

SOUND & COMMUNICATIONS

COVERING TELECOMMUNICATIONS
AND ELECTRO-ACOUSTICS

SEPTEMBER 1985

LAB TEST
REPORT
IRPI'S TRANSVERSAL EQ

MEASURING-UP BOUNDARY MICS

INDUSTRIAL PAGING CITY HALL SOUND



SGND2MBAL5000 *HAO 01 000MAY86*
MARK GANDER
JBL INCORPORATED
8500 BALBOA BLVD
NORTHRIDGE CA 91329



NEW WAVE DESIGN

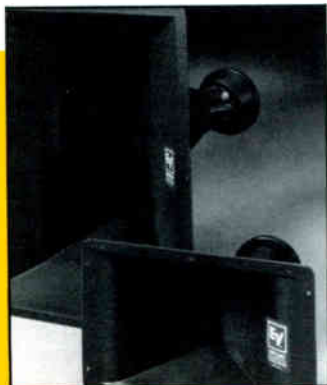
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SOUND & COMMUNICATIONS

SEPTEMBER 1985

Volume 31 #9

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ON THE COVER

September's cover features a conferencing application of a boundary-type microphone (provided by Beyerdynamic). This particular conference room is located at Testa Communications in Carle Place, NY, the publisher of *Sound & Communications*. Photo by Doug Hanewinkel.

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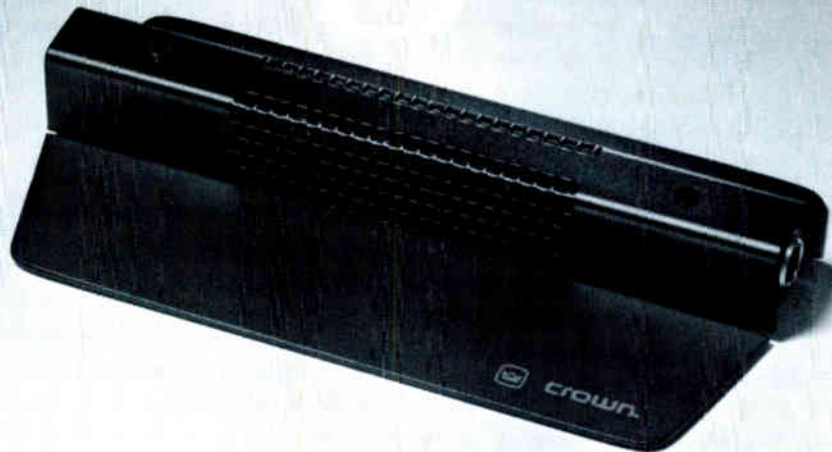
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proves gain-before-feedback, reduces unwanted room noise and rejects sounds from the rear.

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And because the microphone is mounted on a boundary, direct and reflected sounds arrive at the diaphragm in-phase. The result...wide, smooth frequency response free of tonal coloration or unnatural sound which can occur with conventional microphones.

Self-contained electronics eliminate the need for a sometimes awkward in-line preamp box. The PCC-160 can be powered directly from the console or other remote power source. Or if battery power is convenient, a battery supply unit can be inserted anywhere in the mike line...right up to the console or mixer.

For maximum flexibility, the PCC-160 features an exclusive three-way "bass tilt" switch which allows you to tailor, up or down, the low-end response for special applications or unusual boundary sizes.

Due to its low profile and "go away gray" finish, the PCC-160 microphone becomes nearly invisible in use, making it ideal for the stage, newsroom or lectern top.

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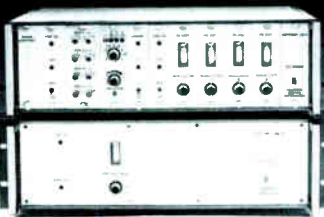
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IDEAS & VIEWPOINTS

A SYSTEM FOR EXPANSION

by Chris Foreman

You guessed it, I'm still on the same soap box. Why does it seem that there is little or nothing new in the sound industry? Why is it that sound seems to be the last thing considered in any new project? Why are we so tied to the ups and downs of the economy as a whole? And, in particular, what can we do about all this?

Those are the questions I've asked from this platform. Last month I started an answer. Next month, I'll continue the ideas developed in last month's editorial. Right now, I'm going to digress just enough to get at what I think is one of the root causes of the sound industry's problems.

Mystery and Confusion

A lot of video people think audio is a mystery. They think dB ratios and gain matching are highly confusing subjects. When they talk about impedance matching they stop at putting a 75-ohm resistor on the end of an unterminated line. There are only two kinds of signals to a video person, NTSC ("composite" video) and RGB (red, green, blue). There's only one basic type of video cable (coax) and only a few types of connectors. Compare that to audio! Video people don't know why audio people make such a fuss about grounding and they have little or no idea of the real reasons for equalization. Video people don't understand why a microphone can't be placed near a loudspeaker (after all, they can put a camera right next to a video monitor).

In some ways, video is a *lot* easier than audio. Why? The most obvious reasons are technical (like those I implied above). But I think there's at least one non-technical reason.

Why Audio is a Mystery

My hypothesis is that audio is mysterious and difficult because we make it mysterious and difficult.

Consider a video camera. It's analogous to a microphone but with an important difference. A video camera is a *more complete system* than a microphone. A video camera has a transducer [the camera tube(s)] and a full complement of preamplifiers and line drivers. A video camera's output is a standard voltage at a standard impedance. If it's a no-frills model, there may not be much more. But most professional cameras come with a built-in compressor (an auto-iris), an automatic equalizer (one-button white balance), and a bunch of other features associated with whatever lens is included.

Now, imagine that the video camera was more like a microphone. Imagine you were a potential camera buyer and had to make the same choices for a video camera that you do for a microphone system. First you'd have to choose the type of tube. One-tube or RGB? Vidicon, nuvicon, or some other type? Will it work in the light level you expect? Then comes the lens, close-up, telephoto, zoom? How about the lens to tube interface and mounting system? Does the lens you chose mount on the tube you chose, or do you need some kind of special adapter? Now, choose a preamplifier. Choose one that's compatible with your tube(s). Carefully examine the preamplifier specifications to make sure the impedances are compatible with the tube(s) you have chosen. Is there enough dynamic range? How's the linearity? What about distortion? Will the color balance be right in the lighting you expect?

Next, the electronic accessories. An equalizer (white balance) would be nice. Should it be automatic? How about compression (auto-iris). Does the lens you chose allow auto-iris? Is the auto-iris you chose right for the light levels you expect? Finally, package all these components in something. Probably a rack. Wire it up properly so that the low-level signals from the tubes don't pick up any RF or other interference and so that all impedances and levels are properly matched. Now provide the proper user controls but shield the user from those controls

(continued on page 36)

Sound & Communications

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COMPUSONICS AND AT&T SEND DIGITAL AUDIO VIA LONG-DISTANCE LINES

A relatively new company founded by MIT graduates David M. Schwartz and John P. Stautner, now president and vice president, recently demonstrated digital audio transmission over AT&T's new Acunet Switch 56 system of high-speed (56 baud) lines. Compusonics manufactures the DSP2000, a professional A/D, D/A converter which stores and manipulates 16 bit PCM multitrack audio on hard disc using a patented encoding (data compression) method. The DSP1000 is a recorder/playback unit based off of specially formatted floppy disks; a pro version is being marketed to radio stations. National sales manager Jim Woodworth said this demonstration, and an upcoming beta test by a major radio network, are just the tip of the iceberg for the technology's possibilities. Compusonics and AT&T recently signed a co-marketing agreement. It is hoped that success of these products will move AT&T to wire the remainder of the country.

TEKTRONIX AND CONTINENTAL RESOURCES SIGN RENTAL AUTHORIZATION PACT

Tektronix Inc. of Vancouver, WA and Continental Resources Inc. of Bedford, MA have finalized a joint contract naming Continental as an authorized Tektronix rental company. Continental carries 400 of Tektronix's products, besides nationally marketing computer hardware and supplies, data communications equipment and microcomputer software through its nationwide sales network.

JBL PROFESSIONAL HIRES PROFESSIONAL BUSINESS STAFF AND VICE PRESIDENT

JBL Professional President Ron Means has named Hugh J. Miller vice president of finance. The company which recently became independent from its consumer division has taken on a dedicated business staff to organize its finances, spearheaded by Miller, an accountant with corporate management experience. Said Means: "JBL Professional was set up as a separate business in admission that the pro business is a totally separate business from the consumer audio business. The final proof of the separation to better address the specific markets is our appointment of Hugh Miller, who with his staff is setting up our individual systems for payables, receivables, financial control and payroll.

ELECTRO-VOICE, INC. NAMES HARRIS TO HEAD COMPANY'S ENGINEERING DEPARTMENT

Earl E. Harris Jr. has been named director of engineering at Electro Voice Inc. Harris will report to President Robert D. Pabst, and will be responsible for administering EV's microphone, loudspeaker, electronics military and aviation engineering divisions. Said Pabst: "As director of engineering, Earl Harris is responsible for the manner in which EV engineering interfaces with the needs of the company. By structuring engineering operations to be responsive to those needs, Harris will play an essential part in EV's evolution to a market-driven organization.

NATIONAL ASSOCIATION OF RADIO AND TELECOMMUNICATIONS ENGINEERS CERTIFICATION

Since the FCC has delegated testing and licensing of radio and telecommunications engineers and the National Association of Radio and Telecommunications Engineers has assumed the process, current FCC licensees must apply for grandfather certification by Dec. 31, 1985 or face re-testing. For more information, contact NARTE, P.O. Box 15029, Salem, OR 97309; (503)581-3336.

H.A. KNOTT LIMITED FORMS ESI INC. TO ADDRESS VIDEO CONFERENCING

H.A. Knott Limited has formed a new company, ESI, Inc. to offer fully-integrated technology and systems to the burgeoning video-conferencing market. The formation of the Atlanta-based company is actually a spinoff of the research, engineering and manufacturing operations of ISACOMM, a United Telecom Company. Francis J. Knott is president and CES of ESI, and Donald Gainty, president of Cheshire Capital Corp of Cheshire, CT is secretary of ESI. ESI will initially supply integrated facilities and systems using ESACOMM's "The Meeting Channel" system.

INTERNATIONAL ELECTROTECHNICAL COMMISSION NOISE MEASUREMENT STANDARDS

The IEC has announced plans to publish a new world standard to help solve the problem of accurately measuring noise pollution levels in industry and in the community. The standard will cover the accuracy and stability of an integrating sound level meter and aims to reduce to a practical minimum any difference in equivalent measurements taken with instruments of various makes and models. For more information, contact Information Officer, Central Office of the IEC, Geneva, Switzerland, telephone: 34 01 50 and request Publication 804: Integrating-averaging sound level meters. The 49-page booklet in format A4 cost S.fr. 66 plus postage and packaging fee.

INTERCONNECT '85 SHOW DOES WELL DESPITE FLOODING PRODUCT OFFERINGS

Organizer's of the United States Telephone Suppliers Association's Interconnect '85 show termed the first of what may become an annual event a success, despite what some predict will be a manufacturer shakeout in the key systems market and despite a threatened boycott by the North American Telecommunications Association (NATA). Total attendance was well over 2,500, well above the predictions prior to the event held in San Mateo, CA.

PANASONIC AND HARD ROCK CAFE "INSTALL" AUDIO/VIDEO FOR ONE DAY EVENT

Panasonic's Audio Video Systems Group teamed up with Hard Rock Cafe chain owner Isaac Tigrett to create an exact reproduction of the New York cafe in a tent backstage at the Live Aid benefit concert in Philadelphia's JFK Stadium. Within 48 hours, a total of \$135,000 worth of audio and video equipment was unpackaged, installed, equalized and run for 17 hours straight, then disassembled, crated, and trucked back to Panasonic's New Jersey headquarters, all to raise proceeds for the world's hungry. The cafe, erected in a parking lot in just a few days, included a full menu and detailed cardboard copies of the eatery's valuable rock'n'roll memorabilia decorations.

1985 INTERCONNECT SURVEY SAYS VENDORS RELY LESS ON NEW SYSTEM SALES

A new survey, "The 1985 Interconnect Survey" by Phillips Publishing Inc. of Potomac, MD reports that respondents indicated that only about 70 percent of their total revenues came from sales of new equipment in 1984, compared to 76 percent in 1983. The remaining 30 percent of revenues came from service offering, leaseings, and follow-up sales of add-on equipment to existing customers. Other results of the survey show that average pay for sales positions rose nearly \$10,000 in 1984 over 1983 (reflecting much larger companies in the survey) while the overall average revenue per employee dropped nearly 10 percent over the same period.

LETTERS & OPINIONS

EDITORIALLY SOUND

I have been admiring the obvious thought and talent that you are bringing to bear in your editorials in *Sound & Communications*. I found your editorial ("Can the Small Contractor Survive," June 1985) on the present and future well-being of the sound contractor disturbing.

A recent editorial in another publication was unbelievably unprofessional. An example of what can happen if the editor is not knowledgeable about audio—which is more often true than not.

Praise the Lord! You can stir *Sound & Communications* away from such banal editorials.

Carolyn Davis
Synergetic Audio Concepts

CLUSTER UPDATE

I read your article "The Evolution of Loudspeaker Cluster Designs" in the July issue of *Sound & Communications* with interest. Unfortunately, you are misinformed. It was well before 1981 that "new coverage description techniques along with new methods of

mapping the coverage of horns on drawings" were developed.

As far as I know, no one has taken the systemized approach to the problem of array design that we did when we started out in the late 60s to develop a method of designing loudspeaker arrays. It's that 1960s North Star Sound engineering research project that gave us isobar maps and room maps along with the ability to automatically design the smallest possible coherent array and draw it as seen from any angle, complete with the location of the center of gravity.

T.G. McCarthy
Chief Engineer
North Star Sound, Inc.

In the July 1985 issue of Sound & Communications we ran an article on the "Evolution of Loudspeaker Cluster Design." By error of omission we neglected to mention the work of T.G. McCarthy of North Star Sound Inc., dated 1978, and his very detailed architectural array mapping program, entitled UMBULUS, which is available to any contractor or consultant. For more

information please contact: T.G. McCarthy, North Star Sound Inc., 1406 First Ave. South, Minneapolis, MN 55403; (612) 871-6016.

—Barry McKinnon



PASO'S COMPUCOM

In the August 1985 issue of *Sound & Communications* ("Duplex Intercom—Back on Track"), we misidentified the Compucom, Paso's duplex intercom. The wall-mountable Compucom can call up to 39 additional phones.

In the same issue, in the article "Servicing Today" the phone referred to on page 34 is a 1A2.

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UNDERSTANDING AUDIO LEVELS

by Jim Brown

One of the most fundamental and certainly most misunderstood characteristics of an audio signal is its level. Incorrect setting of audio levels in a signal processing chain is probably the most common cause of audio problems. A solid understanding of the audio signal and how to measure and describe its level is essential to good system operation and design.

It is important to understand the distinction between audio test (calibration) tones and normal program material. Tones are simple sine waves of constant frequency and level, and last long enough for VU meters to rise to accurately read their level. Program material is the complex combination of an infinite number of sine waves of continuously varying amplitude (size), phase (time relation to each other), and transient behavior (duration). The ways in which they will combine to produce peaks is very complex, and is affected (distorted) by

It is important to understand the distinction between audio test (calibration) tones and normal program material.

frequency response, phase response, and pre-emphasis.

Historically, audio levels have been measured using a mechanical "VU" meter having precisely defined electrical and electro-mechanical (ballistic) characteristics. Dating from the earliest days of audio, this metering standard defined "0 VU" on the basis of measurement with this standard meter ballistic. Such a meter is called a Volume Indicator, and is

designed to measure loudness. The average or the RMS value of the audio (similar in nature, but not usually the same) are related closely to the perceived loudness of the signal. In the process of averaging the audio signal to indicate loudness, the VU meter purposely ignores the short fast peaks. Many commonly used audio meters (including most used in video recorders) do not conform to this standard ballistic, and are thus improperly labelled "VU" meters.

The actual audio peak levels in a system without peak limiting are between 10 and 14 dB higher than the level indicated on a standard VU meter. Put more simply, when a VU meter in a circuit indicates "0 VU," the RMS value of sine waves equal in size to the peaks of that audio are commonly +10 VU to +14 VU. Highly transient (peaky) audio material (drums and other percussive instruments) can easily have peaks on the order of 20 dB or more above VU indication. In most audio circuit applications, what we care about are the peak levels, since that is what over-modulates tape, drives amplifiers into distortion, and moves loudspeaker cones up against their limits.

"0 VU" on the standard VU meter is then calibrated to the actual electrical operating level desired in the system. Common professional operating levels are +4 dBm and +8 dBm, usually referred to 600 ohms. Occasionally 150 ohms is used in network transmission centers. And -10 dBm is common in non-professional (Hi-Fi and garage studio) systems. Calibration is done using a steady tone.

It is instructive to look at the signal levels in a typical system. Consider an operating level of +8 dBm, with steady state calibration at "0 VU." Normal program peaks will occur 10-14 dB higher, or +18 to +22 dBm. Good engineering prac-

tice dictates additional "headroom" of 4 to 6 dB to allow for percussive transients and occasional meter readings "in the red" above 0 VU. This means that the system needs to be able to handle levels of +24 dBm to +28 dBm. Finally, if the system is run with 600 ohm build-out resistance and termination (called a power matched system), an additional 6 dB must be allowed for termination loss. The signal distribution system must thus be capable of +30 to +36 dBm before clipping.

Is this realistic and necessary? Yes and no. Most systems do not benefit from 600 ohm buildout and termination. This is an outdated practice left over from vacuum tube days and the mis-application of transmission line theory to audio circuits. Six-hundred ohm buildout (series output resistance) and termination (parallel load resistance) is not required and not good practice in most audio circuits. Operation without 600 ohm buildout and termination is called constant voltage distribution, and has been adopted by a number of major broadcast (ABC and NBC) facilities in recent years. And it has been standard practice in recording studios for many years.

Operation at +4 dBm rather than +8 dBm will further reduce amplifier output requirements. Operation at +8 dBm is recommended only when system noise due to electromagnetic interference is a problem. Operation at +4 dBm brings the maximum output requirements of the system down to manageable (economical) proportions. Distribution equipment capable of operation at +26 dBm peaks (0.4 watts) is far cheaper than that capable of +36 dBm (4 watts). Headroom requirements can be further reduced by several dB with good peak limiting. The value of compressors and/or peak limiters is more clearly appreciated when viewed in these terms.

Audio and Video Level Calibration Compared

Audio level setting differs from video level setting in that while video levels (as defined by sync and blanking) are relatively constant in a program, audio levels vary instantaneously over a very wide range. An important way of understanding this difference is to say that the video luminance and chrominance information (which varies instantaneously over a wide range) has a constant amplitude sync signal transmitted with it which serves the additional purpose of defining signal transmission levels. The amplitude relationships between sync and non-composite video are rigidly defined by FCC standards and nearly universally followed in the industry. Black and white reference levels are thus tied to their original reference at the time of creation of the video program material.

No universal definition exists for audio. Several commonly used level calibration references and methods of producing them are in use in various portions of the industry.

The audio signal has a "0 dB" reference tone transmitted with it at the beginning of a program (or at the time of system calibration) which attempts to define the level. This definition is, however, tied to the personal gain riding habits of the audio engineer at the time of program generation and the standards and practice of the portion of the industry in which he or she works. If he or she rides gain for absolute maximum peaks of "0 VU" with average peaks at -5 or below and follows (or precedes) the mix with good peak limiting, peaks of 6 dB above "0 VU" will result.

If the audio engineer rides gain for normal peaks of "0 VU" and an occasional peak of +3 VU, dynamic program

(continued on page 45)



MOSFET MASTERY

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BOUNDARY MICS

Measuring-Up

by Charles Bilello
Dr. Peter D'Antonio
RPG™ Diffusor Systems, Inc.

Radio Shack's PZM (#33-1090) has a mounted electret element on a metal plate for "out-of-sight" placement.

Beyer Dynamic's MPC 50 boundary microphone is built into an oak panel. Besides being attractive, this protects the element from damage in the event it is stepped-on in a floor application.

Crown's PCC-160, a phase coherent non-PZM cardioid is designed for easy mounting on a boundary surface. It utilizes a subminiature supercardioid mic capsule to create a directional pattern improving gain before feedback.

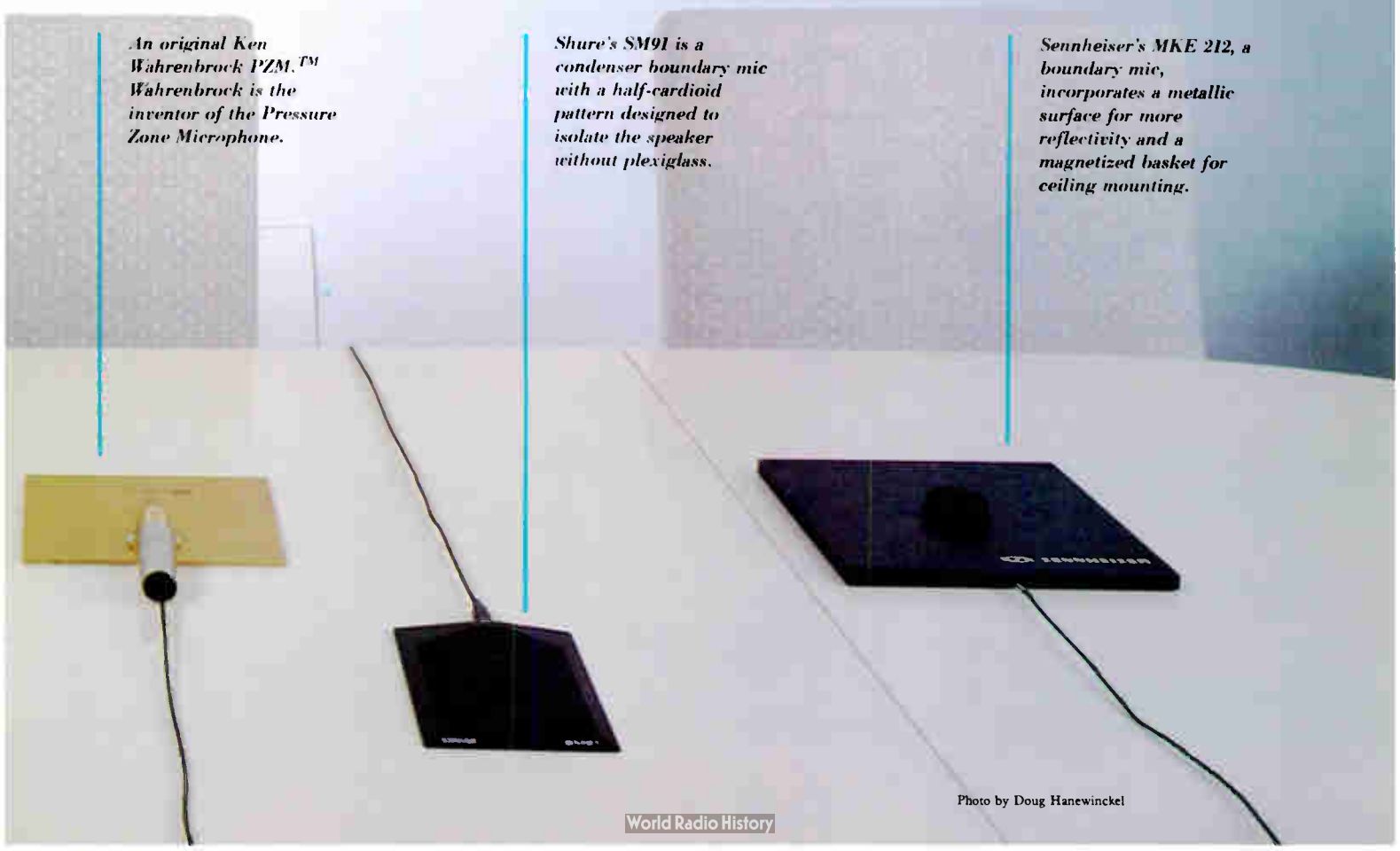


Charles Billelo's TEF analysis of the Ohio Theatre was featured in the January 1985 issue Sound & Communications ("Exploring the Acoustics of a Grand Theatre"). Since then, he and Dr. Peter D'Antonio have been doing research on the RPG Diffusor acoustical panel system utilizing boundary microphones at New York's Kaufman Astoria Studios. Therefore, the two were the logical choice to look into boundary-type microphones for this article. When contacted, it seems they were already ahead of us, and had taken an interest in the mics themselves. We supplied them with a variety of what is currently on the market. The following is what they found. —E.L.

All the microphones reviewed are, in our opinion, fine devices. Also, a listening of each microphone's performance does offer a choice for particular applications. There are times when we do want a "brighter" mic or a mic "not so bright" without the usual "bump" or "dip" that comes along for the ride, and the anomalies caused by nearby reflective sur-

faces. The tests reveal displays of smooth frequency responses.

There are many trade-offs in manufacturing, and microphones are no exception. Many approaches have been used to provide flat response for zero-incidence or random incidence. Since the physical presence of a microphone in a sound field causes a pressure increase which is a maximum at a wavelength that is twice the size of the diaphragm, designers usually compensate by attenuating the high frequencies so that the microphone will have a flat response for zero-degree incident sound. As a result, the response will be rolled off at high frequencies for random incidence. Microphones utilizing the pressure zone are designed to be flat for random incidence and the zero-incidence or direct sound is shielded. This has the advantage of minimizing frequency domain comb filtering due to interference between direct sound and reflected sounds. Mounting the diaphragm close to and facing the boundary



An original Ken Wahrenbrock PZM.™ Wahrenbrock is the inventor of the Pressure Zone Microphone.

Shure's SM91 is a condenser boundary mic with a half-cardioid pattern designed to isolate the speaker without plexiglass.

Sennheiser's MKE 212, a boundary mic, incorporates a metallic surface for more reflectivity and a magnetized basket for ceiling mounting.

moves the first interference null outside the audio range.

Another approach is to flush mount a conventional mic so that the diaphragm is parallel to and forms part of the boundary, with the microphone facing out from the boundary. This arrangement also reduces interference between direct and reflected sounds. However, any off-axis frequency coloration present in the microphone will still be present. Since the direct and reflected energy is essentially in phase, coherent summing yields an inherent 6 dB increase in sensitivity. All boundary microphones have a hemispherical response pattern. Recently, new microphones with directional response patterns have become available. These microphones physically mount on a boundary, for example, table or floor, and are referred to as low profile microphones.

For our tests, Beyer Dynamic and Sennheiser provided boundary microphones, Shure Brothers and Crown International provided low profile microphones, and our lab provided original Ken Wahrenbrock PZM and a Radio Shack #33-1090 PZM.

Figure A

GRAPH PARAMETERS

Frequency range	0Hz-10k (linear scale)
Sweep rate & bandwidth	5k/sec and 10Hz
Horizontal divisions	1k (dotted lines)
Vertical divisions	6dB
Frequency resolution	250Hz and above

The tests were set up as seen in Figure A.

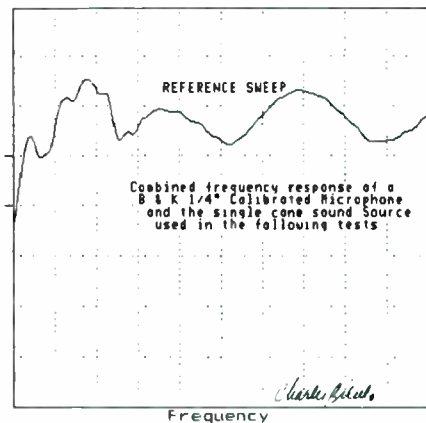
The sound source, which is a popular small speaker, was placed six feet away from each DUT (device under test) on the same boundary (floor). The TEF Analyzer, in TDS mode, was tuned to this exact distance. Unwanted energy was not allowed into the measurements. In each test, the upper curve shows the combined energy versus frequency curve (EFC) of the DUT and the test loudspeaker. Since the microphone and loudspeaker frequency response remains the same in each successive sweep, a couple of neat tricks can be performed by the TEF-10.

First, the computer stores in memory the amplitude, phase angle and frequency of the 400 points of an EFC. The next and successive EFCs can be "differenced" from the stored

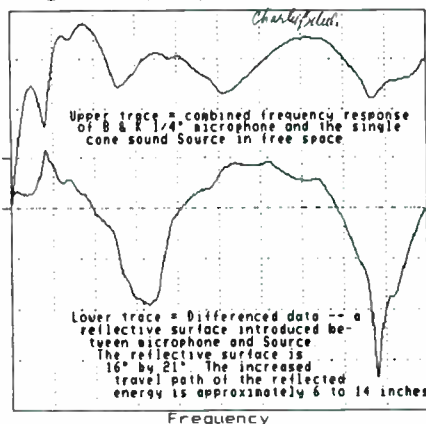
data, and the "difference" displayed. In other words, if all the parameters of the test remain the same, a straight line is displayed. *What is worth noting is what happens in each test when the sound source is moved.*

Second, we can recall the data, of a Reference Sweep and "difference" the data of the DUT sweep. The Reference Sweep used in the following tests is the combined frequency response of a Bruel & Kjaer one-quarter-inch calibrated microphone and the loudspeaker used in all the tests. The B&K microphone doesn't deviate .5 dB from dc to 20 k. If we "difference" the Reference Sweep and the DUT sweep, we eliminate the frequency response of the test loudspeaker, and are left with a fine comparison of the B&K one-quarter-inch microphone and the DUT.

**Bruel & Kjaer
Quarter-inch calibrated mic
Mag vs. Hz (EFC)**



**Conventional microphone
Mag vs. Hz (EFC)**



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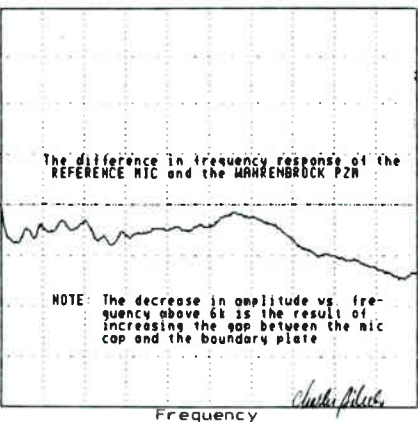
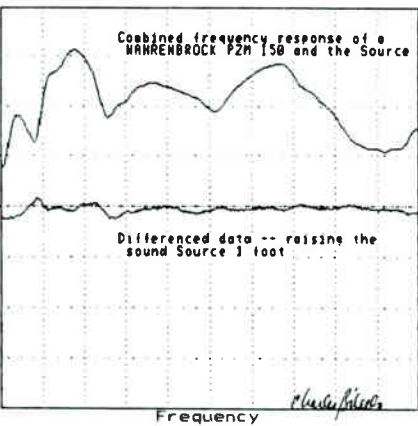
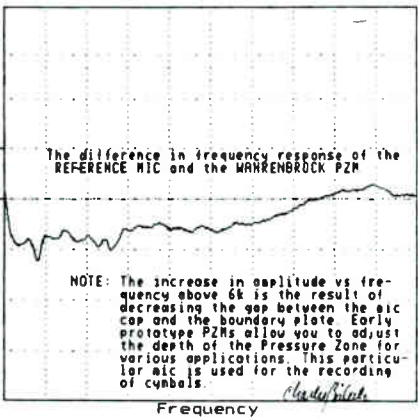
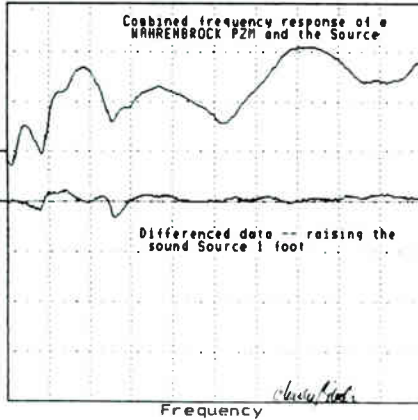
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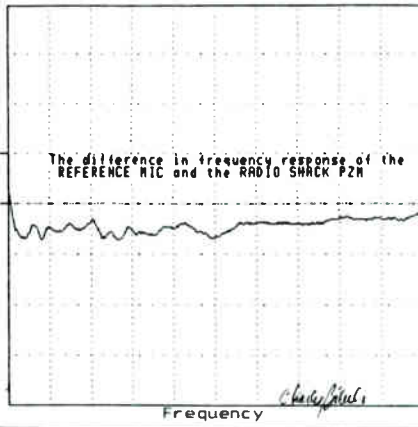
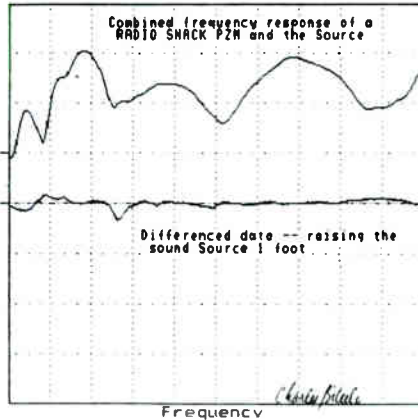
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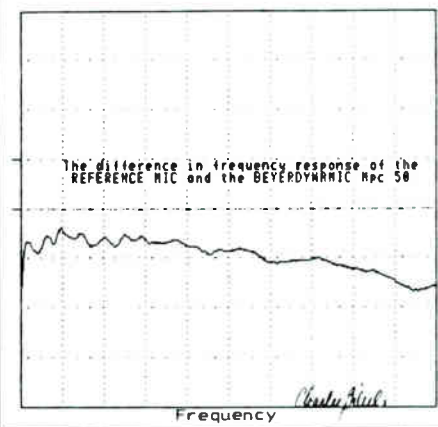
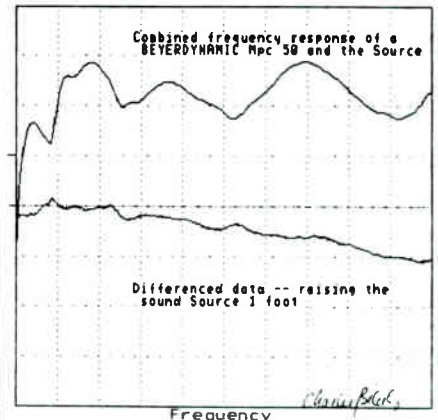
**Wahrenbrock PZM
Mag vs. Hz (EFC)**



**Radio Shack Realistic PZM
Mag vs. Hz (EFC)**



**Beyer Dynamic MPC 50
Mag vs. Hz (EFC)**



Methodology...

In addition to normal use, boundary microphones, especially pressure zone microphones, are very useful in determining the time, frequency, and directivity energy response of a wide variety of test materials, in a sufficiently large reverberant space. Materials which can be studied range from absorptive or diffusive surfaces to loudspeakers.

**Test Example: Two-feet by four-foot flat panel
Two-feet by four-foot QRDTm diffusor**

We used a pressure zone type microphone in the following experimental geometry. The geometry consists of a sound source (S), pressure zone microphone (M), and device under test (D) placed on the floor (F). To make an accurate measurement, we must set up an anechoic situation where the direct sound and other surfaces in the room do not contribute. This is easily accomplished with the geometry shown in **Figure 1a**, using the TEF Analyzer. The geometry is set up such that twice the MD distance is at least 1.75 times the space window

used for the TDS measurement. This provides approximately 33 dB of rejection of the direct resolution (time window of 10 ms) and MD distance of approximately 10 feet is required. **(1.75 x 1.13ft/ms x 10ms / 2)**

It is helpful to set SM equal to MD to eliminate any backscattering from the sound source. If we allow another 10 feet after the arrival of the reflected signal to minimize room reflections, a reflection-free hemiellipsoidal volume with a 24.5-foot minor axis and a

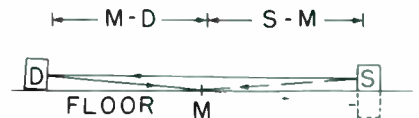


Figure 1a

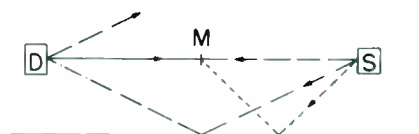
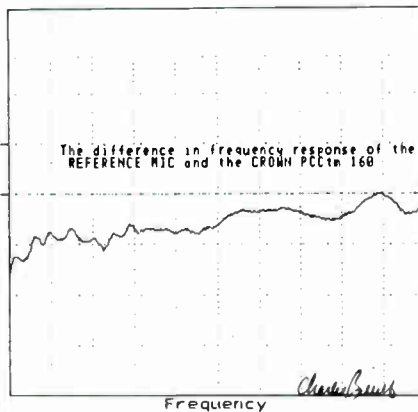
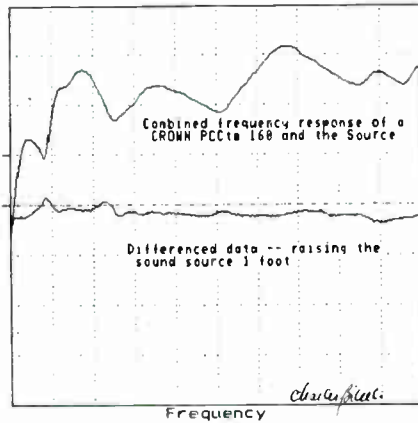
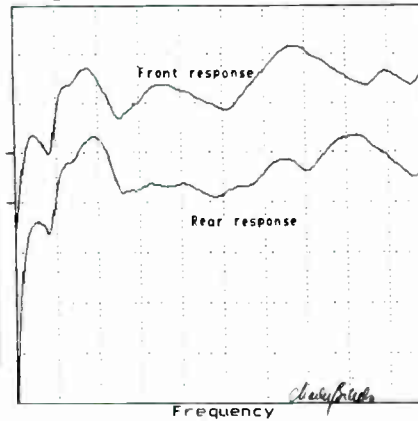


Figure 1b

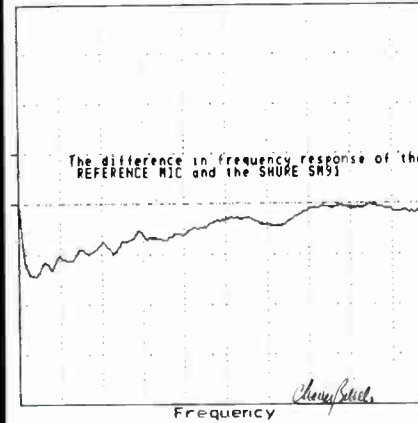
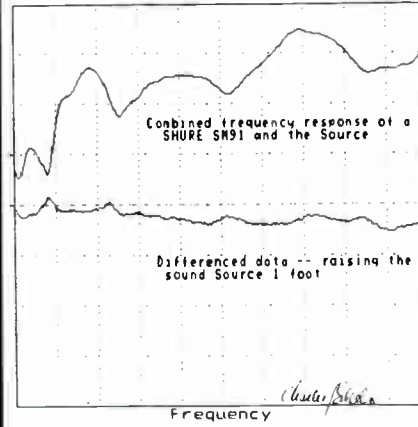
**Crown PCC 160
Mag vs. Hz (EFC)**



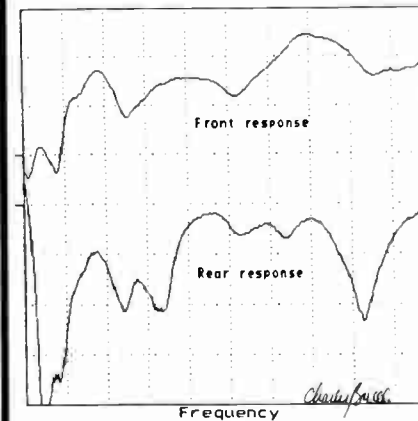
**Crown PCC 160 (rear)
Mag vs. Hz (EFC)**



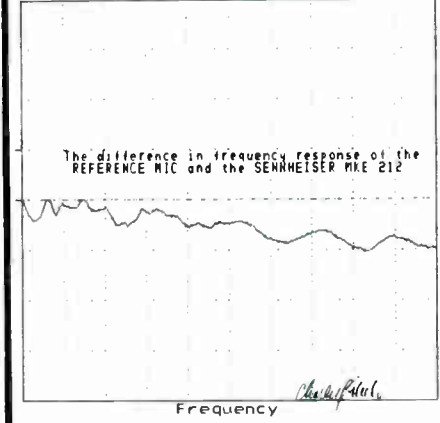
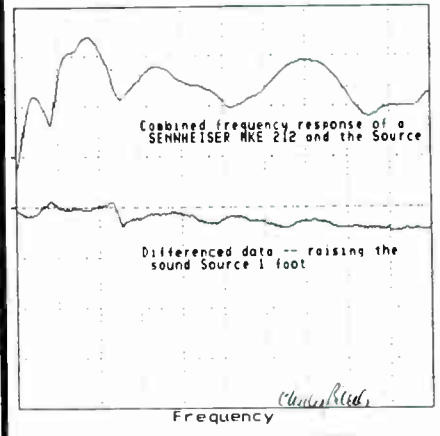
**Shure SM91
Mag vs. Hz (EFC)**



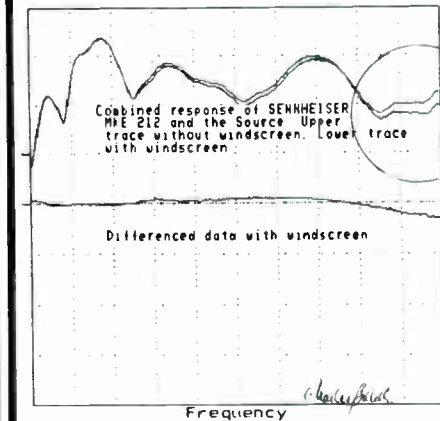
**Shure SM91 (rear)
Mag vs. Hz (EFC)**



**Sennheiser MKE 212
Mag vs. Hz (EFC)**



**Sennheiser MKE 212 (windscreen)
Mag vs. Hz (EFC)**



25-foot major axis is required. The minor axis is given by:

$$[(5 \times SM / 2)^2 - (SM / 2)^2]^{1/2}$$
 and the major axis equals 2.5 x SM. If less frequency resolution is acceptable, then MD can be decreased, since the frequency resolution and time window are inversely proportional. To make polar measurements out to 90 degrees with 100 Hz resolution, we must increase the MD distance because the SM distance is now a function of the polar angle A. If we set SM=MD at zero degrees, the direct sound at any polar angle is give by:

$$SM = [MD^2 - 4COS(A)]^{1/2}$$

Continuing our example, at 90 degrees we want the difference (d) between the direct sound and the reflected sound to be 20 feet. The SM distance needed to achieve this separation is 26 feet (where for this geometry SM=1.3d). These boundary measurements have three main advantages: the S-F-M reflection, which would occur between the direct and reflected sound using the geometry of **Figure 1b**, is eliminated: the reflected energy to direct energy ratio is increased by 6 db; and polar measurements are easily

accomplished by running the microphone around an arc on the floor. In **Figure 2a** the absence of the floor reflection and 6 dB reflected to direct energy increase can be seen. D is a two feet by four feet flat panel. The peak at 5 x SM is the S-D-S-M reflection. The energy-frequency curve is shown in **Figure 2b**. The SM-MD distance is approximately 10 feet. The difference in energy between the direct and reflected sound would be 9.5 dB with the geometry of **Figure 1b**, since the S-D-M distance is three times the S-M
(continued on page 34)

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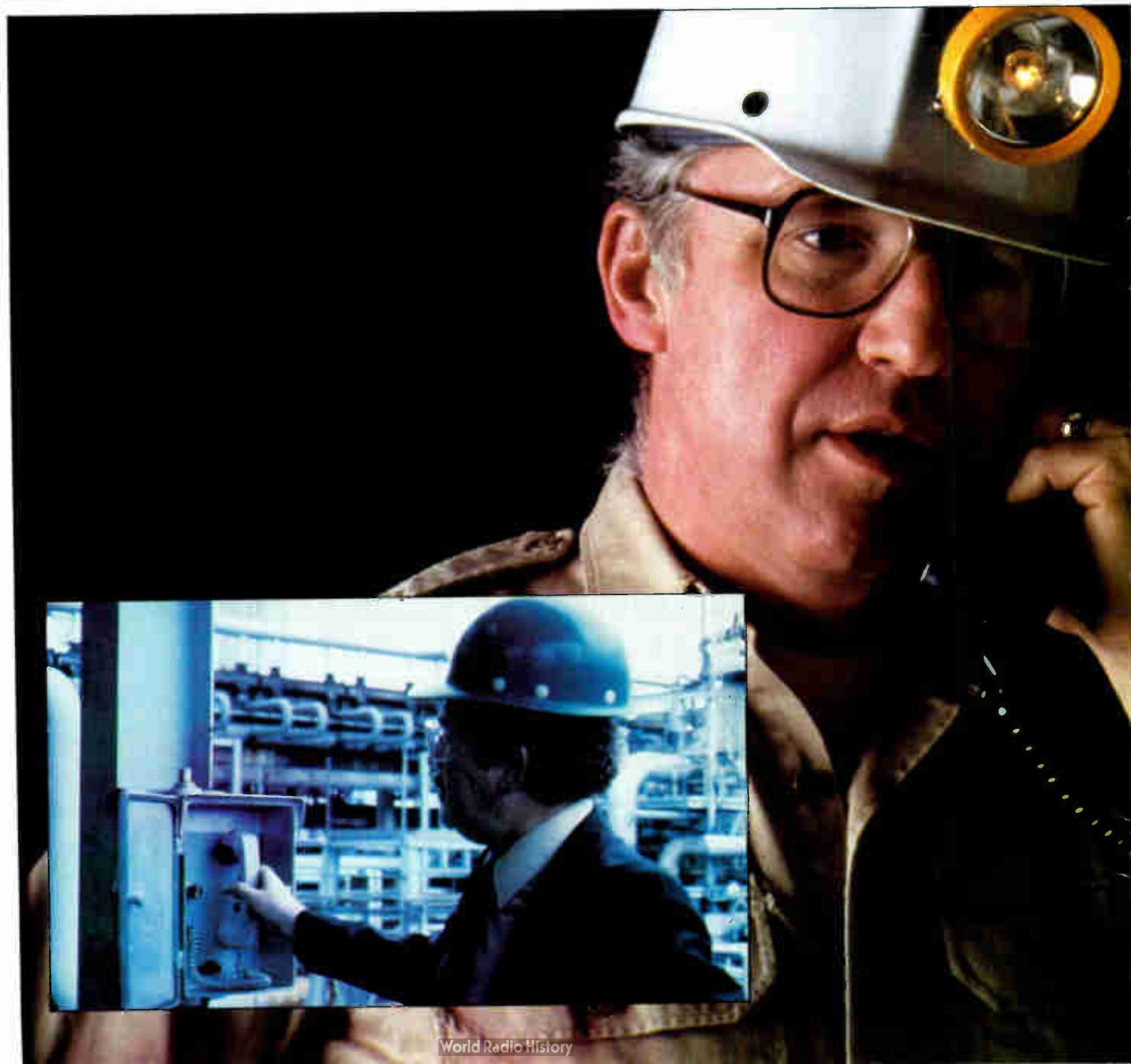
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World Radio History
Reader Service #232



INDUSTRIAL PAGING

Defying The Elem

by Jeffrey Schwartz

We're all familiar with paging systems that are installed in offices and retail stores. But what kind of system would you put on an oil rig eight miles out in the Gulf of Mexico where the salt water, heavy rainstorms and hurricanes prevail? Or five-hundred-feet below ground in a Pennsylvania coal mine where the risk of methane in the air could be easily ignited by the wiring in a paging system?

When a system is installed in a location where the atmosphere is subject to fire, explosion, or extreme moisture; it must be reliable and able to withstand the threatening elements. Since many of these locations need a paging system (in some situations they are required by law), products had to be developed to satisfy these special clients' needs. Therefore, many companies now manufacture and install specialty paging and intercom devices that are designed to withstand such environmental factors as combustion, water, and corrosion.

University Sound (an Altec Lansing Division) of Oklahoma City, OK, manufactures a loudspeaker (7110 XC) that is explosion proof and submergence-proof.

(Top) GAI-Tronics hard-hat headset in use at an oil refinery.

(Center) Mine Safety Appliances (MSA) Pager III being used by a miner.

(Inset) GAI-Tronics page party equipment—weatherproof wall station in an oil refinery.



The 7110 XC can be hooked up to any public address system, according to Gary Rilling, commercial marketing manager for University Sound. "The housing and device makes it explosion proof," said Rilling. The opening of the driver that leads to the horn lets sound out but doesn't let anything in. It's a one-way type system. It's UL listed, so it is conducive to its environment."

University's paging system is designed for use in various specialty environments such as gasoline storage facilities, grain storage silos, and other areas where the risk of explosion is high.

GAI-Tronics, which has its own line of paging systems, is one of the larger contractors to install University's loudspeakers. GAI-Tronics manufactures and installs its full line of paging systems for use in mines and off-shore oil systems.

"Our general markets are environments with high noise in caustic and hazardous locations," said Peter Lang, industrial product manager for GAI-Tronics based in Reading, PA. "We have a heavy grade of equipment suitable for any environment." GAI-Tronics reports that its paging equipment is widely used in the grain, mining, and off-shore oil industries.

GAI-Tronics' Hazardous Area Page/Party series can be used in noisy locations, harsh environments, and areas where explosion-proof equipment is required. The system consists of a handset control, and amplifier, which connects internally through a plug-in harness to the housing base. The handset is explosion proof and the system limits fault-condition voltages and currents to prevent sparks capable of gas or dust ignition.

While the company provides a good amount of custom installation, it reported that its two largest customers to date are DuPont Corporation and the government. Currently the company is working on a two-way explosion-proof container. "We developed the technology to use a standard telephone that would be rated for use in hazardous areas," Lang said. While this would be marketed as a telephone system and not a paging system it could be used in the grain and oil industries.

GAI-Tronics paging systems are also typically installed in chemical plants, paper mills, water treatment facilities, and power plants. The company also manufactures its own line of



GAI-Tronics mine page in use in an underground coal mine.

speakers for application in these atmospheres.

MSA (Mine Safety Appliances Company) of Pittsburgh, PA, manufactures the Pager™ III Mine Communication System. This system is a self-contained system that can be used as a paging system or as a semi-private telephone. It is powered by a 12-volt dry cell battery and consists of a speaker, telephone handset, and a solid state amplifier with associated circuitry.

"In mining you must have a unit that is safe against methane so the system won't cause it to ignite," said Steve Long, product line manager. "We sell these systems by the hundreds in mines." The system consists of a fiberglass case and stainless steel parts allowing it to withstand the dust and moisture that also exists in mines. This system is MSHA-approved, and the units can be integrated into a system using standard two-conductor mine telephone wire.

RTS Systems in Burbank, CA, manufactures an intercom system designed for volatile gas atmospheres. A typical application for this system is the entry path for an aircraft fuel tank where there are heavy fuel fumes. "This system is not capable of generating spark in any way," said Douglas Leighton, vice president marketing. "Thus it is acceptable in that kind of environment. There are no high or medium currents that could set off a spark."

Reach Electronics in Lexington, NB, is a manufacturer of paging systems that feature safety classifica-

tions for use in mines and on off-shore oil rigs. According to Mike Sutton, sales manager, this company's paging systems use VHF frequencies. "We install the pagers and our dealers install the transmitters and antennas themselves," said Sutton. These systems also meet the necessary codes for use in mines. "They have to be intrinsically safe to be used in mines."

Televox Systems, a division of Tele-system Ltd., in Quebec, Canada designs paging systems for any type of industrial facility. Televox installs systems in slaughter houses, water facilities, mines, and any area that needs a system that can withstand environmental factors. "These systems aren't found in books," explained Alain Turcot, sales director for Televox. "Every situation is specialized. You rarely find two systems that are the same. We specialize in selling and installing PA and intercom systems in specialty situations."

The company installed a system at a nearby Montreal water plant. Explosion-proof equipment was necessary due to the high level of noise generated by the plant. A special speaker system was installed there that can penetrate the workers' ear protection devices. Televox also installed a paging system in a slaughter house. Because the slaughter house uses two-inch hoses to wash the facility down, the paging equipment had to be designed in water-tight boxes.

Turcot explained that every installation is custom designed. "Everything is made according to what the engineer requests." Some systems are easy to install while others tend to be more complex. "Trying to take old wires out of old conduit can be difficult," said Turcot. "If it's a new building or facility there are usually less problems because it's new conduit. It can get pretty hairy trying to pull 25-feet of wire out of old conduit."

Atkinson Dynamics of South San Francisco, CA, manufactures a heavy-duty industrial intercom designed for use in high noise areas, in areas subject to wet or corrosive conditions, and excessive temperatures. "We manufacture intercoms for use in heavy industry," said Edward Watson, operations manager. "Our systems are typically installed in diving bells and oil drilling rigs."

Other specialty applications for Atkinson intercoms include breweries and bottling plants, sawmills, airport runways, and sewage treatment plants.

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Installation Profile:



“Three months of planning and five months of installation work brought a new sound system at the City Hall building, but not without crises and deadlines.”

The City Hall building, located in lower Manhattan, is the site of numerous daily political activities ranging from a mayoral press conference to a full-stated council meeting which is held in the 13,500 square-foot City Council Chamber. The original City Hall sound system was built some 26 years ago. While it has served its purpose reasonably well, all of the sound equipment was obsolete by present standards. Its design necessitated the presence of an audio engineer for the manual switching of the 40 microphones for use during a regular stated meeting.

Hamilton Communication Consultants was selected to study and design a sophisticated, state-of-the-art sound reinforcement system in the various chambers of the City Hall building. The several basic requirements included: improving frequency response, increasing SPL, improving signal to noise ratio, improving overall intelligibility, increasing feedback margin and system headroom, automation of the system, physical appearance of the system, and system flexibility.

Telephone Sales and Service Company of New York City, which had completed contracts with the New York City Board of Education and various other municipal agencies, was awarded the contract for the project.

Five separate systems comprised the entire installation, the most complex being that which was installed in the City Council Chamber.

The basic goal in this system was to design a distributed sound system utilizing an automatic microphone switching system and a multipoint low-level amplification to achieve the desired sound power levels. The audio would be processed for automatic gain control and compression, as well as equalized to compensate for the acoustics of the City Council Chamber. Because the system is used in various modes—formal council meetings, public hearing, public events, and broadcasts—it required a specific choice of equipment to cover all the events and to accommodate flexibility and later expansion. In addition, WNYC (sponsor agency) needed media feed for press requirements, Telco feeds for recordings of events at WNYC studios, and feeds to and from each of the five systems being installed in the building for overflow audience, remote operation, and privacy selection.

Hamilton Communication Consultants chose the AMS System from Shure Brothers for its microphone,

CITY HALL SOUND UPDATE

by Claude Ruimy
Telephone Sales and Service Company

mixer, and logic technology in a dedicated and totally integrated system. The logic terminals on the rear panels of the AMS mixer offer the flexibility needed for automatic switching, muting and gating features.

The most difficult problem with any sound reinforcement system in the New York City Hall is satisfying aesthetic requirements without sacrificing function and quality. The original installation included "shotgun" microphones mounted on each council person's desk, thus obstructing the historic and artistic decor of the meeting chambers. The Art Commission's concern was to blend the sound system's elements into the decor in an unobtrusive manner.

The small desk consolette was designed to implement these requirements. The consolette was composed of a low profile Shure AMS-22 microphone associated with a small JBL-8110-H loudspeaker. Included in the consolette are an amplifier with volume control, a microphone "On/Off" switch, LEDs indicating the status of the microphone, and a logic control circuitry to mute the associated speaker when the microphone is gated on. The chairperson's consolette in addition has switches to control muting functions, privacy switches to prevent any audio signal from leaving the confines of the room and a switch to control the audio sent to the overflow audience area. The units are manufactured of fabricated CRS and covered with mahogany colored formica to blend in with the desks. The front plate is made of black anodized aluminum and the legends engraved and filled with gold paint. The unit includes a multi-pin PCB connector accommodating the connection cables to the speaker. A custom speaker enclosure, installed under each council desk, provides interconnection between the portable desk and the junction distribution floor box.



(Left) Testing the City Council Chamber system in the shop.

(Right, Top) View of conference table where the committee meets.

(Right, Bottom) The modified consolette with the AMS-24 gooseneck microphone.



City Council Chamber console and mimic panel.

A custom designed distribution junction box, using a modified Steel City Cast Floor Box Series 640, three gang, with brass cover plate and carpet plate to match the decor of the wood and brass of the City Council Chamber, provides six outputs for consolettes via a multi-pin Bendix connector to supply voltages, audio, microphone, muting and gating circuitry to the consolettes. The audio feed is distributed

through a resistive network to provide a 600 ohms balanced line at 0 dB level for each consolette.

The selected audio console, Broadcast Electronics' Model 8M250 provides sufficient inputs and two outputs, "Program and Audition" to satisfy WNYC's needs for separate mix during direct broadcasts.

The gain structure of the system is very critical considering the multitude

of components through which the audio signal is passed. In order to avoid any impedance mismatch, all inputs and outputs are 600 ohms balanced. The audio distribution amplifier selected had to have a large gain variation to accommodate the various feed levels required. The Ramko Research Distribution Amplifier, Model P-85/16M, provides the system with 16 mono output individually adjustable from -60 dBm to +26 dBm at 600 ohms balanced, and all of it into a one-and-three-quarter-inch height.

The speaker system is comprised of five separate channels:

Council Member Speakers: Forty-three, four-inch JBL-8110-H speakers in custom enclosures, individually controlled by associated consolettes and muted by its microphone, as well as adjacent microphone (selected via a muting card).

President and Guest Speakers: Two, four-inch JBL-8110 HT speakers in custom enclosures, controlled by an attenuator located in the control area on the mimic panel.

Ceiling Speakers: Four, four-inch JBL-8110-HT speakers in a 96-4 enclosure to cover the zone under the balcony and outside the entrance of the chamber.

Balcony Speakers: Eight, three-inch Quam-Nichols 30-C12-8 speakers in a custom metal enclosure mounted on the brass railing.

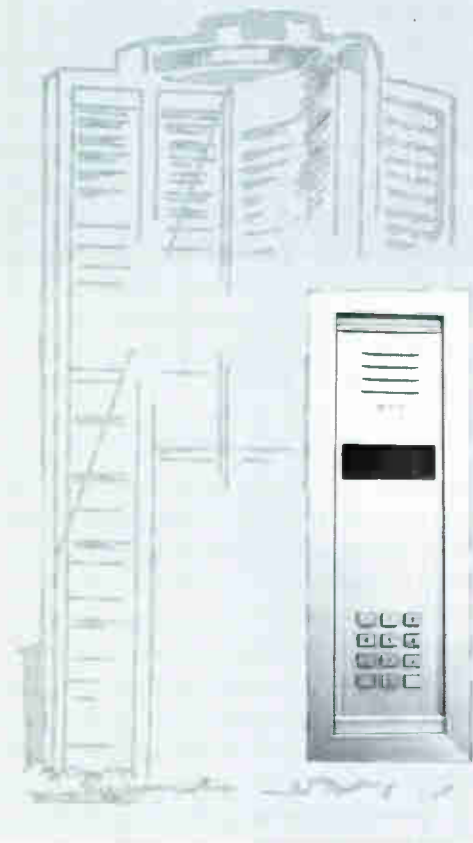
Special Event Speakers: Four Electro-Voice FR12-2 speakers with a TK-60 transformer are located in front of the dais for public events such as the State of the City Address, etc.

The reverberation time of the chamber, $RT_{60} = 1.8$ seconds, and the requirement of a low level multi-point distribution system necessitated a two-channel digital delay with the system. The Eventide Model CD-254 is set for a delay of 25 ms for all council member desks and 50 ms for balcony and ceiling speakers, in relation with the chairperson's location.

Two one-third octave graphic equalizers are used to compensate for room acoustics and speaker response for the two major types of utilization of the system. The Rane GE-27 equalizer is sufficient for the council members desk speakers, as well as the ceiling and balcony speakers, and a second unit is used for the four EV speakers for special events.

Two McMartin power amplifiers, Model LT-500-D, provide a clean 50 watts RMS output in a 70 volt line.

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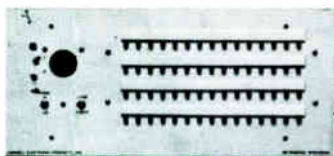
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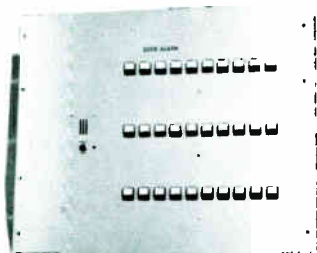
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The system, designed to be utilized without the need for an audio engineer, required an operator during certain functions. For this reason, a "mimic" panel was designed to override the system's automatic switching. Each microphone can be muted at the panel in manual mode (using the "Mic Mute" logic terminals on the AMS mixers). The panel is laid out to represent the physical positions of the microphone within the chamber and, therefore, a simple glance at the chamber from the control area permits the operator to locate the appropriate switch to mute or allow the microphone to be gated. Each position also has an LED to indicate an activated gate. The panel's construction is designed in color and size to match the Broadcast Electronics Console so as the provide aesthetic continuity to the system.

The proposed speaker muting circuitry utilized a "NAND" Gate to convert the logic ground received from a gated microphone to a + signal, triggering a relay for the speaker "mute." Telephone Sales and Service suggested a simple circuit using diodes and DIP switches associated with the OPTO coupler to direct the logic ground (received from a gated microphone) to selected consolettes (via DIP switches). Thus, the need of logic gates and relays was eliminated.

A critical aspect of the system's design was a "Floating" Logic Ground with respect to the audio and chassis ground and the 15 volts power supply ground. The 5 volts regulated power supply feeding the OPTO coupler had to be connected to the Logic Ground Terminal of the AMS mixers and completely isolated from any other GND; otherwise, false gating, muting and oscillation/distortion would be created throughout the system.

For total flexibility of the system, normalised jacks were inserted between each microphone and mixer input, as well as the logic gate and muting circuitry. The seven patch panels, manufactured by Trimm (26 inputs x 2 rows) allow patching of any microphone to any input in case of malfunction of a mixer input. In order to keep the same physical position of the microphone and control at the mimic panel, the logic circuitry is connected through similar patch panels. A line patch panel is inserted through the various audio flows of the system to facilitate trouble shooting or to accommodate special

configuration in the system.

With the design and fabrication of the City Council Chamber system complete, the installation phase began. Needless to say, in a Historic Landmark building as old as the City Hall building, the installation was a delicate and time-consuming process. The contract called for new wiring and new conduit to accommodate the nine junction/distribution boxes and all the media feeds, speaker, etc. The run of close to 10,000 feet of cable in flexible conduit, ranging from one pair shielded to 27 pair individually shielded, took approximately two months for a team of four electricians. The existing control area had to be gutted out and completely rebuilt. The floor was cut in several places to create access for the conduit run and for recessing junction and distribution boxes. Extreme care was taken to avoid ground loops and RF interference by using multi-pair individually shielded cable, and audio shields were tied to the chassis ground at the equipment cabinets only. The testing and trouble shooting of the system took a considerable amount of time since the parallel hook-up of the consolette's voltage supply and logic circuitry made it difficult to isolate specific problem sources. Despite all the difficulties, the system checked out as satisfying all its basic goals.

The system delivers an audio signal level at each council member position of approximately 71 dB and an average of 72 dB in the balcony and back of the chamber. The study, conducted by Hamilton Communication Consultants, pointed out that the average SPL desired before acoustical treatment to be 68 dB with a signal to noise ratio of 12 to 15 dB. The system delivered a signal to noise ratio of 15 dB and an average of 7 dB.

Acoustical treatment was performed at the request of Hamilton Communications Consultants. New carpeting is at the fabrication stage and all windows will be sealed and replaced to create a better isolation with the outside noise.

After completing the installation and testing procedures, the system seemed to be ready for utilization. The first stated the meeting started with a thorough demonstration and pointed out the critical acceptance angle of the microphone due to the fact that the council members were standing up during speeches. Being used to "shotgun" microphones mounted on stands

(continued on page 37)



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INDUSTRIAL RESEARCH PRODUCTS' DG-4017 TRANSVERSAL EQUALIZER

By Farrel M. Becker

Industrial Research Products, Inc. (IRPI) is known in the audio industry as a pioneer in the field of digital signal delays and whose DE-4013 automatic microphone mixer offers features that allow it to be used in ways that no other unit can duplicate. IRPI's DG-4017 Transversal Equalizer is yet another example of IRPI's application of technology to the needs of the audio industry. Although, transversal equalizers are not new (they were described as early as 1940), there has not, until now, been any

manufactured for commercial use.

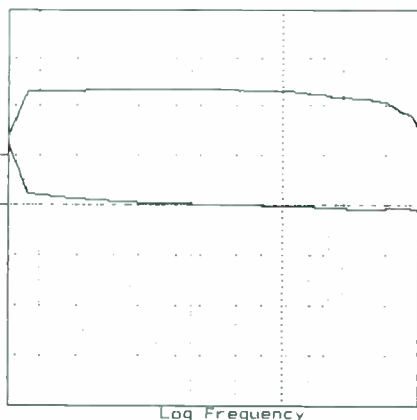
While conventional equalizers use resonant circuits (RLC or some other type of filters) and operate on the signal in the frequency domain, transversal equalizers use a tapped delay chain (a series of analog signal delays) and operate in the time domain. They have no filters in the usual sense of the word. Instead, delayed copies of the original signal are mixed with it at varying amplitudes (it's actually more complex) in order to achieve a desired transient response

(the time domain representation of the desired frequency response). The result is a minimum phase equalizer with very little ringing in its transient response and, therefore, very little ripple in its frequency response.

Since transversal equalizers are not filters, I will use the word "equalizer" when referring to the DG-4017's transversal sections.

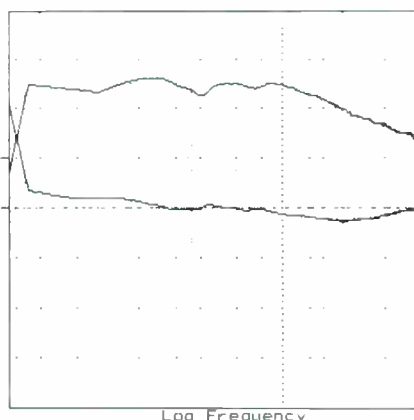
The rack mounted DG-4017 is one and three-quarter-inches (one rack space) high and is provided with a screw terminal strip in the rear for in-

Figure 1



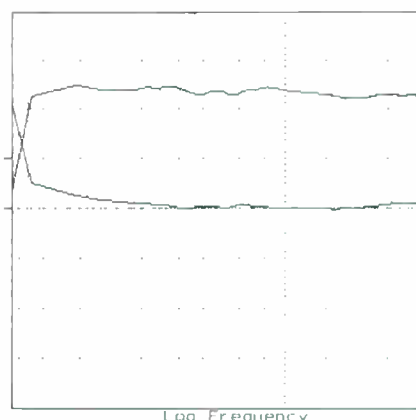
Magnitude and phase of IRPI DG-4017 with EQ out, 3 dB and 45 degrees/division vertical, 0 to 31,768 Hz logarithmic horizontal, 22 Hz resolution.

Figure 2



Same as Figure 1 with EQ in.

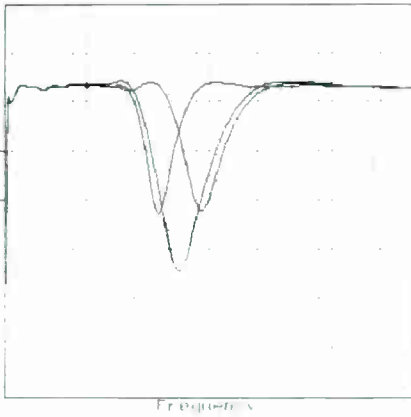
Figure 3



Same as Figure 2 with controls adjusted for flatter response.

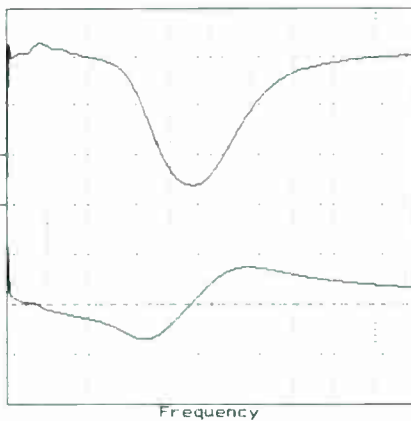


Figure 4



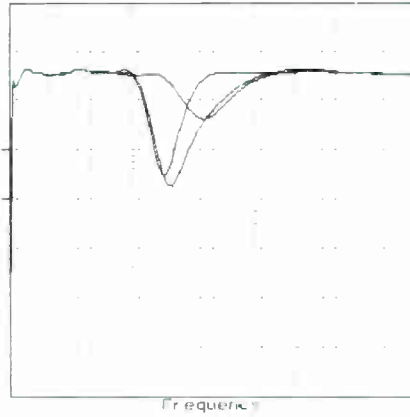
DG-4017 with 1.6 and 2 kHz equalizers set for maximum attenuation individually and together, 3 dB per/division vertical, 0 to 4 kHz linear horizontal, 22 Hz resolution.

Figure 7



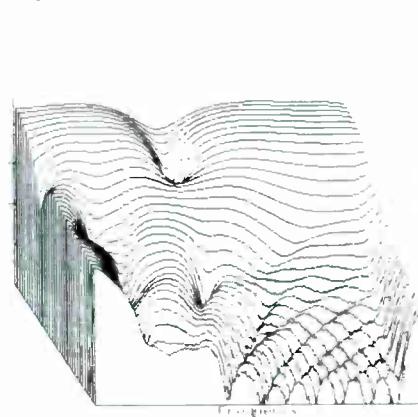
Magnitude and phase of conventional equalizer with 1.6 and 2 kHz filters set for approx. two-thirds attenuation, 3 dB and 45 degrees/division vertical, 0 to 4 kHz linear horizontal, 22 Hz resolution.

Figure 5



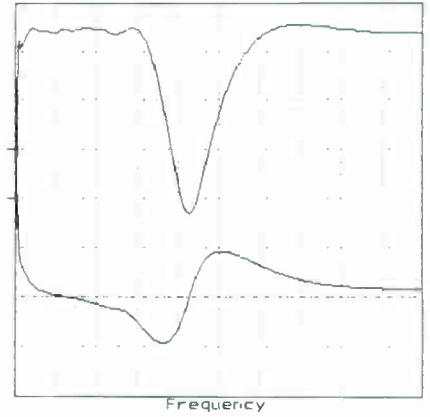
Same as **Figure 4** with 1.6 kHz at two-thirds attenuation and 2 kHz at one-third attenuation.

Figure 8



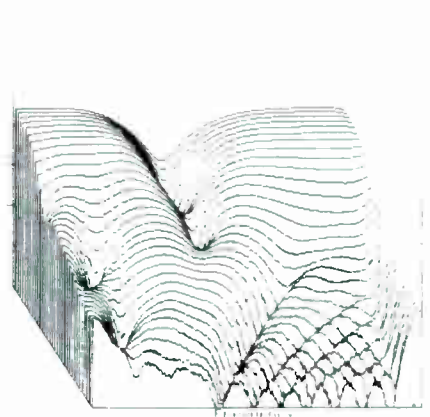
3-D of DG-4017 with 1.6 and 2 kHz equalizers set for maximum attenuation, 12 dB/division vertical, 0 to 4 kHz linear horizontal, 0 to 3 milliseconds back to front.

Figure 6



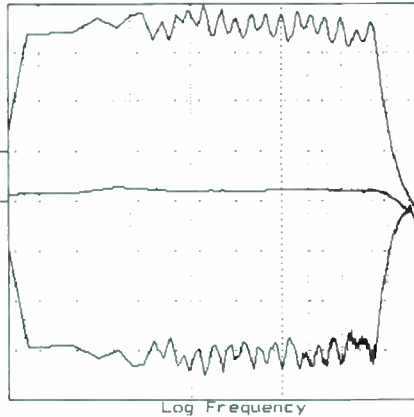
Magnitude and phase of DG-4017 with 1.6 and 2 kHz equalizers set for maximum attenuation, 3 dB and 45 degrees/division vertical, 0 to 4 kHz linear horizontal, 22 Hz resolution.

Figure 9



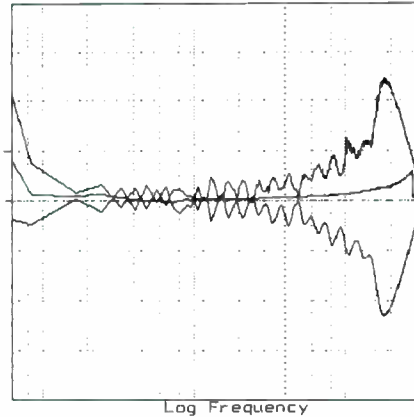
3-D of conventional equalizer with 1.6 and 2 kHz filters set for maximum attenuation, 12 dB/division vertical, 0 to 4 kHz linear horizontal, 0 to 3 milliseconds back to front.

Figure 10



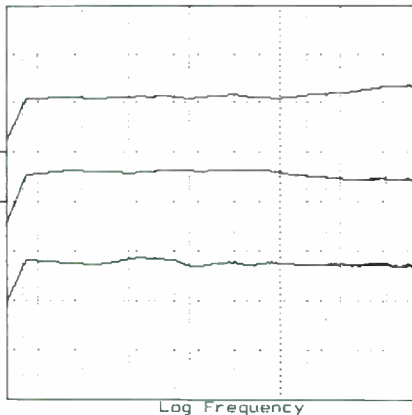
Magnitude of conventional equalizer with all filters set for maximum boost (upper), flat (middle) and maximum cut (lower), 6 dB/division vertical, 0 to 31,768 Hz logarithmic horizontal, 22 Hz resolution.

Figure 11



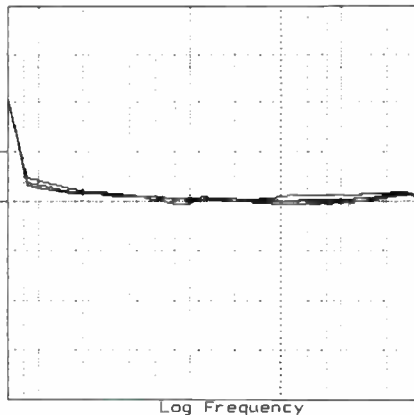
Phase response of Figure 10, 45 degrees/division vertical.

Figure 12



Magnitude of DG-4017 with all equalizers set for maximum boost (upper), flat (middle) and maximum cut (lower), 6 dB/division vertical, 0 to 31,768 Hz logarithmic horizontal, 22 Hz resolution.

Figure 13



Phase response of Figure 12, 45 degrees/division vertical.

put and output connections. The input is balanced and transformer isolated with a measured impedance of 19 kilohms. The 80 ohm output is also balanced and transformer isolated. Although each of the input and output terminals is marked with either a + or a - as an indication of polarity, the unit I tested was polarity reversing (IRPI is aware of this and they said it would be fixed). The front panel gain and equalization controls are rotary pots. Equalizers are provided at 160, 250, 400, 500, 630, 800, 1K, 1.25K, 1.6K, 2K, 2.5K, 4K, 6.3K, and 12K

hertz. Each equalizer can provide up to 10 dB of boost or cut. In addition, there is a 12 dB per octave high pass filter that is continuously variable from 20 to 200 Hz. A high frequency shelving filter provides 10 dB of boost or cut with front panel selectable hinge points of 1,2,4, or 8 kHz. The high pass and shelving filters are of conventional design rather than transversal.

Separate input and output level controls have four LED level indicators each. A switch is provided to bypass the equalization circuitry and a transparent Lexan front cover is provided

to prevent tampering with the controls once set.

Figure 1 shows the magnitude (upper curve) and phase (lower curve) of the unit's frequency response with the front panel EQ switch in the out position. The same information with EQ in and all controls set to the "0" position is shown in Figure 2. The unit is 3 dB down at 13 Hz and 2.6 dB down at 20 kHz with variations in response being within plus or minus a dB. With some control adjustments the response can be flattened out as shown in Figure 3.

Figure 4 demonstrates the combining qualities of the DG-4017 equalizer. Here, the response with the 1.6 kHz (upperleft curve) and 2 kHz (upper right curve) equalizers are shown when set for maximum attenuation individually. The lower curve, showing a deeper notch, is the response that results when both equalizers are set for maximum attenuation at the same time. This combining action, to create a notch that is deeper than the two individual notches and at a frequency that is between the two, is highly desirable. It permits the notch to be set at any frequency, rather than to the filter frequencies only. An example of this is shown in Figure 5. By setting the 1.6 kHz equalizer for two-thirds attenuation and the 2 kHz equalizer for one-third attenuation, the resulting notch is located closer to 1.6 kHz. By manipulating the controls, one can place the notch at any depth and frequency. Not all equalizers do this, thereby limiting their usefulness and resulting in excessive ripple in the response between adjacent filters.

The magnitude and phase of the two adjacent equalizers (1.6 and 2 kHz) is shown in Figure 6. The response is minimum phase. For comparison, the response of a popular and well designed conventional equalizer is shown in Figure 7. Notice the broader notch. The transversal equalizers maintain their "shape" (Q) as they combine.

The time response of the transversal equalizers may be seen in Figure 8. This is a three-dimensional view with frequency running horizontally from left to right, time running from back to front, and amplitude in the vertical direction. The notch is seen to take a small amount of time to develop and then disappear. It later reappears briefly as the signal has pretty well decayed away. This second notch is common (if

(continued on page 34)

LAB TEST

(continued from page 32)

not required by the physics involved). Again as a means of comparison, the 3-D response of the conventional equalizer is shown in **Figure 9**. Notice the notch is broader in time and the secondary notch occurs much earlier, before the signal has decayed away significantly. The transversal equalizer shows an improved transient response.

The setup procedure in the manual for the DG-4017 states: "If cut only operation is desired, set all fifteen band controls fully CW (+10 dB)." This surprised me when I first read it. But then, I was used to conventional equalizers. **Figure 10** shows the response of the conventional equalizer with all filters set at maximum boost (upper curve), flat (middle curve), and maximum cut (lower curve). There is as much as 4 dB of ripple in the response, and band ends always return to the "flat" level. The resulting phase curves are shown in **Figure 11**. These measurements were made at a five microsecond offset to remove the propagation delay. Note how the full boost condition (lower curve at the right side) introduces additional delay while full cut (upper curve) removes delay. The same data for the DG-4017 are shown in **Figures 12 and 13**. The amplitude curves look as if only a gain control had been adjusted (I didn't touch them!) when, in fact, the band controls were set for full boost (upper curve), flat (middle curve), and full cut (lower curve). The phase responses overlay each other almost perfectly. IRPI is well justified when they say that the DG-4017 produces "equalization corrections without introducing extraneous frequency response ripple and unnecessary ringing."

Industrial Research Products' DG-4017 Transversal Equalizer is a significant development in the field of equalization. It is a high quality equalizer with a combination of features sufficient for almost any job. It may be used as a boost and cut, boost only or cut only equalizer with no penalty paid in ripple and excess phase shift. I know of no other equalizer that can make that claim. With the kind of responses shown in **Figures 12 and 13**, I feel certain that transversal equalizers will soon come into widespread use just as digital delay lines have.

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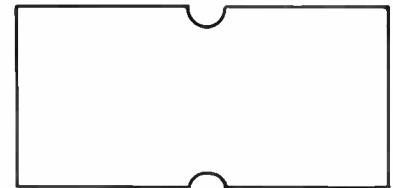
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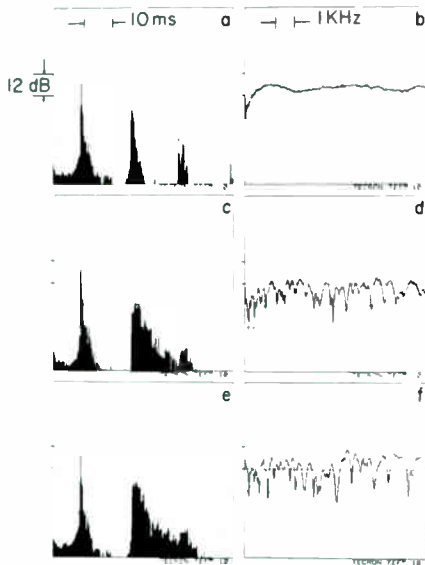
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BOUNDARY MICS

(continued from page 18)

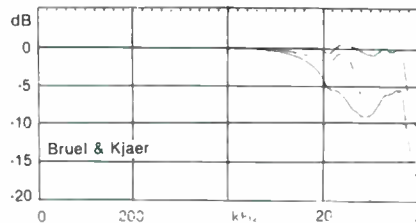


distance and M and D both see the real and virtual sources (dotted). We observe an energy difference of only 3.5 dB. This increase of 6 dB occurs because the PZM with its hemispherical sensitivity pattern, sees only one source, whereas the flat panel sees the real and virtual source, as in Figure 1a.

$$(10\log(3/2))^2 = 3.5 \text{ dB}$$

Figures 2c and 2d show the energy-time curve and energy-frequency curve for a two-foot by four-foot QRD_m diffusor, with the 3 dB down point of the analyzer shown as two vertical dotted lines. Note the increased temporal diffusion and dense frequency notching characteristic of a good diffusive surface. Figures 2e and 2f show the increased low frequency and overall energy response when the diffusive surface coverage is increased.

Directivity-energy-frequency (DEF_m) measurements on loudspeakers can easily be made using this geometry. A new software program called DEF-POLAR makes it possible to extract polar patterns at any frequency, octave or third-octave averaged, from the TEF measurements. The absence of S-F-M reflection allows large windows and good frequency resolution.



ABSTRACT

During the mid 1970s, Ed Long and Ron Wickersham experimented with what they called the "Pressure Response Pickup" (PRPTM). Basically, they mounted a pressure response microphone as close to a boundary surface as was possible.

Why? Their main goal was to eliminate the interference patterns caused by early reflected energy.

Ken Wahrenbrock developed the "Pressure Zone Microphone" in the later 1970s, and Don Davis (Synergetic Audio Concepts) introduced Crown International to Ken Wahrenbrock.

Since that time, several manufacturers have offered microphones with some of the same design enhancements; unobtrusiveness, 6 dB inherent increase in sensitivity, directionality, ability to withstand great sound pressure levels, and high signal to noise ratios. In any but "close microphoning techniques"—churches, theatrical stages, TV, court rooms, conference rooms, surveillance systems, and measurement techniques—boundary type microphones offer many advantages.

This report covers the comparable Energy vs Frequency response of each boundary type microphone.

In most applications, microphones that can tolerate moderate sound pressure levels (90 to 120 dB) are adequate. It should be pointed out that microphones capable of withstanding greater sound pressure levels (150 dB) and/or have better signal to noise ratios, are more expensive...and rightly so...power supplies! Bottom line...listen to the microphone to determine what's best for your reinforcement or measurement applications—and budget.

What perhaps is more important than anything else in this report is the understanding of why each of these device's performance is the result of an intelligent approach to an age old problem.

Editor's Note—The products used in this report are only a sampling of the various boundary type microphones available in this market. Sound & Communications would like to acknowledge Countryman Associates which manufactures the Isomax Series and Electro-Voice which offers a miniature lavalier mic, the C094 with boundary applications when used with the 370 barrier adapter plate.

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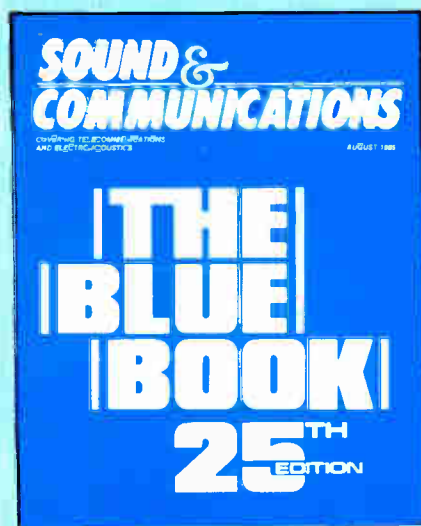
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IDEAS & VIEWPOINTS

(continued from page 6)

that should only be adjusted by a technician. Finally, provide a proper interface to the outside world, through a line amplifier if necessary.

My video knowledge is a bit shakey, but you see my point. The video manufacturers have packaged their components as *systems*. In so going, they have made a video camera (and other video components like monitors) into a thing that can be chosen, connected and operated by someone without a lot of technical training.

Applying the Analogy with Video
Can't be done with audio you say? It

has! Remember tape recorders? The heads, preamplifiers, and drive systems were separate. Which type of head and which type of preamplifier should be chosen for a given job? You'd better know what you're doing. Fortunately, for all concerned, you don't have to make those choices anymore. An audio tape recorder, like a video camera, is a *system*

Could we do this with microphones? Not in the same way we've done it with video cameras and audio tape recorders. But we could certainly start putting preamplifiers in microphones. (Actually, some mics already come with their own preamps.) Ask any microphone design engineer about the

potential advantages of designing a preamp specifically for a given mic.

Sounds like an ideal situation. Why haven't we done this? I'm not sure but I suspect things like manufacturer inertia and good old audio snobbery. Good grief, if you start putting preamplifiers right in the microphones I can't spend hours listening to the effects of five different preamps on my favorite mic!

This isn't the only example of systemizing, of course. One other important one is the integration of a power amplifier into a loudspeaker system. Even though it may not make sense for all combined amplifier and loudspeakers are well known. If some past implementations were unsuccessful, blame that on the design, not the concept.

The Reward

It seems like we always give up something when we make an improvement. What we'd give up in audio is the ability to do endless customization. What we'd get would be a lot more than a few technical improvements. We'd get *market expansion*.

I sense some skepticism. How could "systemizing" our products help expand the audio marketplace? Again, it already has. The "system" that is a tape recorder literally made possible the home recording market. Systemizing the tape recorder allowed that market to develop. It simply couldn't have happened otherwise.

The home tape recorder market happened because an audio tape recorder *system* is much easier to purchase than a collection of parts that have to be assembled to do the same thing. Guess how many home recording studios there would be if a "sound system engineer" had to be called in for tape head selection, preamp impedance matching, and gain and level watching.

Systemizing the tape recorder also allowed the price of a fully functional multi-track tape recorder system to come down dramatically. No need to tell you how bringing down the price can expand a market.

Would the same thing happen if we systemize some other audio component group? I think it would. Which audio component group should be systemized next? Your guess is as good as mine. But I think I know how to evaluate a potential system. It should be a component group that is always the same (no change in products) and is used often in the same application.

Studer Revox PR99

The Audio Production Machine



For quality recording and fast editing. Your production work will move faster thanks to the microprocessor control features of the new PR99 MKII. Features like a real-time counter with six segment LED display of hours, minutes and seconds. Accurate search-to-cue and search-to-zero. Automatic repeat of a timed tape segment of any length. Plus edit mode, tape dump, self-sync, track bouncing, and variable speed control (all standard). Options include roll-around console, carry case, and monitor panel.

For reliability and serviceability. One look inside and you know the PR99 MKII is built to last. Take note of the die-cast

aluminum chassis and headblock, precise Swiss/German craftsmanship, modular electronics, and industrial grade components. And it's all backed by an established worldwide parts and service network.

For cost-effectiveness. Add a sensible price to the list and you come up with an outstanding ATR value. The new PR99 MKII audio production machine is available now from your Revox professional products dealer.

STUDER REVOX

Studer Revox America, Inc., 1425 Elm Hill Pike, Nashville, TN 37210, (615) 254-5651

CITY HALL

(continued from page 28)

(original equipment), they tended to forget about the low profile consolette and, therefore, were "Off Mic" more often than "On Mic". The high background noise existing in the chamber during meetings also was a source of error for the automatic switching system. The AMS-22 microphone's front element, requiring a level of approximately 8 dB higher than the back element (background noise reading), was gating the mixer intermittently, depending on the speakers' voice level, thus creating erratic microphone switching.

Fortunately, in the interim, Shure Brothers designed an AMS compatible microphone, the AMS-24, mounted on an 18-inch gooseneck, black anodized and aesthetically appealing. After further testing, a change order was issued to modify the consolettes. A PC board, including a DIP switch for microphone selection, and an AMS-24 goose-neck microphone were installed, giving the speaker the flexibility to orient his microphone for convenience and also select the AMS-22, AMS-24, or both microphones, via the DIP switches.

The operation of the system was identical to the original design. The next meeting turned out to be a success. Not only had SPL improved from the original design, but the gating was occurring with 100 percent accuracy. The high background noise was no longer critical for the gating because the distance of the microphone/speaker had decreased from 26 inches to 6 inches.

The same basic system was installed in three other chambers (Board of Estimate, Council Committee Room, the Committee of the Whole). Each system, requiring a maximum of 16 microphones, used only two AMS-8000 Mixers and the audio console selected was Broadcast Electronic's Model 5M250, offering 10 selective inputs.

Due to the smaller chamber size, the existing acoustic treatment, and the method of utilization (committee members sat during meetings and hearings), the low-profile consolette with the AMS-22 microphone responded beautifully and the systems delivered better than expected results.

The last system for the Blue Room (mayor's press conference room) is a basic system for reinforcement and

media feeds during press conferences, as well as feeds to and from all other systems for monitoring and overflow.

Three months of planning and five months of installation work brought a new sound system at the City Hall Building, but not without crises and deadlines. Trying to work around continuous meetings taking place everywhere and coordinating the work and decisions with all the parties involved, required a good sense of humor and a lot of patience.

Epilogue

As with many installations, the original contract design, though detailed and sophisticated, required some re-engineer-

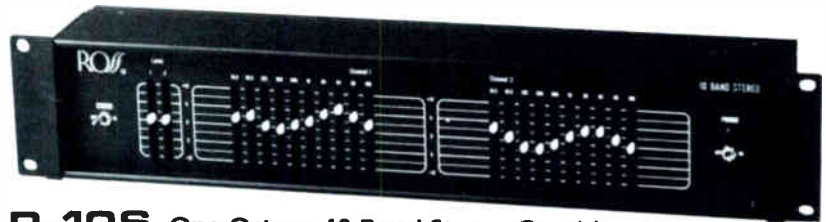
ing to make it practical and to achieve all the desired goals. The contractor implemented these needs by re-designing some critical circuits and selecting equipment which provided.

The most critical modifications were the implementation of a "Floating" Logic Ground and the replacement of noisy and unreliable relays with a totally Solid State Circuitry (by Opto Coupler Isolator and Diodes).

Furthermore, since the New York City Hall is a Landmark Building, the contractor had to provide a system not only functional but also to the satisfaction of the "Art Commission" and the Sponsor Agency (WNYC).

SOUND SHAPERS

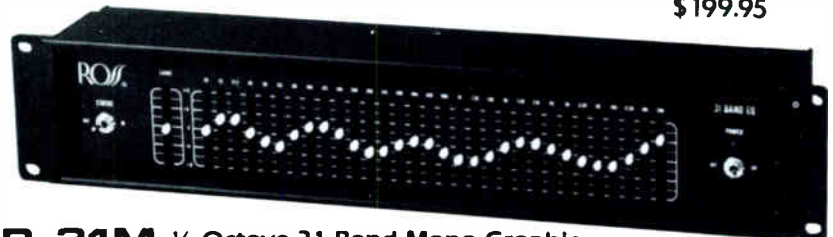
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Reader Service #240

PRODUCTS IN REVIEW



ELECTRONIC IMAGER OFFERS PICTURES BY TELEPHONE

Northern Information Technology, a joint venture with Ameritech, has announced its new briefcase-size portable Tele-Imager. This is a low-cost, high resolution "Electronic Imager" that can transmit and receive a video "snap shop" over ordinary dial-up telephone lines, voice grade channels, cellular telephone systems or even via satellite, anywhere in the world. Now, using a telephone, doctors can review x-rays, contractors can review blue prints with architects, security personnel can visually monitor remote locations, identities can be verified and teleconferencing can be accomplished in one's own office.

□ Contact: Northern Information Technology (312) 640-3220.

Reader Service #70

CARPETED SPEAKER ENCLOSURES WITH FANE WOOFERS & TWEETERS

Ross has introduced a full line of loudspeaker systems from 12-inch two-way to 15-inch three-way featuring Fane woofers and horns. The Ross loudspeaker systems are made of three-quarter-inch birch plywood construction, and feature recessed handles, aluminum trim, metal corners, steel glides, recessed protected crossover



panel, Fane woofers and horns and steel protection grilles. All Ross systems are designed with Thiel small parameters and feature full crossover networks. The enclosures have enclosures to fit all needs.

Special enclosures are voiced for synthesizers and keyboard applications. Other enclosures are voiced for vocal projection, night club, and disco applications. The systems start at \$249.95.

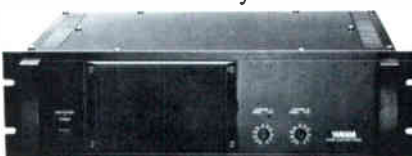
□ Contact: Ross Systems, P.O. Box 2344, Fort Worth, TX 76113; (817) 336-5114.

Reader Service #71

YAMAHA P-SERIES OF COMMERCIAL POWER AMPS

Four new P-Series Commercial Power amplifiers, producing sound characterized by wide band-width, low noise, low distortion, and transient definition have been introduced by Yamaha Professional Products Division.

All models share similar packaging, features and circuitry but differ in



power output per channel and in the number of channels.

Features common to all four amps include: balanced inputs with both SLR and barrier strip connections; barrier strip output connections; optional input and output transformers; dB-calibrated input attenuators; and output protection against overload, turn-on transients and DC offset.

The P1150C is a single channel amplifier rated at 100 watts into 8 ohms or 150 watts into 4 ohms. The dual channel P2150C delivers the same power output per channel. The P1250C is a single channel amplifier rated at 170 watts into 8 ohms or 250 watts into 4 ohms. The P2250C is a dual-channel version with the same power output as the P1250.

A rear panel switch on both dual channel models rewires them for use in a bridged, mono configuration. In this mode the watt delivery is doubled and it's possible to achieve the wide headroom and dynamic range needed

for accurate peaks and transient sounds.

All four models feature octal sockets and Transformer In-Out switches so that, should an input transformer be deemed necessary for a particular installation, can be installed without soldering.

The P-Series Commercial Power Amplifiers carry suggested retail prices ranging from \$395 to \$695.

□ Contact: Yamaha International Corporation, Professional Products Division, P.O. Box 6600, Buena Park, CA 90622; (714) 522-9262.

Reader Service #72



ECHO CANCELLER IMPROVES VIDEO CONFERENCING

GEC McMichael has introduced the Echo Canceller, TE245, which aids in solving the problem of echo effects that can mar the sound in video conference applications. The new Echo Canceller samples the remote conference room audio, estimates the echo signal and subtracts it from the speech signal being transmitted from the local room.

The resulting suppression of audible echo signals improves the sound quality and allows a round dialog to take place over the video conference link.

□ Contact: GEC McMichael Limited, 102 Midland Ave., Port Chester, NY 10573.

Reader Service #73



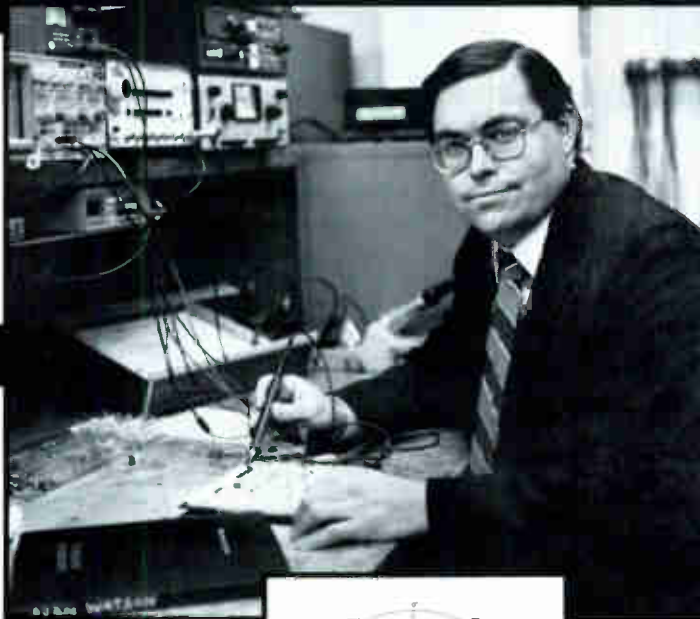
JERON INTRODUCES HP-570 TELEPHONE ENTRY SYSTEMS

Jeron Electronic Systems, Inc. has introduced HP-570 Telephone Entry Systems, which have the features and

(continued on page 41)

Feedback: Reduce the Problem, Not the Volume

Al Watson Tells What the NEW 1772 Can Do For You



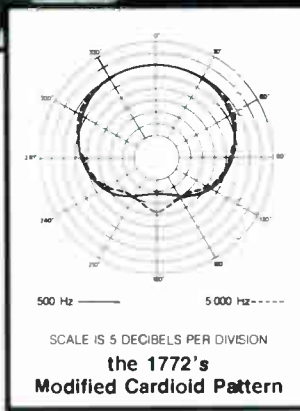
Al Watson

- one of the earliest to recognize the benefits of holographic interferometry and apply laser technology to the study of diaphragm motion
- developer of a proprietary electret charging process that avoids material degradation and provides an exceptionally stable charge of either negative or positive polarity
- a member of IEEE, AES and ECS, Watson holds numerous U.S. Patents

relating to microphone design and has brought more than twenty dynamic, condenser and electret microphones to the marketplace, including the RE34 mike/line level condenser and the RE 18 Variable-D® dynamic

- when not scuba diving, programming (Al's an "apprentice" hacker) or building his completely "self-sufficient" home, Watson can be found at Electro-Voice where he's chief engineer of the microphone group

Nothing's more annoying than a sound system that brings the program to a "screeching" halt. All too often ordinary microphones pick up loudspeaker output and re-amplify the sound. The system begins to ring and keeps right on howling until the volume is reduced. But turning down a system designed to amplify the speaker's voice is hardly an effective answer. You could defeat feedback with expensive equalization. Or you can simply use the new EV 1772 cardioid condenser vocal microphone... the mike designed for sound reinforcement systems where reflection and speaker placement demand superior gain-before-feedback.



How does the 1772 eliminate feedback problems?

Better than any mike in its class.

First, the response curve of the 1772 is exceptionally smooth and, unlike many microphones, free of peaks that can trigger feedback. Second, the 1772's directionality has been carefully tuned to reject off-axis sound from room reflections and speaker systems, offering high gain with little risk of feedback.

Finally, the 1772's innovative transducer position allows unusually close miking. Since the user's voice is more intense, system gain is increased dramatically. The bass boost that results from close miking is rolled off through a sophisticated network of electronic filters. Sound remains crisp and clear, even in large rooms where "boominess" can destroy intelligibility.

What about the 1772's output sensitivity? How hot is it?

The 1772 is so hot . . .

that it provides a 7 dB advantage over most dynamic mikes. At -49 dB, the 1772 boosts vocal and sound sources of low signal strength to achieve maximum output from

minimum power. And with battery or phantom power, the 1772 is compatible with any system.

And what about distortion and handling noise? Can the 1772 eliminate these annoying performance problems?

No problem(s).

The 4.5-V battery in the 1772 provides a wider dynamic range than any competitive condenser. (Most use only a 1.5-V battery.) And with 137 dB of

headroom, the 1772 reproduces the highest sound pressure levels without overload or distortion. Internal low-frequency filters combine with condenser design to minimize handling noise. And an integral windscreen — a truly superior design — takes the "pop" out of close-up use and reduces wind and breath distortion.

Simply stated, the new 1772 microphone is an exceptionally effective tool for stage, choir, podium or pulpit . . . in any hand-held or close-talking application where high sensitivity and superior gain-before-feedback are desired.

The next time your system starts to ring and howl, think about your choices. You can turn down the volume. Or you can "turn on" to the all new 1772 from Electro-Voice and eliminate feedback problems forever. To learn more about what 1772 can do for you, write Al Watson at Electro-Voice, Inc., 600 Cecil St., Buchanan, MI 49107.

EV Electro-Voice®
SOUND IN ACTION™
Worldwide Distributor
Reader Service #246

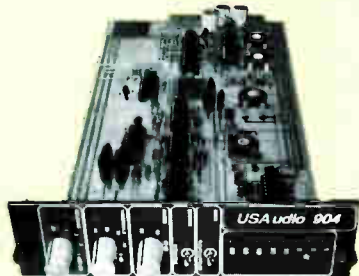
a closer look

by gary d. davis

Gatex 904 Noise Gate/Expander

Since the Gatex 904 is designed to operate in the dbx F-900 powered mainframe, and since it shares the same model number as a similar dbx module, the obvious question arises "what's the difference?" Norman Baker of US Audio tells us that not only is the unit cost about \$100 less than the dbx. (The Gatex model 904 lists for \$250.) It also is easier to use, not only for the less sophisticated engineer, but for anyone who has to work quickly.

The unit has two selectable modes. Gate mode provides a straightforward noise gate. Expand 1 mode selects a 1:2 expansion ratio, whereas Expand 2 mode selects a more gentle 2:3 slope. The Expand 2 mode can be used to provide up to 20 dB of apparent dynamic noise reduction which is especially helpful on vocal tracks. This mode is also handy in broadcast applications, where the processing can be used on top of heavily compressed program material to remove some of the "pumped up" background noise without significantly altering the dynamic range of the compressed program.



The Gatex 904 attack time automatically scales itself by means of logic that "looks at" the program waveform. Basically, the higher the slope of the sinusoidal envelope, the faster the attack. This program dependent attack is said to be particularly effective with percussive instruments.

While there is a front panel Release control, there is also circuitry which prevents the operator from selecting too short a release time. In effect, the

operator sets a desired release, but if the Program Controlled Sustain circuit "decides" that the set release would be too short, and would therefore cause "pumping" or "breathing," it automatically (temporarily) extends the release. This is said to be very useful in avoiding the "muffled" sound often caused by the abbreviated decay when drums are expanded. A front panel switch enables the gain reduction circuitry to be triggered from the program input or from a separate "key" input; a third switch position (out) bypasses the unit. The Gatex 904 is a mono processor, and is not equipped to handle stereo programs (no inter-channel gain control linkage is available). Power and audio connections are provided by the dbx mainframe.

It is my feeling that distortion and noise specs are somewhat meaningless when given for a dynamic gain-altering device, since they're invariable given at unity gain. The Gatex 904 does use the Valley People VCA, which is supposed to be pretty low noise, low distortion amplifier, and Gatex claims -83 dBu output noise at unity gain.

Contact: US Audio Inc., P.O. Box 40878, Nashville, TN 37204; (615) 297-1098

Reader Service #74

Philips M100P Intercom System

The Philips M100P series intercom system has some features that resemble a modern telephone system (i.e. camp-on and automatic recall), but Paul Kovcourek of Rauland-Borg assures us that it is not. The system is "half-duplex," meaning that one party at a time may speak. Generally, the system will sense relative sound levels at two stations, and will give speaking priority to the louder. However, a Push-To-Talk (PTT) switch is available to override the other station if it is located in a high ambient noise field (this is the "simplex" mode).

The system configuration is flexible,

but usually consists of a central controller, a power supply, a branch unit, and from two to 1,600 intercom stations. The central controller processes most of the digital logic. It is connected via an eight-pair cable to the branch unit, which is basically a terminal box that provides up to eight parallel feeds, and which accepts an input from the U.L. approved power supply. Audio lines are unshielded. While a small "star" configuration can be achieved by means of the branch unit, generally just one or two of its outputs are used, and remote stations are linked in "daisy chain" loop.



For convenience, in smaller systems of two to nine stations, one digit calling is permitted. For medium sized systems of 10 to 99 stations, two digit calling can be set, and for larger systems, three and four digit calling is available. The alternative number feature permits a floating number to be assigned to a room rather than a specific intercom station. The normal "loud speaking" configuration utilizes a built-in speaker plus a sensitive electret microphone in the station. If an optional handset is added, then the station will operate in the "loud speaking" mode while the handset is in its cradle, and will automatically turn off the speaker and electret mic, switching to "low speaking mode," when the handset is lifted. Rauland-Borg tells us a coupler for interface to a telephone system is available, but that most customers are using the M100P strictly for intercom purposes.

Contact: Rauland-Borg Corp., 3535 W. Addison St., Chicago, IL 60618; (312) 267-1300.

Reader Service #75

(continued from page 38)

options for apartments, condos or offices to provide tenant controlled access.

The HP-570 units feature flush wall mount—the preferred style of lobby equipment, with choice of handsome clear anodized, gold or bronze finish. The control unit panels have special hinge-mount that facilitates installation and programmer access. Panels are secured with unique screw fasteners. Control units are FCC registered, and can be installed utilizing the existing telephone lines of the building.

HP-570 Systems are available with or without self-contained directory. Jeron models with metal digital keypad and armored cable handset may be used outdoors. Models with plastic digital keypad and coilcord handset are for indoor use. All models—50, 160, 400, or 1,000 apartment capacities—provide 'Keyless Entry' capability for residents.

□ Contact: Jeron, 3554 N. Clark St., Chicago, IL 60657; (312) 528-4020 or (800) 621-1903.

Reader Service #76



NEW BACKGROUND MUSIC SYSTEM BY CUSTOMUSIC

Customusic, a division of Rowe International Inc., recently introduced the new CPC-180 Time-Master on-premise unit that provides a total of 60 hours of background music, with no repeats, and without changing tapes.

Once programmed, the Time-Master turns itself off at the end of the day. It permits operators to intermix relaxing background music with upbeat music to suit business cycles; the unit utilizes endless loop tape cartridges which permit playback of six different cartridges, each containing up to 10 hours of music.

□ Contact: Customusic, Rowe International Inc., 75 Troy Hills Road, Whippany, NJ 07981; (201) 887-0400.

Reader Service #77

SYMETRIX MULTI-LINE BROADCAST PHONE INTERFACE

Symetrix, Inc. has entered into the multi-line broadcast telephone interface market, with its new system, the Model 108, a stand-alone electronic telephone system designed for broadcast applications where multiple incoming phone lines must be routed to an on-air or production audio console. The 108 facilitates communication between host (DJ) and callers either on

or off-air. The system permits control of calls by the on-air personality from a compact, simple-to-use desk module.

In addition, the system supports a second desk module for use by a call director or off-air assistant. Up to six incoming callers may be placed on-air at once. The 108 connects to up to eight incoming telephone lines and routes these signals to three electronic hybrids (two-wire to four-wire converters).

□ Contact: Roy Blankenship, Symetrix, 109 Bell St., Seattle, WA 98121; (206) 624-5012.

Reader Service #78

COMING UP

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Features: Professional Performance & Quality! The outspoken GLA amplifiers are full performance—The mixer amps 35, 60 & 100 watt and the booster amps 60 & 100 watt are user engineered for appearance, operation and electronic protection—Full range of voice coil & constant voltage outputs—Precedence or voice gated operation—Competitive—Call for specifications and low cost.



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Reader Service #228

Not just another microphone. Independent testing proves the TE10 is better!

Recently, Telex engaged Dr. Eugene Patronis, Jr., professor of Physics, Georgia Institute of Technology, to test the TE10 condenser microphone against the Electro Voice BK-1, Audio Technica ATM31R and the Shure SM87. Tests were conducted with complete objectivity without the presence of any Telex personnel. It is of further interest that the competitors' microphones were purchased randomly "off the shelf", and all had Pro Net prices that were considerably higher than the Telex TE10.

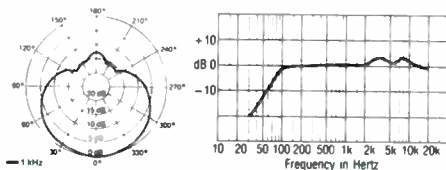
Telex ranks superior

Dr. Patronis tested the mikes by a wide variety of performance criteria and, overall, Telex ranked as a superior value. Telex fared especially well in the areas of **linearity, distortion and frequency response**. Here, Telex was either first or second in terms of performance. Put the TE10 to your own tests and you'll agree—this is a superior condenser microphone at an exceptional price.

A mike with studio precision—built to take road abuse

Even though the TE10 has all of the precision and sensitivity of expensive and fragile studio mikes, it's as rugged as they come. The condenser element resists temperature and humidity extremes and is protected from handling abuse by the exclusive Tri-Flex™ shock isolation system.

If you would like to learn more about the TE10, call or write to: Telex Communications, Inc., 9600 Aldrich Ave. So., Minneapolis, MN 55420.



For quick information, call Toll Free

800-328-3771

or in Minnesota call (612) 887-5550.

TELEX®



Reader Service #244

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SHURE DEBUTS IN-LINE ON/OFF SWITCH

Shure Brothers Inc., has introduced the A120S In-Line On/Off Switch, a compact pushbutton switch designed for use with any type of microphone or electronic equipment. It is particularly suited for use with lavalier microphones and headset microphones.

A cam mechanism built into the A120S allows the user to change it from a locking switch to a momentary, cough-button-type switch. Its double-pole, double-throw construction makes it ideal for a variety of applications. It is, for instance, useful for keying a transmitter or paging system as well as controlling a microphone.

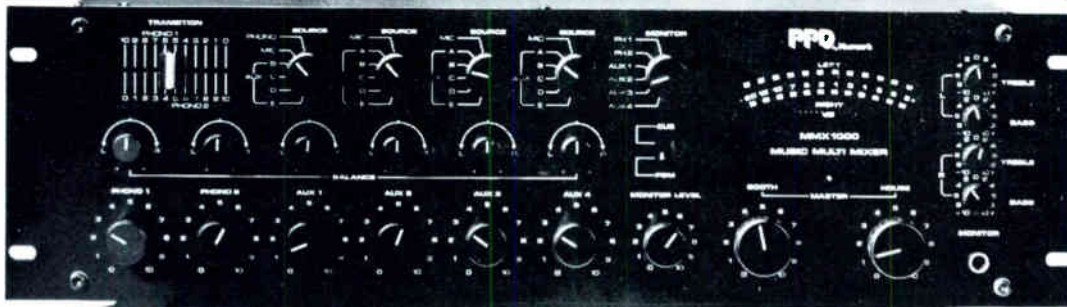
□ Contact: Shure Brothers Inc., Customer Service Department, 222 Hartrey Avenue, Evanston, IL 60204; (312) 866-2573.

Reader Service #79

DATE	EVENT/COMMENT	LOCATION	CONTACT
September 30-October 4	Video Expo New York The latest video equipment, technology, plus seminars.	New York Passenger Ship Terminal New York, NY	Sheila Alper (914) 328-9157
October 1-2	National Telecommunications Educational Conference sponsored by NATA.	Denver, CO	John Buescher (202) 296-9800 Adam Kernan-Schloss (202) 887-5900
October 2-3	Repcon '85/Fall Electronics Show sponsored by the NY Chapter of the ERA.	Terrace on the Park Flushing Meadow Park Queens, NY	A.D. Adams ERA Executive Secretary (212) 685-9060
October 3-4	Electronic Sound & Systems Conferences, Inc. Regional educational conference and exhibit.	Ramada-The O'Hare Inn Chicago, IL	ESSC Bob Barba (313) 781-2010
October 12-16	The 79th Audio Engineering Society's Convention	New York, NY	Ann Smythe (212) 661-2355
October 18-20	The Society of Telecommunications Consultants Conference	Ambassador West Hotel Chicago, IL	STC (212) 582-3909
October 22-24	Northcon85 —High-tech electronics exhibition and conference.	Portland Memorial Coliseum Portland, OR	J. Fossler (213) 772-2965

multimixer

MMX1000



audio
video

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- All Input and Output Level Controls are Conductive Plastic.
- Independent Level Controls for Booth and House Output.
- Stereo Bass and Treble Controls for Program Equalization.
- LED Display Ensures Maximum Output.
- Complete Cueing Facilities.

For more information about the MMX1000 and MMX2000 Mixers, or the complete PPD. Line of Professional Products, please call or write Paul Friedman, National Sales Manager.

MAXIMUM FLEXIBILITY! COMPLETE CONTROL!

Begin with three phono and four balanced mic preamps, add five stereo line inputs. Then add a tough rack-ready package that handles the rigors of non-stop dance mixes, or video production. Finish off with calibrated peak meters, and Phono 1 - 2 Transition fader.

PRO PERFORMANCE: Balanced House outputs (+ 25 dbm into 600 ohms); unbalanced House, Booth, and

Mono outputs; dual Tape Out jacks; internal headphone Monitor amplifier all fed by the six stereo mix channels. Maximum flexibility in any situation. Controls are laid out for intuitive ease of use.

Our MMX2000 shares the same state-of-the-art specs plus a three-band EQ on each channel, Tape 1 - 2 Record-Play-Dub switch, and channel patch points. Recommended for CATV, radio, and critical production.

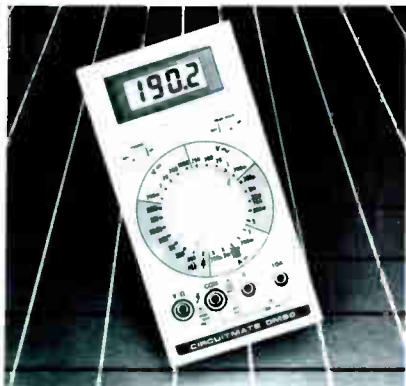
**Suggested Retail — Model MMX1000: \$1,095.00
Model MMX2000: \$1,495.00**



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DIGITAL MULTIMETER FEATURES PEAK HOLD

The Instrumentation Products Division of Beckman Industrial Corporation has introduced the Circuitmate™ DM 50 digital multimeter (DMM) with 28 ranges and features "Peak Hold."

Peak hold is the ability of the meter to detect, store, and display voltage or current peaks, even when they are transient (6 mS minimum) in nature. This is different from a typical data hold function which merely freezes the reading. When used with a proper accessory such as an AC/DC current clamp, the peak hold feature can be used to determine starting currents in AC or DC systems.

According to the company, ease-of-use is a feature of the DM50. A single range/function switch makes measurements fast and efficient. A three-and-one-half digit liquid crystal display provides high contrast viewing even in bright sunlight. Automatic polarity indication plus low battery indication provide feedback to the user.

Other key features of the DM50, which retails for \$99.95, include 0.5 percent DC volt accuracy, 10 Megohm input impedance, diode test function, continuity beeper, 10 amp current range, a tilt bail, and safety designed test leads.

Contact: Beckman Industrial Corporation, 630 Puente St., Brea, CA 92621; (714) 671-4800.

Reader Service #80

OMNIMOUNT OFFERS NEW HORN/DRIVER INTERFACE

Omnimount Systems has introduced a horn/driver mount that is said to be installed quickly and efficiently. Used to implement computer layouts for ar-

rays, the mount offers focusing over the entire listening area.

The key is Omnimount's patented ball and clamp assembly goes beyond the usual pan-and-tilt function. One end of a claw-shaped steel plate is attached to the horn/driver by two mounting bolts. The other end of the steel plate receives a heavy-walled steel tube formed at a 45 degree angle. The tube joins the ball and clamp assembly at its other end. The claw-shaped plate attaches at the position where the bolt recesses are located in the horn. The bolts go through the steel plate, through the horn flange and thread directly into the driver—with no compromising of the mating surfaces.



Omnimount has two models currently available for horn/driver installations: Model 101UDM-1 fits combinations with two-and-one-quarter-inch bolt circle, three holes on 120 degree centers. Model 101UDM-2 fits horn/driver combinations with a four-inch bolt circle, four holes on 90 degree centers. Maximum recommended load for these models is up to 70 pounds.

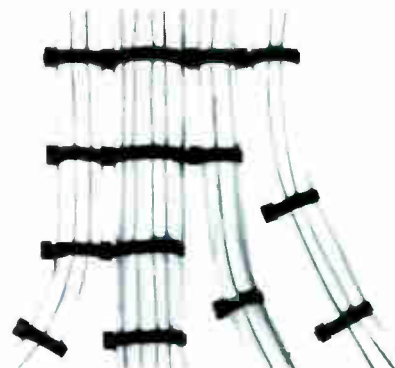
Contact: Omnimount Systems, 10850 Vanowen St., N. Hollywood, CA 91605; (818) 766-9000.

Reader Service #81

CONTINUOUS LENGTH CABLE TIES FROM STRAP LOC™

Advanced Cable Electronics has announced the marketing of its new "Strap-Loc" continuous length cable ties. Strap-Loc's new patented design allows cables and wires to be tied and spaced in a secure and organized manner. Strap-Loc allows wire bundles to lie flat and pass through narrow open-

ing providing more space for internal components or a reduction in total unit size. Spacing keeps groups of wires separate and organized for easy tracing and termination.



Strap-Loc's "low insertion force" locking device gives assurance of super strength and reliability. Stainless steel grip locking device is recessed into the lock body to protect wires. Rounded edges on strapping prevents damage to wire insulation.

Applications include: organizing and arranging wire and cable for narrow passages; fasten items through panels, fasten to guide wires for aerial support; helps absorb vibration, separates, holds, and supports conduit, hose, tubing, and pipe.

Contact: Advanced Cable Electronics Corp., P.O. Box 4264 Westboro, MA 01581; (617) 366-0669.

Reader Service #82



SEE THE PHONE RING WITH MODULAR PHONE RELAY

A modular, solid-state telephone relay that can actuate AC appliances when the phone rings is now available from Wheelock Inc. Designated Tel-Relay,™ the system can be used in situations where hearing is impaired. For example, the FCC registered unit can actuate a fan, desk lamp or strobe during the telephone ring cycle.

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

Reader Service #83

THEORY & APPLICATION

(continued from page 12)

peaks of 12 to 16 dB above steady state level will result. Once again, compressors and/or peak limiters are normally used to reduce peaks by several dBs.

At present, there is no commonly used standard for tone levels for digital recording. Digital mastering levels are presently set by playing the entire program, noting the level of maximum program peaks, and setting system gains so that program peaks do not cause system overload in the storage medium (digital disc or tape).

Analog tape recorders are normally set up for "0 VU" on the order of 6 to 10 dB below tape saturation. This is also true of the audio tracks of professional video recorders. It is thus not uncommon for some peaks to be clipped by the relatively soft saturation curve of the magnetic tape. Standard practice is to avoid saturation by using peak limiting prior to the tape machine or recording very "peaky" material well below "0 VU."

Digital audio recorders, optical sound tracks, and the Hi-Fi tracks of home video recorders all exhibit very severe distortion when driven to overload. It is important that these devices be very carefully protected from overload. Where the analog tape recorder produces a relatively soft clip from a too hot peak, digital and Hi-Fi tracks splatter very badly. Control of program peaks in modern audio is very important.

Peak Reading Meters

All of this educated guessing about the relationship between VU indication and the peak levels has led to the development and widespread use of quasi-peak reading meters (or displays) in some modern audio equipment. The meter is then calibrated to the desired saturation point of the tape machine or amplifier, eliminating the need for the 8, 10, or 14 dB "fudge factor" to translate the VU meter's averaged reading of program levels to system peak level requirements. Several studies by network engineering departments have shown that conversion to PPM metering (a European standard, adopted several years ago in this country by ABC) at their transmission centers has reduced system headroom requirements by at least 2 dB.

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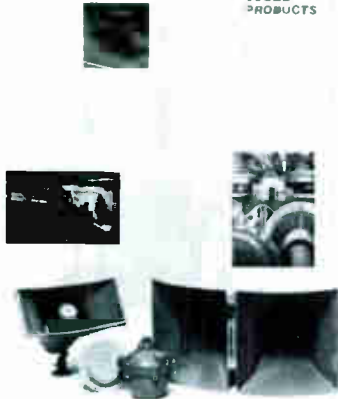
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Reader Service #247



COMMERCIAL
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New Catalog From University Sound® Covers Product Line

Altec Lansing Corporation, a Gulton company, has released a new product catalog for its University Sound Products Division. The six-page catalog gives technical performance data on compression drivers, horns, paging-talkback trumpets, underwater and submergence-proof and explosion-proof loudspeakers, and matching transformers.

From: University Sound, P.O. Box 26105, Oklahoma City, OK 73126-0105; (405) 324-5311.



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CLIFFORD

Clifford Publishes Catalog On Telecom Cable And Wire

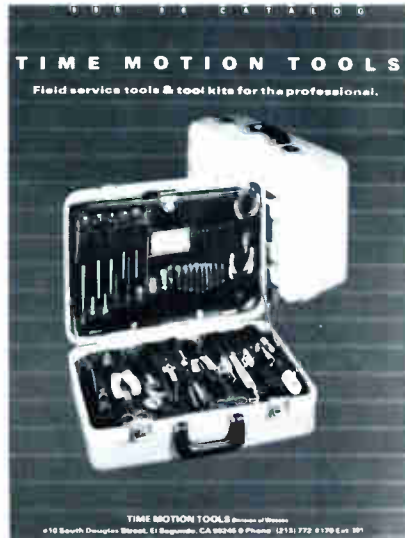
Clifford Inc. is offering a new catalog that takes a look at telecommunications and control cable, wire and related accessories; with pictures and descriptions of physical characteristics and general applications.

The booklet lists computer cables; extensive details on electronic cable and wire; plenum cables; instrumentation cables; custom cable ordering; telephone cables and wires; accessories; industrial control cables; Quik-Pull wire assemblies; alarm wires; and signal cables and wires.

From: Clifford, Inc., 83 Main St., Bethel, VT 05032; (800) 451-4381 or (802) 234-9921.

Time Motion Tools Publishes New 1985 Product Catalog

Time Motion Tools has published its 1985 catalog which features its line of electronic hand tools, as well as an array of test equipment for field technicians. The new catalog also features current test equipment.



This 56-page catalog contains nut-driver/screwdriver sets as well as wire stripper and crimpers, special application work holders, heat guns, soldering irons/stations, and electronic aids.

From: Time Motion Tools, 410 S. Douglas St., El Segundo, CA 90245; (213) 772-8170.

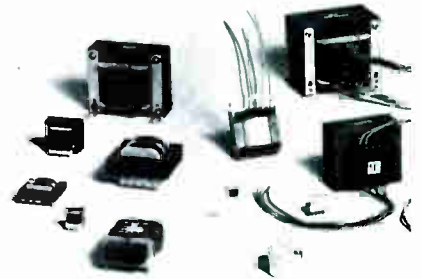
Profile Electronics Introduces New Transformer Catalog

Profile Electronics, Inc., has announced the availability of its latest 10-page catalog of transformers used by the electronics, computer, and telecommunications industries.

The catalog describes power transformers from 2.5 to 1,400 VA output and audio, modem, and telephone line transformers.

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From: Profile Electronics, Inc., Box 1297, Concord, NH 03301; (603) 224-2553.

Mogami's New Catalog Features Cable & Wire Products

The Mogami Products Div., of Marshall Electronics has introduced a new General Wire & Cable Catalog featuring multi-conductor cables with specific applications in broadcasting, satellite transmission, computer interfacing, and audio installation.

This reference catalog includes a new series of ultra-miniature multi-conductor cables, superflexible computer cables and a series of high-conductivity cables with oxygen-free copper conductors.



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GENERAL WIRE & CABLE

From: Marshall Electronics, Inc., Mogami Products Division, Department WC, P.O. Box 2027, Culver City, CA 90230; (213) 390-6508.

BOOK REVIEW

by Ted Uzzle

ENCYCLOPEDIA COMES UP SHORT

Gibilisco, Stan [ed.], *Encyclopedia of Electronics*, TAB Professional and Reference Books, 1985. xxxviii + 983 pp., \$60.

The encyclopedia is peculiarly an 18th century invention. The great French encyclopedists, Diderot and D'Alembert, believed that all human knowledge could be schematized and outlined, and their encyclopedia, and the best ones since, have given educated adults insight into specialties otherwise too mysterious to approach.

At its best, the gigantic new *Encyclopedia of Electronics* succeeds in this function. But, it is *not* the kind of reference book experienced technicians will refer to every day, because it does not include data tables or detailed solutions necessary to assist him in solving his daily problems.

In addition, the book does have some problems. The accuracy and quality are regrettably uneven, and the reader can easily be misled.

Some entries have the appearance of having been a last-minute thought. For example, some of the line art looks as if it were sketched on the back of an envelope, and in one case (the illustration for "angle of lead") the caption was put with the wrong illustration. There is also a photograph of a printed circuit board that would shame a 12-year-old Heathkit builder, and the photograph is used no less than three times in the *Encyclopedia*.

The schematic of a sample crossover network will never pass any signal to the tweeter. The typesetting of a number of mathematical expressions, especially in the articles of calculus, are iffy and clear only if you know the correct form, *an assumption an encyclopedist must never make*.

Howlers abound, and these are indicators of haste. This is a typical example:

Bell wire, being solid, has a tendency to break under stress. This is enhanced because of its small size.

What the author means is that bell wire breakage is made worse by its small size, but "make worse" and

"enhance" do not mean the same thing.

In the same way, we are told:

For the best results, a Dolby tape should be played on a Dolby machine.

Yet, Dolby Laboratories Licensing Corp. makes neither a tape nor a tape machine. The author's meaning is clear to those who know what Dolby noise reduction is, but not to others.

There are more serious problems. The word "median" is affirmatively misdefined in the article on "arithmetic mean," but correctly defined in its own article. We are told a dBm is a strange creature which can only live in 600-ohm circuits. We are told to measure power in "RMS watts." "dBa" appears but not "dBA," leaving the reader to guess whether the latter means the same thing. The port in

a bass-reflex enclosure seems to let the low frequencies out of the box. While this may strike a blow for low-frequency liberation, it doesn't correspond to your reviewer's understanding of bass-reflex theory.

In a way, it is unfair to go through a book like this with a magnifying glass and point out syntactical errors. Many technical writers publish melapropisms when working haste. This *Encyclopedia of Electronics* is a landmark project. We're looking at the first printing of the first edition. Sound contractors may want to add a book like this to their technical libraries, but probably should keep their sixty dollars in their pockets until they've had the opportunity to examine it and see if they disagree with some of the basic audio definitions.

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FACES AND PLACES

Roseberry New Director of Marketing and Sales at IED

Innovative Electronic Designs, Inc. has announced the appointment of Tom Roseberry as director of marketing and sales. Roseberry's primary responsibility will be in the worldwide marketing of IED's professional quality, computer-controlled audio equipment.

Prior to this new position, Roseberry spent nine years as midwestern regional manager of JBL/Professional Division. His experience also encompasses 18 years as a sound contractor, and he has been a member of AES since 1958.



TOM ROSEBERRY



RICHARD E. SMITH

Smith Joins Wiltron's Telecom Division

Richard E. Smith has joined Wiltron Company's Telecom Division as northeastern/mid-Atlantic area technical sales engineer. He is based in Connecticut at the division's new northeastern area sales office. Smith provides technical sales and customer support for the eastern seaboard states between North Carolina and Canada.

Smith was formerly with Pulsecom, Inc., where he was the northeast regional sales manager. He holds a B.S. in Business Administration and an M.B.A. from Grand Valley State College in Michigan.

Augat/Altair Appoints McAuliffe Sales Engineer

Russell McAuliffe has been named sales engineer for Augat/Altair according to general sales manager, Wilson Burns.

As sales engineer, McAuliffe is responsible for the promotion of sales into the New England area of the company's product line.

McAuliffe was previously a design engineer for Texas Instruments, Connector Systems Division and holds a B.S. from Fitchburg State College.

Anixter Promotes Execs and Adds New Director

Anixter Bros., Inc. announced the promotion of several of the company's top executives and the addition of an outside director. The changes include: Alan B. Anixter, president and chief executive, becomes chairman and remains CEO. Three vice chairmen elected are: William R. Anixter, senior executive vice president; James Anixter, executive vice president and assistant to the president, and Bruce Van Wagner, president of Anixter Communications and executive vice president international.

The company has formed an executive committee composed of the chairman and three vice chairmen. John A. Pigott, executive vice president-administration, was elected president of Anixter Bros., Inc. the parent company. John M. Egan, formerly executive vice president-operations, is now president of Anixter Communications. Robert J. Wilson, previously vice president-sales, becomes president of Anixter Wire and Cable.

The Board of Directors has been expanded with the election of Scott C. Anixter, an independent investor who is a member of the Chicago Board of Trade, the Chicago Mercantile Exchange and the Chicago Board of Options Exchange.

Renkus-Heinz Names Larson Director of Marketing

Renkus-Heinz has announced the appointment of Jason Larson/Jason Larson Associates as its new director of marketing.

Larson is the president of Jason Larson Associates, a consulting firm based in San Diego, CA. His background includes a long association in the industry as a touring musician, sound engineer and marketing manager for companies such as RSD/Studiomaster, Soundtracs & Marshall Electronic, and as consultant to many other organizations within the industry.

Gerr Appoints Jackman Canadian Product Specialist

Gerr Electro-Acoustics Ltd. has appointed Pat Jackman, Canadian product specialist for sound and communication systems applications.

Jackman has seven years experience in live sound balance, multitrack studio, and remote radio broadcast engineering. His background will assist him in fostering and consolidating a network of registered "Meyer" users in Canada through on-site product demonstrations and technical application sessions.



PAT JACKMAN



OSCAR B. RUDOLPH

Electronic Distribution Show Elects Rudolph President

The Electronic Distribution Show and Conference has announced the election of Oscar B. Rudolph of AMP Products Company, its new president of the electronic Industry Show Corporation.

As new technology continues to change the face of distribution, Rudolph announced a more visible role for new technology programming at EDS '86, with special emphasis on surface mount technology, as the focus of a New Technology display.

Advances in distribution have also had an impact on technology, the EDS president added, with availability of sophisticated components "off-the-shelf" a key factor in the proliferation of electronics to more and more OEM applications, and thus to more MRO applications as well.

Industry Mourns Westbay

Dale Westbay, district manager for the southeast sales district of ADC Telecommunications, Inc., recently suffered a fatal heart attack in Atlanta, GA. Dale worked many years in the telecommunications industry.

REP NEWS

In recent ceremonies, **Riley and Petchell Sales, Inc.** (Detroit/Kalamazoo, MI) was named "**Rep of the Year**" by **Electro-Voice, Inc.**

According to Paul McGuire, vice president of marketing at Electro-Voice, "Riley and Petchell Sales posted the best overall performance in any of EV's 23 U.S. and Canadian rep territories. Their consistent increase in sales through the year reflects the total professionalism with which George Riley, Tom Petchell, and Rick Brown conduct business."

Following the success of Repcon '84, the New York Chapter of the **Electronics Representatives Association (ERA)** announced another ambitious program to include ten rep firms occupying 22 booths and four professional seminars. The announcement was made by **Lou Keller of Keller Associates, Inc.**, show co-chairman.

Repcon '85 is the annual fall electronics exhibition sponsored by ERA's metro New York's leading manufacturers representatives firms serving dealers, distributors, mass marketers, chain stores and other prime outlets of consumer and commercial products. The show is scheduled for Wednesday and Thursday, October 2 and 3 at Terrace on the Park, Flushing Meadow Park, Queens, N.Y.

ERA members exhibiting are: **Stan Axelrod Associates, Inc.**; **Irv Brown Company**; **Jack Brown Electronics Sales, Inc.**; **Steve Fisher Sales Corp.**; **Keller & Associates, Inc.**; **Bill Kist & Associates, Inc.**; **LCA Sales Co.**; **Metrocom System Sales**; **Miller Associates Ltd.**; and **R. P. Moses & Co., Inc.**

Among the products on display will be computers, peripherals and accessories; telephones and cellular

phones; components, car and home audio; satellite TV, games, tools, security systems, professional and industrial sound equipment and many other parts and accessories for the electrical/electronics, consumer, commercial and service/repair markets.

For more information, contact A.D. Adams, ERA executive secretary, A.D. Adams Advertising, Inc., 9 East 38th St., New York, NY 10016; (212) 685-9060.

LCA Sales Company has named **John Cardone** as an additional sales representative for the metropolitan New York territory. This appointment fills a new position in LCA's organization. It will augment existing sales coverage in the greater New York area.

Prior to the appointment, Cardone spent eight years with other electronic representative firms, selling commercial and distributors plus interfacing with architects and consulting engineers.

Monfort Electronics Marketing of Indianapolis, IN, has announced the relocation of its offices and warehouse to 8788 Robbins Road, Indianapolis, IN 46268; (317) 872-8877. The company is a manufacturers representative in commercial sound, communication and security equipment, and warehouses a variety of products, including wire and cable.

Cushman Electronics, Inc., manufacturer of communications test equipment, has announced it has **re-aligned its rep network** in order to give more extensive coverage to its customers in the southeast.

Delaware will now be covered by **All American Associates**. Kentucky and the northeast areas of West Virginia will be handled by **G-TEC**. And **Communications Marketing of the Southeast, Inc.** will be covering Georgia, Alabama, and Tennessee.

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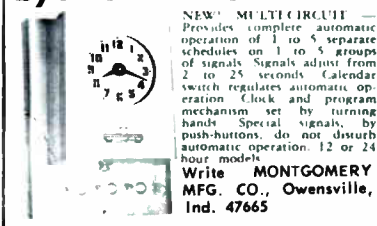


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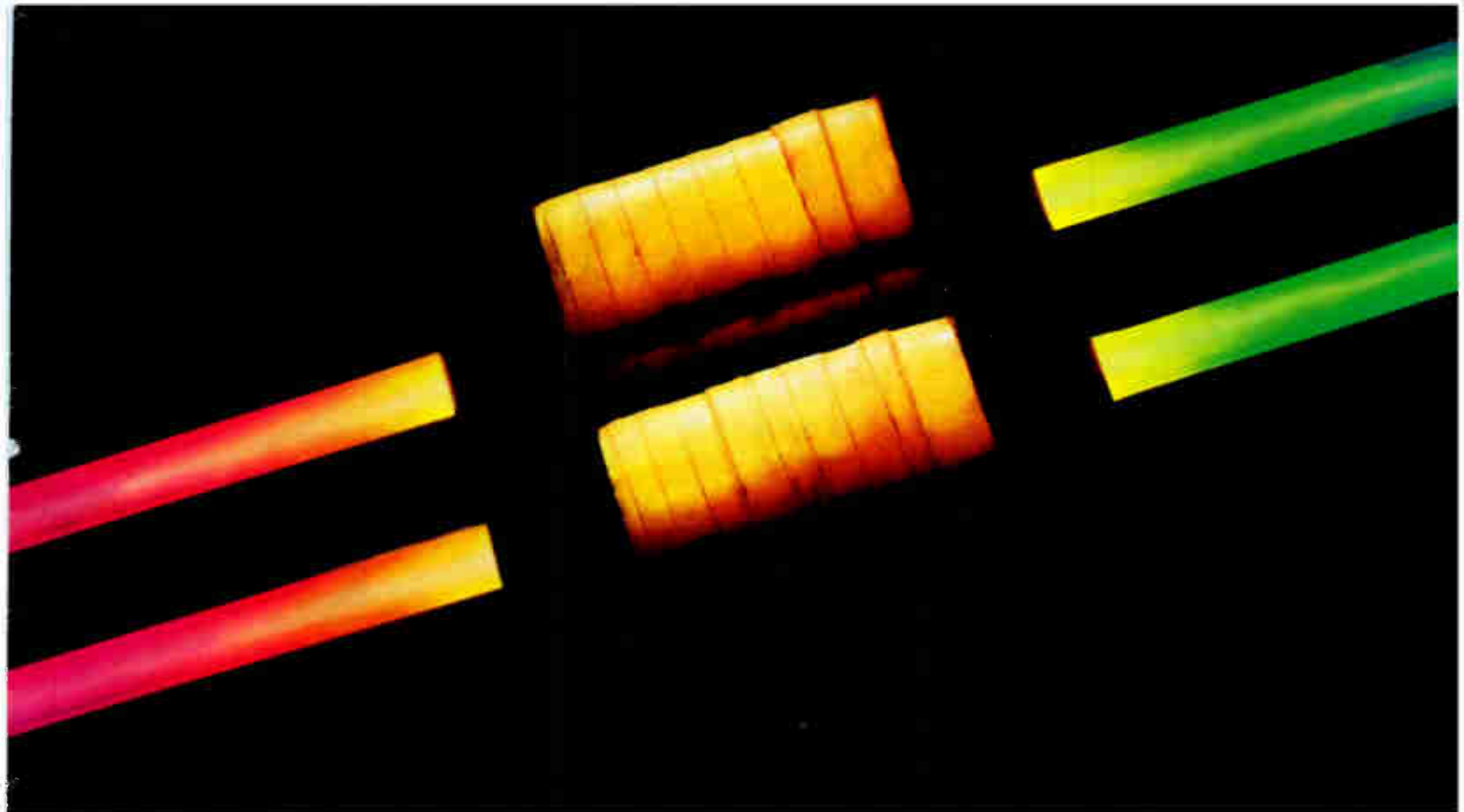
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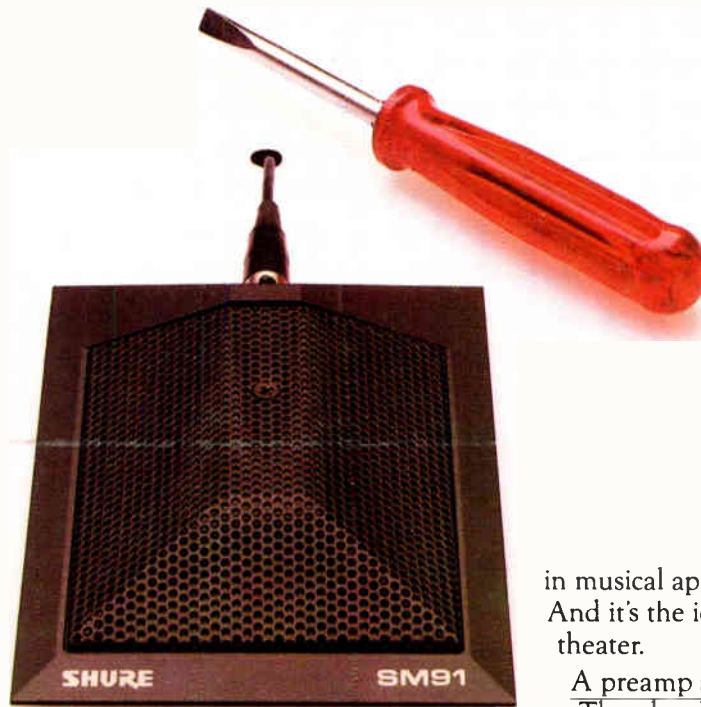
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No carpet strips or plastic baffles needed. Until now, all surface-mounted mics have been omnidirectional. Trying to add directionality has required a lot of busy work. The new SM91 brings the big advantages of unidirectionality to boundary effect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

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

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

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

A preamp ahead of its time.

The ultra-low noise preamplifier provides switch-selectable flat or low-cut response, excellent signal-to-noise ratio and a high output clipping level. A low-frequency cutoff filter minimizes low-end rumble—especially on large surfaces.

If you're going omni. Our new SM90 is identical in appearance to the SM91 and just as rugged.

For more information or a demonstration, call or write Shure Brothers, Inc., 222 Hartrey Ave., Evanston, IL 60202. (312) 866-2553.

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