTANT'S COMMENTS

*by Marc L. Beningson*
*Jaffe Acoustics, Inc.*

# HOW TO BE THE BEST CONTRACTOR

What is it that separates the best from the average contractor? Details. Attention to details above and beyond that listed in the specifications is the calling card of the above average contractor. This applies to all aspects of a project, from bidding through acceptance testing.

Why should a contractor pay more attention to a project than required by specification? For a number of reasons, not the least of which should be pride in a job well done. Not every detail can be specified and it is not unreasonable to expect the contractor to be capable of dealing with some details.

What kind of details are we talking about? The little ones that older and more experienced installers take for granted which, for some odd reasons, are not so common today. Details like these:

Wires entering a rack should be combed straight, tie-wrapped every 6 to 10 inches and attached to structure as necessary. All wiring should be squared to the equipment racks. Service loops should be provided to permit equipment removal from racks without disconnecting.

Wire ends should be wrapped with heat shrink tubing, with a plastic tube surrounding the shield to prevent its touching anything metal. Where capacitors are used to couple the shield to ground, it too should be dressed.

Each wire should be identified with a number at each end, and a running sheet kept of the wire's function to assist in trouble shooting. This applies to wire within a rack assembly as well as wire in conduit.

Every wire should be checked for proper polarity for the piece of equipment at each end.

Panel mounted connectors and switches should be mounted at right angles to the panel axis.

Rack panels should fit closely, but not so tightly that they or adjacent

equipment cannot be easily removed.

Every piece of equipment should be tested prior to installation to ensure proper operation.

All equipment should be protected from dents, scratches, and everything should be cleaned prior to acceptance testing. All garbage and other scraps should be removed from sound areas.

At least one set of fabrication drawings should survive the installation process with all the appropriate mark-ups, but without being very dog-eared, ripped and dirty.

Operator's manuals for *all* equipment should be assembled into a bound manual for the user. A separate binder should contain custom instructions for the system operation, along with other system documentation such as as-built drawings, running sheets, one-line diagrams, risers, etc.

When the consultant arrives for acceptance testing, have all required test equipment present and checked for proper operation. Sending out a technician to replace dead batteries for a sound level meter in the middle of tuning an array is not an impressive feat.

During acceptance testing, the project manager and at least one technician who is intimately familiar with the project installation should be available to assist the consultant. The company president and the salesman who sold the project are not needed, unless they actually were a part of the installation team.

Hopefully, the majority of contractors reading this can say without doubt that the above details—and many more—are standard procedure within their organization. However, many young installers have insufficient experience to realize that these details are an essential part of every project, whether the specification includes them or not. It is attention to details such as these that will help sell your *next* project.

by Dale R. Patrick

# COMPUTER-BASED SYSTEMS

*This article was reprinted with permission from the book* Electrontic Instruments *by Dale R. Patrick. The book is published by SAMS Publishing and costs $21.95.*

## INTRODUCTION

Industry now has a number of instruments and machines that are classified as "intelligent" or "smart." A "smart" machine is unique because it has a built-in computer. The computer permits the equipment to make decisions that may control or alter its operation. Intelligent equipment may also be described as a computer-based system. The computer is an integral part of the machine or instrument that it controls. It may be built directly into the machine or be part of a network that connects several machines to a central computer. The computer-based system is now an important tool of industry.

## COMPUTERS

Computers are primarily responsible for the rapid expansion of the digital electronics field that we are experiencing today. This technology has had a decided impact on industrial instrumentation equipment. Computers make it possible to perform control operations automatically. Calculations can be made quickly, data can be manipulated, deductions can be made, and a variety of operational processes can be performed with the computer. Inventory, accounting, programmable control, manufacturing operations, and process control instrumentation have caused industry to be more dependent on the computer. Computer applications in the future will obviously be more significant than they are today.

There is a great deal more to the operation of a computer than the average person realizes. When we look at a computer-based system, we generally only see its hardware. The hardware includes such things as typewriter keyboards, crt display terminals, disk drive units, counters, flip-flops, decoders, signal generation, and electronic displays. As a rule, the hardware by itself is rather useless. It cannot function or perform an operation unless it is told what to do. It must be instructed before it can be of any value in the operation of a machine. Firmware and software are needed to communicate with the computer. Essentially, these two things tell the com-



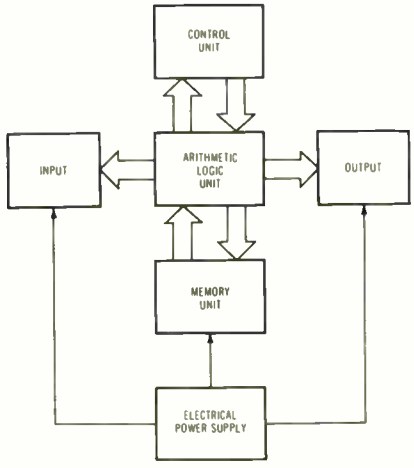



**Fig. 7-1. Block diagram of a basic computer.**

puter what it can and cannot do. Firmware is a permanently installed set of instructions placed in computer memory. It tells the computer circuitry what functions to perform and in the sequence that it must follow. The manufacturer of a computer is responsible for firmware and its installation in memory. Software is used to instruct the computer how to do a specific operation. After one operation has been completed, the computer may be instructed to perform another task. The software function of a computer is usually called a program. In general, a computer can utilize an unlimited number of programs. The computer operator is responsible for program use, its installation, and in some cases its development. This, in general, accounts for the versatility function of the computer.

## COMPUTER HARDWARE

The hardware of a computer can take on a variety of different shapes and sizes depending on the system. Most industrial computer-based systems are now of the microcomputer type. This type of system has the computer assembly built on a small printed circuit board or card. Other systems may have the computer function built on a single integrated circuit chip called a microprocessor. This chip can perform the basic functions of a computer. As a rule, microprocessors are responsible for most industrial applications of the computer.

Regardless of a computer's design, it has a number of basic operational functions that must be performed by the hardware. These functions are arranged in a specific sequence or pattern. In general, all computer-based systems must conform to this basic operational pattern. The end result of each computer is primarily the same. A block diagram of basic computer functions is shown in Fig. 7-1. Notice that this includes input/output, an arithmetic logic unit, control, memry, and a power source.

The input of a computer is often considered as an interface between the real world and the machine. Interface refers to the process of bringing two or more things together. The keyboard of a computer frequently serves as an interface device. This device accepts real-world input and converts it into something that the computer understands. Basically, the input of a computer is responsible for encoding. This refers to the process of changing decimal numbers and/or alphabetic characters into a coded signal. The resulting signal is generally some type of binary data. Typewriter keyboards and calculator keyboards serve as the input for most digital electronic systems. In addition to this, data may also be

supplied by punched cards, magnetic disks, and analog to digital converters.

Coded data developed by the computer input is applied to the arithmetic logic unit (ALU). The ALU manipulates this data according to a prescribed set of instructions in the firmware. Normally, the incoming data is placed in a data register. This part of the computer serves as a short-term storage circuit for binary data. Registers are capable of storing one data word. A word may be either 8 or 16 bits of data in a group. Registers consist of a number of flip-flops. Each flip-flop will store one bit of data. This data can be applied to all flip-flops at one time, or may be shifted into the register one bit at a time.

To demonstrate the operation of the ALU, assume that the computer needs to add two numbers. Initially, the first number is applied to the input. It is transported to the ALU and applied to register A. The second number is then entered into register B. A command from the control section tells the ALU to add the values in registers A and B. The sum is then placed in Register A, replacing the first number. In performing this operation the ALU responds only to binary data words. The ALU is responsible for all computer math functions and logic decisions.

The control unit of a computer is responsible for directing the operation of the ALU. In a sense, all functional operations are directed by the control unit. Control is basically achieved by two operational cycles called fetch and execute. During the fetch cycle instructional data is retrieved from the memory unit. The execute cycle tells how to carry out the instruction. Computer operation is based on repeated fetch and execution cycles. The operational time of each cycle is directed by the control unit.

After the ALU has completed an operational cycle its accumulated data is transferred to the computer output. This informational data must then be translated into something that the real world understands. Normally, this operation is called decoding. Essentially, decoding is responsible for changing data into alphabetical or digital information. This information is then used to actuate the output device. Printers, typewriters, cathode-ray tube terminals, and digital displays are typical computer output devices. For an industrial computer-based system, the output could be used to actuate motors, relays, solenoids, lamps or heating elements. The computer output serves as the control element for these load devices.

## MICROPROCESSORS

A microprocessor MPU is the arithmetic logic unit and control section of a computer scaled down so that it fits on a single IC chip. Typical chip sizes are 0.16 inch × 0.16 inch and contain thousands of transistors, resistors, and diodes. Several dozen U.S. companies are now manufacturing these chips in a multitude of different variations. Most of these devices are of the metal-oxide semiconductor (MOS) technology, with some being of the complementary MOS (CMOS) type. A rather substantial number of these devices are found in dedicated industrial computer-based systems.

A microprocessor is essentially a digital device that is designed to receive binary data. It may then store this data for future processing, perform arithmetic and logic operations in accordance with previously stored instructions, and deliver the results to an output device. In a sense, a microprocessor is responsible for performing the operational functions of

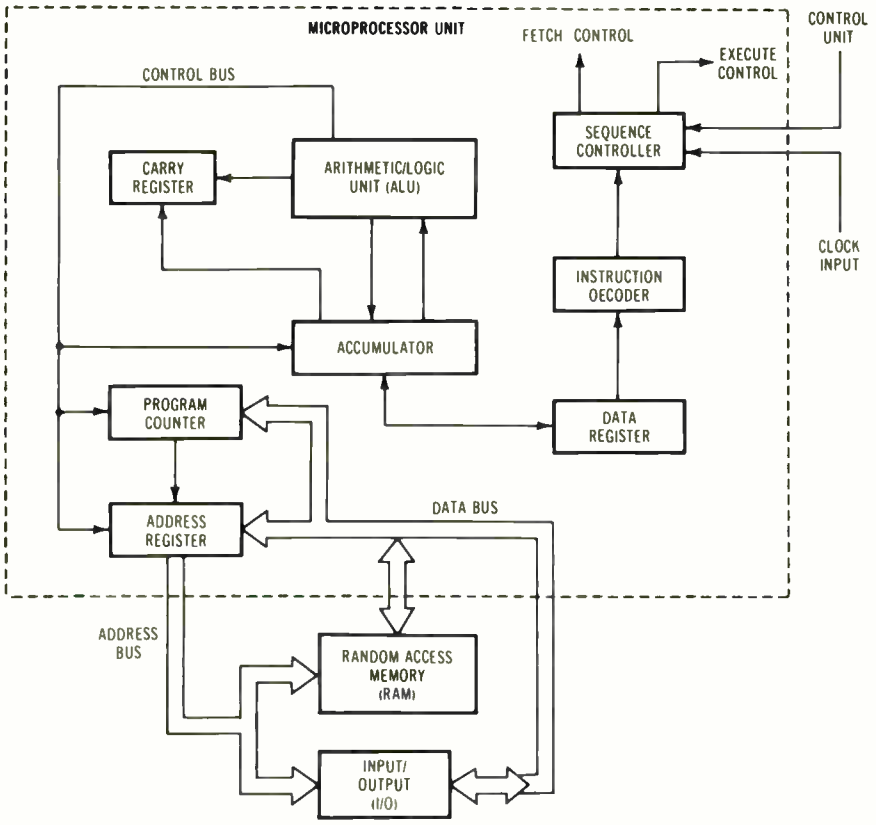



Fig. 7-2. Block diagram of a microprocessor.

a basic computer.

A block diagram of a typical microprocessor shows that it contains a number of basic computer components connected in a rather unusual manner. Fig. 7-2 shows a diagram of the internal functions of a microprocessor. Its construction includes an arithmetic logic unit, an accumulator, a data register, address registers, program counter, instruction decoder, and sequence controller.

## ARITHMETIC LOGIC UNIT

All microprocessors have an arithmetic and logic unit, or ALU. The ALU performs mathematical and logical operations on the data words supplied to it. It is made to work automatically by control signals developed by the instruction decoder.

The ALU simply combines the contents of its two inputs, which are called the data register and accumulator. As a general rule, addition, subtraction, and logic comparisons are the primary operations performed by the ALU. The specific operation to be performed is determined by a control signal supplied by the instruction decoder.

The data supplied to the inputs of an ALU is normally in the form of 8-bit binary numbers. Upon being received at the input, this data is combined by the ALU in accordance with the logic of binary arithmetic. Since a mathematical operation is ultimately performed on the two data inputs, the latter are often called operands.

To demonstrate the operation of the ALU, assume now that two binary numbers are to be added. In this case, let us consider the addition of the numbers $6_{10}$ and $8_{10}$. Initially, the binary number $00000110_{10}$, is placed in the accumulator. The second operand, $00001000_{10}$, representing the number $8_{10}$, is then placed into the data register. When a proper control line to the ALU is activated, binary addition is performed, producting an output of $00001110_2$, or $14_{10}$, which is the sum of the two operands. This value is then stored in the accumulator, where it replaces the operand that appeared there originally. The ALU only responds to binary numbers.

## ACCUMULATORS

The accumulators of a microprocessor are temporary registers that are designed to store operands that are to be processed by the ALU. Before the ALU can perform, it must first receive data from the accumulator. After the data register input and accumulator input are combined, the logical answer or output of the ALU appears in the accumulator. This particular function is essentially the same for all microprocessors.

In microprocessor operation, a typical instruction would be to "load the accumulator." This instruction enables the contents of a particular memory location to be placed into the accumulator. A similar instruction might be "store accumulator." In this operation the instruction causes the contents of the accumulator to be placed in a selected memory location. Essentially, the accumulator serves in one capacity as an input source for the ALU, and then as a destination area for its output.

## DATA REGISTERS

The data register of a microprocessor serves as a temporary storage location for information applied to the data bus. Typically, this register will accommodate an 8-bit data word. An example of a function of this register is operand storage for the ALU input. In addition, it may be called on to hold an instruction while the instruction is being decoded, or it may temporarily hold data prior to the data being placed in memory.

## ADDRESS REGISTERS

Address registers are used in microprocessors to temporarily store the address of a memory location that is to be accessed for data. In some units this register may be programmable. This means that it permits instructions to alter its contents. The program can also be used to build an address in the register prior to executing a memory reference instruction.

## PROGRAM COUNTER

The program counter of a microprocessor is a memory device that holds the address of the next instruction to be executed in a program. As a general rule, this unit simply counts

the instructions of program in sequential order. In practice, when the MPU has fetched instructions addressed by the program counter, the count advances to the next location. At any given point during the sequence, the counter indicates the location in memory from which the next information will be derived.

The numbering sequence of the program counter may be modified so that the next count may not follow a

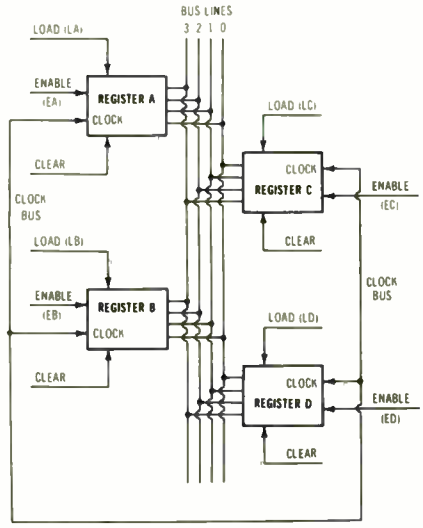



**Fig. 7-3. Registers connected to common bus lines.**

numerical order. Through this procedure, the counter may be programmed to jump from one point to another in a routine. This permits the MPU to have branching capabilities should the need arise.

## INSTRUCTIONS DECODERS

Each specific operation that the MPU can perform is identified by an exclusive binary number known as an instruction code. Eight-bit words are commonly used for this code. Exactly $2^8$ or $256_{10}$ separate or alternative operations can be represented by this code. After a typical instruction code is pulled from memory and placed in the data register, it must be decoded. This instruction decoder simply examines the coded word and selectively decides which operation is to be performed by the ALU. The output of the decoder is first applied to the sequence controller.

## SEQUENCE CONTROLLER

The sequence controller performs a number of very vital functions in the operation of a microprocessor. Using clock inputs, the circuitry maintains the proper sequence of events required to perform a processing task. After instructions are received and decoded, the sequence controller issues a control sign that initiates the proper processing action. In most units the controller has the capability of responding to external control signals.

## BUSES

The registers and components of most microprocessors are connected by a bus-organized type of network. In a computer based system, the term bus is defined as a group of conductor paths that are used to connect data words to various registers. A simplification of registers connected by a common bus is shown in Fig. 7-3.

The utility of bus-connected components is the ease with which a data word can be transmitted or loaded into registers. In operation, each register has inputs labeled clock, enable, load, and clear. When the load and enable input lines are low or at 0, each register is isolated form the common bus line.

When transferring a word from one register to another, it is necessary to

*(continued on page 57)*

# The St. Thomas Hospital Learning Center

**by Peter Mikelbank**

*"Three things are necessary for the salvation of man: to know what he ought to believe; to know what he ought to desire; and to know what he ought to do."*
*—St. Thomas Acquinas*

The St. Thomas Hospital Learning Center in Nashville, Tennessee, is a vast theater-sized auditorium with miles of electronic wiring and circuitry designed to expand and enhance medical knowledge. The Learning Center began as a vision shared by two men nearly a decade ago.

The initial dream belonged to Macon Ayres, the pioneering technical operations director of the American College of Cardiology's Learning Center in Bethesda, MD. It is Ayres' design for the Bethesda "Heart House" pavilion, an electronically enhanced forum for heart specialists, that inspired the second dream.

Dr. Lawrence Grossman attended a conference at the Bethesda facility in 1978 and returned to Nashville with a dream. "The concept was all Lawrence Grossman's," hospital architect and Learning Center designer Ron Franks of Hart, Freeland and Roberts, recalled. "He thought the concept was super and encouraged and led the fundraising."

Grossman's fundraising efforts convinced hospital authorities to contribute half of the Center's $3.2 million costs before its 1984 opening. It also resulted in the opportunity for Ayres to revise and revamp his original designs.

"Our thinking was that the hospital wanted multiple-use facility," Franks said, "one for learning, conferences and the orientation of new employees." This led the architectural design team into a more multiple use and flexible facility, moving it away from the elite individual seating the Bethesda facility has, and more towards the shared working console areas, and a much more sophisticated series of equipment application. Ayres was hired as a consultant to the project, providing knowledge in both engineering skills and practical experience. Local contractors were assigned the construction, equipment spec and installation responsibilities.

## LOGISTICS

Larry Link, who installed the Center's complex audio and visual systems, explained, "Macon Ayres had developed a performance specification based on his Heart House experience: what the learning experience should be like, what the facility itself should be built like and what electronic materials should be involved.

"We reviewed his performance specs and proposed our way of meeting his specs," he continued. "We were able to select for the most part which equipment we eventually used. He insisted on very little specific equipment."

The problems involved in meeting the Learning Centers' unique marriage of form and function was further complicated by the demands of integrating into an already existing space, while obeying strict state codes governing existing patient care areas.

In deciding to make the Learning Center an integral part of the hospital's daily operation, administrators chose to place the pavilion between two legs of an already existing K-shaped St. Thomas wing. Design and installation adjustments then had to be factored in on all five sides of the eventual pie-shaped design. Adjustments included installing an extra thick floor because the Center is over the Radiology lab; reconstructing sidewalls for existing corridors; and placement of the control booth and staging area.

## PERFECT LOCATION

Unanimously, despite some well-concealed shortfalls created by these limitations, the respective systems designers consider its chosen site a blessing in disguise. "It was really a perfect location," hospital architect Ron Franks said.

What emerged was a sloped auditorium dramatically focused into its natural V-shaped space. Its proscenium is dominated by a 12 foot x 20 foot rear projection screen and a speakers' podium. Behind the screen in the V-angle itself is a turned staircase-landing-staircase arrangement set at 90 degree angles, which serves as staging area for the multiple projection systems, tape library and access way to the control room.

Built flush along the auditorium sidewall, just below the acoustical ceiling level, the narrow control room is

**Peter Mikelbank is a freelance writer based in Nashville, TN. He is a former *Washington Post* staff writer.**

The Learning Center's audio-visual equipment includes an electronic character generator and television cameras.

New module (left), old module (right)

the center of the Learning Center's sophisticated audio/visual/computer response/satellite systems.

If the speakers' podium is the system's 'brain', and the individual response modules its 'pulse,' then the control room is the electronic 'heart' pulling the various systems together. Miles of wiring and a single 4 foot x 8 foot window connect the systems' engineers to the performances below. From its window access point, engineers are able to adjust giant screen images without distortion and easily oversee production responsibilities and observe the lecturer. Because of its height and unobtrusive location, the control booth and engineer activity is at a minimum during lectures and demonstrations.

"The wiring had to go in troughs on the floor because of the Center's location," Larry Link, President of Allied Sound said, "and because no one wanted to see any wiring or conduit of any kind."

## INDIVIDUAL SYSTEMS

Working with Macon Ayres, Link designed the individual modules and monitoring systems which St. Thomas installed, as opposed to the individual seat system at the Heart House. "The troughs had to be specially shaped to follow the curve of the circular shaped arena," said Link. "All the wiring had to go to an opposite wall and up that wall to the room's plenum space. From there, it went into the projection room's plenum space and then into the control room. And there's tons of wire in there."

The control room has a computer floor through most of it, with a wiring trough that goes back to the audio control console, lighting control and projection control areas. The specifics of installation to these demands required another week or two of extra cable running.

The control room is a model of efficiency, economy of space, innovation, and expanding technology. Equipment and rack space is organized and integrated among the four disciplines demanded by the Learning Center's productions (sound, visual aids, video and computer-response), as well as its functions as a satellite receiving-and broadcast center and commercial production unit.

A Digital RLO2 model computer with hard disk and backup runs the student monitoring response system in one corner near the workbench area. Beside it is a DEC Writer III system for printouts of the system's programs. Across from these are several rack systems integrating satellite receiving equipment (with a Zenith ½ inch recorder, a tracker for satellite dish control); video editing bay (Sony ¾ inch with three Videotek and Panasonic monitors), along with a Convergence 195 programmable editor with digital readout that is now interfaced with an Echolab SE/3 for post-edit special effects.

## MONITORS

Fourteen assorted preview and program monitors bank the Chyron RGU character generator and Harris 630 Frame Synchronizer and Microtime T-300 time base correction equipment is right angled to the audio console board. These monitors are used to work with not only feed from the satellite and Learning Center presentations from the floor—using five cameras, two JVCs and Ikegami units —but from a wide variety of other outlets around the hospital. The Learning Center has the broadcast capability of displaying endoscopic and micro-surgical operations, micro-pathological slide display and an overhead X-ray projector, which Allied Sound has since begun manufacturing based on its own design.

Recently, the control booth has seen the introduction of a computer animation work station including a Time Arts (IBM compatible) keyboard, Kurta electronic palete, Microvitec definition monitor and a Caspar program monitor. This approximately $20,000 station currently shares the wall space with the Centers' Samurai film camera, used to produce slides.

## AUDIO SYSTEM

The audio system is the key to the Center, containing the master control for the audio link between lecturer and students. The audio link is through an 18-input, four-channel output Audiotronics mixing board (with EQ available on only one channel) and a talk/back system designed by Allied for booth/speaker communication; a Swintek wireless mike receiver and the Symetrix audio-teleconferencing system are built in as well. Reel-to-reel (TEAC X-2000R and Otari MX-5050) and two Technics cassette recording units are available for playback and recording presentations. At eye level above the console, two enormous JBL 4411 studio monitors dominate the confined area.

Many of the control booth's functions are duplicated in the speakers' podium, giving those familiar with the system the advantage of directly controlling the system without engineering assistance. Space is at a premium and storage is a key area of concern to the Center's seven-member crew. While the floor area behind the rear projection screen is reserved for camera and cable storage, all concerned admit that storage areas were traded off early in exchange for other design concerns.

## TELEVISION COMMERCIALS

Recently, the Center crew began producing television commercials for the hospital, and while its proscenium can be adapted for a television production situation, they and the systems designers admit that a separate studio situation adjacent to the Center would be ideal.

The landing, which spans the V-angle behind the rear projection screen, is used for several different audio-visual stations. Three Kodak carousel projectors with Buhl 90 degree angle slide heads are mounted side-by-side for left, center and right image projection; a 16mm film projector, which can also operate from the front of the house when its reversing image lens is removed; and a GE rear screen projector are aimed at the reverse of the screen.

Though the screen appears frosted, it is actually "a lens with patterns ground into it," according to Franks. At the time it was the largest single pane size that 3M manufactured, and he notes, the largest one of its kind installed in the Southeast.

Through an innovation, the hospital managed to resolve one plaguing problem of rear screen projection and save itself several thousand dollars in return.

One problem with lecturing before a rear screen, center director John Welsh said, is that light points disappear against their coherent light. This problem was eventually solved by mounting a laser pointer on a security camera tilt-and-pan head and wiring its control into the speakers' podium. Total cost of the invention was under $900, while less effective manufactured models along the same principle were priced at $4,000.

## ENTERPRISE LOOK-A-LIKE

With a panel reminiscent of the

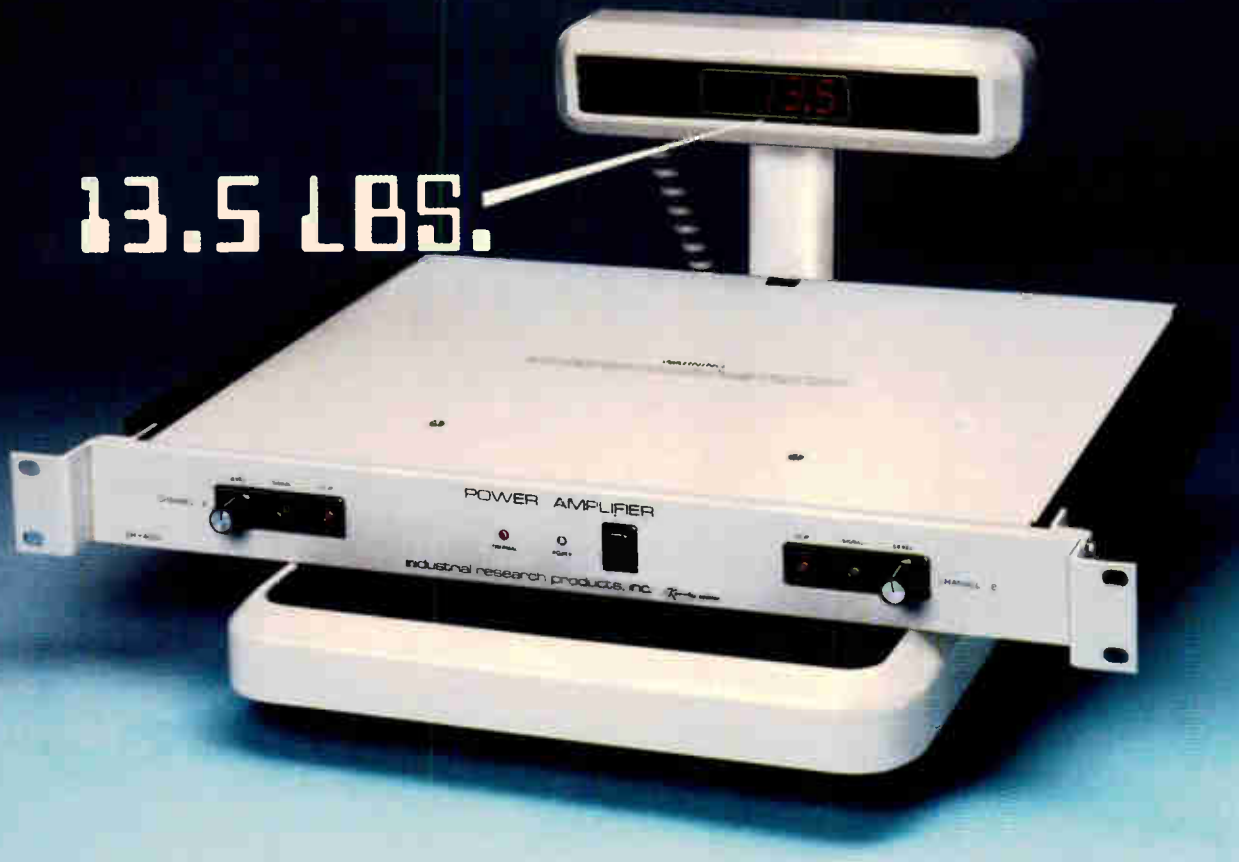
# The New lightweight Champ!

UL LISTED

## Model DH-4020 Power Amplifier

...a dual 100 watt per channel amplifier

13.5 LBS.




### NEW TECHNOLOGY

- **Signal dependant power supply**
- **100k Hz switching power supply**
- **Solid-state - no relays**

### FEATURES

- High efficiency MOS FET output stages
- Very low heat dissipation
- High reliability design
- Maintenance free/no fans
- No 60 Hz magnetic field
- Solid-state load protection and mute
- High fidelity specifications
- Absolutely clean clipping
- Optional 70 volt transformer

INDUSTRIAL RESEARCH PRODUCTS, INC.
A Knowles® COMPANY
321 Bond Street
Elk Grove Village, IL 60007
312-439-3600
Telex: 701845

*Circle 205 on Reader Response Card*

Starship Enterprise, the speakers' podium is a deceptively complex affair. The left hand side facing the speaker contains an exact schematic push-button system of the floor plan before him, with one button representing each learning module. When a student wishes to speak, he depresses a button at his console alerting the sound booth engineer and speaker that he wishes to be recognized.

Besides this unusual two-way communication link, the speaker also has controls for left-right-and center slide and television image control, a monitor screen, video pointer autopan joystick VP380 and a Valley People dyna-mic with two channels, and an equalizer. The entire podium is set on a scissors jack so it can be raised and lowered, and again its systems are run in tandem with the control booth to allow speakers freedom to wander around the lecture area. Additionally, all the rear projection equipment can be manually overrun and used by a projectionist behind the screen.

Yet, perhaps the most unusual facet of the Learning Center is the 72 shared console stations that tier away from the speaker. These were based upon the Heart House concept, but involved much further design enhancement to make them more flexible than their predecessors. After several prototypes were designed on paper, a design was developed that placed two students at each console to share the monitor unit, while minimizing some of the electronic wiring needs. Before each student is a console with several functions. Jacks were installed to allow students to use headsets for translation, stethophone (an amplification system enabling students to listen to a patient examination at the front of the auditorium) and a recording jack to allow for personal recording of sessions.

## MAIN CONSOLE FEATURE

But the main feature of the consoles are their computer-response systems. Five multiple choice buttons linked with the control room allow students to answer questions raised by either the instructor or the video screen, and for the instructor to instantaneously obtain test results by either number of answers or percentage at the same time. Either a red or green light with LED readout provides the student with correct answers or affirmation of their choice. Additionally each contains a message light indicating to individual hospital staff members, visiting doctors or conference attendees that they are being paged. Each module is placed along the banked tiers, so that there is an aisle's width directly behind it allowing members to exit a seminar without disturbing an entire row. Message center information is positioned directly behind the theater in the pavilion's spacious atrium lobby and office area.

Additionally, 99 gallery seats serviced by video monitor and PA systems were installed behind the computer modules to accommodate larger seminars.

## SO MANY OUTPUTS

"The main thing that's different about this situation," Link said, "from say, what you might find in a regular television studio is that there's so many outputs.

"Every desk and position can have noise-free, high resolution pictures," he continued. "The video system directly interfaces with the computer response system, so the person at a module can vote opinions, be tested or respond with the program the instructor is presenting. You can also know how often the person has changed his mind. And it provides very fast response to the instructor as to how well they're learning. And how well he's doing.

"As far as the Learning Response system is involved, no such system existed outside of the Heart House. Mac Ayres wanted this one to be better because he'd thought of ways it could be improved while using it for five years," said Link.

Similarly, Link credits Ayres with envisioning the larger role the facilities will play as teleconferences continue to become more and more a part of their operations. "When Mac Ayres theorized and developed the program for St. Thomas, he knew that downlinks first and then uplinks would eventually be in there. It was their future. Technically they started with enough equipment to get the job done without a transmitter to get it on the air...it's a studio."

## LIGHT BARS

Recently light bars were installed to provide the additional light required when the Learning Center broadcast its first satellite conference on April 2 to over 30 locations. Those were not the first improvements made in the Center since it opened. The initial design of the modules were more vertical and made of a dark oak housing. After use, it was determined that a slightly more angled housing was desirable which would allow students to ease back, while still being able to follow the speaker and their readout panels. The modules were redesigned to accept these changes and also encased in a white surface, which the hospital workers suggested might be more informal and less intimidating.

Additionally, lighting was adjusted in the theater to accommodate screen light and maximize the effectiveness of the rear screen projection, in sort of an electronic shakedown cruise.

"The object of the rear projection," Link emphasized, "is not so much that you don't have equipment in the room, but that it has added value creating an atmosphere where the room is light enough to enable students to take notes." The alignment of the slide projection, TV projection and correct lenses and angles, as well as diffusing monitor light was a challenge all its own he admits.

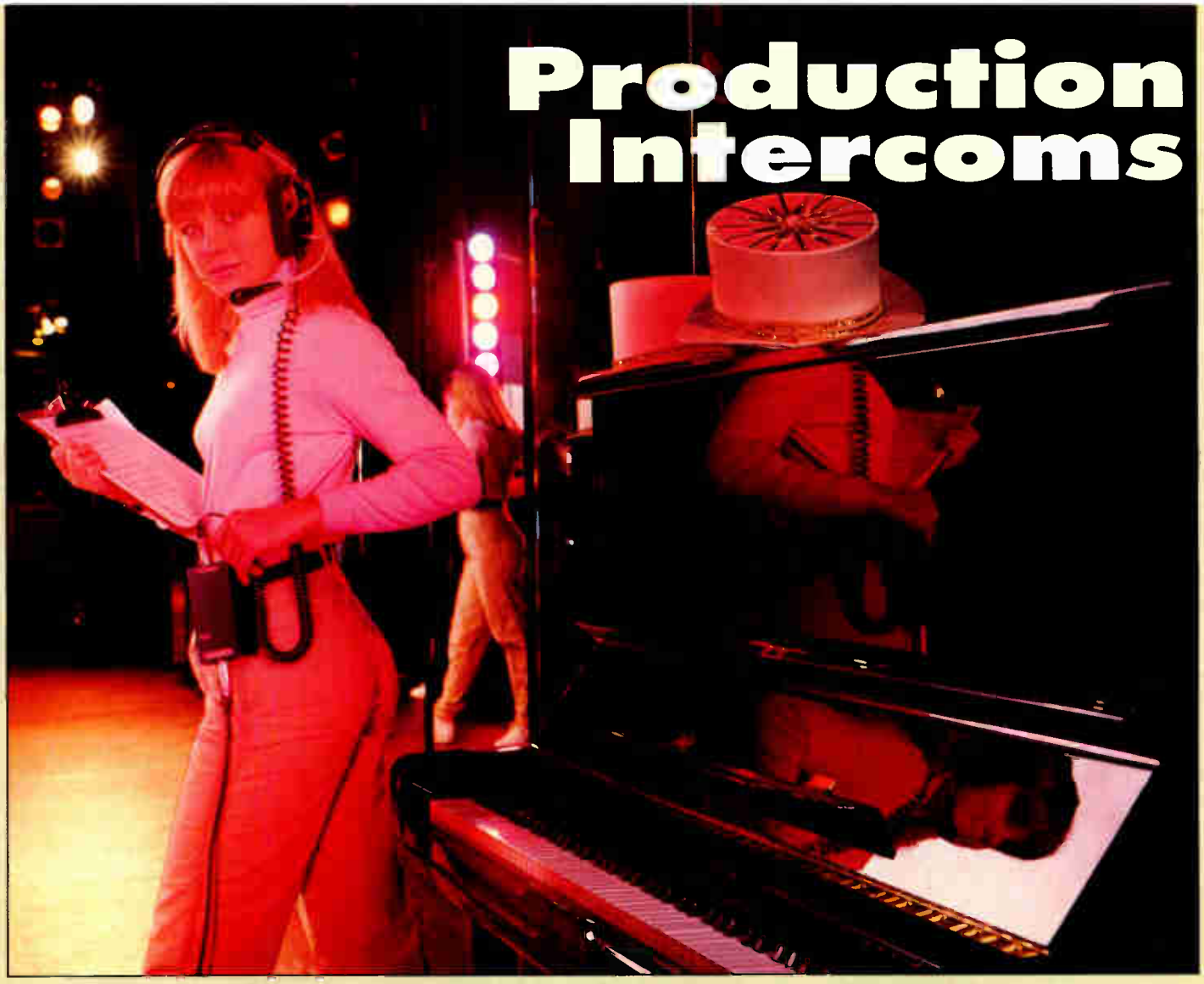
## AUDIO QUALITY

According to Link, the challenge of installing the room's many systems were demanding and the audio quality is a compliment to the rooms design. "It's very succesful. The system is interfaced with teleconferencing using a hearing aid type cartridge condensor microphone flushed into the desktop (Yamaha processing and amplification equipment and Allied Sound customized pickup and related audio pre-amplification equipment).

"Since its been installed with both high-level and low-level loudspeakers that are equalized and time-delayed properly, the student can achieve sufficient audio gain before feedback," he said.

Installing the speakers' system meant creating naturalness and realism through "a high level system with the sound emanating from the front end of the room to provide localization for the students to hear from the sounds point of origin," Link noted. "The room having a relatively low ceiling at the rear extremities dictated a time-delayed JBL loudspeaker that supplements the high-level source and doesn't appear to be on at all. The loudspeakers are back there," he smiles, "and you don't even know they're on."

# Production Intercoms



Telex's audiocom system, IC-2A line beltpack remote headset station is used at the Chanhassen Dinner Theatre in Minneapolis, Minnesota, during a production of "A Chorus Line."

## By Richard Feld

Communications is the lifeblood of any successful team from the food servers at the local fast-food restaurant to opening night on Broadway. A tutorial covering mic-cable intercoms including powering, audio signals, signalling, and circuiting will be presented.

The word intercom may be misleading when it is not further defined by a secondary descriptive term such as security, simplex, duplex, apartment, school/console, etc. The key defining term however, is whether the intercom is simplex or duplex. For this discussion concerning intercom technology we shall define intercom as a full-duplex system that uses two-conductor shield/ground cable to interconnect its various components. The cable specified lends itself to be used with standard mic-cable—hence, its common description of mic-cable intercom.

The functions in the mic-cable are to provide a path for: power, audio and control signalling, and common ground.

Usually the transmission lines are set up as low-impedance circuits and any devices placed on the line are

of a much higher bridging-impedance so that many "stations" may be easily used in a given system, or channel of a system without effecting the audio level. Another benefit to the scheme also allows for long cable runs without large drops in power supply voltage. A primary function in the intercom system can simply be viewed as a system of supplying power to receive/transmit stations within a distributed network, typically using mic-cable.

In supplying cable for the intercom it is important to select the proper cable size and connectors. The most important factor in choosing the correct size of cable for the majority of systems is the D.C. power loss due to voltage drop across the length of the cable. Ohms's law shows this to be calculated by: Voltage drop equals the current drawn multiplied by the resistance of the cable loop. The current drawn is dependent on the number and type of stations, and the resistance is characteristic of the cable. Typical cable resistances are shown in Table 1. It can be observed that the cable size must be increased for: increasing number of stations, increasing length of cable, use of high current-drawing stations (e.g., loudspeakers).

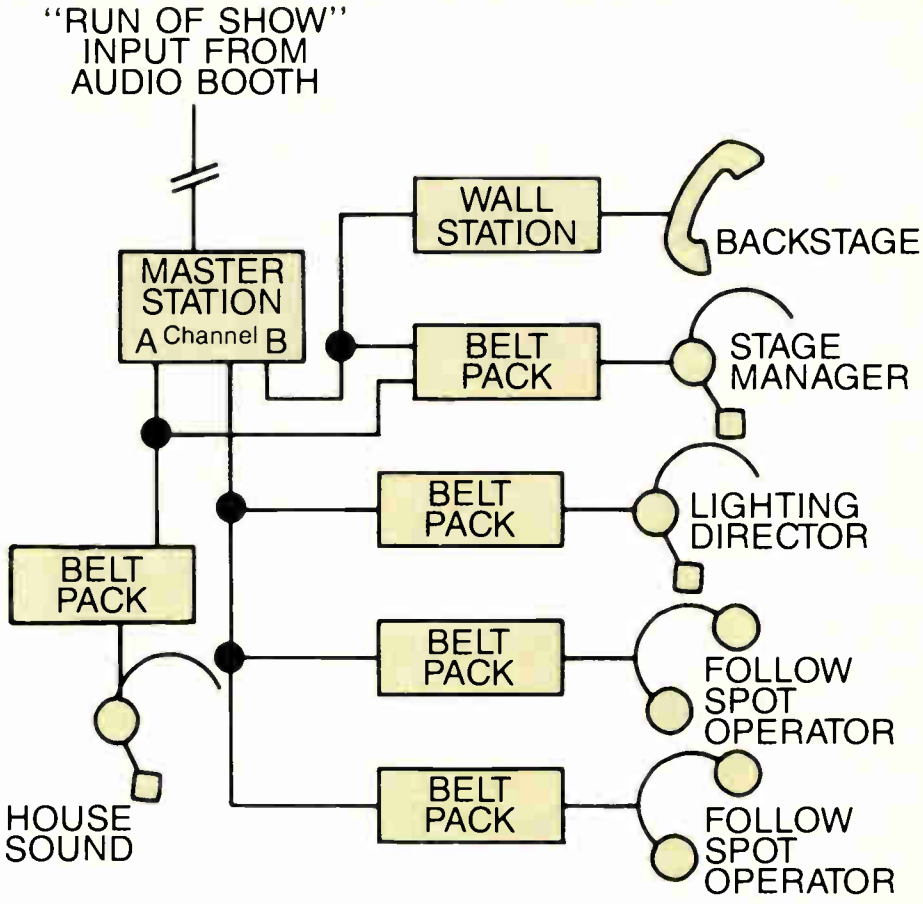



**Table 1 Cable Resistance**

| Resistance AWG | Ohms/1000' |
|---|---|
| 24 | 25 |
| 22 | 15 |
| 20 | 10 |
| 18 | 6 |
| 16 | 4 |
| 14 | 2.5 |

***Note: This table is approximate and for guidance only. For critical applications refer to cable manufacturer's specifications.***

The second function, audio and signalling, of the transmission path presents another aspect in cable specification—high frequency response. The cable capacitance and the cable resistance of the total cable run length will determine the high-frequency cut-off point of the system. In small lengths (under 500 feet) the capacitance is normally insignificant. In larger systems (over 3,000 feet) it becomes more critical. The capacitance of a cable is usually quoted as a pF/foot (pico-Farad) figure. For long lengths, or small size cables, this can become significant in reducing high-frequencies as the impedance of the cable reduces to approach that of the standard termination (usually somewhere around 200 ohms).

For systems with several distant stations, the requirements of larger cable to reduce voltage drops, which usually ensures capacitance, is sufficiently low. However, this factor must be considered in very long, low current applications. Remember, it will affect the (ib) while (ie) system and not just the remote station as with the voltage drop. The cable length we are considering here is not the length of a single run, but the total cable on any one circuit. Typically, a loss of 3 dB at 3 kHz is considered the maximum loss acceptable, although this may not be the case in situations where intelligibility is critical. The maximum cable capacitance for all the cable used is defined as:

(1) $C = 2FcR$

where:

Fc = cut off frequency in kHz

R = termination impedance in k ohms

**HM Electronics' series 700 cabled and wireless intercom systems**

Besides the power and frequency-response parameters of the system cabling, the absolute polarity of the cabling must be uniform throughout the entire network. Usually, pin 1 is designated as "ground" and pins 2 and 3 are designated as power and audio/control signals. Even though most intercom systems incorporate some type of reverse connection protection circuitry, any device hooked up backwards will not work. Also, the grounded A.C. plug on the system power supply unit(s) should be the only ground point in the system. This single-point ground will reduce ground loops and hum problems. Conversely, in permanantly installed systems, the shield/ground wire should not be tied to the conduit.

It should be mentioned that besides the three-wire unbalanced system there are two other configurations. RTS uses a convention of combining D.C. power, audio, and 20 kHz control signal on a single conductor—allowing for two-channel systems on mic-cable. Telex, however, uses a similar convention but uses a second conductor to form a bal-

**Clear-Com's RS-502 two-channel beltpack (left) and RS-501 single-channel beltpack**

anced line. The advantages are increased immunity from interfering electrical noise sources, and systems may be wired using any twisted three-pair conductors (no shield). Nevertheless, this is provided the wiring complies with the above mentioned reisitive and capacitive factors which in this case is in a 600 ohm line.

Thus far, it can be seen that two major aspects of an intercom system are the distribution of D.C. power and audio/control signals. These tasks can be as simple as connecting a power supply/main station and a belt-pack with a mic cable; to systems with multiple power supplies and matrix networks, and distributing power and signals among many "branch" circuits. However, the majority of installations call for just two channels of communications. In these typical situations two separate circuits are established and distributed throughout a facility with individual mic cables.

The most common control signal is the "all-call" type. Typically, this signal is either a D.C. voltage or a high-frequency (above the limits of audibility) tone that is sent down the audio line and received at each station. In most cases the signal is used to drive a lamp which lets everyone on that circuit know that somebody wishes to speak. These control signals may also be used for other control functions, turning loudspeakers off, or on.

Just about any intercom system used in the production/theatrical venue is based on the techniques outlined here. Many products offer sophistication and complexity beyond the scope of this article, but they are all based on the premise of distributing power, audio, and control signals down two or three conductor cable. It is up to the specifier of the system to chose the appropriate system and components to fulfill the communication needs of the facility. Armed with the basic knowledge of how these systems work, the design task can be simplified.

### Intercom Terminology

*Bridging, high impedance* (hi-Z): A parallel connection by means of which some of the signal energy in a circuit may be withdrawn with imperceptible effect on the normal operation of the circuit.

*Duplex:* The method of operation of a communication circuit in which each end can simultaneously transmit and receive.

*P.L., or party line:* In intercom terminology it is taken to mean when all stations are capable of communication with each other.

*Sidetone:* The reproduction, e.g., in a telephone receiver, of sounds received by the transmitter of the same head/hand set, as in hearing one's own voice in the receiver of a telephone set when speaking into the mouthpiece.

*Simplex:* A form of communication operation which involves transmission in only one direction at a time.

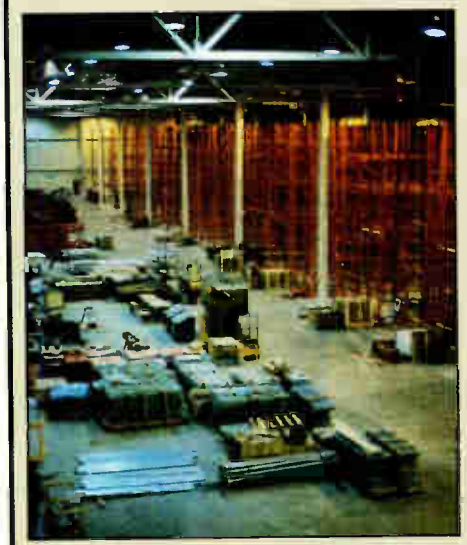
*TELCO* (TELephone COmpany): Refers to the transmission lines, telephones, and other equipment which complies with standard phone system specifications. Typical TELCO lines are 600-ohm duplex pairs, with a frequency response of 300 to 3 kHz, although many other variations are also available.

## An Unusual Application of a Production Intercom System

An unusual application of intercom technology is exemplified by the P.A. system at the Charley Brothers warehouse in New Stanton, PA. Designed and installed by Independence Communications Inc. of Pittsburgh, the system enables two operators to monitor calls and page, using headset microphones, within the 331,200 square-foot facility. The P.A. system, a distributed 70-volt paging-horn type, consists of 51 Atlas APT-34T horns, a TOA M-900 mixer, one TOA A-901, and two TOA P-912 amps. Installed throughout the warehouse were 66 Astatic WM635S wall mounted microphones, and an additional seven Astatic 631L hand-held microphones were installed at the center of the warehouse on top of a conveyor system.

Independence had installed several other similar systems at the customer's other warehouses. According to the system's designer, Duane Laufenburg, "Normal operation would be for a man to push-to-talk and page over the sound system. The customer did not care for excessive pages being made for non-vital purposes. We proposed a headset system for the control room in which all warehouse pages would be fed to an operator with a headset. The operator would then make the page himself, if necessary, using his headset mic."

A Technical Projects AD-903 2-4 wire adaptor was used to interface the P.A. system with two headset stations for the operators. The use of an intercom headset station allows the operators to hear "call-ins" from any of the 74 microphones. Since no audio monitoring is available at the microphone call-in locations, LED's were installed at each microphone plate indicating when a push-to-talk button is depressed at any other station.



**P.A. system operators use Technical Projects headset stations to help move dry goods around Charley Brothers 331,200 square-foot warehouse.**

**A typical intercom system found in a production or theatrical application.**

by Steve Orfield

# OUTDOOR SOUND

**Clair Brothers' S4 speaker systems, using JBL components, US Festival, Glen Helen Regional Park, CA.**

While many acoustic consulting firms, audio designers and dealers are involved with the problem of designing sound systems for interior use, many of those same companies tend to avoid the business of designing outdoor sound systems, due to apprehension concerning the difficulties to be encountered.

Inherent in the design of outdoor sound is knowledge of the differences between interior sound system design issues and those related to design of outdoor applications, and these differences can be understood and worked with on a predictable basis.

As with all sound systems, outdoor sound systems are designed based on one of a number of quality criteria, depending on the program material:

1. Intelligibility
2. Accuracy
3. Clarity
4. "Quality" of sound

Normally, the problem of sound system design increases with increases in:

1. Reverberation
2. Room shape echoes
3. Time delay
4. Distance to listeners
5. Background noise level
6. Increasing angular distribution requirements

Outdoors, the problems tend to shift, in that there are usually fewer problems with reverberation or echo (based on room shape), but other problems tend to increase moderately to dramatically. Specifically, there are a number of environmental acoustical issues that crop up in outdoor sound design, including:

1. Absorption of sound by air
2. Anechoic environment - no reinforcement
3. Barrier attenuation due to land contours
4. Environmental noise
   - traffic
   - aircraft
   - wind
   - rain
5. Crowd noise
6. Concession noise
7. Lack of visual cues from the speaker or performer

Thus, while indoor sound system quality is often based on low power system design supporting the room environment and background level of the particular space, outdoor systems are generally high in power due to the anechoic environment, distance to listener and background noise levels, and tend to

electronically create the "architectural presence" of the sound system in lieu of that normally provided by the room. Some guidelines to consider in the design of outdoor sound are:

1. Design to a minimum 15 dB signal to noise ratio based on the actual outdoor environment maximum levels. If the message to be presented is very important, this could easily be increased to a 25 dB S/N. A simple assumption of various environmental levels is:

| | |
|---|---|
| Residential Area | 50-60 dBA |
| Commercial Area | 60-70 dBA |
| Noisy Crowd | 70-80 dBA |
| Freeway Proximity | 70-80 dBA |
| Airport Proximity | 80-110 dBA |

This would suggest minimum levels at the audience of:

| | |
|---|---|
| Residential Area | 65-75 dBA |
| Commercial Area | 75-85 dBA |
| Noisy Crowd | 85 + dBA |
| Freeway Proximity | -- dBA* |
| Airport Proximity | -- dBA* |

(*I would suggest that the last two categories of noise levels would determine that an outdoor event should be moved to a quieter location, although the racetrack enthusiasts would certainly argue with this view.)

It is an unfortunate aside to this discussion that there are many outdoor events that produce levels of sound far beyond the desires of requirements of the audience as a result of the equation of music level with quality, especially with rock music. Some of these problems are due to the hearing loss of the performers, and some are due to totally inadequate monitoring equipment for performers. I encourage the performers to experience the maximum level that the audience is exposed to as a minimum cue to appropriate loudness.

**Table 1**
**Noise Criteria Curves**

| Curve Designation | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 |
|---|---|---|---|---|---|---|---|---|
| NC 35 | 60 | 52 | 45 | 40 | 36 | 34 | 33 | 32 |
| NC 40 | 64 | 56 | 50 | 45 | 41 | 39 | 38 | 37 |
| NC 45 | 67 | 60 | 54 | 49 | 46 | 44 | 43 | 42 |
| NC 50 | 71 | 64 | 58 | 54 | 51 | 49 | 48 | 47 |
| NC 55 | 74 | 67 | 62 | 58 | 56 | 54 | 53 | 52 |
| NC 60 | 77 | 71 | 67 | 63 | 61 | 59 | 58 | 57 |
| NC 65 | 80 | 75 | 71 | 68 | 66 | 64 | 63 | 62 |
| Threshold of Audibility | 42 | 22 | 13 | 8 | 5 | 3 | - | - |

(Reference NOISE AND VIBRATION CONTROL, Leo L. Beranek, McGraw Hill Book Company, 1971.

A more sophisticated determination of the definition of background noise via Noise Criteria or NC curves (see Table 1) or via Ln (L10, L50, L90) environmental noise definitions should be undertaken, if available. These Ln levels define the hourly exposure of the site to environmental levels.

Some typical definitions of probable NC curves follow, although it is certainly minimally appropriate to actually sample site noise to create a more exact definition.

2. Calculate the power required in each frequency range, based on the directional coverage of the source and the required distance to the listener. (Remember greater levels of power that low frequency coverage suggests.)
3. Consider that sound reduces at a theoretical level of 6 dB for each doubling of distance, and that sound levels theoretically increase by 3 dB for each doubling of power, and use this to determine furthest listener power requirements.

The calculation of reduction over distance is simple in most cases, and is described in the formula:

$$SPL = 20 \log \frac{\text{Close Reference Distance}}{\text{Field Desired Distance}}$$

Usually, the close measurement distance is taken to be three feet or one meter, as speaker manufacturers measure sensitivity in that distance range.

4. Assume that an appropriately designed performance shell can add significantly to the level increase of the performance, for sources that have some rear or vertical orientation in their directional intensity.
5. Try to originate the sound from one position, so that time delay and level variations can be controlled, and try to provide enough mounting height so that the distance from the cluster to the front and the rear of the audience does not provide too extreme a level variation.

   Determine any possible problems of multiple path interference by ray diagramming the plan view and a number of axial sections through the site.
6. Remember that air is a sound absorber, and that it is more efficient at higher frequencies and lower temperatures; thus, sound tends to shift to a lower frequency distribution over distance. A guide to air absorption under typical conditions may be found in Table 2.
7. Test the site prior to design and after completion with one of the known methods of speech intelligibility evaluation, to insure that the performance was based on a prediction from accurate assumptions and that the result was satisfactory.

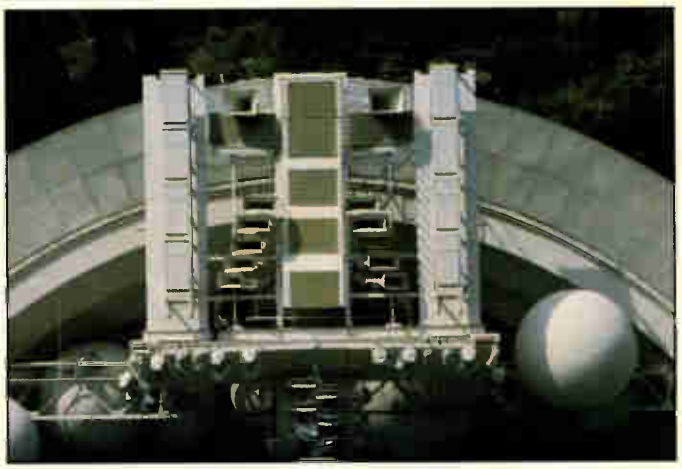
Current methods of speech intelligibility evaluation include:

- Word Score Test
- Articulation Index Test
- Articulation Loss of Consonants Test
- Rapid Speech Transmission Test

Intelligibility theory and test methodology are covered in some detail in the October and November 1986 issues of *Sound & Communications Magazine*.

While the information in Table 2 provides a sketch of some

**Bose's 802 series II articulated array loudspeakers, Liberty Weekend**



**B.E.S.' RB-301s, Hollywood Bowl, CA**

of the issues involved with this type of project, there are a number of others that should also be noted, and these would be regarded by some practitioners as the principle issues in this type of project.

**Table 2**
**Atmospheric Attenuation Coefficients (dB / 100m): Frequency**

| | RH | 125 | 250 | 500 | 1000 | 2000 | 4000 |
|---|---|---|---|---|---|---|---|
| | 10 | .09 | .19 | .35 | .82 | 2.6 | 8.8 |
| | 20 | .06 | .18 | .37 | .64 | 1.4 | 4.4 |
| 86 F | 30 | .04 | .15 | .38 | .68 | 1.2 | 3.2 |
| | 50 | .03 | .10 | .33 | .75 | 1.3 | 2.5 |
| | 70 | .02 | .08 | .27 | .74 | 1.4 | 2.5 |
| | 90 | .02 | .06 | .24 | .70 | 1.5 | 2.6 |
| | RH | 125 | 250 | 500 | 1000 | 2000 | 4000 |
| | 10 | .08 | .15 | .38 | 1.21 | 4.0 | 10.9 |
| | 20 | .07 | .15 | .27 | .62 | 1.9 | 6.7 |
| 68 F | 30 | .05 | .14 | .27 | .51 | 1.3 | 4.4 |
| | 50 | .04 | .12 | .28 | .50 | 1.0 | 2.8 |
| | 70 | .03 | .10 | .27 | .54 | .96 | 2.3 |
| | 90 | .02 | .08 | .26 | .56 | .99 | 2.1 |
| | RH | 125 | 250 | 500 | 1000 | 2000 | 4000 |
| | 10 | .07 | .19 | .61 | 1.9 | 4.5 | 7.0 |
| | 20 | .06 | .11 | .29 | .94 | 3.2 | 9.0 |
| 50 F | 30 | .05 | .11 | .22 | .61 | 2.1 | 7.0 |
| | 50 | .04 | .11 | .20 | .41 | 1.2 | 4.2 |
| | 70 | .04 | .10 | .20 | .38 | .92 | 3.0 |
| | 90 | .03 | .10 | .21 | .38 | .81 | 2.5 |
| | RH | 125 | 250 | 500 | 1000 | 2000 | 4000 |
| | 10 | .10 | .30 | .89 | 1.8 | 2.3 | 2.6 |
| | 20 | .05 | .15 | .50 | 1.6 | 3.7 | 5.7 |
| 32 F | 30 | .04 | .10 | .31 | 1.08 | 3.3 | 7.4 |
| | 50 | .04 | .08 | .19 | .60 | 2.1 | 6.7 |
| | 70 | .04 | .08 | .16 | .42 | 1.4 | 5.1 |
| | 90 | .03 | .08 | .15 | .36 | 1.1 | 4.1 |

ANSI standard S-1.26/ASA 23-1978 (Proposed) )

First, the equipment may need to be durable under unusually poor conditions, such as moisture and direct impact; it is not well-known outside of the group for constant users of this type of gear that the reputation of amplifiers for quality often derives from durablity exhibited by some equipment, rather than the level of audio reproduction accuracy.

Secondly, while indoor sound systems have a constant performance definition in time, outdoor systems are often in need of far more monitoring due to the changing program requirements, the changing temperature and humidity and the changing levels of background noise.

Thus, many outdoor systems are in need of a method of constant evaluation of the level of performance at relevant audience points. It may well be that the newer program based equalization techniques, such as the SIM method of employing the dual channel FFT analyzer, will find quite a legitimate use in these cases.

The research that is now underway in the evaluation of the basis for quality decisions in the audio field, such as that undertaken by Floyd Toole of the National Research Council, should provide far better set of performance definitions that the audio designer can respond to with more confidence.

Finally, most indoor sound systems are evaluated in the presence of visual cues from the performer; this is assumed in speech intelligibility standards; with the increasing distance between talker and listener in outdoor sound, there is very litle ability to depend on visual cues. Interestingly, the use of large video images of a talker in a large stadium can predictably increase intelligibility where that view is accessible and subtends a large enough viewer angle to be visibly informational.

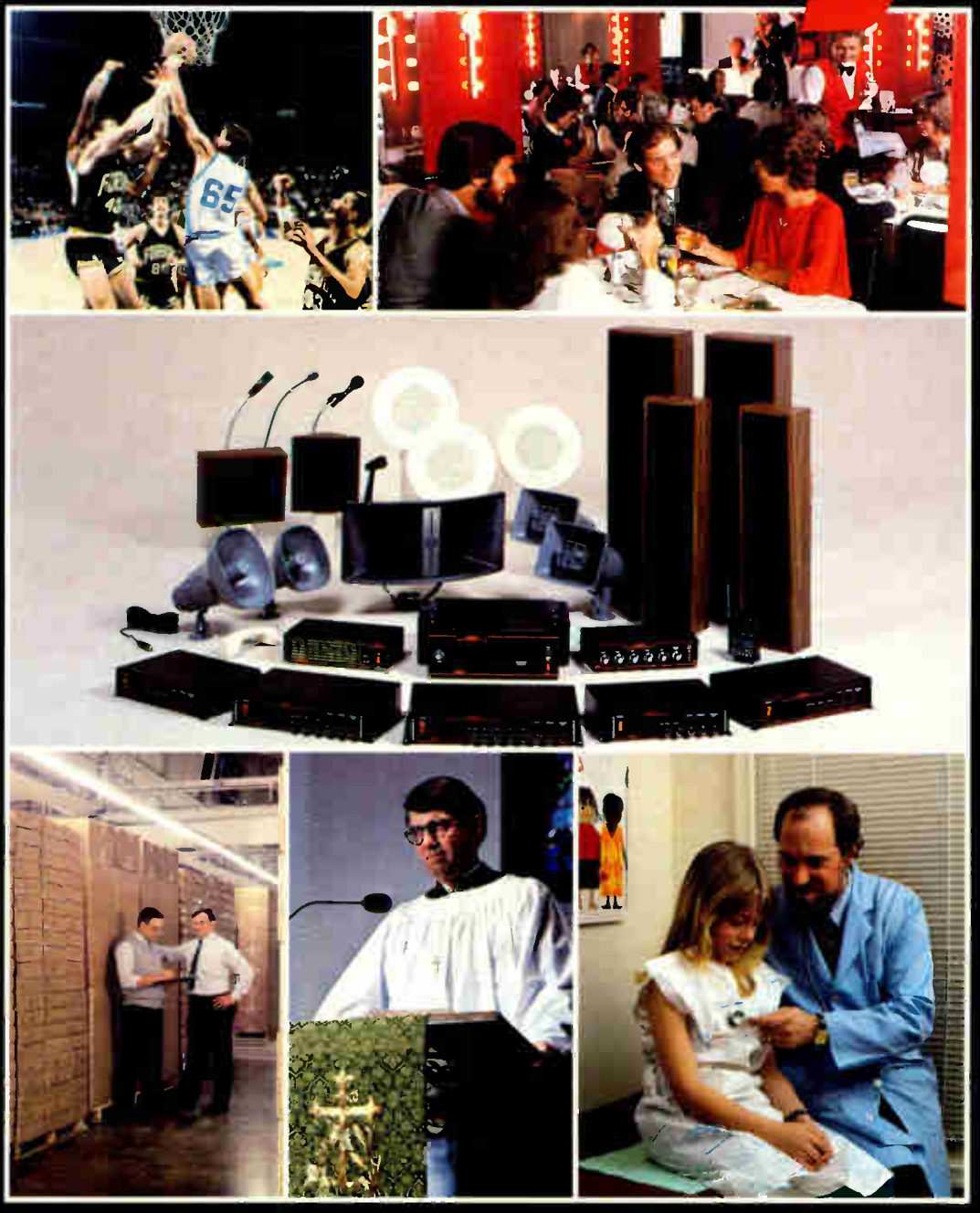
Since the measurement of sound became the province of the audio designer, we have travelled through three measurement dimensions:

- Sound Level
- Frequency Distribution
- Time (reverberation)

In the last few years, sound measurement has been increasingly interested in the third variable, time, in both the time delay spectrometry measurements of the TEF computer and in the European Rapid Speech Transmission Index. The measurement and quantification of time-based distortion components is moving very quickly toward a point of common use in the field.

The next frontier under attack by the measurement community is that of sound direction; while we have long been interested in the use of polar diagrams of sound sources, we

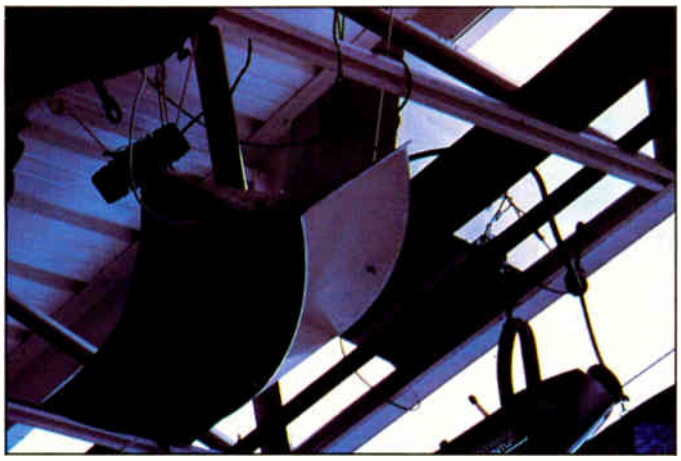
# Clarity™



*The Difference Is Perfectly Clear.*

*1111 Industry Avenue/Roanoke, Virginia 24013/703-982-3900*

Circle 210 on Reader Response Card



**Electro-Voice's T1606AX low-frequency bass bins, Tennessee State Amphitheater**

**Altec Lansing's MR64 constant directivity horns with 731 drivers, Shea Stadium, NY**

are not yet very familiar with the process of viewing polar diagrams of sound from the listener position. There are a number of developments of interest in evaluation of sound direction in mesurement:

1. The National Research Council is working on a system of software to evaluate the "lateral fraction" of sound from the listener position. I have recently visited with David Bradley of the NRC and have seen a very interesting embodiment of this type of measurement in the use of this software with the Norwegian Electronics dual channel real-time analyzer.
2. Farrel Becker of Audio Artistry, a consultant to Techron, is independently working on a program to develop polar listening position data, and this program will be introduced this year.
3. The TEF analyzer has the capability to define and separate the energy-time-curve data from this analyzer into fractional information based on user definitions, in order to look at direct-to-reverberant ratios.
4. Sound intensity measurement via two spaced microphones is coming of age, and this is the only direct method of measuring sound direction. As yet, it has seen very little application in audio, for such a promising technology.
5. Richard Heyser, the inventor of time delay spectrometry, is working on the uses of sound intensity measurement to simulate the actual binaural hearing process, and this should provide invaluable information in the process of understanding psychological acoustics performance definitions.

**Bibliography**


Beranek, Leo L., *Noise and Vibration Control*, McGraw Hill Book Company, 1971.

Harris, Cyril M., *Handbook of Noise Control*, McGraw Hill Book Company 1979.

Peppin and Rodman, *Community Noise*, American Society for Testing and Materials, 1979.

Davis, Don and Carolyn, *Sound System Engineering*, Howard W. Sams and Company, 1987.

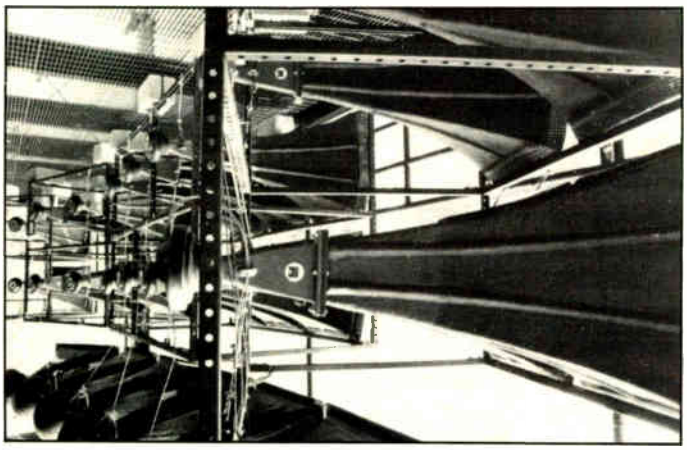
"ISO, Acoustics, Vibration and Shock," *Standards Handbook 4*, International Organization for Standardization, 1985.

Orfield, S. J., "Speech Intelligibility: Part 1," *Sound & Communications Magazine*, October 1986.

Orfield, S. J., "Speech Intelligibility: Part 2," *Sound & Communications Magazine*, November 1986.



**Steve Orfield, a Minneapolis consultant, has been involved with architectural technology consulting for 15 years and practices in the fields of acoustics, audio, lighting, daylighting and thermal environment. He is a member of ASA, AES, ANSI, ASTM, IES and IFMA, and is on the ASTM E-33 Committee on Environmental Acoustics.**

**JBL's Bi-Radials 2366, Baltimore Orioles Stadium.**

**JBL's 2360 Series Bi-Radial horns, Texas Stadium.**

# What is a Board Room or Conference Room without Microphones or Speakers?

# Beautiful!

INTRODUCING THE MOST ADVANCED
VOICE-LIFT & TELECONFERENCING
PRODUCTS AVAILABLE TODAY.
T.A.I. SYSTEMS BY BOZAK.

CALL TODAY. (203) 225-0555

Bozak®

*TECHNICAL ACOUSTICS INC.*
*326 SOUTH ST., NEW BRITAIN, CT 06051* *TELEX: 955439*



***Circle 209 on Reader Response Card***

# THE INEPTRONICS MODEL TA-4761 ELECTROACOUSTICAL SUPERFLURATOR®

by Hiram Levity and Sosumi

**Editor's Note:** We hold no responsibilities for the claims or any statements made by the manufacturers or reviewers of this product.

From time to time we are called upon to evaluate new and innovative audio products. It was with antithetical anticipation we awaited the arrival of the new digital-ready Model TA-4761 ElectroAcoustical Superflurator® from Ineptronics. For those that have not been following the growth of Ineptronics, allow us the liberty to promulgate their secrets to success.

Since their conception in 1929, Ineptronics has solely based their entire product line on one theory by Dr. J. Johanson (or Jimmy John to his friends). Dr. J's theory of relaxtivity basically states that, "No molecules or electrons will flow before their time."

## The Perplexities

Most products we evaluate lend themselves to a somewhat straightforward approach inasmuch as we go about the evaluation procedure. The Ineptronics Electroacoustical Superflurator (EAS) presented us with some rather unique challenges. The EAS has been analyzed by some of the greatest minds in electroacoustical science today including Dr. Itchkin Fingres of the University of Chelm, Prof. Alfred Loudshpeakerenfryer, and Alex S. Smith, Provost, of the doctoral program in Anti-Autophony at the University of Dumkopfsville. Therefore, it is with great trepidation that we delve into this historically epochal project.

There was great excitement caused around our laboratories precipitated by the announcement of our facility being prestigiously selected as the most eminently qualified test-site. Our facility proudly boasts the recent acquisition of an anti-dated Blem-Fractometer, a Kumquat-Kit hi-distortion Inflatulator, and a Bromar Brain. These recent incorporations of the latest in state-of-the-art technologies and our new head-technician Aska Lotta, a recent "Precipitation Vocation." The test procedures we designed for the EAS are rather complex and redundantly detailed in nature and, therefore, dictated the need for our three-and-a-half man team to work very closely throughout the neurofastidious procedures described henceforthcoming.

## The Test Procedures

These procedures will be limited to a brief outline, as they are the subject of an upcoming predacious lawsuit. As aforementioned, the energy source relies heavily upon a critical blend of Krypton, quasi-polysteric leisure suits, Jolt Cola, and Zayda's corned beef. It is the duty of the technician on duty, while in an inebriated procumbant state, to ensure throughout the testing procedures a steady flux of Jolt and Zayda's corned-beef. Germane to these procedures is the facile understanding that perpiscuity of noncongnitive terms of the following equaltion are profligated:

(1) $E = mc^2$

With these preconceptions of energy sources, we move on to the remaining aspects of our testing. Unfortunately, this brings up the estimable points thus far pugnaciously enumerated in the above aforementioned litigations. However, we will rest on our laurels and metaphorically state that the reader will have to take us on the honor or our word.

## The EAS System

The EAS is a highly complex analog/digital, systolic, pseudo/quasi-linear device which includes, but is not limited to, a maxi-reciprocalator (under patent litigation of course), reverse particle-flow inflexor, and proprietary data-obliteration system. The EAS, which comes in your choice of decorator colors, processes data which is input to it through its Archimedes-function, exponentially-tapered, con-

ical rapid input device, or data funnel (more on this later); the datum are then passed through data-arbitration, under control of a generic micro-preditor, and then all non-pertinent datum are combined systolicly through a Monte Carlo number randomizer/collation trasher. The execution is simply startling. The brain of the machine, located on one end, is known among infamous electroacousticians as the Input Stream Data Encoding and Encryption Processor, or IS-DEEP, a patent-pending graphite linear-feed designed to perform the message input/recording function. Protection against the hostile environment is provided by a cellulose fiber reinforced-resin IS-DEEP protection layer.

The opposite end incorporates an ingenious solution to error-correction problems, an abrasive data character erase module. In the erase mode, the module is briskly rubbed across the data characters to be deleted and, by the phenomenon known in physics as "lift-off," the undesired data may easily be expunged.

Reliability tests, conducted under rigid federal test parameters, revealed an extremely low failure rate, with the graphite fracturing only once in every thousand performances.

A peripheral product has been devised, to be used in the rare event of such a failure, which incorporates the use of a clever device called the Linear Feed Maintenance System. The LFMS literally "sharpens" the "pencil" by removing the graphite protection layer, exposing a fresh length of graphite to the IS-DEEP.

The IS-DEEP and LFMS systems were initially developed as part of an extensive and intensive research and development program for the U.S. Government Defense Department. The unit sets originally cost the government $778.95 each. However, through an engenious network of coercion, Ineptronics was able to procure a rather substantial surplus stockpile of the IS-DEEP and LFMS systems and pass on the savings as an enhanced consumer feature.

**The Tests**

The testing proceeded smoothly and the EAS performed as we expected. Its permeation index remained constant through increase in data input and varying spectral contortions. We also observed an extraordinarily low conversion efficiency of 0.000⅓ percent. This is in part due to the energy source used by the EAS. While we do not normally use such drastic and unsafe testing, we ran a battery of Blem-Fractometry profiles.

Subsequent tests were performed with our Kumquat-Kit hi-distortion inflatulator, other ISO, ANSI, and IEEE non-approved instruments, and of course our Bomar Brain. The Kumquat-Kit provided an unstable inconsistent pulse test source which confirmed the highly non-linear nature of the IS-DEEP as stipulated in the product statement of unindemnity. As an aside we performed an EPT, and found no excessive traces of induced flux-density. However, the closely interrelated curves plotted of the hysteresis of the balanced maxi-reciprocalator in its pseudo-linear state versus its quasi-linear state are astonishing. Unfortunately, we are unable to show these results at this time since our touch-up artist is on vacation.

Upon close inspection of the Archimedes-function exponentially-tapered, conical, rapid input device, we found a slight manufacturing defect in that the taper slightly departs from a true Archimedes function. When we called this to the attention of the engineers at Ineptronics they replied, "So What!" We also questioned the validity of using a generic micro-preditor to control a reverse particle-flow inflexor. It is our understanding that a custom predecessor would require much less software programming. The Ineptronics engineers ensured us that they were "looking into it."

The "proprietary data-obliteration" device works as exactly detailed in the

# THE PROS SAY A FEW WORDS ABOUT THE MANY COMPONENTS OF JBL.

High-quality components teamed up with results-oriented engineering. That's how JBL Professional helps the pros achieve superior sound for specific applications. Here's what JBL means to five leading professionals—all with vastly different requirements:

"JBL products are very reliable and efficient, and that's why we've used them for 16 years here at Abbey Road Studios. We have JBL equipment in many locations throughout the studios, and these products give us the sound uniformity we really need. We can count on JBL for professional, solid, great-sounding products."
**Ken Townsend, General Manager**
**Abbey Road Studios, London, England**

"In the concert sound business, we don't get any second chances. If the sound system doesn't perform, the audience can't come back next week when we've got it right. That's why we chose JBL. JBL products offer professional dependability and great sound—and that's how we define quality in our business. JBL really cares about making their products the best."
**Roy Clair**
**Clair Brothers Audio**

"You can't create a truly outstanding soundtrack without being able to hear everything accurately. That's why JBL's clarity was the first thing that impressed me. And with JBL, I can rest assured that our soundtrack will sound just as good in the theaters as it does in the studio."
**John Bonner, Chief Engineer**
**Goldwyn Sound Department**
**Warner Hollywood Studios**

"We first installed JBL equipment when we were selected as the boxing venue for the 1984 Olympics. Our P.A. system brings great consistency and clarity to all our sporting events, including wrestling, motor sports, track meets, and basketball. JBL components deliver outstanding sound regardless of your seating location or the size of the crowd."
**Glenn Mon, Acting Director**
**Los Angeles Sports Arena**

"We chose JBL equipment because of its great reliability and transparency. All the worshippers in our 7,000-seat sanctuary must be able to hear equally well. JBL horns accomplish this without coloration. The sound is very clear and natural no matter where you're sitting."
**David Taylor, Director of Media**
**First Southern Baptist Church**
**Del City, Oklahoma**

At JBL Professional, we believe that components should match your application, not the other way around. To hear more about what sound professionals see in us, contact your JBL Professional dealer.

JBL Professional
8500 Balboa Boulevard
Northridge, CA 91329

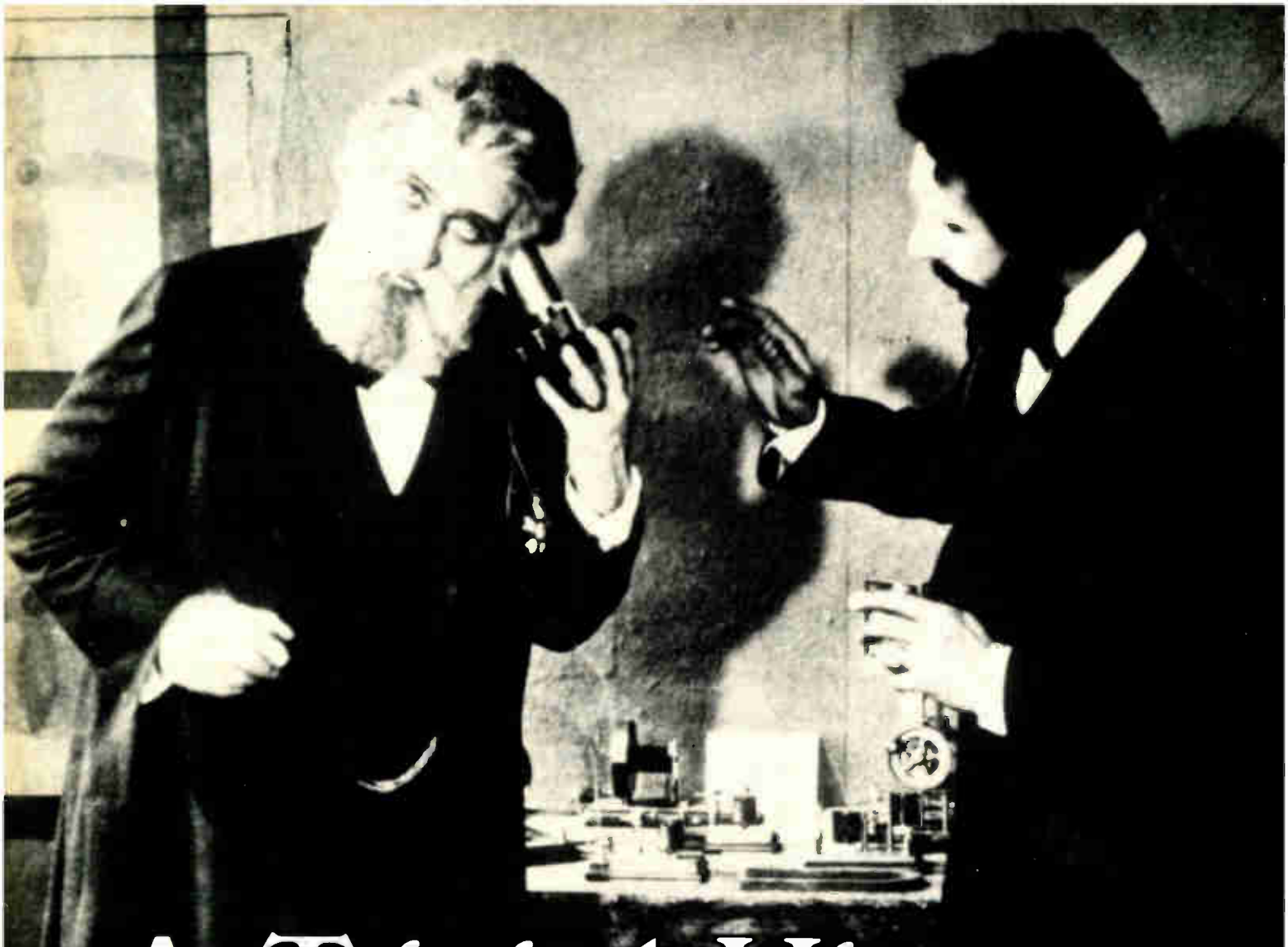
*Circle 232 on Reader Response Card*

U.S. Defense Department Classified Report, which we happen to have a copy of. Obviously, we promised not to devulge its operation. The real slick part of the EAS is the data-arbitration unit we mentioned earlier. This section is the latest innovation of Ineptronics based on Dr. Johanson's theory of Relaxtivity. Any data which have been encrypted by the IS-DEEP flow where and when they want or need to—not before. The data-arbitrator acts as a referee to ensure that no individual data-fragments collide with each other. These processes were confirmed by our Illogiscope.

Using our Histronics PeekoNanameter we checked for reverse particle-flow and measured the degree of reversing and the ramifications of spectral phasing due to the boundary effect and found them to be subliminal. At this point there are perinent and non-pertinet data present in the system. It is the job of the Systolic Imager and Monte Carlo number randomizer/collator to discriminate, sort, and further manipulate said data. All pertinent data are "trashed," and non-pertinent data are passed on to the output stages. Since we do not understand this part of the EAS, we took the manufacturer's word for it.

In a telephone call to his home, Dr. Johanson conceded that the EAS reaches a quasi-oscillatory state during the minimum-entropy phase while accelerating to its peak-throughput using what he called the "chimney effect." We found this contradicatory to our findings and beliefs. Perhaps we did not achieve the proper blend in our energy source. If any reader has experience in these areas and can be of some elusive aid, please drop a note to: Aska Lotta, Head-Technician. All in all after retreating to our "Council Status," we report inconclusively, and bilaterally agree in a "thumbs up" for the Ineptronics digital-ready Model TA-4761 ElectroAcoustical Superflurator.


Acknowledgement: The authors, Jesse Klapholz and Richard Feld would like to thank Norm Crosby and Prof. Erwin Corey for their perspiration and perplexiocesness during the conceiving and delivery of this trajectitorial.



# A Trivial History of the Telephone

by Sandy Kyrish

A rare photograph of Bell instructing Dom Pedro, the Emperor of Brazil, on use of the centennial phone receiver at the Philadelphia Centennial Exposition in 1876. At the Expo, Pedro exclaimed, "My God! It talks!"

If Alexander Graham Bell had known more German, he might not have invented the telephone. This is a trivial history of the telephone system -- about the unlikely ways we got things like telephone numbers, automatic switching, and service connection charges.

A common myth about the invention of the telephone is that Bell was working on a device for deaf persons. Bell was actually being paid to invent a "harmonic telegraph," a primitive multiplexing device for sending several telegraph messages down a single wire. But Bell was a teacher of the deaf, and his formal training was not in electronics but in sound and its propagation. He was interested in producing a harmonic telegraph since it paid the bills, but he was more interested in trying to send voice signals across a wire.

## Many Failed

At the time, lots of inventors were trying to do the same thing, but their ideas failed because they naturally patterned their techniques after the intermittent transmission principles of the telegraph. (Ironically, they were way ahead of themselves in trying to "go digital" in the 1870's.)

But Bell's understanding of the physiology of hearing had inspired him to the theory that an electrical current could be made to vary in intensity corresponding to the variations in air pressure caused by sound waves. And he had gotten the idea of using electricity as the transducer when he incorrectly translated an article by a German scientist; Bell thought the scientist had sent sounds from a tuning fork across a telegraph wire.

Fortunately, Bell didn't have enough training in contemporary electronics to know that his analog transmission idea violated most of the theories of the day. Bell himself once remarked, "Had I known more about electricity, and less about sound, I never would have invented the telephone."

And although Bell and Thomas Watson did experience the historic acid-spilling episode, Bell's statement of "Mr. Watson—come here—I want to see you," peeped out of the other end at a loss of at least 60 decibels. The early telephone experiments depended largely on Bell's stentorian voice and Watson's acute hearing. (Watson invented the first telephone booth when neighbors complained about all the shouting that went on—he draped blankets over barrel hoops and nearly suffocated a few times.)

## Telephone Introduced

The telephone was introduced at the 1876 Centennial Exposition in Philadelphia. Most people were afraid of its black magic, but a Boston mechanic explained that there was a hole in the middle of the wire. Bell and Watson went on tour to promote the telephone, and the lectures raised enough money to allow the little Bell Company to lease, not sell, its telephones. Telephone investor Gardiner Hubbard had learned this approach when he served as attorney for a shoe machinery company. The company leased its shoemaking machines and collected royalties on each pair of shoes sewn. Hubbard realized that leasing the telephones would yield far more than their purchase price, a policy which remained until divestiture.

Hubbard made one other farsighted contribution to the telephone industry: he hired Theodore Vail as general manager of the Bell organization. Vail had been running the Government Railway Mail System, where he introduced the obvious idea of mail sorting. Previously, local postmen selected their mail from randomly stuffed mailbags brought by train; they sent the remainder ricocheting around the country. Vail's department also invented the first civil service test as a way to get rid of political patronage employees. Vail used his talents to create the Bell monopoly, by building a strong national organization, refusing to interconnect with independents, and establishing a strong patent protection department.

## "Number Please"

Telephone numbers came along in 1879, during a measles epidemic in Lowell, Massachusetts. The local doctor feared that all four of the town's switchboard operators would be stricken, and that substitute operators would not know the location of all names on the switchboard. The doctor suggested that numbers replace names; the epidemic passed, but the idea didn't.

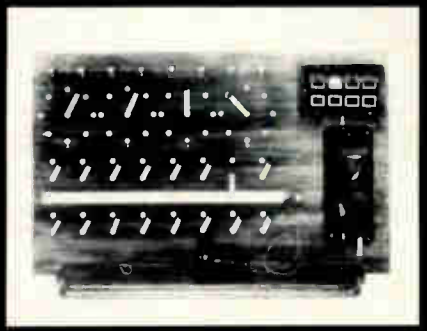
The telephone was no bargain in the 19th century. Transmission was terrible and rates were incredible. In New York City, a subscriber would pay $200 a year, while a quart of milk cost five cents. The party line, usually associated with rural areas, began in New York City as a method of lowering subscriber costs.

The party line was a big success, but telephone booths didn't work as well. Public booths were ornate, curtained kiosks which most people mistook for elevators and privies. They were quite expensive—about 15 cents a call—and there was no provision to return the money if the line was busy or no one was at home.

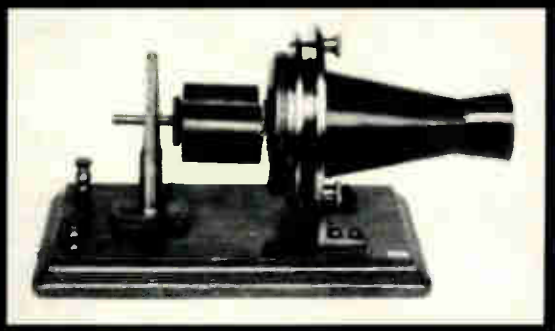
In rural areas, farmers joined together and rigged their own exchanges, often using their barbed-wire fences as telephone lines. (This worked well, except when it rained.) Wives and daughters operated the switchboard. At night, several homes would be connected to the same number, and talented citizens would sing into the telephone. This promptly spawned the request line.

## Beating the System

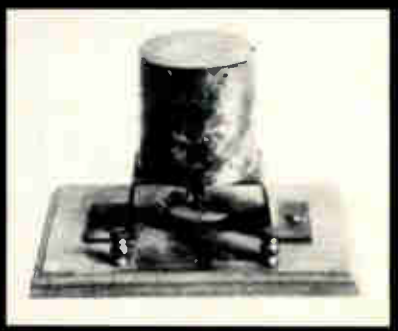
In 1891, a Kansas City undertaker decided that malicious switchboard



The first switchboard in New Haven, 1878.



The centennial phone.



Bell's "iron box" of the centennial model phone.

Photographs reproduced with permission of AT&T Corporate Archives.

San Francisco Traffic Operator, China Exchange, 1895.

operators were shunting his calls to a competitor. He decided to bypass the human element. Almon Strowger went home, took two pencils, some pins, and some stiff-necked collars, and invented a prototype for an automatic switch. The Strowger step-by-step switch is still used in some parts of the United States and Europe.

Prank calls didn't take long to catch on. The chief engineer of the Bell System in 1902, John Carty, told in a speech of the common caper in Boston of asking the operator to connect a call to a Mr. Fish. When the operator contacted the number, she would realize she had called the aquarium.

As long distance service went nationwide, thick copper cables were required for transmission. But hard-drawn copper wire had to be developed after the copper cables sagged to the ground. Telephone service was routinely interrupted because copper cable running in open areas was stolen and re-sold, or fashioned into jewelry.

## Government Control

When World War I started, the government assumed control of the telephone lines, based on a national security imperative. The experience was a mild catastrophe. The government had to award itself rate increases to keep up with costs, increases it had previously denied to the phone company. But the takeover left a more permanent legacy: service connection charges. Telephones had always been installed for free, but the government assessed the hook-up fee to bring in more revenue. Naturally, the Bell System did not discard the idea after the war.

When radio caught on in the 1920's, AT&T decided to pursue what it considered a logical extension of telephone service. In 1922, AT&T formed station WEAF in New York City. Through WEAF, AT&T contributed several vital innovations: the VU meter, the mixing board, and mutliple microphone arrangments. WEAF was also careful to uphold moral decency; the station managers once postponed a toothpaste commercial for several days, fearing it was too personal a subject.

AT&T's attempts to dominate radio turned into bad public relations, and the company got out of the business in 1926. By then, however, engineers at Bell Labs had invented a device for synchronizing sound to film, and AT&T found itself in the movie business. The movie subsidiary worried about pictures like "Moonlight and Pretzels," and about strangling RCA out of the movie sound business. The predatory part was a second PR disaster, and AT&T withdrew from the entertainment industry.

## Flair Without Density

The company decided to start putting some flair in their telephones in the late 1950's. The first Princess telephones had plenty of pastel but not enough density; the phone was so light that persons dialing it sometimes pushed it right off the table.

Touch-Tone keypads came along a few years later. Bell engineers automatically patterned the keypad after the configuration used on adding machines—with the number one on the bottom left and the number nine on the upper right. But electronic switching technology could not yet handle rapid entry of numbers, and persons proficient with the upside-down pad could outdo the switch. The engineers turned the number pad around to its present design, to slow these people down.

AT&T launched its first communications satellite, Telstar I, in 1962. Its first test was almost a failure. About 20 AT&T officials ended up listening in on the terrestrial circuit used in the test, and they overloaded the line. No one wanted to tell them to disconnect. A Bell Labs official came on and announced in a loud, authoritative voice, "Will everyone please get off this line?" They did, and the test succeeded.

## Anti-Digit Dialing League

The phone company was unprepared for the clatter which ensued when it phased out alphabet letters in telephone numbers. 3,500 citizens in San Franscisco, opposing the "cult of technology," formed the Anti-Digit Dialing League. Not to be outdone, persons in Washington, D.C., ambitiously responded with the Committee of Ten Million to Oppose All-Number Calling.

And the last vestiges of nineteenth-century telephony disappeared on October 11, 1983. Bryant Pond, Maine finally converted from crank-operated telephones and manual switchboards to Touch-Tone and dial phones using automatic switching. Two operators had run the switchboard from Elden Hathaway's living room. Hathaway, former owner of the Bryant Pond Telephone Company, remarked in a 1984 wire service article that most local citizens seemed to like the new equipment. Hathaway wasn't sure if the new service was better or not, but he liked it because he and his wife had the house to themselves for the first time in 30 years.

**Sandy Kyrish, who has a master's in Communications Technology, is a video conference marketing representative for Peirce-Phelps Video Systems Division.**

# PRODUCTS IN REVIEW

## CROWN INTRODUCES STEREO ELECTRONIC CROSSOVER

Crown International's new FFX-2 is an inexpensive stereo electronic crossover with fixed crossover frequencies. The crossover frequencies can be preset by changing plug-in resistors, an arrangement that results in a low cost for a high-performance device. In stereo mode the FFX-2 provides 18 dB/octave, two-way (hi-low) filters. In mono mode it provides three-way (hi-mid-low) filters.

The FFX-2 installs in a standard 19-inch rack. Inputs and outputs are balanced screw terminals, inverting or non-inverting.

According to the company, the unit was designed for fixed installations by contractors because the screw terminals accept crimp-on cable connectors or direct wire. There are no controls for the user to misadjust.

The FFX-2's specifications are: filter type, 18 dB/octave highpass and lowpass; noise,-100 dB [10 VOHS reference (20 Hz-20 kHz)]; distortion is less than 0.01 percent IM and THD; input/output connectors, 20 pin barrier black (screw terminals), balanced inputs and outputs.

*Circle 1 on Reader Response Card*

## NEW MINI LOUDSPEAKER FROM JBL AND ASHCRAFT

JBL and Ashcraft Design have combined their talents to produce Control 1, a miniature speaker that has a frontal area of six inches by nine inches. In addition to traditional professional recording studio applications Control 1's design is equally suited for contemporary restaurant and retail store installations. It can also be used at home with music synthesizers, according to JBL. The transducers are magnetically shielded, permitting the speaker to be safely used in close proximity to video monitors without causing picture distortion.

Ashcraft Design, developed a new mounting bracket system for Control 1. This unique bracket system enables the user to mount the speaker from either a wall or ceiling, or clamp it to a table or shelf.

Designed to withstand rigorous professional use, Control 1 has no easily damaged veneers or chipboard panels, as used in many speakers. It's enclosure is made of high impact plastic with protective rubber end caps.

*Circle 2 on Reader Response Card*

## BOSE UTILIZES MONSTER'S M SERIES

Monster Cable "M Series" loudspeaker and interconnect cables were utilized by Bose Corporation to introduce the new Bose Cinema Sound System, a modular configuration of audio components computer-designed to match the acoustic of the particular theater in which it is installed.

The new loudspeaker system provides low bass at high sound levels, generating the power and impact

needed for today's film special effects. This is made possible by the Bose-developed Acoustic Wave® Cannon bass system which is capable of reproducing low frequency notes that reach the threshold of human hearing, according to the company. The M1 loudspeaker cable winding configuration incorporates Monster Cable's "Microfiber"™ dielectric technology plus "Bandwidth Balanced" construction for improved imaging.

*Circle 3 on Reader Response Card*

## SOUNDOLIER ADDS AMPLIFIED MONITOR PANEL

Soundolier has announced the availability of an amplified monitor panel, model MVXA-195, intended for application in engineered sound system control centers.

Designed for standard 19-inch wide EIA mounting in metal upright racks or console turrets, the new sound system accessory requires 5¼-inch vertical panel space and provides both aural and visual monitoring with a selection of up to seven independent inputs or sound signal sources.

The monitor panel incorporates a VU meter with three switchable sensitivity ranges (−dB, 0dB, +10dB), a two watts RMS IC amplifier and a high compliance 4-inch diameter speaker with integral attenuator for monitor signal adjustment.

*Circle 4 on Reader Response Card*

## TECPRO HEADSETS FOR VIDEO CAMERA INTERCOMS

Since many intercom circuits built into video camera systems require headsets equipped with 50 ohm carbon microphones, severely limiting selection, Technical Products has introduced a new lightweight headset for this application.

An active circuit, hidden in the earphone cup, requiring no batteries or external power supply, permits the cardioid dynamic microphone of Tec-Pro headsets to operate in this application. An internal control may be preset to the microphone loudness required by a particular camera system.

Single and dual muff versions, with or without a momentary TALK button, are available. All are fitted with the hard-to-find special phone plug required by many Japanese-made cameras.

Suggested pro net prices are as follows: single muff is $160 (with TALK button: $175); and the dual muff is $180 (with TALK button: $195).

*Circle 5 on Reader Response Card*

## 3 M's "CANTATA" AUDIO DECK FOR BUSINESS MUSIC

Restaurants, hotels, clubs and other businesses can now enjoy background or foreground music without needing someone to operate the machine thanks to a new "Cantata" brand audio deck from 3M.

The unit called the Model 293 DG "Cantata" can be switched on and off at the machine or remotely via a power line or master switch.

The Audio Deck's pre-amp is matched to 3M's line of professional AT amplifiers and other commercial type amplifiers. This permits the sound engineer to assemble a sound system from the ground up, reducing costs and exactly matching customer needs. Noise reduction circuitry provides clean, quiet musical passages, according to the company.

*Circle 6 on Reader Response Card*

## CIRCUIT RESEARCH LABS CRL 2200 INTEGRATED CIRCUIT

Circuit Research Labs, Inc., (CRL) has announced its take over and ownership of the SSM 2200 Integrated Circuit, renamed the CRL 2200. The I.C. contains a newly patented noise reduction system which has been trademarked as Dynafex®.

The CRL 2200 is a single channel, single-ended noise reduction system requiring few external components. It employs both variable bandwidth low pass filtering and variable downward slope expansion.

The Dynafex noise reduction system requires no encoding/decoding and can be used to improve the quality of any existing signal.

The I.C. will be selectively offered to qualified OEM's on a royalty-free basis.

*Circle 7 on Reader Response Card*

## SCA INTRODUCES FM PLUS RECEIVER

SCA Data Systems has introduced the FM Plus SCA Receiver. This receiver is frequency and subcarrier agile and has an adjustable EQ two position cut-off filter with a built-in bandpass amplifier utilizing GaAsfet preamplifier, which produces less noise as compared to other preamplifiers, as well as higher gains, according to the company. The receiver has applications in background, foreground music as well as any enthic radio being carried on subcarrier stations.

*Circle 8 on Reader Response Card*

## SEIDLE'S HOME MUSIC INDUSTRIAL INTERCOM

Siedle's latest, the SIC 2001-02, is an open voice semi-duplex intercom system that can be wall or desk mounted. It features two-four speech paths, built-in paging and privacy. The Siedle 2000 can also be used to answer one or up to 400 doors with built in door bells, door releases and baby listen in.

Each unit has three watt RMS amplifier and up to 99 stations may be used with a total wire distance of 14,000 feet. All common wiring with no central processing cabinet makes for easy installation. Individual no volume on each unit is controlled with a 10-foot connection cord and plug.

Remote control systems also integrate into the SIC to operate lights, open drapes, tune stereo systems to different channels, and operate multiple camera systems.

*Circle 22 on Reader Response Card*


## SOUTH WESTERN'S PERSONNEL LOCATER

South Western Tec. Inc. has announced its new silent paging system called an "Automatic Personnel Locater", location system 1202.

This system is capable of locating and displaying the location of a person by name, room number and telephone number, on an alpha numerical display within four seconds of request.

Its features are its ability to locate a person without a voice page, its ability to cause a telephone call to be transferred to a person automatically by the use of present telephone equipment, such as a PBX system, etc., its ability to continuously display personnel location on a wall display or desk display upon request, its ability to collect and store the time and location of all personnel, making it an extremely valuable piece of equipment to management, its programable capabilities makes it especially useful to security in highly sensitive areas according to the company.

Also available is a message center that allows messages to be stored and retrieved by that individual only.

*Circle 23 on Reader Response Card*

## LYNTEC'S INTRODUCES MASKING SOURCE

The new LynTec stand-alone Masking Source with Slo-Start generates one to five channels of pink noise and automatically raises the level/s slowly at initial turn-on. Each channel's output increases 1.5 dB per day from a field programmable starting point 1.5 to 22.5 dB below the full 0 dBm masking level.

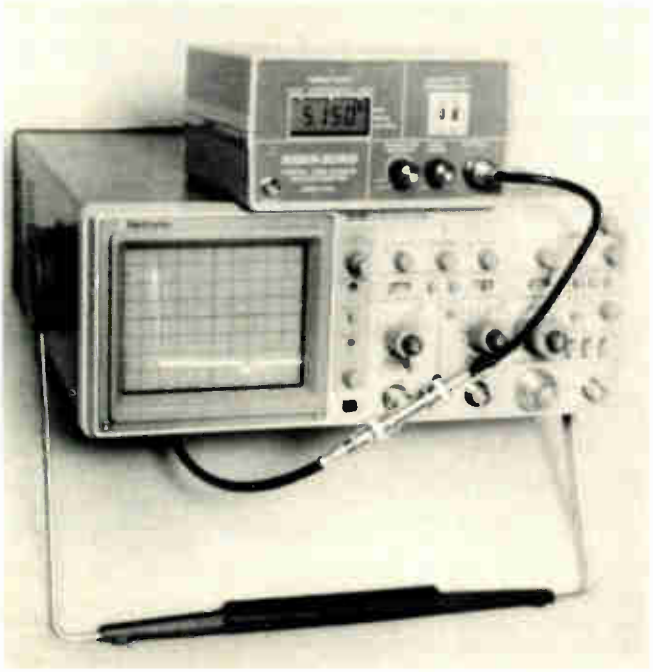
The pricing for one channel—$630 (MNSS-1). Additional channels are $150 each.

*Circle 24 on Reader Response Card*

# PRODUCTS IN REVIEW

## a closer look

by gary d. davis



**Riser-Bond Instruments: Cable Fault Locator**

Riser-Bond Instruments announces the introduction of its latest instrument, the Model 2901B+ Digital TDR (time domain reflectometer) Cable Fault Locator with "oscilloscope output capability."

The Model 2901B+ is Riser-Bond Instruments' newest model Time Domain Reflectometer, Cable Fault Locator. The new "oscilloscope output capability" feature of the 2901B+ enables the operator to connect an external oscilloscope to the front panel of the 2901B+. This allows the operator to view the transmitted and reflected pulse and actual signature of the cable under test. The digital liquid crystal display will simultaneously display the distance to the cable fault in feet (or meters).

The 2901+ also features a variable sensitivity control for maximum flexibility. The 2901B+ can be used for cable fault location and for cable length measurement on any metallic paired cable. Each instrument sells for only $795.00.

**Comments:** How many times have you known—or worse, suspected—a problem in a long cable? Typically, it's an inaccessible one, or one where repair or replacement is not trivial, right? Well, before you start chopping holes in the concrete to get at that stage snake...before you haul all the spaghetti out of that plenum...before you take an axe to that conduit...take notice. Riser-Bond's Model 2901B+ may help you pinpoint the nature of the cable fault and its precise location. Now you can take a surgically precise approach to diagnosis and treatment of your cable ills.

The Model 2901B+ TDR (Time Domain Reflectometer) operates by sending a train of very brief signal pulses down the cable: 10 nanoseconds in "short range" mode (good to about 1,100 feet, depending on the cable) or 100 nanoseconds in "long range" mode (good to about 11,000 feet). The device then times the return of reflected signal energy from the cable. There's always some reflected energy at the end of the cable, or at an impedance "bump," and this device converts the time interval between transmission of a pulse and return of an "echo" to distance. The only trick is that propagation time is affected by the dielectric properties of the cable. It is therefore necessary to dial in a dielectric value for the particular type of cable.

The accuracy of the device is claimed to be within 1 percent of the indicated value, although deviations in cable characteristics can add another 2 to 3 percent error. However, by measuring the distance to the fault from each end of the cable (ah ha, a simple device), one can null out the errors and arrive at a very precise fault location.

The ability to connect an output from the TDR to an oscilloscope means you can closely examine the nature of the fault. This device is said to display partial shorts, partial open circuits (frayed conductors), and weak shields or off-center conductors in coax. It will work with zip cord, shielded or unshield mic and speaker cables, and so forth. In terms of checking for problems in a multichannel cable while other channels of the sound (or video) system are in operation, there should not be a leakage problem, though you would have to verify this ahead of time. The unit outputs a pulse train signal of nine to 12 volts, one pulse of 10 or 100 nanoseconds about every 500 microseconds. At this frequency, the signal is not likely to leak into any audio circuits, but RF or video circuitry could be conceivably affected.

Marshall Borchart at Riser-Bond says that the manual is very detailed, and the unit is sufficiently simple to operate that within 20 minutes or so of use you should be capable of making accurate, repeatable fault measurements. For anyone who has anything to do with installing or troubleshooting cable this instrument definitely bears *your closer look*.

*Circle 9 on Reader Response Card*

# S&C's Job Report

***Format***
***STATE***
***city:*** Name of Job, $ Total of Construction, Phase of Project. Contact: Name, Company, City, State; Telephone Number.

**TOTAL CONSTRUCTION**
**1—up to $1 million**
**2—$1 million to $9 million**
**3—$9 million to $17 million**
**4—$17 million to $25 million**
**5—$25 million and up**
**NA—Not Available**

**PHASE OF PROJECT**
**A—Planning = Consultant is designing system**
**B—Pre-Bid = Final plans near completion**
**C—Bidding = Bid date set**
**D—Starting = Electrical Contractor/ General Contractor/ Owner buying now**

**The following jobs are in various phases leading up to bid. If you are interested in any of the projects, please contact only the names printed below.**

## CALIFORNIA

***Bakersfield:*** Bakersfield Christian Life Center, 3, D. Contact: Neil A. Shaw, Paul S. Veneklasen & Associates, Inc. Santa Monica, CA; (213) 450-1733.
***Beverly Hills:*** Ma Maison Hotel, 4,C. Contact: Neil A. Shaw, Paul S. Veneklasen & Associates, Inc. Santa Monica, CA; (213) 450-1733.
***Cerritos:*** Performing Arts Center, 4,A. Contact: Robert Long, Theatre Projects, New York, NY; (212) 873-7211.
***Los Angeles:*** Simon Wisenthal Center, 3, A. Contact: Neil A. Shaw, Paul S. Veneklasen & Associates, Inc., Santa Monica, CA; (213) 450-1733.
***Ojai:*** Ojai Valley Inn, 5,A. Contact: Neil A. Shaw, Paul S. Veneklasen & Associates Inc., Santa Monica, CA; (213) 450-1733.
***Pasadena:*** Lake Avenue Congregational Church, 4,A. Contact: Neil A. Shaw, Paul S. Veneklasen & Associates, Inc., Santa Monica, CA; (213) 450-1733.
***Sacramento:*** Mercy Hospital, 2,B. Contact: Neil A. Shaw, Paul S. Veneklasen & Associates, Inc. Santa Monica, CA; (213) 450-1733.
***San Francisco:*** St. Mary's Cathedral, NA,A. Contact: Marc Beningson, Jaffe Acoustics, Norwalk, CT. (203) 838-4167.
***Santa Monica:*** Santa Monica Bay Hotel, 5,A. Contact Neil A. Shaw, Paul S. Veneklasen & Associates, Inc., Santa Monica, CA (213) 450-1733.
***San Jose:*** Fairmont Hotel, 5,D. Contact: Neil A. Shaw, Paul S. Veneklasen & Associates, Inc., Santa Monica, CA; (213) 450-1733.

## CONNECTICUT

***Hartford:*** Connecticut State Capitol Hall of the House of Representatives, NA, C. Contact: Marc Beningson, Jaffe Acoustics Inc., Norwalk, CT; (203) 838-4167.

## FLORIDA

***Miami:*** Bayfront Park, 2,B. Contact: Marc Beningson, Jaffe Acoustics, Inc., Norwalk, CT; (203) 838-4167.
***Naples:*** Naples Performing Arts Center, 4,B. Contact: Robert A. Lorelli, Brannigan-Lorelli Associates, Inc., New York, NY; (212) 420-8787.
***St Petersburg:*** Bayfront Center Auditorium Renovations, 3,C. Contact: Robert Long, Theatre Projects, New York, NY; (212) 873-7211.

## ILLINOIS

***Highland Park:*** Ravinia Young Artists Insititute, 2,C. Contact: Chuck McGregor, Jaffe Acoustics, Inc., Norwalk, CT; (203) 838-4167.

## KENTUCKY

***Alexandria:*** Campbell County H.S. Gymnasium, 1,B. Contact: Richard J. Lemker & Associates, Covington, KY; (606) 261-9529.
***Covington:*** Holmes High School Auditorium, 1,D. Contact: Richard J. Lemker, Lemker & Associates, Covington, KY; (606) 261-9529.

## MISSOURI

***Mokane, Callaway County:*** South Callaway R-2 School District, NA, C. Contact: J. T. Weissenburgger, Engineering Dynamics International, St. Louis, MO; (314) 991-1800.

## NEBRASKA

***Lincoln:*** Lied Center for the Performing Arts, 4,D. Neil A. Shaw, Paul S. Veneklasen & Associates, Inc., Santa Monica, CA; (213) 450-1733.

## NEW YORK

***Astoria:*** American Museum of Moving Images, NA,B. Contact: Marc Beningson, Jaffe Acoustics, Norwalk, CT; (203) 838-4167.
***Jamestown:*** Palace Theater, 2,B. Contact: Robert A. Lorelli, Brannigan-Lorelli Associates, Inc., New York, NY; (212) 421-8787.
***New York:*** John Jay College for Criminal Justice, 5,C. Contact:Robert Benson, Knudson-Benson Associates Inc., Mercer Island, WA; (206) 232-2273.
***New York:*** JP Morgan Bank Trust Committee Room, NA,C. Contact Marc Beningson, Jaffe Acoustics, Inc. Norwalk, CT (203) 838-4167.
***New York:*** Metropolitan Opera, NY Philharmonic Summer Parks Concerts, 3,A. Contact: Chuck McGregor, Jaffe Acoustics, Inc., Norwalk, CT; (203) 838-4167.

## OKLAHOMA

***Oklahoma City:*** Remington Park, 5,B. Contact: Neil Johnson, Ewing Cole Cherry Parsky, Philadelphia, PA; (215) 923-2636.

## OHIO

***Cleveland:*** Cleveland State Music Building, 5,A. Contact: Marc Beningson, Jaffe Acoustics, Norwalk, CT; (203) 838-4167.
***Cleveland:*** Palace Theatre-Playhouse Square, 2,D. Contact: Marc Beningson, Jaffe Acoustics, Inc., Norwalk, CT; (203) 838-4167.
***Columbus:*** Ohio State Office Tower (Office) NA, C. Contact: Marc Beningson, Jaffe Acoustics, Inc., Norwalk, CT; (203) 838-4167.
***Columbus:*** Ohio State Office Tower (Theaters), 5,C. Contact: Chuck McGregor, Jaffe Acoustics Inc., Norwalk CT; (203) 838-4167.
***Columbus:*** Ohio State University Wexner Center for the Visual Arts, 5,D. Contact: Chuck McGregor, Jaffe Acoustics, Inc., Norwalk, CT; (203) 838-4167.
***Sharonville:*** Sharonville Municipal Building, 2,C. Contact: Richard Lemker, Lemker & Associates, Covington, KY. (606) 261-9529.

## SOUTH CAROLINA

***Columbia:*** University of South Carolina, Kogor Center for the Arts, 3,B. Contact: Chuck McGregor, Jaffe Acoustics, Inc. Norwalk, CT; (203) 838-4167.

## WASHINGTON, D.C.

***Washington, DC:*** National Council of Catholic Bishops Conference Center, 2,D. Contact: Marc Beningson, Jaffe Acoustics, Inc. Norwalk, CT; (203) 838-4167.

## CANADA

## NEW BRUNSWICK

***St. John:*** Bicapital Theater Project, 2,A. Contact: Robert A. Lorelli, Brannigan-Lorelli Associates Inc., New York, NY; (212) 420-8787.

## NOVA SCOTIA

***Halifax:*** Art Gallery of Nova Scotia, NA,B. Contact: Peter Terroux, Halifax, N.S.; (902) 429-4616.

*(continued on page 57)*

# DATAFILE *info.sources/new literature*


### Marconi Brochure Describes Checkmate ATE Systems

Marconi Instruments has released a new brochure describing Checkmate, a new ATE Test System. Checkmate offers a high-speed digital functional and analog functional and in-circuit capability with a GPIB interface and fully interactive programming.

The 16 page, full color brochure reviews and illustrates: manufacturing defect analysis and in-circuit testing; functional testing, analog; functional testing, digital; programming and software plus service and support. Technical features are described in each section.

The brochure details how Checkmate offers high performance test facilities only previously available on larger systems making it suitable for: board manufacturers with existing ATE who need to increase test capacity; small companies requiring a low ATE investment; designers to check their products for high stndards of manufacturing and testability and service organizations that need cost effective equipment.

*Circle 10 on Reader Response Card*

### Corning's Guidelines Features Fiber Optics Technology

Increasingly sophisticated end-user requirements and faster computers are spurring a proliferation of optical-fiber-based datacom networks, according to a number of communications managers interviewed for the current issue of *Guidelines*, a Corning Glass Works' quarterly news magazine, which is entering its third year of publication.

The end-users most often cited bandwidth/distance and electrical isolation as important factors in choosing a fiber-optic solution. Fiber-based systems, now about four percent of all user-premise local-area networks (LANs), will by 1995 account for 15 percent of all user-premise communications systems.

The new *Guidelines* issue offers a discussion of the role of fiber-optic technology in data communications by Rod Hodgman, technology marketing manager for Digital Equipment Corps'. Networks and Communications Group.

Also included in *Guidelines* is a selection of fiber installation case histories.

*Guidelines* is published by Corning's Telecommunications Products Division as a service to customers, end users and those interested in the fiber-optics industry.

*Circle 11 on Reader Response Card*


### Carter-Craft Catalog For Audio-Stereo Field

Carter-Craft, Inc. has announced the availability of its new Audio-Stereo Catalog AC-86. This catalog is a reference guide and is a must for anyone who requires competitively priced audio and stereo accessories from a first-quality source, according to the company.

The catalog has 24 colorful pages and lists a complete line of audio-stereo products including: speaker wire and speaker cables, audio cables, audio and stereo adaptors, earphones, microphones and speakers, stereo headphone and accessories, AC/DC adaptors, stereo cables, "Y" adaptors, plugs and jacks, and battery chargers/checkers.

Each listing includes a description of the product, detailed illustration, and model number. Also included in the catalog is a product index which lists part numbers, pages and descriptions for a "hands-on", convenient ordering tool.

*Circle 12 on Reader Response Card*

### Connector Literature Guide Available from Samtec

A new Connector Literature Guide from Samtec allows design engineers and electronic purchasing agents to order the literature needed without sorting through mounds of publications, according to the company.

The guide is arranged in four categories: Catalogs, Interconnect Systems, Reference Materials and Technical Publications. Literature is available on .025 inch square post interconnects, board-to-board interconnects, surface mount interconnects, low profile interconnects, pin grid array interconnects and IDC cable interconnects. Reference materials include comparative wall charts, test reports, cross references and specification guides.

*Circle 13 on Reader Response Card*

### Black Box to Offer System 3X® Catalog

Black Box Corp. has published its first full line catalog of alternative twinaxial products needed for the IBM® System 34/36/38 interface. The catalog is available as of March 1.

Applications-oriented like the entire family of Black Box catalogs, the System 3X® Catalog will be a tool for specialists and everyday users of this family of IBM computers.

"With the right device, System 34/36/38 users can add the peripherals of their choice, regardless of brand or compatibility, and save considerable money in the process by using products carried in this catalog. And, as we do with all products we sell, we provide free technical application support both before and after the purchase of any device in our System 3X® Catalog," said Peter Highberg, vice president, marketing at Black Box Corp.

The 32-page catalog, carries all the devices needed in the twinax interface—cables, switches, printer interfaces, protocol converters and terminal workstations.

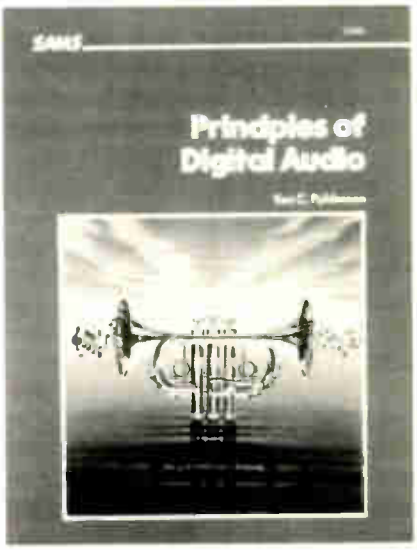
*Circle 14 on Reader Response Card*

# BOOK REVIEW

by Ted Uzzle

# Bridging The Audio Gap

Pohlmann, Ken C., *Principles of Digital Audio*, Indianapolis, Sams Books, 1985, 285 pp., $19.95 (paper)




Most of us have been introduced to digital concepts, and most of us have been introduced to digital audio devices. Not many of us have been able to see the application of ones and zeros and truth tables to compact disc players or reverberation effects devices. At last there is a book that bridges this gap, that begins with base-two arithmetic and develops the concepts right up to the digital audio machines that surround us today. The product engineer who designs digital circuits has books just for him; the repairman who has to fix compact disc players has books just for him; now there's a book for the rest of us.

Ken C. Pohlmann is well known to readers of the audio trade press for his articles and columns on digital sound and other topics. He is also on the faculty of the University of Miami in Coral Gables, FL, where he teaches digital audio as part of recording engineering. His work in digital audio goes back more than 10 years, and the results are visible in *Principles of Digital Audio*.

Much of the material in this book was developed for instructional purposes, and the book is stronger for it. An incisive metaphor, if it is good enough, will explain something in a way no graph or equation can, and also be so memorable it sticks in the mind long after the equation is gone. It's difficult to do, and rarely met with in technical books, but an important part of this one.

Imagine a bucket whose capacity we want to measure. We can fill it with water, and this way all the little internal surface irregularities will be accounted for, but there are ambiguities in the measurement of water flowing out of the bucket. Also, the measurement is more difficult to preserve, because of evaporation or water slopping out of the bucket as it is carried.

Fill the same bucket with small steel balls: BBs or ball bearings. The quantity of steel balls may be determined much less ambiguously: we remove the balls one at a time, and count them: say, 8,263. Quite accurate, quite repeatable. Or is it? The steel balls do not account for small irregularities in the bucket surface: each steel ball, we may say, is a sample of the bucket volume, but all together they do not fill it completely.

The use of metaphor shows two things about the author. First, it shows a conceptual understanding of his subject right down to its fundamentals. This is surprisingly rare. Secondly, it shows a knack for communicating understanding, rather than transmitting information.

A chapter is devoted to sampling and quantizing, and the concepts that are involved with them, such as aliasing and signal-to-error ratios. We are shown that the material to be digitized (primarily its bandwidth, in the case of an audio signal) determines the way it is digitized. Success requires discretion in the selection of the time interval at which we will sample, and the amplitude interval to which we will round the sample.

A chapter on digital recording shows that analog-to-digital conversion is only a small part of the job, and not one of the more interesting. Other parts of the digital recording chain include filtering, modulating, and dither generation. If this last digital pact sounds alarming, fear not, there are alternate proposals to use self-noise in the analog parts of the recording chain in place of dither.

A chapter on digital playback seems to deny a grand symmetry between recording and playback; the problems and solutions seem quite different coming out, compared to going in. In the earliest days of the tin-foil phonograph, Edison used precisely the same parts of the device to record as to playback, and used them in just the reverse function. Today, we can see the same thing in the ordinary photograph, making an analogy between the microphone voice coil and the loudspeaker voice coil, between the cutting stylus and the pickup stylus. It seems very, very much more asymmetrical with digital techniques.

Actually, there is a grand symmetry between digital recording and digital playback, but it is much more cerebral than with analog, and much more subtle.

A chapter on digital audio media devotes five times as much space to magnetic recording as to the compact disc. That's probably appropriate, because in the case of the compact disc there is only one standard, only one operating theory, while with magnetic media there are a number of ways to record digital information. Finally, this chapter ends up with descriptions of satellite broadcast, cable transmission, and interactive cable uses of digital signal processing.

A chapter on error correction points out that of all formats for audio recording, only digital offers the opportunity to recover lost bits by means of computer analysis and reconstruction. An analog lost chord is lost indeed, but a digital lost chord may have left enough genetic material to be cloned numerically (the reviewer is indulging in three metaphors of his own, all mixed together).

At the end of the book is a lengthy chapter on the compact disc. Can it be only so few years since 1984, when the first compact disc players were sold in the shops in the U.S.? Is there any

*(continued on page 51)*

# Ad Index





# FACES AND PLACES

**Electrovert Appoints Dave Ryan Marketing Manager**

Electrovert Inc. has announced the appointment of Dave Ryan to the position of marketing manager-North America. He reports to A.J. Chiarello, executive v.p. for the company.

Ryan's experience includes 17 years of various sales, marketing and management positions in the electrical and electronic control industries. He was general manager of Phoenix Canada prior to joining Electrovert in 1985 as manager, new product development.

As marketing manager, his new responsibilities will include: coordination of marketing activities throughout USA and Canada, new market and new product development; market research; and sales training.

Ryan, who is a native Canadian, will be based at the company's Canadian headquarters in Toronto.

**DAVE RYAN**

**JOHN WARDER, JR.**

**IED Appoints Warder Production Manager**

John B. Warder, Jr. has been appointed production manager of Innovative Electronic Designs, Inc. His responsibility with IED is to develop an expanding manufacturing program which will meet the demand for computer controlled audio systems in the market.

Before joining IED, Warder worked 20 years for Robinson Nugent, a manufacturer of electro mechanical production control systems and became their manager of manufacturing.

Warder attended Indiana University where he majored in business administration.

**TRW LSI Products Division Names New General Manager**

Albert J. Martinez has joined TRW as vice president and general manager for the LSI Products Division of TRW Electronic Components Group.

Martinez served most recently as executive vice president, operations for the Burr Brown Corporation, where he played key roles in the international expansion and public offering of that company.

Martinez began his career in electronics as a technician at Motorola in 1966.

During his 15 years with Motorola, Martinez held increasingly responsible engineering and management positions including operations manager for that company's linear and hi-rel product lines.

At TRW Martinez will be responsible for the business strategy, capital planning, and the world-wide manufacturing and marketing for the LSI Products Division.

# REP NEWS

**Crest Audio** has appointed **RPM Marketing** and **Taub Sales, Inc.** as new manufacturers' reps. Taub Sales, Silver Spring, MD, will cover Maryland, Delaware, Virginia, Eastern Pennsylvania, and Southern New Jersey. RPM Marketing will cover Eastern Texas, Oklahoma, Arkansas, and Louisiana.

**Cetec Gauss** has announced the appointment of **Philips AKG Acoustics** as its exclusive representative for all of Canada. AKG will act as stocking distributor for all Gauss loudspeakers, high frequency drivers, horns, and systems. Also AKG will stock recone kits, etc.

**Charlie Winkler & Associates** has announced that **Jeffrey N. White** has joined them as a sales representative. White will represent the firm in its Indiana and Kentucky sales area, effective immediately.

**Monfort Electronics Marketing, Inc.** has opened a new sales office in Cleveland to serve contractors in the Ohio and western Pennsylvania area. Monfort Electronic's main office is in Indianapolis.

## BOOK REVIEW

*(continued from page 49)*

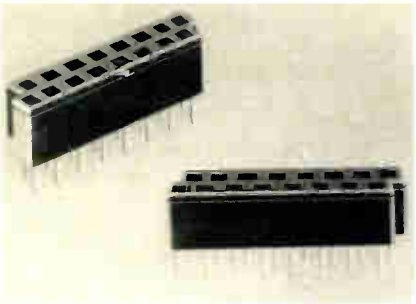
other consumer technology that poured down on us so like Niagara? The compact cassette ... color television ... stereo itself ... all these came on much more slowly. The closest other thing is the pocket calculator. And that's digital also.

So saying, one can probably forgive the author an indiscreetly exuberant final essay, entitled, "A New Beginning." Hang no crepe for analog audio, not yet: Dolby SR shows that analog can hang in there for highest-quality studio recording, and the compact disc only just matches the technical specifications of a defunct consumer tape format from more than 10 years ago. Well, enthusiasm is no disqualification for an outstanding book.

Sams Books is to be congratulated for the production values of this book. The cover art is outstanding, as Sams (and only Sams) often provides. Inside, line art is clear and professionally rendered, and the typography and layout are straightforward; there's little flipping around looking for graphs referred to in the text. It's a very, very rare page without an illustration or table. One minor complaint: some of the illustrations are a bit too densely loaded with information and callouts. One can imagine Professor Pohlmann standing at a blackboard and adding bit by bit to a graph, while making verbal explanations. We have only the end result in this book, and in a few cases the eye must search for the basic meaning.

*Principles of Digital Audio* is in a class by itself. Apt conceptualization, abundant illustrations, clear, direct writing free of unexplained jargon, and a minimum of mathematics, all make this the ideal introduction to digital audio technology for those motivated to find out about it.

**Ted Uzzle is a member of AES, the Acoustical Society, and SMPTE. He is director of marketing development at Altec Lansing and has written several book reviews for *Sound & Communications*.**



**Samtec's Low Profile Connectors**

Samtec's ZIP series connectors are designed for zigzag style memory packages. The low profile, (5,21 mm) .205-inch high from board to top of the connector, allows minimum vertical distance between boards to complement the improved density achieved on the boards through using strip packages rather than dual in-line packages.

Samtec ZIP sockets feature a closed entry body construction to protect the high quality double side wipe contact from damage. The Phosphor Bronze contacts mate with both sides of the flat surfaces of the leads for lower contact resistance and longer connector life. Contacts are available with tin or selective plating.

The black glass filled polyester body is UL rated 94V-O and is both side and end stackable for maximum density.

*Circle 15 on Reader Response Card*

**Aarmor Case Introduces the "Rack Pod"**

The Aarmor Case company has introduced the "Rack Pod" design for electronic equipment racks. The "Rack Pod" design is a molded high spec plastic rack case, in front and back door format.

Compared to current ATA style racks the "Rack Pod" designs are: 40 percent to 50 percent lighter weight, stronger (meet and exceed more MIL, ASTM, and ATA specs), 25 percent to 40 percent cheaper than same size ATA style rack cases, offer secure nesting (stacking) ability, and have a unique and modern appearance, according to the company.

The first available "Rack Pod" is the "RP 6X20D", which has six rack spaces and a 20 inches main body depth.

"Rack Pod" designs are available in several configurations and with numerous options. Some of the options include: air and water tight, with or without isomount shock attenuation systems, automatic atmospheric relief valves, and can be bolted together in the nested position.

*Circle 16 on Reader Response Card*

**Master Bond's Medium Viscosity Thread Lock Adhesive**

Master Bond has introduced a single component anaerobic thread lock adhesive called GP166. This system self-hardens at room temperature when applied between steel, aluminum, copper and most other metal surfaces. It is employed for locking, sealing and bonding rigid assemblies of all types. Master Bond GP166 prevents loosening due to vibration, impact and shock and eliminates corrosion and leakage by providing complete sealing over en-

tire engaged area. GP166 retains and seals bearings, bushings, gears, splines and keys.

Master Bond GP166 has a viscosity of 1,500 cps. The cured adhesive is a high strength, heat and chemically resistant thermoset polymer. It can be used over the wide temperature range of −65°F to +300°F. GP166 is a superior electrical insulator.

Master Bond GP166 is available in 10cc, 50cc, 250cc and liter bottles. It has a minimum storage stability of 1 year in original closed containers.

*Circle 17 on Reader Response Card*

### DTI's Line Activity Meter

Datacommunications Test Instruments (DTI) has introduced the Line Activity Meter (LAM). The LAM is designed to measure line utilization in networks using BISYNC or any bit-oriented protocol (HDLC/X.25, SDLC/SNA, UDLC,


ADCCP, BDLC).

Available with either V.25 or RS-232C interface, LAM measures the Instantaneous, Average and Peak line utilization. This hand-held device operates at line rates up to 1.544 mbps for 250 hours on a single commercial nine volt battery.

The RS-232 version is prices at $349 and the V.35 version is prices at $399.

*Circle 18 on Reader Response Card*

### Tajimi PRC Series Miniature Circular Connectors

Tajimi Electronics of Japan has introduced the TMW line of Coaxial and Multi-pin Connectors.

TMW PRC Series Miniature Quick-Release Connectors are lightweight, multi-pin connectors crafted with high specifications to mate easily using a simple "push-pull" action according to the company. Most popular configurations of pin contacts are available: from two thru 37 positions in Cable Plugs, Cable Jacks, SF Receptacles, and Bulkhead Receptacles. The PRC Series offer an insulation resistance of DC500V 1000M Ω min.; and contact resistance of 5m Ω max. at DC 1A; and are made to accept a variety of cable sizes (from 28-Awg to 12-Awg).

Other TMW Miniature Circular Connectors are available with "Bayonet" and "Screw-Lock" quick-release connections; in addition to waterproof versions.

Tajimi Coaxial Connectors consist of BNC, TNC, SMA, SMB, OSM and N Type Connectors in standard and MIL-type formats; and are complimented by a series of isolated ground chassis bulkhead jacks for BNC and TNC connectors.

Marshall Electronics, Inc. is the exclusive importers of Tajimi TMW Connectors in the U.S.A.

*Circle 19 on Reader Response Card*

### New Hose Clamps By Heyco

Heyco Molded Products Inc. has introduced a complete line of nylon hose clamps.

The Heyco Double Tang hose clamps are available in 17 sizes ranging from a minimum diameter of one-quarter-inch to a maximum diameter of 2-3/8 inches. Quickly installed, they tighten instantly with hand pliers according to the company. In high pressure tests, tubing and hoses fail while the clamp remains intact. The hose clamps are removable, reusable, light weight and resistant to corrosion.

*Circle 20 on Reader Response Card*

# T.I.G. 50th Anniversary

Techincal Industries, Inc. of Geor- largest audio-visual and video system dealerships in the Southeast celebrates its 50th anniversary this year.

Technical Industries was originally formed as "Regan Visual Education Company" in February, 1937, and in the 1940's became known as the Calhoun Company.

Currently the operation, owned by Ed Matthews and Sonny Davis, is housed in 25,000 square feet of office and warehouse space in North Atlanta in the technology belt of the city.

Since focusing on the system contract business in 1981, the company has experienced growth. Customers include Fortune 500 companies, and the company is also installing systems throughout the nation for customers such as Mazda and Storer.

Due to the company's need for customized equipment and service, it progressed into an in-house manufacturing operation called Tech Electronics, Inc. This company builds customized equipment sold through T.I.G. as well as markets these products and services throughout the country. Using two CAD/CAM workstations to do circuit and product design, they also added a complete drafting package to support T.I.G.'s systems contract business at the workstation.

The company staffs 52 people, including two engineers and nine company installers who are part of a complete Installation Department. Plans are underway to expand into the CCTV System business through a newly formed department in January.

## Sight & Sound Entertainment Goes Shopping

Sight & Sound Entertainment has installed a video system for Potomac Mills Mall located in Woodbridge, VA. The mall named its system the Potomac Video Network (PVN), which is a specially created blend of music videos, public service announcements, special event simulcasts, consumer advice, and special sale promotions. Nine giant overhead video screens display the many features, as well as three-dimensional, animated electronic directories.

The system was installed, developed and programmed by Sight & Sound for PVN. Among the equipment used was a Sony 1020Q projector, a JVC BR7000 VCR, TOA amplifiers and speakers, and a Panasonic video monitor.

## IED Goes to City Hall

Pro Media a sound contractor in San Franciso and consultant Richard Negus of Prucell, Noppe and Associates has completed a sound reinforcement system for the Santa Clara, CA County Council boardroom using IED equipment.

The system, based on the IED model 4000 Series Automatic Mixer and the model 5000 series Audio Processing System, has 64 microphone inputs. The signal from each councilman's mircophone is distributed to all speakers in the room except the one at his position. The number of active microphones in the system may be limited by IED's filibuster feature. The level of each microphone is automatically adjusted for the speaker's voice level by IED's gain control.

## Corral's Conference Call

Corral Camera and Video completed a new communication system in the Conference Center of Marriott's Seaview Country Club Resort in Absecon, NJ.

New amplifiers, speakers, video distribution systems and controls were installed in Seaviews' Garden State I and II Keystone and Empire Rooms as part of the facility's expansion and renovation program.

According to Terry Alan Price of Corral, the unique situation that faced the company was that the Marriott "wanted high quality sound for music and still have standard voice requirements."

The solution was provided for by the equipment itself. Price said, "We use a high quality loudspeaker from Electro-Voice called the MC-124 and Lowell Baffles and Enclosures." Other equipment installed included Bogen amplifiers, Denon and Benjamin cassette recorders and Shure microphones.

## Swanson Sound Installs Background Music System

Swanson Sound designed and installed a state-of-the-art background sound system at Growers Square, a downtown office-shopping complex in Walnut Creek, CA.

Program material consists of classical music taken from digital compact discs. To provide a full days worth of music in an unattended system, a CD player from Nikko Audio was chosen. The Nikko Audio NCD-600 is able to continuously play up to 60 CDs.

Although processing equipment has been kept to a minimum, a dbx 160x compressor and a Rane SM26 splitter-mixer were included. Four Carver PM1.5 amplifiers (without 70v transformers) power the more than 100 Bose 102 speakers located throughout the complex.

CALENDAR OF EVENTS

# DATEBOOK

| DATE | EVENT/COMMENT | LOCATION | CONTACT |
|---|---|---|---|
| April 30-May 1 | **"Forecasting Federal Facility Contract Potential."** Training Session by Frost & Sullivan. | Arlington, VA | Frost & Sullivan (212) 233-1080 |
| May 4-5 | **"Computers and Communications in the Healthcare Industry."** Conference by Frost & Sullivan. | Dallas, TX | Frost & Sullivan (212) 233-1080 |
| May 5-6 | **Texpo '87**. Pacific Bell's telecommunications product show. | San Francisco, CA | Texpo In California: (800) 322-0440 Outside California (800) 222-1699 |
| May 5-7 | **Static Overstress Seminars**. | Scottsdale, AZ | Judy Ward Hitchcock Publishing 1-800-826-6270 |
| May 13-15 | **EDS '87**. Seminars, exhibits. | Las Vegas, NV | EDS (312) 648-1140 |
| May 17-22 | **ICA '87**. 40th Annual Conference and Expo. | New Orleans, LA | International Communications Associations (214) 233-3889 |
| May 18-21 | **National Fire Protection Annual Conference**. | Cincinnati, OH | (617) 770-3000 |
| May 27-29 | **Reliability and Quality Assurance for Communication Systems**. Course presented by George Washington University. | Washington, D.C. | George Washington University. (800) 424-9773 |
| May 30-June 2 | **CES** | Chicago, IL | CES/EIA (202) 457-8700 |
| June 8-11 | **"Instrumentation for Engineering Measurements."** Course presented by the Center for Professional Advancement. | East Brunswick, NJ | The Center (201) 238-1600 |
| June 12-14 | **Recording Studio Designer's Workshop**. Sponsored by Syn-Aud-Con. | Astoria, NY | Syn-Aud-Con (812) 275-3853 |
| June 13-19 | **International Communications Association's Second Summer Program**. | Boulder, CO | ICA (214) 233-3889 |
| June 15-17 | **Audiotex '87**. Exhibition and conference. | New York, NY | Carol Peters (212) 279-8890 |
| June 15-18 | **National Computer Conference** | Chicago, IL | NCC 1-800-NCC-1987 |
| June 27-30 | **NAMM**. | Chicago, IL | NAMM (619) 438-8001 |

# Looking back at SOUND & COMMUNICATIONS

## 10 Years Ago. . .

RCA Services Company passed the 200,000 mark in installed telephone interconnect lines.

An item in *Mobile Communications* proclaimed "Pathcom, Inc. and Hy-Gain Electronics, two big producers of CB gear, are slowly withdrawing from the fabrication of CB in favor of professional two-way business radio." The item continued: "Pathcom has reoriented its transceiver business into two groups: consumer products and land mobile and marine products. Hy-Gain, which reported a first-quarter loss of over two million dollars because of a chaotic CB market, plans to offer new professional radios and more marine radios."

## 20 Years Ago. . .

The column *Mobile Communications/Industrial Radio* had reports of long distance interference to mobile services operating on frequencies between 25 and 50 Mcls which had been received by the FCC during periods of increased sunspot activity. The services most seriously affected are the Industrial Land Transportation, Public Safety, Domestic Public Class D Citizens Radio and Remote Pick Up Mobile Service. Even police radio systems have been disrupted for hours at a time, according to the column.

## 30 Years Ago. . .

In the column *Late Lines*, an item reported on "an improvement in magnetic recording that is expected to have importance in the computer field. This patent, assigned to Bendix Aviation Corp., covers a mechanism, which makes it possible to play back a record at any speed. Sound is recorded by moving a tape, ribbon or wire past a magnet. To reproduce it, the tape is passed through a "pick-up-coil."

One of the *New Product Offerings* was the Model 132 microphone from the Turner Company. According to the column, "Model 132 features a small dynamic head with the transformers built into the breastplate of the Third Hand. Company engineers say the Model 132 was developed to allow a small compact dynamic head to be used with the Third Hand, and is ideal for use by square dance callers, auctioneers, in paging systems or any other applications where both hands must be free for working."

One of the *People and Companies* making news was Radio Corp. of America, Camden, NJ, who reported "they've developed a commercial pocket-size FM receiver for mobile communication service with a range of several miles." The unit was fully transistorized, weighed 10 ounces and operated on the 148-174 mc band.

## BUSINESS FRONT

*(continued from page 14)*

rep's income is fixed (salary) incentive earnings should be possible at two-thirds of goal achievement.

Another school of thought says that if no incentive (commission) is paid until the two-thirds point, income will be too low for the first eight months, assuming sales are equal each month. This could discourage a rep because the *best* he or she might do would be to compress the "base period" by a month or two. This incentive becomes a *dis*incentive. You may therefore use the "two-thirds" concept for calculation, but *pay* commissions, at least in part, as sales are credited.

This last point raises an interesting psychological idea: the sooner the reward follows the performance, the smaller it can be and still achieve motivational results. In other words, for a good day's work, a nice lunch might be an appropriate reward. If I have to rally hustle for a *month*, I expect at least dinner and a show! The same idea holds true for contests and incentives. Long contests require *big* prizes at the end, shorter ones require smaller ones.

*This article was reprinted with permission from the International Communications Industries Association. The article is from the book* How to Compensate the Sales Force *by R.W. Sharer and published by the ICIA. The book can be purchased from the ICIA for $8.50 for members and $11 non-members. Write to: Terri Campbell, ICIA, 3150 Spring St., Fairfax VA 22031-2399.*

**Bill Sharer is founder and president of Advanced Development Systems, a New Jersey-based firm, consulting in sales, management, marketing communications, and education. For four years, he has been a featured speaker and instructor at NAVA/ICIA Institutes.**

## JOB REPORT

*(continued from page 47)*

***Halifax:*** A/V system for City Council Chamber of Halifax, NA,C. Contact: Peter Terroux, Halifax, N.S.; (902) 429-4616.
***Halifax:*** St. Theresa's Church, NA,B. Contact: Peter Terroux, Halifax, N.S.; (902) 429-4616

**ONTARIO**
***Toronto:*** Greenwood Race Track, 2,A. Contact: Neil A. Shaw, Paul S. Veneklasen & Associates, Inc., Santa Monica, CA; (213) 450-1733.
***Toronto:*** Metro Toronto Convention Center Ballroom, 1,A. Contact: Neil A. Shaw, Paul S. Veneklasen and Associates, Inc., Santa Monica, CA; (213) 450-1733.

**To have your jobs listed in S&C's Job Report, send your information to:**
**S&C's Job Report**
**220 Westbury Ave.**
**Carle Place, NY 11514**

## COMPUTER

*(continued from page 21)*

make the appropriate inputs high or at the 1 state. For instance, to transfer the data of register A to register D, enable A (EA) and load D (LD) inputs must both be in the 1 state. This will cause the data of register A to appear on the common bus line. When a clock pulse arrives at the common inputs, the transfer process is completed.

The word length of a bus is based on the number of conductor paths that it employs.

**Dale R. Patrick is a professor of Industrial Education and Technology at Eastern Kentucky University.**

# CLASSIFIEDS

**FOR SALE**
IQS-401-L; FFT analyzer with speed up card, I/O. Box and lots of software. Call Jesse Klapholz (215) 473-6176.

**Background Music for**
SCA-CATV-Telephone
**BGM INTERNATIONAL**
A Division of
**F.T.C. BREWER COMPANY**
P.O. Box 8057
Pensacola, Florida 32505
904-433-7932

SESCOM, INC.
1111 Las Vegas Blvd. North
Las Vegas, NV 89101 U.S.A.
"the audio source" FOR ALL OF YOUR AUDIO NEEDS
CALL OR SEND FOR A COPY OF OUR CATALOG
CATALOG REQUESTS & ORDERS: (800)634-3457
OTHER BUSINESS: (702)384-0993 TWX (910)397-6998

## HELP WANTED

**SERVICE TECHNICIANS**
New England's leading communications contractor is looking for qualified service technicians for its Boston, MA and Hartford, CT offices.

Applicants should be experienced in professional audio, nurses call, C.C.T.V., M.A.T.V., and card access networks etc.

Positions to be filled are union I.B.E.W. telecommunications technicians and provide excellent opportunities and benefits.

Qualified applicants should forward their resumes in confidence to:
Edward R. Duffy
SEABOARD Electronic Service Co., Inc.
Five Woodworth Street
Boston, MA 02122
(617)825-7100
An equal opportunity employer.

SEABOARD ELECTRONIC SERVICE CO., INC.
SESCO
Serving New England's Communication Needs


**EXPRESS INVENTORY**
CALL FOR FREE COMPLETE LIST
1-800-528-7591

**BUY/SELL**
ET&T, Inc. We buy and sell new/used telephone systems. Mitel SX-20, 100, 200 PABX's and Inter-Tel MPK, SPK key systems only. Call 800-433-4331; in PA-4338.

RJ31X JACKS & CORDS
WIRE & CABLE
UL-PLENUM-FIRE
"B" CONNECTORS, TIE WRAPS
DRIVE RINGS & PINS
ARROW STAPLERS
FASTENERS
CALL TOLL FREE
**cabletronix**
800-431-WIRE (USA)
800-942-WIRE (NY)

Ideal Wire Products, Inc.
Electrical Wire & Cable
Lorum Street, Tewksbury, Mass. 01876
Tel. (617) 851-4541
**Manufacturers of quality sound & communications cable. Stock and price list mailed on request.**

**SALES/BRANCH MANAGER**
Need a working sales manager. Applicants must have 2 yrs. min. successful sales experience in commercial sound products sales. We sell and install BGM, CCTV, Drive thrus, and Intercoms. Former 3M, AEI, or Muzak sales experience preferred. Position open in Little Rock, AR and Jackson MS. Send Resume, salary requirements, and past earnings history in confidence to:
Ray Beardsley
Beardsley's Sound Products, Inc.
P.O. Box 19508
Little Rock, AR 72219

**SERVICE MANAGER**
Need a working service manager. Applicants must have 3 yrs. min. experience in installation, bench repair and on-site service of audio, video, and intercom equipment. We service and install BGM, CCTV, Drive thrus, and intercoms. Prefer applicant to have 2 years min. associates degree in electronics schooling. Former 3M, AEI, or Muzak experience a plus. Positions open in Little Rock, AR and Jackson, MS. Send Resume, salary requirements, and past earnings history in confidence to:
Ray Beardsley
Beardsley's Sound Products, Inc.
P.O. Box 19508
Little Rock, AR 72219

## CLASSIFIEDS

☐ **Regular Classified—$52 per column inch.**
☐ **Marketplace Display—**
**25 percent off rate card** (up to 1/3 page).

Classified listings are accepted up to the 25th of the month preceeding publication.

Name _____
Address _____
City/State/Zip _____
Telephone _____
Credit Card # _____

**Check Heading You Want**

☐ SERVICES ☐ MISCELLANEOUS
☐ FOR SALE ☐ SITUATIONS WANTED
☐ FOR RENT ☐ HELP WANTED

**Please send copy & payment to:**
**Sound & Communications Classifieds**
220 Westbury Avenue Carle Place, NY 11514
TELEPHONE (516) 334-7880

# Install Confidence.


Investigate Toa's new **HS Series**, the complete line of loudspeakers for clear, transparent vocal and music reinforcement. The HS Speakers combine with the 900 Series and the 500 Series Paging/Music Systems to provide reliable, quality sound.

These rugged, two-way and three-way loudspeaker systems can be painted to match any decor. They provide built-in mounting hardware for ceiling suspension, and input terminals for full-range or bi-amp operation.

Join Toa in providing uncompromising quality to churches, schools, offices, or any medium-size installation. After 50 years of designing commercial sound equipment, Toa continues to deliver reliability and profit.

TOA

Toa Electronics, Inc.
Commercial/Engineered Sound Division

480 Carlton Court
South San Francisco
California 94080
(415) 588-2538

Toa Canada: (403) 489-5511 Edmonton, or (416) 624-2317 Toronto ■ Toa U.K.: (0277) 233882 Essex ■ Toa Europe: (040) 811127 Hamburg

*Circle 237 on Reader Response Card*


# Now Shure can reveal the secret* behind the world's only Automatic Microphone System.

Most so-called automatic mixers use a predetermined threshold level to decide when to turn a microphone on or off. But when meeting participants or background noise change, these threshold levels must be readjusted for proper operation.

**Shure's AMS eliminates threshold adjustments for truly automatic operation; faster set up.**
Shure's patented Automatic Microphone System provides unique direction sensitive gating by continually "reading" and comparing the separate audio signals provided by two matched unidirectional capsules placed back-to-back in each AMS microphone.

The rear capsule provides an instantaneous point-of-reference, continuously monitoring ambient noise. Whenever the output of the front capsule exceeds the rear capsule by at least 9.5 dB, the mic gates "on."

A person must speak within a unique 120° "window of acceptance" to activate an AMS mic. Sounds originating from the side or rear will never cause an AMS mic to gate "on."

**Greater user flexibility.**
TTL level logic terminals on the AMS mixer provide unprecedented design flexibility including chairman muting, video switcher control, zone loudspeaker muting and more.

**The easiest to use automatic mic mixer you can buy.**
Thousands of installations throughout the world, from courtrooms, conference rooms and churches...to broadcast studios and state legislatures, attest to its superiority.

To find out how this revolutionary system can solve your audio problems, write or call Shure Brothers Inc., 222 Hartrey Ave., Evanston, IL 60202-3696 (312) 866-2553. G.S.A. Approved.

*Patent No. 4,489,442

**SHURE**

*Breaking Sound Barriers for over 60 years*

Circle 203 on Reader Response Card