SYNERGETIC
SYN AUD CON
AUDIO CONCEPTS

newsletter

Volume 13, Number 3
Spring 1986
P.O. Box 669, San Juan Capistrano, CA 92693
Ph: 714-728-0245

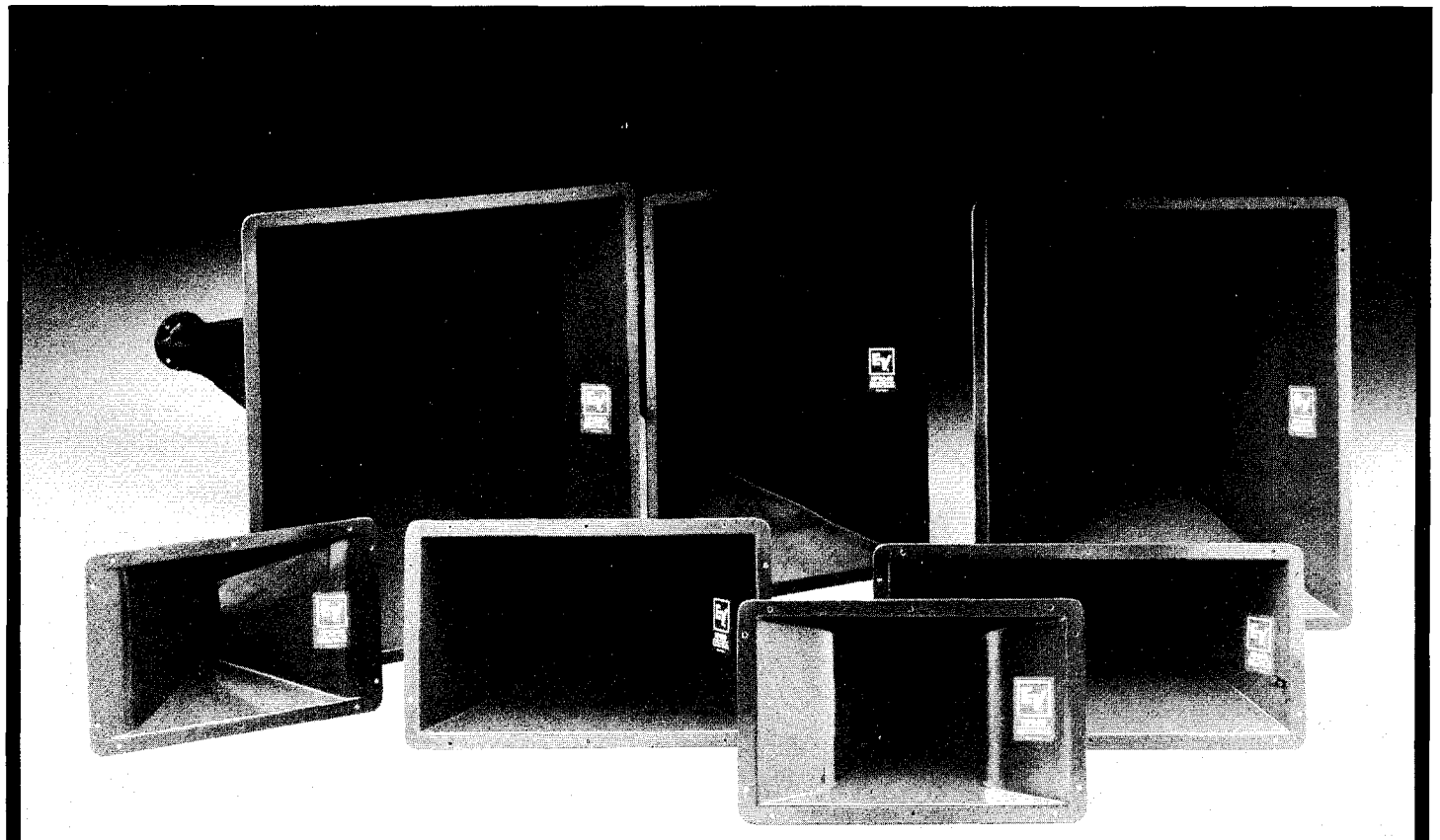
SYNERGETIC
Working together; co-operating, co-operative

SYNERGISM
Co-operative action of discrete agencies such that the total effect is greater than the sum of the two effects taken independently.

EXCHANGE OF IDEAS

I met a man with a dollar
We exchanged dollars
I still had a dollar

I met a man with an idea
We exchanged ideas
Now we each had two ideas



Electro-Voice® — HP TransPlanar™ Series

ELECTRO-VOICE NEW SYN-AUD-CON SPONSOR

TABLE OF CONTENTS

ELECTRO-VOICE NEW SYN-AUD-CON SPONSOR

Electro-Voice of Buchanan, Michigan, has become the latest Syn-Aud-Con Sponsor. Electro-Voice was incorporated on July 1, 1930. (Don was two years old.) Our first encounters with EV were during the years we worked for Paul Klipsch and EV licensed many premium loudspeaker designs from Mr. Klipsch. During those years, we met Al Kahn and Lou Burroughs as well as many fine young engineers starting their careers at EV.

Syn-Aud-Con's interest was renewed in EV with the tremendous step forward represented by the development of the constant directivity series of horns in the early 70's. We had a healthy skepticism of their claims for such high directivity factors Qs. Sam Bridges of Electronic Design heard me voice this skepticism and went to great effort in a large reverberant space to measure the Qs of the HR9040 and HR4020. We published the happy results in a Tech Topic, V3N5 1975, "High Q Measurements Confirmed in the Field." We were thrilled to find that they actually were true. EV specification sheets became the standard by which all others are judged at this time. Over the years since their founding, EV has maintained an innovative presence in the P.A., broadcast, and commercial sound fields.

EV was one of the first manufacturers to build their own anechoic chamber, use Holography, and recently they purchased a TEF analyzer.

Syn-Aud-Con is pleased to welcome Electro-Voice as a sponsor and to have the opportunity to become better acquainted with the engineering talent behind their new wave of loudspeaker technology.

Electro-Voice®
SOUND IN ACTION™

STAFF

Editors:
Don & Carolyn Davis

Design & Production:
Carolyn Davis
Pat Carlson
Debbie Lohrman

Syn-Aud-Con NEWSLETTERS and TECH TOPICS are published quarterly by Synergetic Audio Concepts, P. O. Box 669 (Rancho Carrillo), San Juan Capistrano, CA 92693.

This is Volume 13, Number 3, Spring 1986.

Subscriptions are available for $32.00 per year. Single or back issues are available. Write for price list. Air Mail subscriptions outside the United States are $38.00.

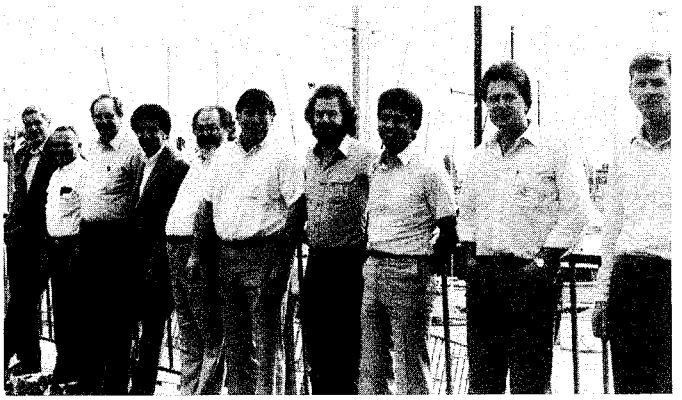
CENTRAL CALIFORNIA ELECTRONICS

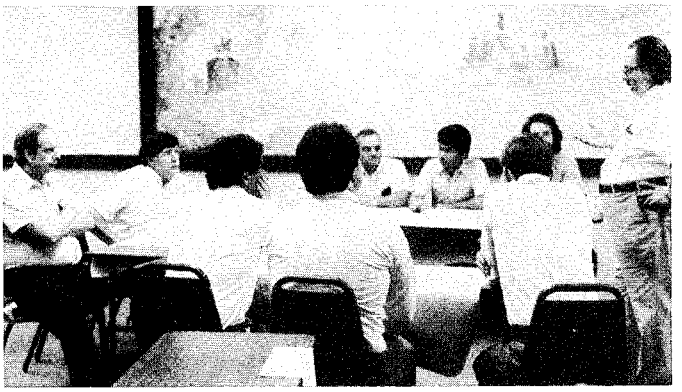
Central California Electronics in Fresno is the first to ask us to hold a special in-house seminar on one subject - Sound Masking or Speech Privacy systems.

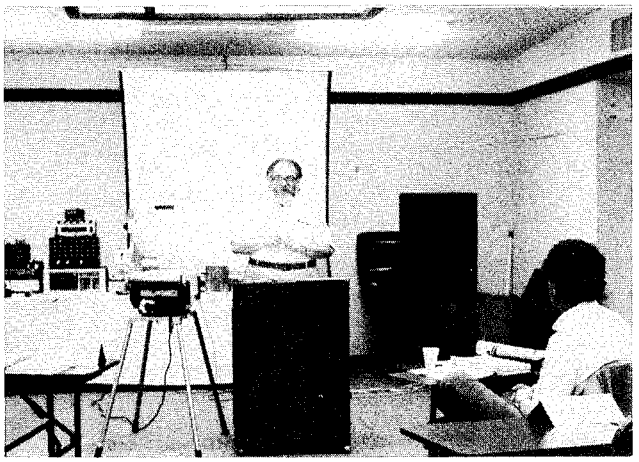
It was a fun day. Rolly Brook of BBN Labs/Los Angeles joined us for the full day class - 7:30 A.M. to 9:30 P.M. It was a day of learning and doing.

The session was held at the Marina Inn at Dana Point Marina and brought back fond memories of other classes held there over the years. Rolly shared with this group advanced copies of his chapter on open plan offices in the soon to be published Audio Engineers Handbook. More important, he shared freely from his vast storehouse of experiences.

Any building owner's dream should be to have this crew on his installation of a masking or privacy system in an open plan office. California Electronics is a motivated and informed organization.







CENTRAL CALIFORNIA ELECTRONICS

February 18, 1986

Joseph A. Bienkowski	John M. Peters
Jay Johnson	Michael Pray
Gene Kline	Jim Van Camp
Jesse Mejorado	Jim Walker

"IN HOUSE" SEMINARS

Our special seminar for Central California Electronics made us think about other special "in house" seminars. In addition to Central California Electronics, we have had classes for:

Hollywood Sound, Hollywood
Communications Company, San Diego
Plantronics, Santa Cruz
Maryland Sound, Baltimore
Pran, Inc., New Braunfels, Texas
Peirce Phelps, Philadelphia
White House Communications, DC
Griffiss Air Force Base, Rome, NY
Opryland, Nashville
Disneyland, Anaheim
Disney World
NBC, Burbank
Crown International, Inc.

We would like to do more "in house" seminars - by "in house" we don't necessarily mean in your facility. It may be held in a nearby hotel, but the material presented is structured for your group.

If you are interested in exploring such a seminar, contact us. We plan a schedule several months in advance. We will be in the Middle West this Summer, in the East/Southeast in the Fall and in the West in the Winter.

NEW SHIPPING ADDRESS

EFFECTIVE IMMEDIATELY - Syn-Aud-Con's new shipping address is:

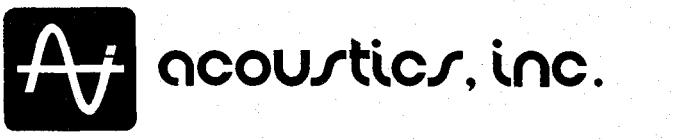
Synergetic Audio Concepts
32141 Alipaz, Suite I
San Juan Capistrano, CA 92675

Our mailing address and telephone number remain the same.

AUDIO IN THE PHILIPPINES

John Burgoyne, from Manila, has attended two Syn-Aud-Con classes, the first in 1973.

When we heard of the election turmoil in Manila, we wrote John to be sure that all was well with him and received the following report. We though readers of the Newsletter would be as interested as we were in John's letter.



708 AURORA BOULEVARD
QUEZON CITY, PHILIPPINES

TELEX: 22031 IMC PH
CABLE: ACOUSTICS

Dear Friends:

Thank you for your letter of the 18th of last month expressing your kind concern and well wishes. We are happy to report that there is a bright side to all that has come to pass.

After the unique phenomenon of a "bloodless revolution", the Filipino Nation has once more unshackled itself from the bonds of tyranny and regained its freedom and democracy. Henceforth, many a "never ending story" will be told regarding one's participation in what is now popularly known as People's Power and an open acknowledgement of God's guiding hand.

We at Acoustics played our small part having provided the opposition groups with the sound systems for their major conferences over the past two years. The last two events were the final public rally of President Corazon Aquino and her running mate, Mr. Salvador Laurel, prior to the celebrated fraud ridden election and a mass prayer rally that followed 9 days after. EV loudspeakers, microphones and electronic components were there for these two historic events that were reported to have pulled in a crowd of about 2 million.

In view of the sheer size of the job, and in deference to the enthusiasm of other firms to participate, their loudspeakers and systems were laid out along the perimeter of the park. Unfortunately, the constant high sound levels cost the local dealer of a reputable Japanese brand of equipment two burnt out driver units. We ar happy to report that EV came through without a scratch.

Thanks to the knowledge gained from our attendance at the Syn-Aud-Con seminars, we now have the reputation of putting up the simplest and yet most effective sound systems. We have offered our professional services for the formal public inauguration of the President. We intend to take advantage of this event to show the other sound firms the virtues of a properly designed central loudspeaker cluster of Electro-Voice components over the usual split stack of excessive hardware. We'll keep you posted.

Again, thank you for your kind thoughts.

ACOUSTICS,INC

John Leo Burgoyne, Jr., President

"LIFE OF JOHN WILLIAM STRUTT"

As is our custom when travelling, we explored some of the book shops in the cities we visited on our recent Northwest tour. Portland produced two superb buys.

The first was "Life of John William Strutt, Third Baron Rayleigh, O.M., F.R.S." by his son Robert John Strutt, Fourth Baron Rayleigh, F.R.S. This is the 1968 edition with annotations by the author and a foreword by John N. Howard. Published by the University of Wisconsin Press, Madison, Milwaukee, London.

The Rayleigh book is a remarkable study of what science is really about and how real scientists react to new as yet untried ideas. The man who discovered ARGON set the standard measurement of the volt, ohm, and ampere that is still in use today, and was the author of the epic "Theory of Sound" could also investigate spiritualization with an open mind, hoping that mind was indeed separate from matter. There is even an appendix of his favorite jokes that he had kept a record of. Rayleigh's championship of the long buried paper by J. J. Waterston on the kinetic energy of colliding molecules anticipating by some 15 years the work of Joule, Clausius, and Maxwell, and which had been rejected by the Royal societies referees, brings to mind today's great problem of peer review. A prime example is the rejection of Heyser's first paper submitted to the AES Journal and its rescue by Olsen of RCA.

Rayleigh's son once quoted Huxley to his father wherein Huxley had said, "Scientists over 60 are past their useful work." Rayleigh had replied, "Yes, if they criticize younger workers' efforts, but perhaps not if they work alone." This 439 page book is an intimate view of a prominent Victorian scientist's life and a description of a laboratory and research technique that produced work worthy of detailed study a full century later.

"PHYSICS FOR THE INQUIRING MIND"

Powell's bookstores in the Portland area proved to be a goldmine of older used books. The second find was "Physics for the Inquiring Mind" by Eric M. Rodgers, Tenth Printing 1970, published by Princeton University Press. This book is intended for the instruction of non-physicists and is admirably suited to "self-instruction". It contains an exceptional special chapter on arithmetic. Mr. Rodgers received the OERSTED medal in 1969 from the American Association of Physics teachers and the book itself is developed from the course Professor Rodgers taught for over twenty years.

COMPANY BROCHURES

Often sound contractors send us a copy of their new brochures. Some we admire for how a strong message is conveyed at a minimum expense. Some we admire for sheer beauty. Such is the one that Al Frank of Electro Media of Colorado sent us. Magnificient. Mr. Frank has been in the audio business for 38 years. The brochure clearly reflects it.

DO YOU KNOW THIS MAN?

Those who know Don Davis well know that he has deep respect for those who serve their country in the armed forces and for those who help enforce rule by law. Those who do their duty, especially in the most difficult posts, are heros in the true sense of the word. Acceptance of the mental burdens such duty can impose are what is heroic.

Without further ado, here is a Syn-Aud-Con hero. Can you recognize him without his customary camouflage? Answer on page 10.

MORE ON SONICS' TAC-86

In Newsletter V12N4, we included literature and a short write up on Sonics' TAC-86, a theater audio control system. When Farrel Becker, consultant for Wolftrap read it, he commented that we didn't enthuse enough. Farrel was hired at the Smithsonian to make measurements of an IMAX installation where the TAC-86 was used.

We personally had not seen the TAC-86 in operation, but we always enjoy giving encouragement to "grads" who are providing a unique service or product, so we included a mailing for Lynn McCroskey at Sonics.

Farrel says we should tell you a bit more about it. The TAC-86 "allows computerized or manual control over large, multichannel audio presentations. It allows you to switch sources quickly, to fade between channels, to account for differences between program material, to enhance the dynamic range and to improve signal-to-noise by cutting of channels not to use."

Since writing the first article, we met Bill Shaw in New York, developer of the IMAX film. Bill was in our Minneapolis class in 1974. He invited us to visit the IMAX projection room at the Smithsonian when we were in Washington for our class. We got a full demonstration of the TAC-86 before viewing the dramatic films "I Fly" and the "Dream Is Alive."

Farrel was correct. We didn't enthuse enough about the TAC-86 in V12N4.

NEW EUROPEAN REFERENCE

Hellmuth Kolbe of Zurich Switzerland has acted as the engineering consultant for the new ice hockey stadium in Borne, Switzerland. This is one of the few central cluster systems in Europe using horns. The building has a 7.5sec RT_{60} at 1.0KHz.

Hellmuth is, of course, well known to Syn-Aud-Con graduates for his TDS, TEF and LEDE work in Europe. Hellmuth has both B&K and Techron TEF equipment, has designed innovative LEDE control rooms, helped us measure the Musikveriensaal in Vienna and now has utilized the Prohs-Harris PHD Program in the design of this new sound system.

Electro-Voice personnel in Europe met Hellmuth while attending our European classes. They worked together on this project to take advantage of the E-V constant directivity devices, carefully designing them into a difficult acoustic environment and adjusted by TEF measurements. Now the European community has a reference standard for comparison purposes with older techniques.

We are indeed proud to report the accomplishments of Syn-Aud-Con "grads".

CONSTRUCTION DETAILS

On our Northwestern trip in April, we stopped by to see David Moore's new facility at Electrocom in Seattle. It was an exciting visit and we will be writing about it in the next Newsletter. But we had to share with you in this issue a sign that Morris Fosse had framed in his office.

"CONSTRUCTION DEFINITIONS"

AUDITOR - People who go in after the war is lost and bayonet the wounded.

BID - A wild guess carried out to two decimal places.

BID OPENING - A poker game in which the losing hand wins

COMPLETION DATE - The point at which liquidated damages begin

CONTRACTOR - A gambler who never gets to shuffle, cut or deal.

CRITICAL PATH METHOD - A management technique for losing your shirt under perfect control.

DELAYED PAYMENT - A tourniquet applied at the pockets.

ENGINEER'S ESTIMATE - The cost of construction in heaven.

LAWYER - People who go in after the auditors and strip the bodies

LIQUIDATED DAMAGES - A penalty for failing to achieve the immpossible

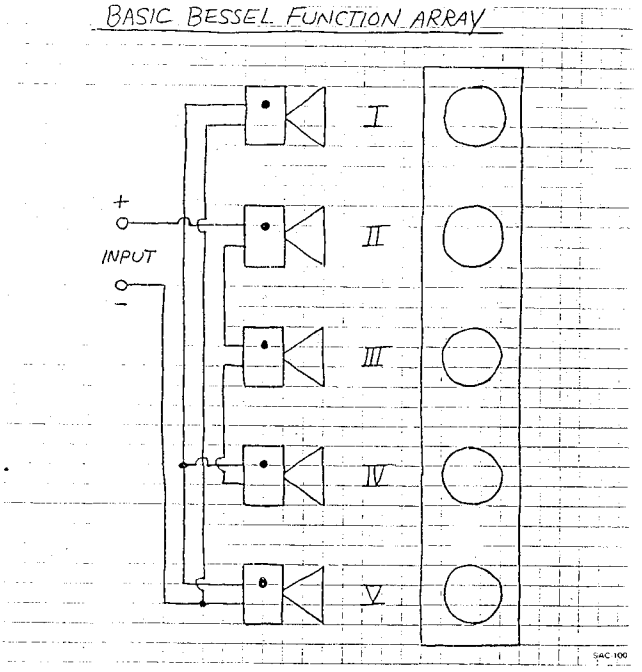
LOW BIDDER - A contractor who is wondering what he left out.

PROJECT MANAGER - The conductor of an orchestra in which every musician is in a different union.

STRIKE - An effort to increase egg production by strangling the chicken.

THE BASIC BESSEL FUNCTION ARRAY

While we have been demonstrating the basic Bessel function array in our classes for the past three years, we have not published any circuitry on it because of commitments to the Philips Corp. who had graciously granted us permission to experiment with it prior to the issuance of a patent. The U.S. Patent #4,399,328 has now issued and the diagram below represents the simplest manifestation of the use of this function.



SIMPLE BUT IMPORTANT DEFINITIONS

1. VI - Volume Indicating Instrument

2. VU - Volume Units (what a VI is calibrated in)

3. On a sine wave only: 0 VU = 0 dBm

4. On program material (speech or music) 0 VU = + 10 dBm (by universal agreement)

5. What is read on a VI scale is called the instrument indication. The *level* is the instrument indication plus the *attenuator* setting ± any impedance corrections *if* required.

6. 0 dBm is one milliwatt (0.001w) period! Any voltage across any resistance that results in a power of 0.001w is a power *level* of 0 dBm.

7. There is output power level L_{OUT} and available input power level L_{AIP}. L_{OUT} is actually developed at the output of the system. L_{AIP} is what is *theoretically* available from the output of one device at the input of the following device.

8. Gain or loss is the difference in level between the input of a device and the output of a device. The input will be the L_{AIP} of the previous device. The output will be the L_{AIP} of the device itself relative to the next device. When the device is the final electronic device in the chain, then the L_{OUT} is *measured* and used.

   Gain is the term used to describe the change in *level* expressed in decibels *at the listener's ears* upon the insertion of a device into the system in place of a piece of wire.

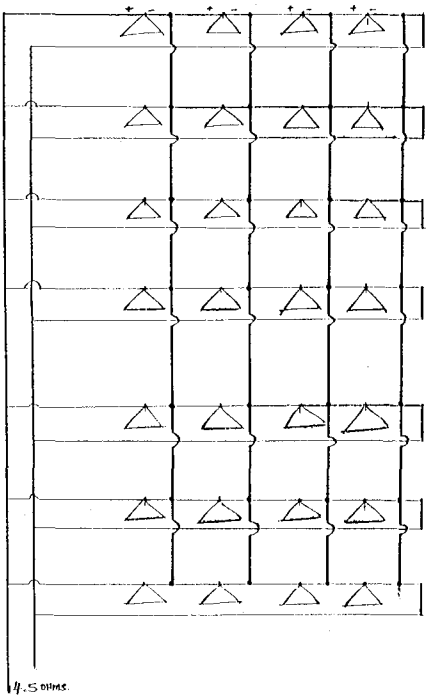
If you have these definitions solidly in mind, you should be a handy man around a sound system installation job. #

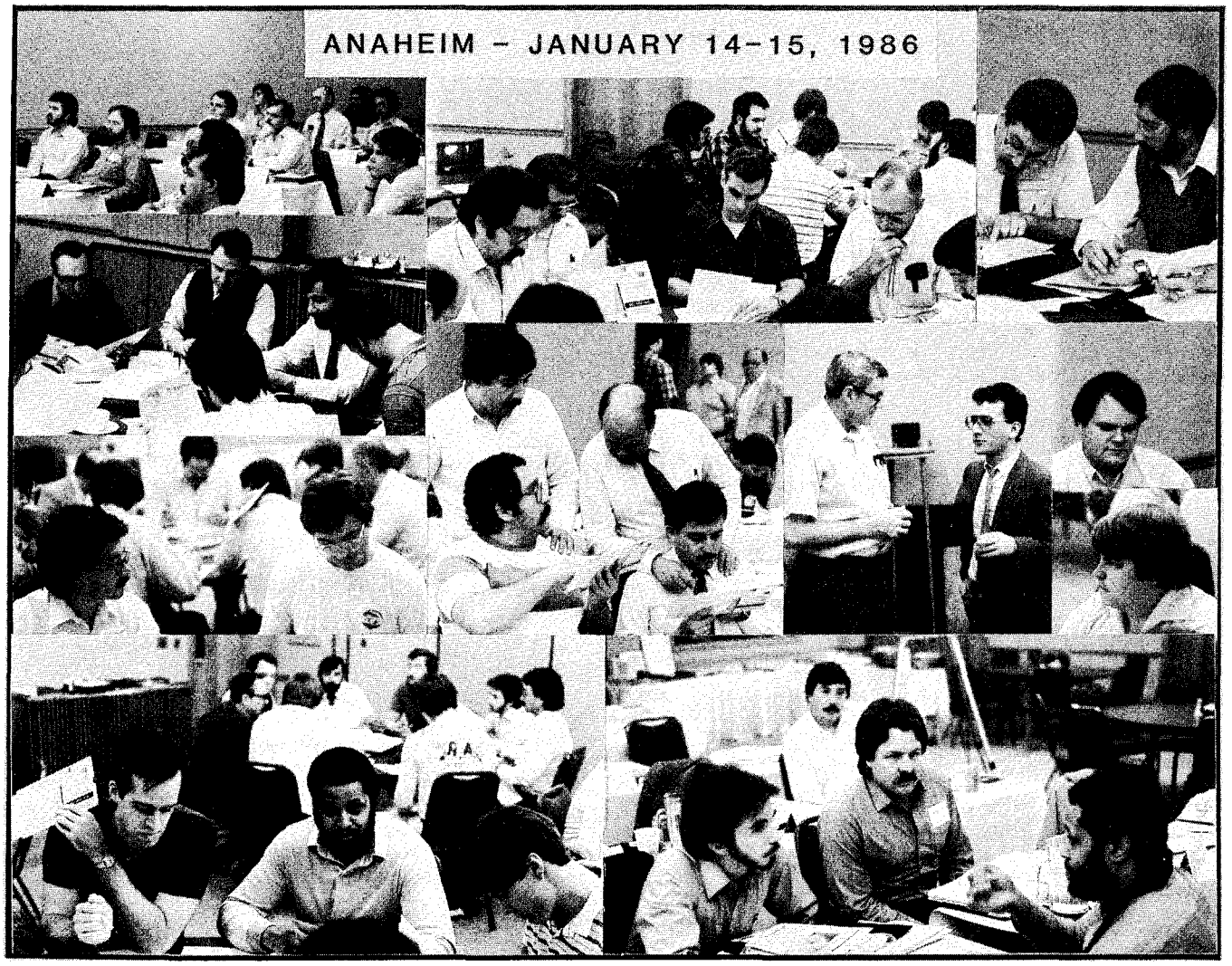
DISTRIBUTED LOUDSPEAKER VARIATION

Syn-Aud-Con normally does not advocate the use of series-parallel loudspeaker arrangements; however, the one shown here is of interest and is reported to work well. The tying together of the equipotential points is a variation worthy of further analysis.

From Peter Ames, Sports & Games Ltd., Trinidad:

> Enclosed is a schematic of a loudspeaker system we have just installed. Its an overhead distribution system. It overcomes the major advantages of a series parallel network. The amplifier we were using did not have a 70V line so that was out, connecting all speakers in parallel would have resulted in an impedance of less than 1 ohm which we could work with if we could find an autoformer that would handle the current - we could not. We decided on 7 series lines each with four 8 ohm speakers, the 7 series lines were then connected in parallel to give 4.5 ohms.
>
> All the equipotential points were then tied together to provide damping.





CHECKING OUT A MIXER FOR OUTPUT LEVEL

Checking out a mixer, whether it be a simple 2 input device or a massive console, for output level is never quite so simple as it first appears. Many are content with the output voltage and the knowledge that they are not clipping. Others wish to actually know the gain of the mixer in terms of what happens at the listener's ears, when it is inserted into the system.

AN IMPORTANT VOLTAGE

We suggest that you make sure first that you know the mixer's output impedance as a source impedance to the following device. Then measure its true level across a known load (600Ω). Use an oscilloscope or distortion analyzer to find the maximum output level within the desire distortion limits. Once this level is established, remove the load and measure the open circuit voltage at the mixer's output. The degree of regulation that the mixer possesses is found by

$$20 \text{ LOG } \frac{E_O}{E_M}$$

A Shure M267, for example, will measure 1.95V across 600Ω at +8dBm and 2.31 V for the open circuit condition for

$$20 \text{ LOG}\left(\frac{2.31}{1.95}\right) = 1.49 \text{ dB}$$

This means that the maximum error in level that can occur for impedances between 600Ω and ∞Ω will be 1.5 dB.

Having the E_O allows us to use that value as our Thevenin source voltage, E_S. We can then compute the desired input voltage E_{IN} to the following device. (This allows levels to be set from voltage readings across the circuit in use.)

$$E_{IN} = \frac{E_S \times R_{IN}}{R_S + R_{IN}}$$

If we use the figures already given above, we can calculate for a 600Ω R_{IN}

$$E_{IN} = \left(\frac{(2.31)\ 600}{130 + 600}\right) = 1.9V$$

$$20 \text{ LOG}\left(\frac{1.95}{1.9}\right) = 0.23 \text{ dB}$$

If we set the E_{IN} to exactly 1.9V, we have the maximum level of available input power of

$$L_{AIP} = 10 \text{ LOG } \left(\frac{(E_S)^2}{0.001\ R_S}\right) \quad -6.02 \text{ dB}$$

$$L_{AIP} = 10 \text{ LOG } \left(\frac{(2.31)^2}{0.001(130)}\right) \quad -6.02 \text{ dB} = 10.11 \text{ dBm}$$

MEASUREMENT PRECAUTIONS

All measurements discussed above are sine wave measurements. All voltages are RMS voltages. Special care should be taken to ensure that the overload point observed is truly the output overload point and not an overload at the input.

CONVERTING RASTI TO %AL_{cons}

Farrel Becker does it again. Using his curve fitting program on his Compaq, he has come up with the equations for converting a RASTI reading to %AL_{cons} and vice versa, plus scaling both ratings against the B&K subjective scale. Syn-Aud-Con says Bravo!

	RASTI	%ALcons
	Ø.2Ø	57.7
	Ø.22	51.8
BAD	Ø.24	46.5
	Ø.26	41.7
	Ø.28	37.4
	Ø.3Ø	33.6
	Ø.32	3Ø.1
	Ø.34	27.Ø
POOR	Ø.36	24.2
	Ø.38	21.8
	Ø.4Ø	19.5
	Ø.42	17.5
	Ø.44	15.7
	Ø.46	14.1
	Ø.48	12.7
	Ø.5Ø	11.4
FAIR	Ø.52	1Ø.2
	Ø.54	9.1
	Ø.56	8.2
	Ø.58	7.4
	Ø.6Ø	6.6
	Ø.62	5.9
	Ø.64	5.3
GOOD	Ø.66	4.8
	Ø.68	4.3
	Ø.7Ø	3.8
	Ø.72	3.4
	Ø.74	3.1
	Ø.76	2.8
	Ø.78	2.5
	Ø.8Ø	2.2
	Ø.82	2.Ø
	Ø.84	1.8
	Ø.86	1.6
EXCELLENT	Ø.88	1.4
	Ø.9Ø	1.3
	Ø.92	1.2
	Ø.94	1.Ø
	Ø.96	Ø.9
	Ø.98	Ø.8
	1.ØØ	Ø.Ø

ALcons = 17Ø.54Ø5*EXP(-5.419*STI)

$$STI = -Ø.1845 * Ln\ (\%AL_{cons}) + 0.9482$$

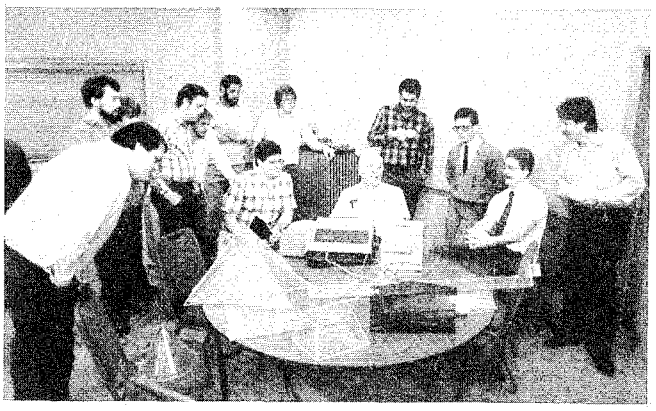
REFLECTIONS OFF THE CONSOLE

Near Field Monitors solve some problems in the control room, but do they create another problem?

John Newberry, NBC in Burbank, said the near field monitors on the console he measured with his TEF created audible and measurable anomalies because the polar pattern of the monitor allowed console reflections.

"WHAT DO WE HEAR FROM KEN?"

A question frequently asked by callers to Syn-Aud-Con is "What do you hear from Ken Wahrenbrock?" Ken is now happily retired. He spends 25 hours a day with computer, ham radio, photography and other personal interests and still finds time for cross country trips with the Davis's in mid-winter from the middle west, frequent trips to Rancho Carrillo to help the girls at the office solve computer problems, and even visits local classes to show what his creative talent is doing with PZM research.



ELECTRONIC CIRCUIT VS ACOUSTIC CIRCUIT

Having just finished another of the myriad of electronic circuit designers' discussions of Linkwitz-Riley crossover alignment articles, I am amazed at the persistence in the belief that the loudspeakers attached to such devices are all resistor-like flat phase response devices. Statements, such as, "making sure that the speakers are mechanically in phase either by adjusting them physically or providing an electronic means to accomplish the same result" indicate a designer who has never had the opportunity to measure a real loudspeaker's acoustical phase response.

One writer even acknowledges that "a very careful analysis of all acoustical radiation in front of a speaker system will startle even the most calloused audio professional." That's a true statement, but the writer goes on to describe a network for use with a perfectly flat phase response device needing only signal delay (he calls it time delay) compensation. A future experiment would be to digitally record the real phase response of a loudspeaker and calculate its conjugate for use as part of a theoretical network.

We are pleased to see that some electronic circuit designers have at last recognized that what they do electronically has dramatic effects, not only on the on-axis response of acoustic devices, but often devastating effects on the polar responses as well.

HINTS ON WRITING

James H. Burkhalter

* Always check your spelling and elinimat/e typographical 3rrors.
* It is the essence of de rigueur to adjure circumloculatory pheriphrases and to eschew obfuscation.
* Non sequiturs are ubiquitous, so writing is getting worse.
* Resolve to never split an infinitive, and dangling participles are also something you shouldn't.
* Never repeat yourself and don't be redundant.
* Never explain the obvious; that is, don't elaborate on what the reader obviously already knows.
* Ending a sentence with a preposition is uncalled for.
* Make sure your numbers and tense matches.
* Never a sentence without a verb.
* `However' is an appositive to relate to a preceding phrase or sentence, however, it should never be used as a conjunctive to join two sentences - use `but' instead.
* Using adjectives for adverbs doesn't help you write clear.
* One of the principle things to remember is, for two similar words, be sure to use the right one.
* When using non-conversational words, make sure your deplay them correctly.
* It is not apparent that the intended enhancement of credence resulting from verbosity and linguistic pomposity is not negated by reader revulsion, with the concomitant loss of credulity.
* It is a faux pas to attempt to demonstrate savoire faire by using foreign phrases en masse. Au contraire, simplicity is the sine qua non of the au courant.
* It should never be expected that neglecting to abstain from obliquity should not fail to enhance lucidity.
* Jargon is a bucket of snakes that should be archived to write-only memory, since one or more of your data sinks may be incompatibly encoded.
* In order to create a positive delta in your intended reader's total decryption of your data dump, say it in plain English!
* It has been espoused by some that, perhaps, under certain conditions, a positive statement might possibly be marginally more effective than an equivocal one.
* It's a billion times worse to exaggerate than to understate.
* One trouble is, everybody always generalizes.
* One of the principal principles to prevent writing rotten writing is to avoid literary alliteration.

Contributed by Richard Downes, Orlando, FL.

HME EXPERIENCES EXPLOSIVE GROWTH

Rarely have we had the privilege of witnessing a company grow as rapidly a HME has in the past two years, a company that is based so solidly on creative personnel, good management, and needed, well designed products. HME's wireless and wired intercom systems are exceptional in both conception and in execution. Their customers think so too, as was readily evidenced by production demands that are already outgrowing their new facility reported on in our V12N2 Newsletter, Winter 1985.

We were also very pleased to hear that the measurement world is discovering the HME Precision Audio Link, PAL, wireless telemetry system. Many involved in field measurements of entertainment systems have discovered PAL's usefulness.

HME has a unique employee policy that assists personnel in the purchase of a personal Compaq computer by providing very low interest financing. Since HME uses Compaqs at their facility, this allows those seriously interested in becoming computer literate to do so, both at home and at work. The results as we witnessed them are some really clever in house software in all of the departments at HME.

Finally, we were impressed by the fact that throughout the HME plant and their hundreds of workers there is no smoking within the building. The Smokeout Award shown below is another of the many management innovations at HME.

hme

HM ELECTRONICS INC.

Smokeout Award

Be It Known That

_____

Having smoked an average of ____ packs of cigarettes per day for the past ____ years has with great pride and wisdom stopped smoking for six months as of ____ ____

Dated ____ ____ ____ at San Diego, California, USA

_____

President

CASE COVERS

Jean Cavallaro was at the NAMM show in Anaheim giving away samples of her 100% waterproof lined and unlined instrument covers. The prices are extremely reasonable as are special orders. Worth writing for her brochure and price sheet: Jean Cavallaro, 20 Vernon Street, Somerville, MA 02145.

SPEAKER REVIEW

Dick Heyser has been writing speaker reviews for **Audio Magazine** since 1974. For years we read the text and looked at "the pretty pictures" understanding little of what we saw.

Finally, after a few years making TEF measurements, we are beginning to understand the measurements and they are a true education.

We are reproducing a few excerpts here:

"It was clear right from the beginning that the grille is a source of problems. Figures 8 and 9 show the **change** in sound (relative to Figs. 6 and 7) which is produced when the grille is removed. A peak-to-peak amplitude variation of 4dB in mid-band and a mid-band phase variation of 25^{o} is enough to make me suggest that a musically sensitive owner should remove the grille in order to achieve better sonic accuracy."

"Energy-time curve (ETC) measurements verified that the substantial ripples in response above about 1kHz are due to ceiling reflections which arrive about 3.5 mS after the direct sound. The culprit, if that be the word, is the very large vertical dispersion pattern of the midrange and tweeter. Figure 11 is the ETC of the first 4.5 mS of sound, where the principal problem lies. The first peak, at 9.5 mS, is the direct sound. The next peak, at 11.1 mS, is the floor reflection, and the third peak, at 12.8 mS, is the ceiling reflection. The energy level of the ceiling reflection, in the d.c. to 20 kHz band, is only 8 dB less than that of the direct sound... These 3-meter sound measurements, Figs. 11 and 12, show, that the CS3 should definitely not be placed directly under any overhanging shelf or near an object which can reflect sound into the listening area....Both dispersion curves indicate that no acoustically reflecting object, such as a chair or bookcase, should be placed near the CS3."

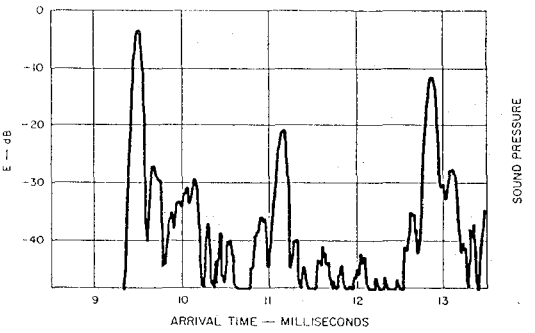


Fig. 11--Energy-time curve for 3-meter room response.

"To my ears, the most accurate reproduction was achieved with these loudspeakers placed about 50 cm in front of an acoustically absorbing wall and subtending a 60" angle at the listening location."

A speaker designer could learn much from reading a Heyser speaker review.

DO YOU KNOW THIS MAN? Page 5 Answer: DAVE ANDREWS

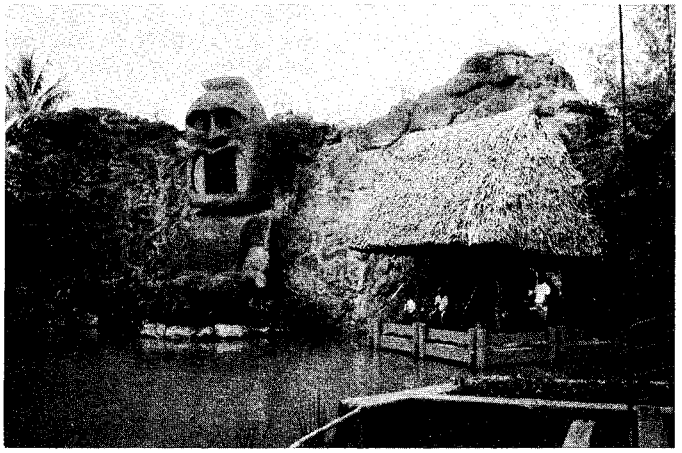
POLYNESIAN CULTURAL CENTER

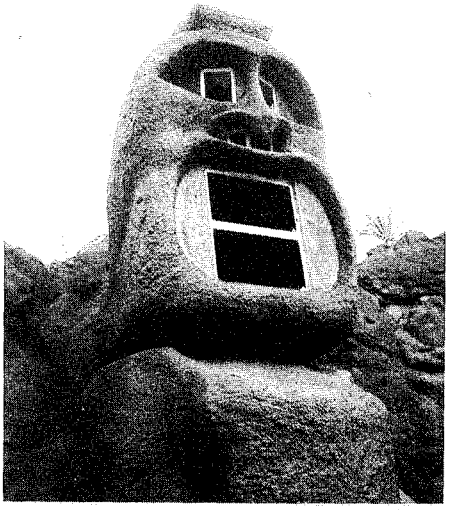
We often give lip service to the fact that audio allows its practitioners to engage in both art and science. Here is a perfect example. A "Menehune" Tiki was built to house the speaker systems in the Hale Aloha mountain.

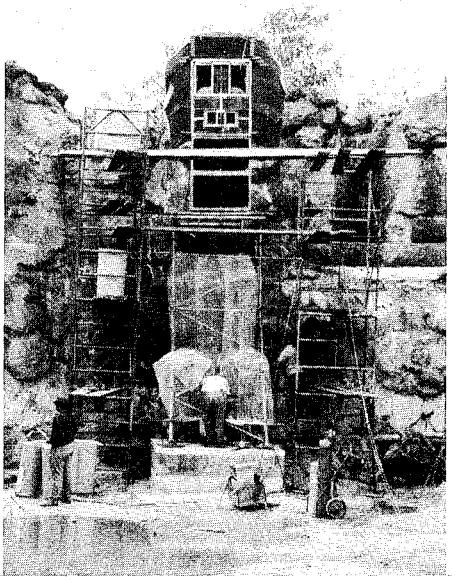
The Polynesian Cultural Center now has a God with eyes made of Emilar horns and drivers, a nose of Design Direct Sound horns and Emilar drivers and a mouth made of two Community BBH dual 15" horns with PAS drivers.

This God speaks with the voice of authority. As designer/installer Rick Parlee of Audissey writes, "Audissey's approach was no compromise in audio performance while maintaining visual integrity."

We suspect it will be many moons before we witness a more creative solution to "out of sight" sound.







AUDISSEY

1020 Auahi St., Bldg. #6 • Honolulu, Hawaii 96814
Phone: (808) 521-6791

SHOCK MOUNT DRIVERS IN THEIR ENCLOSURES

We recently received reports of a sound system that had decoupled the bass drivers from the baffle they were mounted on with remarkable improvement in the bass response and significant reduction in spurious radiation from the bass enclosure. We'd like to hear of more of you trying this obvious (once it's tried by someone else) improvement in the mounting technique for large low frequency drivers, i.e., shock mount the woofer on a sub-baffle just slightly larger than the woofer itself.

NEW EDITION OF THE YELLOW BOOK

Howard W. Sams reported in their January Newsletter that the 2nd Edition of **Sound System Engineering** would be out in April and all orders for the 1st Edition were returned with a notice that no further printings of the 1st Edition would be made.

Since we have not received our galleys to proof, we questioned the April date. Now we are told the 2nd Edition will be available in August. We prevailed on Sams to make a 9th printing of the 1st Edition.

HELLMUTH DOES IT AGAIN

The control room rear wall has QRDs and PRDs and Haas Kickers.

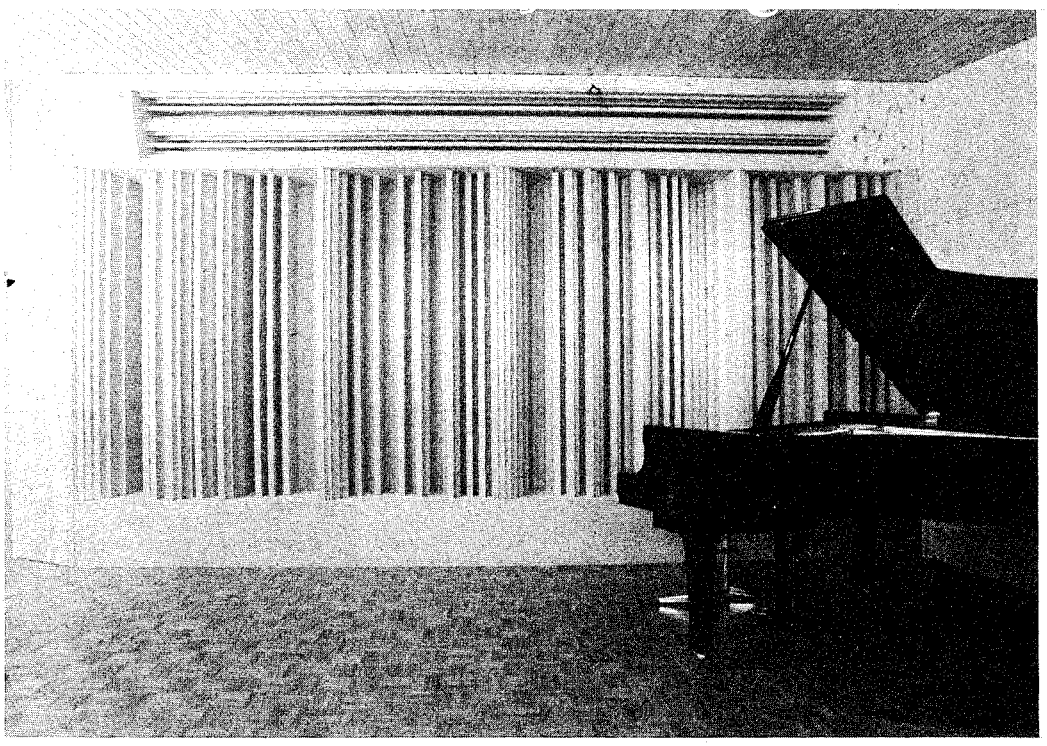
There is an old saying that the truth is known by the fewness and faithfulness of its followers. The LEDE concept is rapidly being expanded by a small but very dedicated group of engineers, uniquely equipped to handle the theory, the math, and the measurements. Russ Berger, Charles Bilello, Bob Todrank, Doug Jones, Neil Grant and Hellmuth Kolbe have led the research into the application of diffusors in such rooms. Peter D'Antonio's manufacturing efforts have experienced remarkable support from these designers.

Hellmuth Kolbe has carried these concepts into the studio as well. We particularly respect Hellmuth's judgment on these innovations because he is not only a skilled acoustical consultant, but has a gifted, musical background as well.

"The studio has one side entirely covered by diffusors, giving a crisp natural-blended lively sound which musicians appreciate very much," Hellmuth reports. Hellmuth added, "For the AES in Montreaux, Bruel and Kjaer used it for demonstrating their studio mikes in a really good recording environment, and everybody was very delighted."

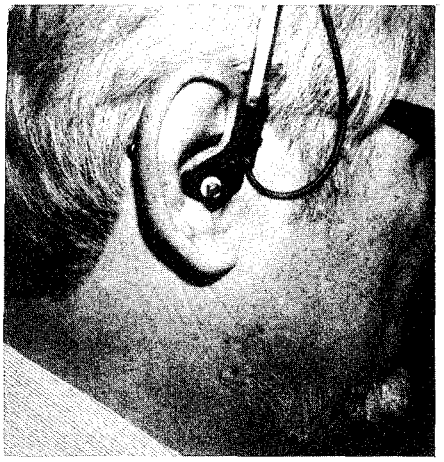
Hellmuth Kolbe has done a remarkable job in this control room and studio for Wolfgang Ehrlich of Lausanne, and we look forward to the research results that will flow from this kind of creativity. (Wolfgang was in our TEF and LEDE workshops in Hamburg in March 1985.)

The "Human Dummy Head" designed and worn by Hellmuth consists of a pair of microphones worn where they can hear both the program signal and the reflections from the human pinnae. Hellmuth is using these microphones to investigate RASTI vs $\%AL_{cons}$, Inter-aural correlation coefficients, and live recordings of both concert hall acoustics and live jazz concerts.



Here's diffusion used in what we believe is its most important function, namely, creating a diffuse musical sound field in the studio. Early reports on this installation are bearing this out.

Shown below is "A Human Dummy Head" constructed by Hellmuth Kolbe.

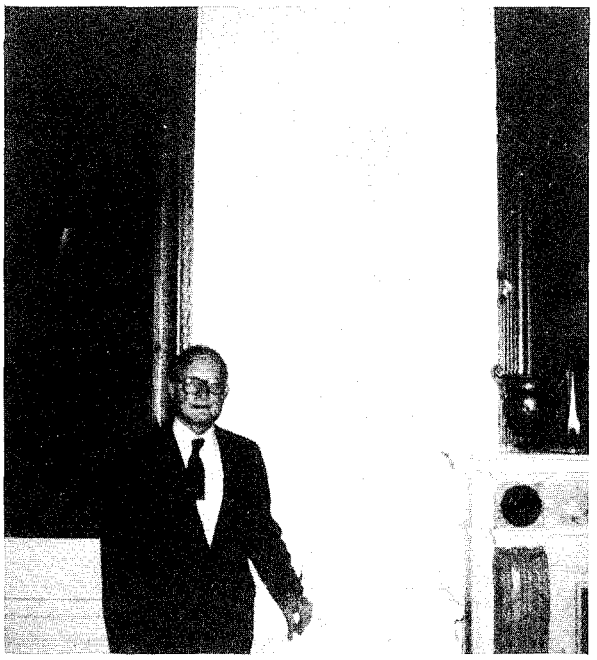


GENE PATRONIS TESTS WATERS

It is rumored that Gene Patronis, shown here at the President's podium in the East Room at the White House, has been considering running on the LaPlace Transform ticket after his success in providing a loudspeaker that can outshout Sam Donalson.

That the White House press corps needs a physic is beyond doubt and I'm sure Gene Patronis included that frequency for emergency purposes.

We were very pleased to see Dr. Patronis' innovative design placed in operation in this prestigious site. The design was constrained by the requirement to fit the array inside the existing architecture and still provide full frequency and dynamic range for both speech and music. Dr. Patronis did this design on behalf of the White House Communications Agency, working with their personnel in the installation and checkout of the system.



Standing next to one of the speakers in the East Room.

Pretending to be President. Speaker in background.

THE EFFECT OF N FACTOR

Rolly Brook took the time on a recent job to conduct a most useful test. Using a loudspeaker on stage as a substitute for a talker into the sound system microphone (see illustration), he then compared sound fields for

1. Loudspeaker on stage only (a talker from the stage).
2. Loudspeaker on stage plus a center cluster with a Q ≃ 11.
3. Loudspeaker on stage plus two low Q stereo loudspeakers. Q ≃ 2.
4. All loudspeakers on at the same time.

The effects of the complex N factor (see Tech Topic Vol 5 number 5, Jan. 1978, pages 35-38 of the new Syn-Aud-Con Lab Manual section on Sound System Design) are clearly evident as well as some interesting effects from descrete early reflections that affect the ratio of direct (defined here as the first 50 msecs) sound level vs reverberant sound level. The effect of N is a 10 log function and **if** all five sources developed equal acoustic power (remember the stereo **pair)** then the expected deterioration would be:

10 LOG 5 ≃ 7 dB

Looking at the summary table for all the measured samples indicates that this rule followed within few decibels at all the sampled locations.

Our gratitude to Rollie Brook of BB&N for the careful experimentation and thoughtful manner in which he approached gathering this data.

MEASUREMENT PARAMETERS

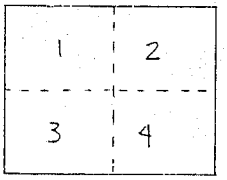
Frequency Range: 1500-2400 Hz

Time Span: 444ms with 10ms offset (10-454ms)

Sweep Rate: 200 Hz

Single pole integration, 5ms

Microphone Locations: Rows 1, 6, 11, 16, 21, 26, 31 (last)

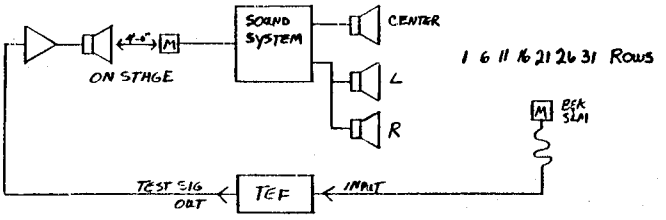


1. loudspeaker on stage only
2. 1 + center cluster
3. 1 + L & R stereo
4. 1 + 2 + 3

Center: 2 Renkus-Heinz C8H250-9 85°x50°; Q=11

L&R: BES Q≃2

Test Setup:

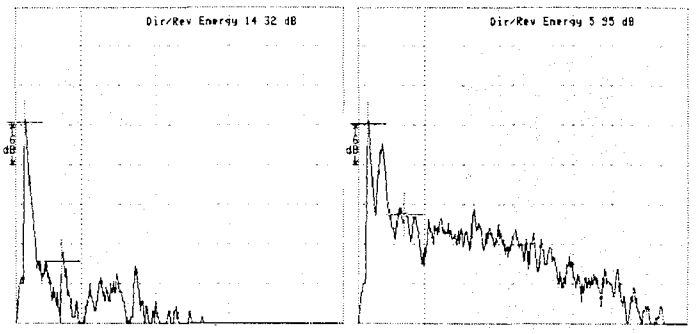


SUMMARY OF Dir/Rev Ratios

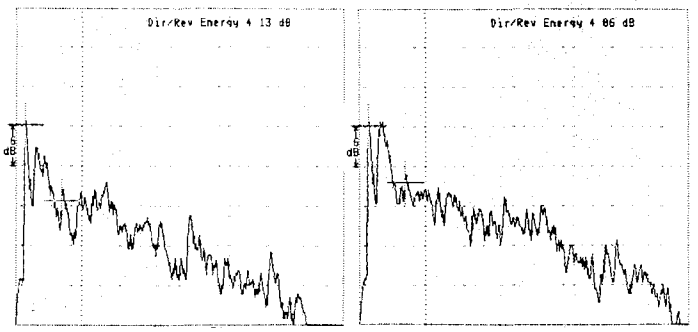
ROW	STAGE	CENTER	STEREO	ALL
1	14	6	4	4
6	14	7	3	3
11	13	5	5	4
16	12	4	5	3
21	10	9	0	4
26	9	6	4	3
31	8	4	1	1

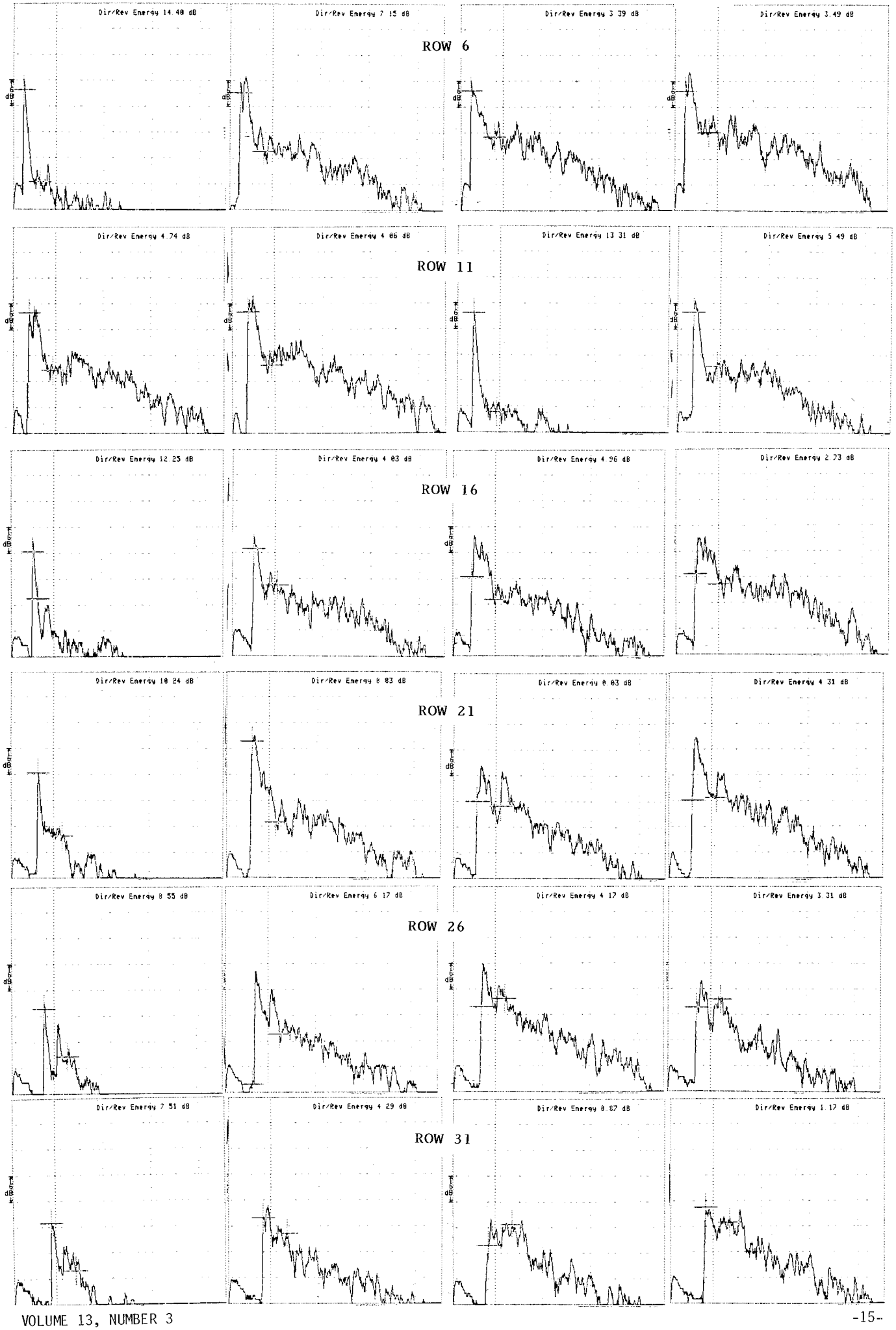
Dir = 0-50ms

Rev = 50ms - 444ms



ROW 1.




Dir/Rev Energy 14.40 dB
Dir/Rev Energy 7.15 dB
Dir/Rev Energy 3.39 dB
Dir/Rev Energy 3.49 dB
ROW 6
Dir/Rev Energy 4.74 dB
Dir/Rev Energy 4.06 dB
Dir/Rev Energy 13.31 dB
Dir/Rev Energy 5.49 dB
ROW 11
Dir/Rev Energy 12.25 dB
Dir/Rev Energy 4.03 dB
Dir/Rev Energy 4.96 dB
Dir/Rev Energy 2.73 dB
ROW 16
Dir/Rev Energy 10.24 dB
Dir/Rev Energy 8.83 dB
Dir/Rev Energy 8.63 dB
Dir/Rev Energy 4.31 dB
ROW 21
Dir/Rev Energy 8.55 dB
Dir/Rev Energy 6.17 dB
Dir/Rev Energy 4.17 dB
Dir/Rev Energy 3.31 dB
ROW 26
Dir/Rev Energy 7.51 dB
Dir/Rev Energy 4.29 dB
Dir/Rev Energy 8.87 dB
Dir/Rev Energy 1.17 dB
ROW 31

JOB DESCRIPTION

We appreciate Andy Anderson sharing with us his internal memos outlining the job qualifications within his company, Audio-Tech, Inc. of Norcross, GA (Atlanta area). Young men and women in high school should note that later employers will look at their scholastic record as part of their qualifications. One characteristic of a majority of audio professionals is their eagerness to pursue adult education throughout their careers.

Audio-Tech, Inc.

6990-D PEACHTREE INDUSTRIAL BLVD • NORCROSS, GEORGIA 30071
(GWINNETT GATEWAY PARK)
(404) 448 3988

MEMORANDUM No. 13

DATE: July 10, 1985

SUBJECT: Qualifications - Lead Technician

FROM: Andy Anderson, President

TO: All Employees

This is the first of a series of memos to clarify job qualifications, wage schedules and job descriptions. You are encouraged to obtain the education and training outlined to advance into a higher pay slot. Good Luck!

Education

1. One year graduate at an accredited school. GED test acceptable.
2. Two years vocational/technical school at an accredited school (military training acceptable, if equal) with background in electronics, computer programming and computer troubleshooting. GED (2 years college) test is acceptable.

Work Experience

3. One year installation experience with Audio-Tech, Inc., or another company if specializing in Dukane or equal equipment (must be verified).
4. Two years field service experience with Audio-Tech, In., or another company if specializing in Dukane or equal equipment (must be verified).

Other Training

5. Minimum of three Dukane technical schools
6. Minimum of two Jerrold or Blonder-Tongue Technical seminars
7. Minimum of one Syn-Aud-Con Technical seminar

Other Pertinent Requirements

8. State of Georgia Low Voltage License
9. Clear driving record with no moving violations for past five years
10. Clear police record as an adult (18 years or older)
11. Clear credit record
12. Valid Georgia Driver's License

Applicants for the position of Lead Technician must have graduated with a "B" average or better (10th, 11th and 12th grade averages only are considered for high school) and submit a copy of all pertinent school transcripts (mailed directly from the school to Audio-Tech, Inc.), diplomas, training certificates and honorable discharge papers. All applicable work experience must have been favorably rated at quarterly reviews with supervisor. Employees are required to sign waivers for verification of driving, criminal and credit records upon request. Availability for overtime work required. Other pertinent work experience will be rated accordingly.

Applicants must accurately complete a written and oral examination administered by Audio-Tech, Inc., before promotion to Lead Technician position. Submission of false information will be grounds for immediate dismissal without compensation.

THE 2ND GENERATION

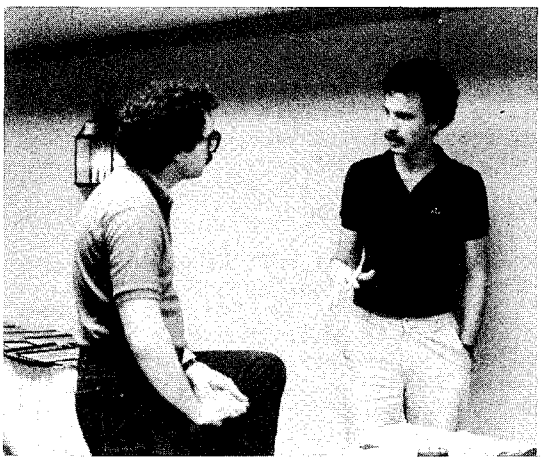
When members of the class start arriving on the first day we sometimes see someone walk in that we're sure we know but can't quite place him. Then we delightedly realize that it just has to be so and so's son, who was in our class 14 years ago.

It's fun to see the second generation arriving in Syn-Aud-Con classes with, "My dad says to say hello."

Ben Rosner, son of Alex Rosner of Rosner Custom Audio, Long Island City. Alex Rosner attended the first New York class in 1973 and many thereafter.

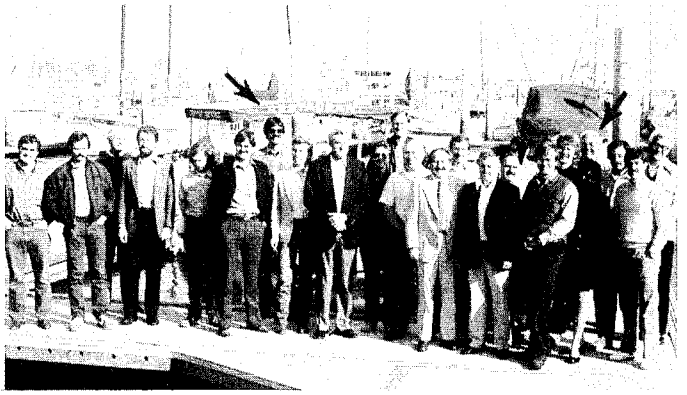
David Menasco with his father, W. T. Menasco of Stereo Sales in Tallahassee.

Richard Menasco from our 1984 Orlando class.



Jim Greenberg, son of Fred Greenberg, Dutchess Tel-Audio in Poughkeepsie, NY.

David Ballou, son of Glen Ballou, who started attending Syn-Aud-Con classes in 1974. (Glen is editor of the soon-to-be released replacement for **Audio Cyclopedia.**



Steve Wahrenbrock, son of our wonderful friend, Ken Wahrenbrock, who attended his first Syn-Aud-Con class in 1976.

WOOFER PROGRESS

Don Keele pointed out a number of years ago (1973) that nearfield measurements of woofers correlated well with anechoic measurements, i.e., by placing the microphone in the pressure zone of the woofer, accurate measurements of its response could be made in normal environments. (See "Loudspeakers" an anthology from the AES Journal Vol. 1 - Vol. 25 (1953-1977) pages 330-338.)

MEASURING LOW FREQUENCIES

Using this technique, our 1/4" B&K measuring microphone, and our TEF analyzer, we made the following measurements of Gene Patronis' new small Pataxial, designed for J.W. Davis & Co. in Dallas. Note particularly the very detailed frequency resolution of 7 Hz. The cursor on the second chart is at 40 Hz. The third chart was made in the far field in the same room (albeit of the full response, but with a resolution of 10 Hz) and what happens to the bass response caused by the standing waves in the room.

For an example, take the deep notch just below 300 Hz on chart three.

Our time window for the desired 10 Hz resolution is:

$$\frac{B}{S} = \frac{10}{100} = 100 \text{ milliseconds}$$

In a small room with a mean free path (MFP) of 7 feet,

$$MFP = \frac{4V}{S}$$

we could calculate that if sound travels

$$\frac{1130'}{1\text{sec}} = \frac{x'}{100 \text{ millisecond}} = 113' \text{ in } 100 \text{ msec}$$

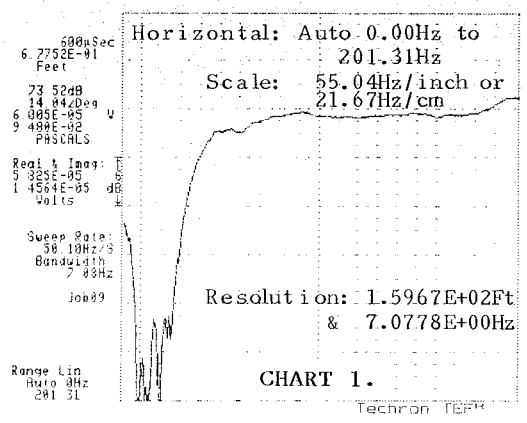
and the MFP is 7 feet then there were

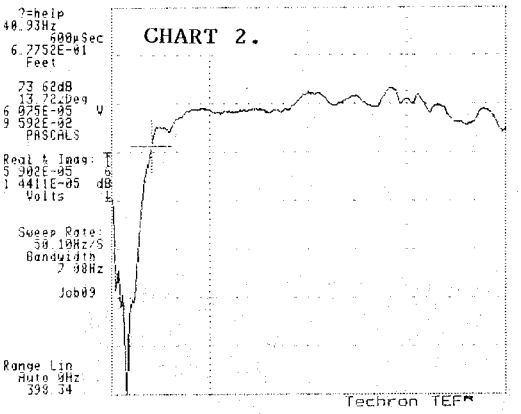
$$\frac{113}{7} = 16 \text{ reflections during}$$

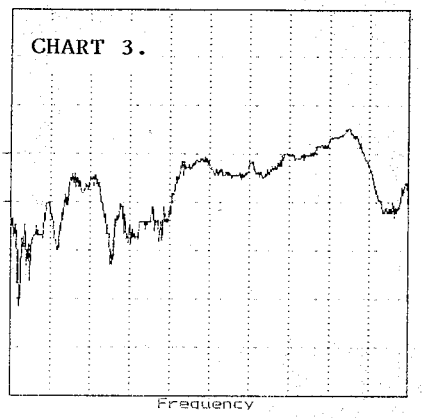
that time interval.

When we measure within a few inches of the woofer, we are in its pressure zone and we have a very high signal (the woofer) to noise (the reflections in the room) ratio.

How many of you remember the days when the "experts?" assured everyone that you couldn't measure bass frequencies with TEF analyzers.







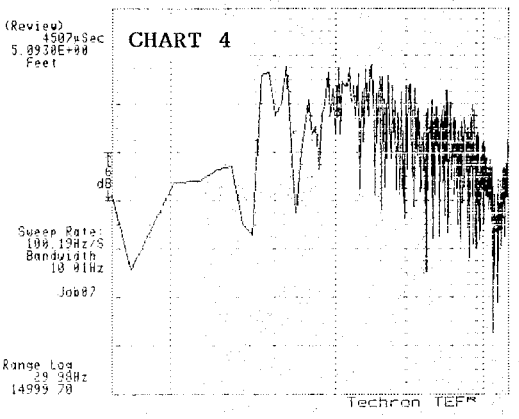
Vertical: 6dB/div with base of display at -7.0dB
0dB is located at .00002 Pascals

Horizontal: Auto 0.00Hz to 201.31Hz
scale: 55.04Hz/inch or 21.67Hz/cm.

Resolution: 1.6094E+02 Feet & 7.07Hz

Time of test: 4536 microseconds, 5.1597E+00 Feet

Sweep Rate & Bandwidth: 49.96Hz/Sec & 7.07Hz



Vertical: 6dB/div with base of display at -31.0dB
0dB is located at .00002 PASCALS

Horizontal: 29.98Hz to 14999.70Hz
Log freq axis (2.7decades)

Resolution: 1.1291E+02 Feet & 1.0010E+01Hz

Time of test: 4507 microseconds, 5.0930E+00 Feet

Sweep Rate & Bandwidth: 100.19Hz/Sec & 1.0010E+01Hz

FRACTIONAL OCTAVE DISPLAYS

Don Eger of Techron had a new disk waiting for us upon our arrival home from the Northwest. It has a new T-cursor program that converts EFCs to 1/1, 1/2, or 1/3 octave displays. Samples are shown here.

MEASUREMENT PARAMETERS:

Vertical: 5dB/div with base of display at 53.0dB
0dB is located at .00002 PA

Horizontal: 50.33Hz to 10001.70Hz
Log freq axis (2.7decades)

Resolution: 4.5114E+00 Feet = 2.5048E+02Hz

FIGURE 1. RAW CURVE

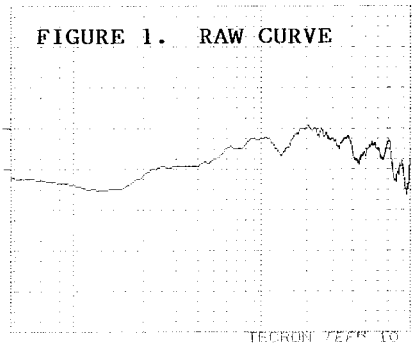


FIGURE 2. LOG. FREQ. 1/3 octave

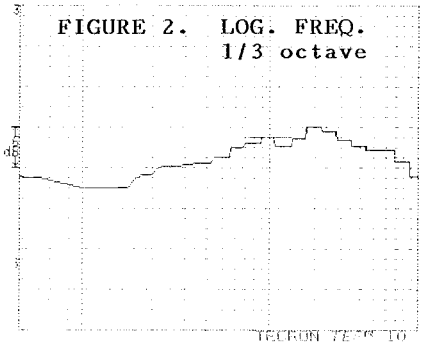


FIGURE 3. LOG FREQ. 1/3 octave Overlaying raw curve

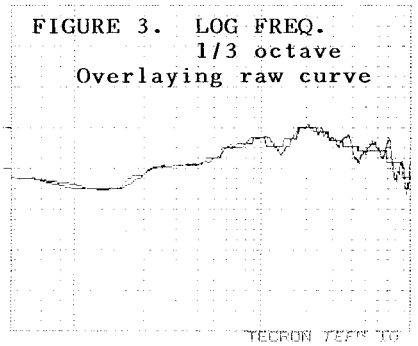


FIGURE 4. Linear Freq. 1/3 octave Overlaying raw curve

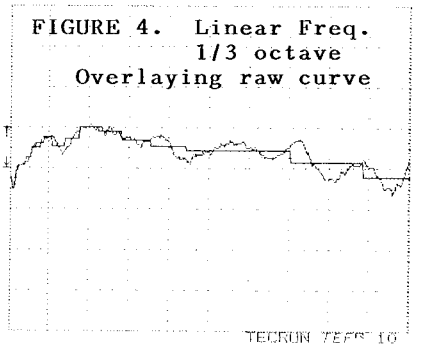


FIGURE 5. LINEAR FREQ. 1/3 octave

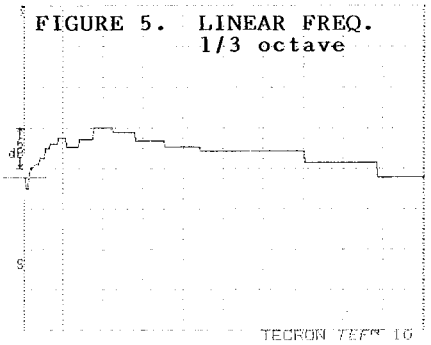


FIGURE 6. LOG FREQ. 1/1 octave

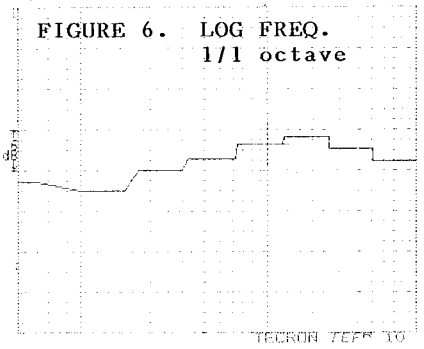
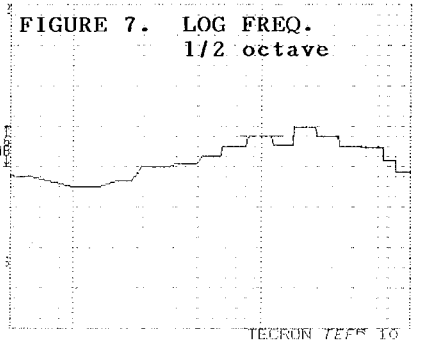


FIGURE 7. LOG FREQ. 1/2 octave



1933 DEFINITION OF GAIN OR LOSS

"In communication work, the common logarithm of the ratio of power P_2 which exists in the **termination or receiver** when the device or circuit under consideration is inserted, to the power P_1 which exists in the **termination or receiver** when the device or circuit is removed, is a measure of the transmission "loss" or "gain" in bels, which the device or circuit introduces.

$$\text{bels} = \text{LOG}\ \frac{P_2}{P_1}$$

dB is defined as $\frac{P_2}{P_1} = 10^{0.1}$

$$1.0\ \text{dB} = \chi\ \text{LOG}\ 10^{0.1}$$

$$\chi = \frac{1.0\text{dB}}{\text{LOG}10^{.1}} = 10$$

$$\therefore\ 1.0\ \text{dB} = 10\text{LOG}\ 10^{0.1}$$

RADIO PHYSICS COURSE
ALFRED A. GHIRARDI 2nd Edition, 1933.

MR. BABBAGE'S SECRET

Syn-Aud-Con is attempting to find a copy of Ole Immanuel Franksen's book, "Mr. Babbage's Secret: The Tale of a Cypher-and APL" published by Prentice-Hall, Englewood Cliffs, NJ 07632.

This book relates what secret codes a Victorian Scientist and a programming language APL have in common. They are all associated with the Cryptographic Conservation Law, Charles Babbage's rule for solving cryptographs. According to Franksen, Babbage generalized his theories of the nature of data into the laws of cryptography. In Syn-Aud-Con's opinion, Charles Babbage is one of the most brilliant humans ever to face the frustration of being a full century ahead of his time.

We already possess a number of books on Babbage and have never failed to come away from each of them with enhanced knowledge about present day data procedures. Two ideas Franksen develops in his book we are told by a reviewer "are the relationship of the study of data to all other sciences and the interrelationships among data."

That alone would seem to qualify Mr. Franksen's book for careful study.

NEW TEF OWNERS

Fran
Ronco Communications
595 Sheridan Drive
Tonawanda, NY 14150
(716) 879-8162

Earl Rapp
Eastman Kodak
901 Elm Grove Road
3rd Floor Bldg. 1
Rochester, NY 14650
(716) 726-0543

Amel Hill
Hill Engineering Assoc.
807 So. Orland, Ste. O
Winter Park, FL 32789
(305) 628-0552

Claire Ford
Ford Audio-Video
4800 W. I-40
Oklahoma City, OK 73128
(405) 946-9966

Jim Porter
Eastern Michigan Univ
130 Old Alexander
Ypsilanti, MI 48197
(313) 487-4144

Kurt Wasserman
K S Wasserman Audio
P O Box 596
North Hampton, MA 01060
(413) 584-2883

Accusonic Systems
2101 Jericho Turnpike
New Hyde Pk, NY 11040
(516) 328-3330

W. T. Menasco
Stereo Sales Inc
637 W Tennessee St
Tallassee, FL 32301

TECHRON LEASE /PURCHASE PLAN

We were talking to Cliff Sroka, a consultant in Portland, Oregon who said that he was purchasing a TEF analyzer and had been very pleased with the lease/purchase plan that Techron had available for potential TEF owners so we asked Larry Shank at Techron to send us the information:

Here's the information on leasing you wanted: Techron currently is working with two leasing companies. The first is Commerical & Municipal Financial Corporation, 2801 Crabtree Lane, Northbrook, IL 60062, 312-480-0767. The other is Colonial Funding Corporation, 789 Walt Whitman Road, Melville, NY 11747, 516-673-6850. Currently, the best rates are obtainable through Commerical & Municipal.

A sample rate plan would be: $10,000 equipment purchase with a $1,000 down payment.

Monthly payments for 36 months would be $321, 48 months $254 and for 60 months $213. At the end of the lease, the user of the machine would have the option of buying it for $1.

The advantage to using a third party leasing company is twofold. First, we are able to pass along our cash discount (2%) and a second if the person ac- quiring the machine has special needs, the leasing company is equipped to work out a package that would best suit the company.

The purpose for the lease program is to the TEF Analyzer into a form that is much easier to cost justify. By bringing it down to a cost of $250 per month, a contractor can include the cost of analysis and documentation in one or two jobs a month andallow the TEF Analyzer to earn it's keep.

FINDING THE E_{IN} FOR A GIVEN L_{AIP} OR THE L_{AIP} FOR A GIVEN E_{IN} SENSITIVITY

$$E_{IN} = \frac{\sqrt{0.001\ R_S\ (10^{\frac{(L_{AIP} + 6.02\ dB)}{10}})\ (R_{IN})}}{(R_S + R_{IN})}$$

$$L_{AIP} = 10LOG\left(\frac{(E_{IN}\ (\frac{R_S + R_{IN}}{R_{IN}}))^2}{0.001\ R_S}\right) - 6.02dB$$

EXAMPLES

Mixer output is +4VU and the R_S = 130Ω. Power amplifier sensitivity is 3.6V for full output. Its R_{IN} = 47,000Ω .

$$VU + 10dB = L_{AIP} = +4 + 10 = +14dBm$$

$$E_{IN} = \frac{\sqrt{0.001(130)\left(10^{(\frac{+14 + 6.02}{10})}\right)\ (47,000)}}{(130 + 47,000} = 3.6V$$

$$L_{AIP} = 10LOG\left(\frac{(3.6(\frac{130+47,000}{47,000})^2)}{0.001\ (130)}\right) - 6.02 = +14dBm$$

$$VU = L_{AIP} - 10dB = +14 - 10 = +4$$

"THE FIRST SIXTY YEARS"

Not many audio companies can look back 60 years under the same ownership. Shure Brothers can. They are looking forward to a very bright future. As President, James Kogen says, "We are in the forefront of teleconferencing and already have become a recognized industry leader in this important new area of communications." And so they are.

If you want to look back 60 years with Shure, they have published a catalog "The First 60 Years Were Just The Beginning." Look at it for an example of what we think is an excellent catalog. It conveys Shure's illustrious and exciting past and their dynamic future in 16 pages.

NEW FP-32 STEREO MIXER

SHURE®
85-7-26 9-85

FP32 STEREO AUDIO MIXER

With the introduction of stereo television broadcasts, the need for a stereo mixer has become critical.

Like its forerunner the FP31, the FP32 puts a multitude of features into an extraordinarily small package. These include two transformer-isolated outputs (one for each stereo channel) and three transformer-isolated outputs (one for each stereo channel) and three transformer-isolated input, each of which includes a level control, center-detented stereo pan pot, and a switch permitting mic- or line-level operation. The mixer's stereo capability is further enhanced by a concentric clutched stereo master gain control.

Condenser microphones may be powered by the FP32's built-in 18 Vdc phantom power or 9 Vdc A-B power source. In addition, a "phantom" jack permits the use of an external power supply if desired. Both mini and 1/4-inch stereo headphone jacks with level control are provided, as well as a monitor input for monitoring from a VTR.

The FP32 also includes a built-in slate microphone with automatic gain control and a slate tone for identifying take locations. Other features include a built-in limiter with adjustable threshold, dual VU meters with lamp and battery check function, 12 Vdc external power jack, stereo auxiliary-level outputs, and a functional carrying case.

Some products delight by their simple elegance. We have been a fan of the mono FP31 since its inception and feel that the stereo FP-32 is as timely a product introduction as we have witnessed in a long time. This unit will be widely used outside of broadcasting as well.

RCW 320 LABORATORY SIGNAL PROCESSOR

In November Don addressed the local section of the AES in D.C. During questions, someone asked a question on adaptive filters. Don said, "The best man to answer that question is Dr. Paul of Digital Audio Corp." The man said, "I am Dr. Paul."

Digital Audio Corporation has introduced a multipurpose digital laboratory signal processor. This new instrument replaces several analog laboratory instruments and provides the superior performance of 16/32 bit digital signal processing. It performs AGC, adaptive filtering, comb filtering, clipping, and spectral filtering. Included in the instrument are selectable 80th order linear phase, eight-pole elliptic, and eight-pole Butterworth digital filters.

The RCW320 is self-contained and is easy to operate. The user merely selects the mode and sets the desired values on two numeric displays. The RCW320 automatically carries out the specified signal processing. The RCW is priced at $5990.

DAC has a new address: 6512 Six Forks Road, Suite 203B, Raleigh, NC 27609-2946. Phone: (919) 848-0845.

SPEAKER MOUNTING QUESTIONS

James Neo, a TEF owner from Yamaha Music in Singapore, asked us some interesting questions.

1. Are there any books or articles available on speaker mounting techniques and its constraints?

2. Which is better fabrication or steel brackets or using steel chains or a combination of both?

3. Which has a greater vibration transmission - steel bar or chain?

4. Would the vibration transmitted from the speaker especially the low frequency enclosure from the steel bar damage the reinforced concrete?

My answers are (1) no, unfortunately; (2) both; (3) bar; and (4) very doubtful.

Does anyone have anything to add? We'd appreciate hearing from you.

BELL LABS ON THE VU

Harry Miyahira, President of HME, recently called our attention to a book we had in our library that contained a discussion we had failed to see. We are reproducing the sections below.

Remember that the value in VU is never read from the instrument, but from the attenuator associated with the instrument. The statement "by someone who knows how" means both how to average the dynamics of the signal and how to algebraically sum the attenuator value and the instrument indication.

TRANSMISSION SYSTEMS FOR COMMUNICATIONS

By

Members of the Technical Staff
Bell Telephone Laboratories

THIRD EDITION

Bell Telephone Laboratories, Incorporated

Volume

A *periodic* current or voltage can be characterized by any of three related values: the rms, the peak, or the average. The choice depends upon the particular problem for which the information is required. It is more difficult to deal with complex, *nonperiodic* functions like speech in simple numeric terms. The nature of the speech (or program) signal is such that the average, rms, and peak values, and the ratio of one to the other, are all irregular functions of time, so that one number cannot easily specify any of them. Regardless of the difficulty of the problem, the magnitude of the telephone signal must be measured and characterized in some fashion which will be useful in designing and operating systems which involve electronic equipment and transmission media of various kinds. Signal magnitudes must be adjusted to avoid overload and distortion, and gain and loss must be measured. If none of the simple characterizations is adequate, a new one must be invented. The characteristic unit used is called "volume" and is expressed in *vu* (volume units). It is an empirical kind of measure evolved to meet a practical need and is not definable by any precise mathematical formula. The volume is simply the reading of an audio signal on a carefully specified volume indicator, called the vu meter, when the meter is read in a carefully specified fashion.

The development of the vu meter was a joint project of the Bell System and the two large broadcasting networks. It was decided that the principal functions required of such a measuring device were:

1. Measuring signal magnitude in a manner which will enable the user to avoid overload and distortion.
2. Checking transmission gain and loss for the complex signal.
3. Indicating the relative loudness with which the signal will be heard when converted to sound.

Since one of the principal functions is the detection of overload conditions, it might be suspected that a peak reading instrument would be most desirable. A difficulty arises, however, when a peak reading instrument is used to compare signal magnitudes at various points in a long circuit. The effect on waveshape of delay which is not constant with frequency is drastic, particularly on sharp peaks. Thus, two readings taken at widely separated points might indicate a loss or gain in the circuit when in fact there was only delay distortion. For this reason the vu meter is an rms-reading instrument, in effect integrating the signal over a short period, but a period long enough so that circuit delay distortion will have negligible effect on readings. At the time the vu meter was proposed, subjective tests were made to assure that it was a good indicator of overload, despite its inability to follow the sharpest peaks. An rms-reading meter can be used satisfactorily because of the physiological and psychological factors involved in the ear's appreciation of distortion. Considerable distortion can apparently be tolerated if it occurs in rare, short peaks.

While the rms meter used in the vu meter is slower than a peak reading device, it does not measure long term power. The meter follows a complex signal with a certain amount of sluggishness and, as the results of the overload detection test indicate, it is a good indicator of the signal peaks which cause annoying overload, i.e., peaks that vary at about a syllabic rate. In actual use, it is read with a special technique. The peak swings of the meter are observed and averaged mentally, with occasionally rare, high-valued peaks ignored. The resulting "averaged" reading, taken in this unique fashion, is the "volume" of the audio signal being observed. The value of the vu meter as an indicator of relative loudness in the eventual acoustic signal is derived from the fact that there is a statistical relationship between peaks, integrated peaks, and the longer term average power in speech and program material. As a matter of fact, either a peak reading or an rms-reading meter would be satisfactory in this respect. It is true that this statistical relationship depends upon the type of material. In practice, however, it is found that the vu meter can be used equally well for all speech, whether male or female. There is some difference between music and speech in this respect, and so a different reading technique is used when using the vu meter for measuring program material.

For convenience, the meter scale is logarithmic, with a 10-log scale. That is, readings bear the same relationship to each other as do decibels. However, the scale units are in vu, *not* in decibels. It is true that the meter will measure a continuous sinusoid imposed upon it. It is also true that a correlation between the volume of a talker and his long term average power or his peak power can be established. Such correlations are valuable, but the fact that they exist should not be allowed to confuse the real definition of volume and vu. Putting it as simply as possible, a −10-vu talker is one whose signal is read on a volume indicator (by someone who knows how) as −10 vu.

It should be noted that the vu meter has a flat frequency response over the audible range and is not frequency weighted in any fashion.

WHAT LEVEL ARE YOU SENDING?

You are out on a remote site with a Shure M267 and have turned on the oscillator on input number one. You carefully adjust to an instrument indication of zero. What level are you sending down the phone line you have the output of the Shure mixer connected to? The answer depends solely on which way the instrument attenuator on the rear of the mixer is set. It can be either +4 or +8. Since you are sending a sine wave oscillator signal, let's say of +4, you call it +4dBm. If you had the same reading on program material (speech, music, etc.), you'd call it +4VU.

To obtain an idea of the minimum power capability you'd have to have at the output of the mixer in order to actually be safe at +4VU, add 10dB to the VU reading (meter indication plus attenuator value) for the +14dBm capability required.

Mixer Without A VI Instrument

Now let's suppose you're using a mixer that does not have its own VI instrument properly built in as in the case of the Shure unit. You are going to place one of the new high impedance VI instruments across the mixer's output. How should it be calibrated if you are to see true levels? Let's again say we want to send a +4dBm oscillator signal down the phone line. In this case, you are no longer reading the mixer's E_{Θ} unless the load was of very high impedance. You can now do the following:

1. Measure the impedance of the telephone line, i.e., 900 Ω.

2. Measure the output impedance of the mixer, i.e., 130 Ω.

3. Measure **the open circuit voltage** of the mixer when at the level that generated the desired level across a 600Ω load, i.e., 1.46V).

4. Desired E_{IN} equals:

$$E_{IN} = \frac{E_S \times R_{IN}}{R_S + R_{IN}}$$

$$E_{IN} = \left(\frac{1.46\ (900)}{130 + 900}\right) = 1.28V$$

CLASSIFIED

JOB OPPORTUNITIES:

AUDIO CIRCUIT DESIGN ENGINEER: Due to recent expansion and increased business activities, UREI has an opening for a product designer. Applicant must have substantial experience in all phases of audio circuit design, B.S. preferred. UREI offers competitive salaries and excellent benefits. Forward resumes to R.B. Combs, UREI, Inc., 8460 San Fernando Road, Sun Valley, CA 91352.

* * * * * * * * * *

SALES ENGINEERS/MANAGERS: Join our expansion program and enjoy unlimited earning potential.

Openings exist for experienced Sales Engineers in Audio/Video Systems and Health Care Communications in Michigan, Ohio and Florida. Positions offer an outstanding salary and bonus plan plus excellent fringe benefits including a stock ownership plan.

If you have a successful background in the Professional Sound and Communications Industry and are looking for an opportunity to gain personal and financial independence, call or send your resume to:

Frederick J. Shuart, Industrial Communication Company, 21470 Coolidge Highway, Oak Park, MI 48237. Phone: (313) 399-4900.

All replies will be held in strict confidence.

FOR SALE:

* **HP-41C** with Quad Memory Module, Printer, Wand, Card Reader, PPC ROM, Home Management ROM, Extra magnetic cards, new box of black printing paper, Audio 41-C programs, HP User Club programs. $650.00

CONTACT: Tim Purcell, 3020 Balboa St., San Francisco, CA 94121. (415) 386-7154

* **TECRON TEF 10** System. Includes: Analyzer with 2-DD, Soft Case, Asst. cables, Epson MS-80F/T printer, extra software. All for. . . $10,500.00

CONTACT: Richard Lee at Home: (305) 587-3041 or Office: (201) 833-5220

* **ACOUSTILOG** Reverberation Meter. A precision decay timer with built in noise generator and digital readout. $250.00

CONTACT: Syn-Aud-Con, P.O. Box 669, San Juan Capistrano, CA 92693. (714) 728-0245.

* **TV DISTRIBUTION** Amplifier/Stabilizer/Enhanced/ RF Converter, Model V1890 . . . . . $ 50.00

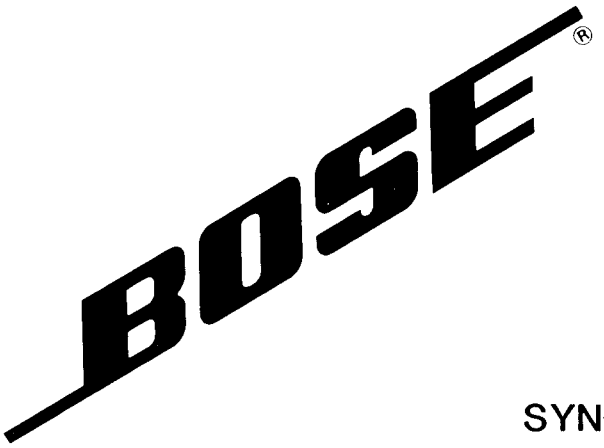
* **EV MICROPHONES**, all excellent condition - low Z Balance: (1) RE-20; (3) 664's; (2) 630

* **ANTIQUE MICROPHONES:** 04G Lavalier microphones; hand microphones; desk microphones; one Stevens Tru-Sonic mike, pre-amp, with leather carrying case.

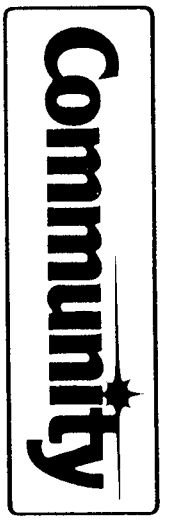
* **TWO RCA** Suitcase speakers.

* Other antique sound equipment.

CONTACT: Foster Barker Sound/Jim Stinson
Home phone: (714) 548-1622



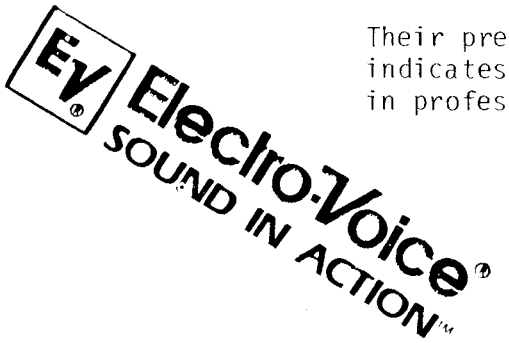
SYN-AUD-CON SPONSORS



Syn-Aud-Con receives tangible support from the audio industry, and twelve manufacturing firms presently help underwrite the expense of providing sound engineering seminars. Such support makes it possible to provide the very latest in audio technology while maintaining reasonable prices relative to today's economy and to provide all the materials and continuing support to all graduates of Syn-Aud-Con.

Personnel from these manufacturers receive Syn-Aud-Con training which provides still another link in the communications circuit between the ultimate user and the designer-manufacturer of audio equipment. They are "in-tune" with what a Syn-Aud-Con graduate needs.

Their presence on this list as a Syn-Aud-Con sponsor indicates their desire to work cooperatively with you in professional sound.



Benchmark Media Systems, Inc.
Bose Corporation
Community Light & Sound, Inc.
Crown International
Electro-Voice
Emilar Corporation
HM Electronics, Inc.
Industrial Research Products, Inc.
JBL Professional/UREI Electronics
Shure Brothers Inc.
Switchcraft, Inc.
TOA Electronics