SYNERGETIC
SYN AUD CON
AUDIO CONCEPTS

newsletter

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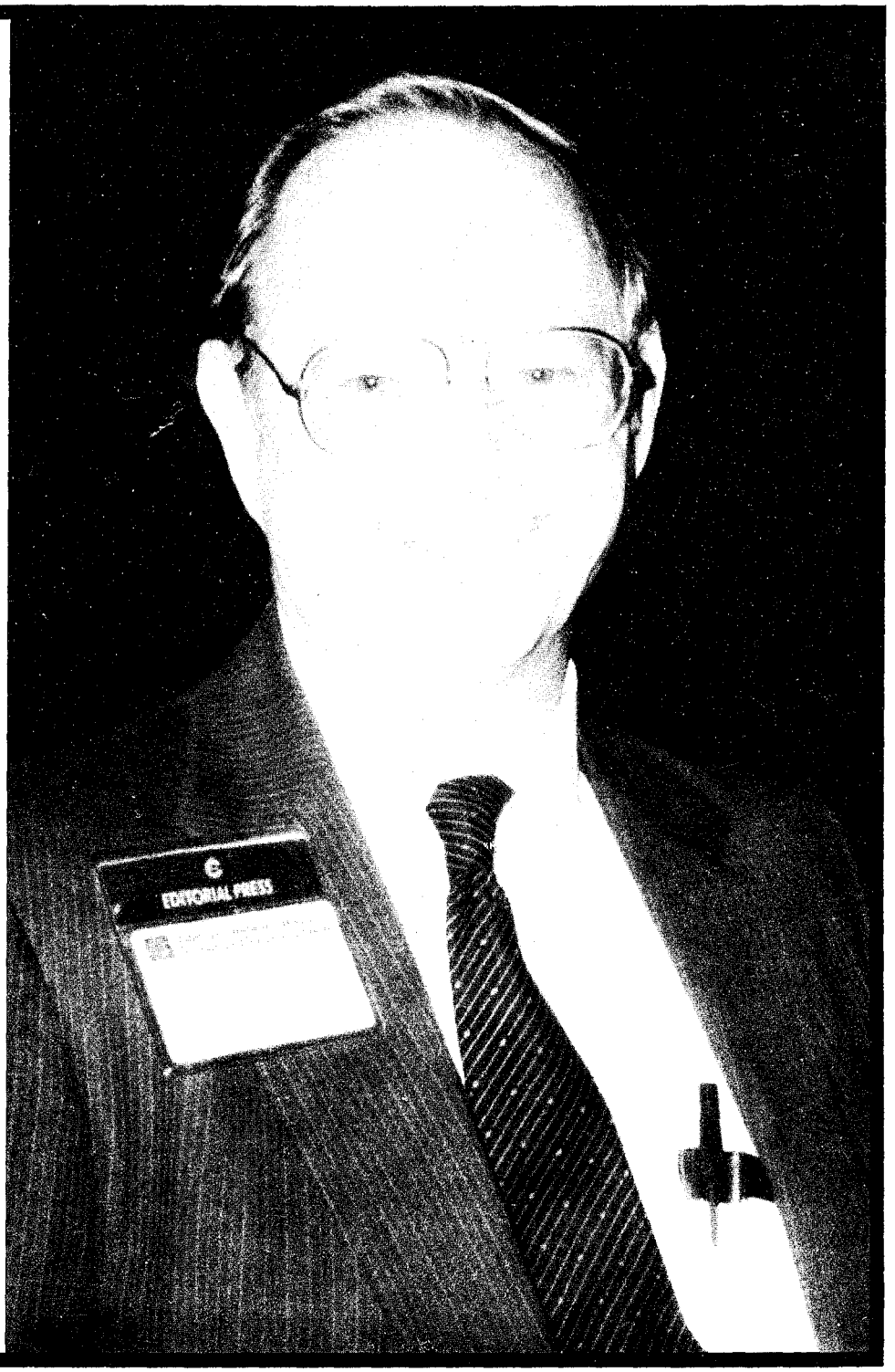
Spring 1987

The photograph shows Richard C Heyser-- Dick Heyser to the thousands of Syn-Aud-Con grads privileged to know him--at one of his happiest moments.

This beaming face, alert eyes, and overflowing pent-up mental energy was his standard operational mode. To all of us privileged to know him well (twenty-plus in our case - from 1965) he exemplified every concept of a great scientist.

We **knew** we were in the presence of a great mind being fully exercised. That he shared so much with us humbled us at first, then left us exalted at having understood a "widows mite".

I believe that his statement, "There is an IS" sprang from a God-given glimpse of a fundamental new proof of casuality over chaos in our universe. I believe the glimpses frightened him at times because he had no one with whom he could communicate his vision.



RICHARD C. HEYSER 1931 - 1987

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RICHARD C HEYSER 1931 - 1987

Richard C Heyser, 1931-1987, was a man of unique genius. On March 14, 1987, the world lost a wonderfully gifted human being after a heroic fight against cancer.

Dick Heyser is a continuing companion in all our thoughts. He single handedly founded a whole new school of analysis. He was unswervingly true to his vision. He was always a steadfast friend to anyone willing to try to understand. He knew no enemies.

Audio was Dick's hobby, his passion if you will. He found audio still in the 15th century and when he left, he had almost single handedly brought it into the age of quantum mechanics.

Because of his remarkable human qualities and his innate belief that others were as bright as he was he shared again and again his practical skills and his theoretical insights with the most humble of his disciples. He remarked one time in the midst of a paper he was presenting, *"It gives me a certain amount of pain to give away in 10 minutes what it took 10 years to gather".*

He loved music and regularly attended concerts at the Ambassador auditorium near his home.

He had a deep spiritual yearning and was totally comfortable around committed religious beliefs, though he was not a member of any church. He once expounded with fervor that his understanding of the truth was that "there is an is."

He loved fast sports cars. He was interested in firearms - his father had been a Chicago policeman and had flown in World War I. He resisted most scientific toys - calculators, computers, but when the Techron TEF analyzer came along with a computer attached he rapidly became a very gifted programmer.

Dick's Other Lives

Audio was merely Dick's hobby. He earned his daily bread as a senior scientist at California Institute of Technology's Jet Propulsion Laboratories, JPL, operated by them for NASA. He was intimately involved in deep space probes, underwater sound exploration, ultrasonic analysis, and many, many other scientific endeavors. He operated as consultant to every department at JPL as needed and was reported to walk into a difficult problem and say *"let's try this"* which was in a majority of the cases the correct final solution.

Never in the twenty five years we were privileged to know him did he ever sit in any group where he was not the focus of everyone's attention as a natural right that falls to giants on this earth.

Dr. Emanuel Tward, who worked closely with Dick for 20 years at JPL writes of Dick,

His great love of acoustics allowed him to use his theory to derive measurable quantities which verified his concepts. The validity of the concepts are being attested at the most practical level by the growing number of users of commercial products based on TDS.

On a personal note, Dick Heyser was a Renaissance man in my eyes. He was a boy genius until the day he died. He questioned everything, had to understand everything, and knew so much about everything. He delighted all who surrounded him by his ingeniousness, his ingenuity, his kindness and his modesty.

Illustrative of the man is this story he told me, two weeks before he died, of one of his earliest memories -- He recalled being an infant in a pram which had a little window in the hood and looking out through the hood at a car passing on the street. The car had spoke wheels. He remembered wondering which direction the spokes were turning as the wheel rotated.

Richard Heyser questioned everything and answered many of the questions that we mere mortals didn't have the sense to ask in the first place.

Richard C Heyser - The Geometer

Dick addressed our Intelligibility Workshop in Chicago in September, 1986 only a few days before he entered the hospital with a "sore neck muscle". He remarked to the class that in the First Church of the Chirp that he would like to be remembered as a geometer.

In today's world the term genius is so often so tritely used as to despoil the real sense of the word. The company Dick is now with is surely Archimedes, Descartes, Newton, Leibniz, La Place, La Grange, Fourier, Euler, Gauss and Hilbert. Heyser's transform is a fact that cannot be ignored. It may take another century before its full importance is realized and understood.

Plato said " God ever geometrizes". Heyser, the geometer, should feel at ease with that God.

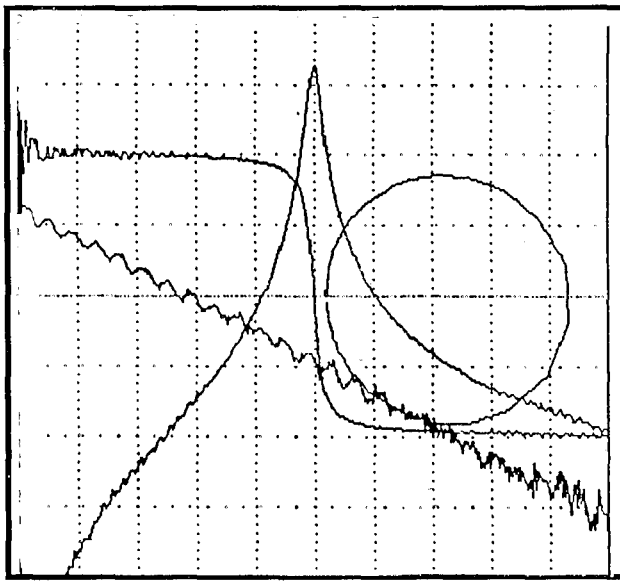
On his special Heyser disc for TEF analyzers Job #1 contains the data that allowed the display shown in Figure 1. Only one of the curves shown in Figure 1 originated with Heyser. Easy access to all of them did originate with Heyser. Long before FFTs were available at even unreasonable prices to do any of this, Heyser was doing it with ease on an analyzer he had paid $125 for at a surplus outlet and converted to do his transform.

The beautiful mathematics of his transform that details the geometry seen here is a series of complex exponential expressions.

Heyser once said to a Syn-Aud-Con class,

"The axioms and postulates of that which we call common sense is math. When its dried up and withered and appears as little chicken tracks on a piece of paper, that isn't math! That's just the residue of it, just the shorthand that lets people know that a mind went past here on this page."

In Heyser's case, a giant of the scale of Newton went past and the earth is still shaking. As the 1800s began, Fourier developed his transform. As the 1900s began, Hilbert gave



These plots are:

1. The ETC of a bandpass filter.
   (The line that slants from left to right lowering in level as it goes)

2. The phase response of the bandpass filter.
   (The line that starts high on the left, passes through 0 precisely at the center and then curves off the screen to the lower right)

3. The amplitude response of the bandpass filter.
   (The curve that rises to a peak at the top center)

4. The Nyquist phase plot.
   (The circle to the right)

us his transform. As the year 2000 approached Heyser saw the overall general case transform which included his predecessors as special cases.

Some of us were privileged to know this man and his work while he was here with us. We cherish that unique opportunity and feel indebted to him for it. Heyser once said in a technical paper for an Australian Journal:

"We may have been casting our analytical gaze on the ground all this time, not realizing we could look upward to the heavens."

To be inspired means "to be touched by the hand of God". Dick Heyser was easily the most inspired human most of us will know. Like a bright light in a dark room, he was always the sole focus of attention at those functions he graced. For decades we measured other men by their response to Heyser. It would have been grossly unfair to measure them against Heyser but in their response to him one could quickly see either alertness and receptivity or else dullness and insensitivity.

A special duty falls to those of us who knew and respected Dick. It is to further his work, protect his ideas from being taken by others, and to come together when we can to explore how to complete his unpublished energy theorem.

We are all saddened by the passing of such a giant. But, the memorial he would have most preferred would be the full and complete utilization of his ideas in the world of engineering and science. We can all help bring that to pass. It's the least we can do.

Written for Mix Magazine

JEFF LOETHER & AUTOCAD

We have a lot of respect for Jeff Loether. We first met Jeff when he came to one of our seminars at Rancho Carrillo about 1980. He was new at Marriott and new to audio. He asked to stay over an extra day after the seminar to go over all the material, and we agreed because his desire to learn was so evident. Jeff took two up-date classes from Syn-Aud-Con. Additionally, the late Mel Sprinkle tutored Jeff.

Anyone who has worked with Jeff Loether on a Marriott specification or read his recent articles in **Sound & Video Contractor** knows that Jeff has become a force in the audio industry, especially with hotel sound systems. Sound contractors that have worked with him know that he will not compromise quality.

Jeff wrote us recently about the two articles he has written for S&VC and mentioning his work with AUTOCAD. He asks,

"Are you aware of an interest in an audio engineering user group for AUTOCAD drafting?" He goes on to say that "So far, I have assisted 10 audio/video contractors in setting up their own CADD workstations and systems such as AUTOCAD. Please advise."

Jeff's offer is an outstanding value and a wonderful opportunity to work with a real professional in our industry.

Don & Carolyn Davis
Synergetic Audio Concepts
P.O. Box 1239
Bedford, IN 47421

Dear Don and Carolyn:

I recently received the long-awaited second edition of Sound System Engineering, and was very pleasantly surprised to see my work referenced in the chapter "Installing the Sound System." I am honored and encouraged by your validation of my approach to easy-to-use yet flexible system design.

The entire book is very timely, and is desperately needed in our industry. It should be a ready reference on every audio engineer's bookshelf. To that end, I am referencing Sound System Engineering, Second Edition, in Marriott's audio/video specifications as defining the standards of system design and installation.

Enclosed is a copy of my article which appeared in S&VC, as well as a draft of the follow-up article which should be published soon. For your records, my new office phone number is (301) 738-6405, or (301) 840-0074.

Much of my recent work has been accomplished using AUTOCAD, a microcomputer-aided drafting package. Are you aware of any interest in an audio engineering user group for CADD drafting? So far, I have assisted 10 audio/video contractors in setting up their own CADD workstations and systems using AUTOCAD. Please advise.

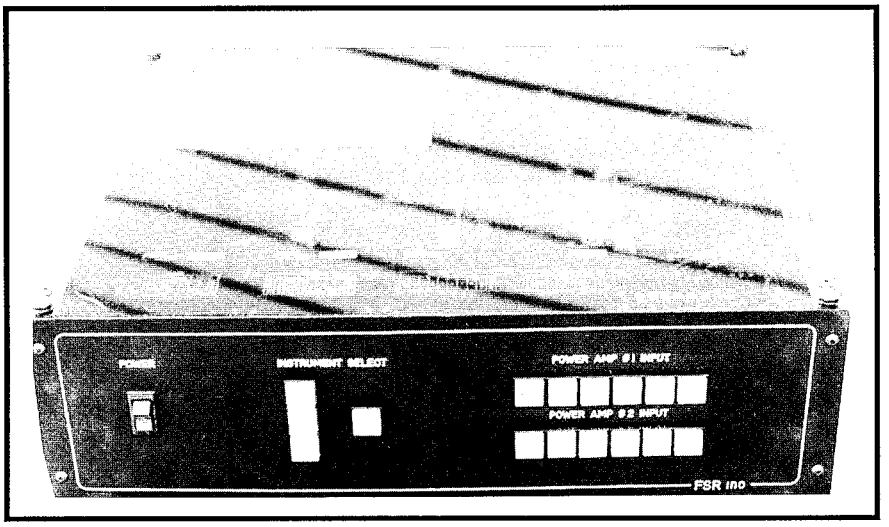
I will keep you current on developments regarding automated control systems, and I look forward to seeing you soon. Thanks again.

Faithfully,
Jeff Loether
Jeffrey J. Loether

You can write Jeff at 1214 Autre Court , Rockville, MD 20851

FSR, INC

Just a year ago we knew very little about FSR. We attended the NSCA show in Las Vegas in 1986 and saw Jeff Loether of the Marriott Corp. in the FSR booth. We stopped to chat with him and he said, "*Get to know these people. They have products the audio world should know about..*"



When Jeff Loether speaks, we listen (see Newsletter write up in this issue on Jeff's work at Marriott).

We had a friendly talk with Mr. Fitzsimmons and picked up their booth literature. It wasn't long before we were on the phone to Janice Sandri, vice president of FSR. We were excited about their products. We talked to engineering about building us a controller for our classroom equipment setup.

New FSR Controller for Syn-Aud-Con

Jeff Fischer, FSR chief engineer, came into our New York class so that he could see first hand what we really needed. He and Bob Allen engineered a unique controller for use in Syn-Aud-Con classes.

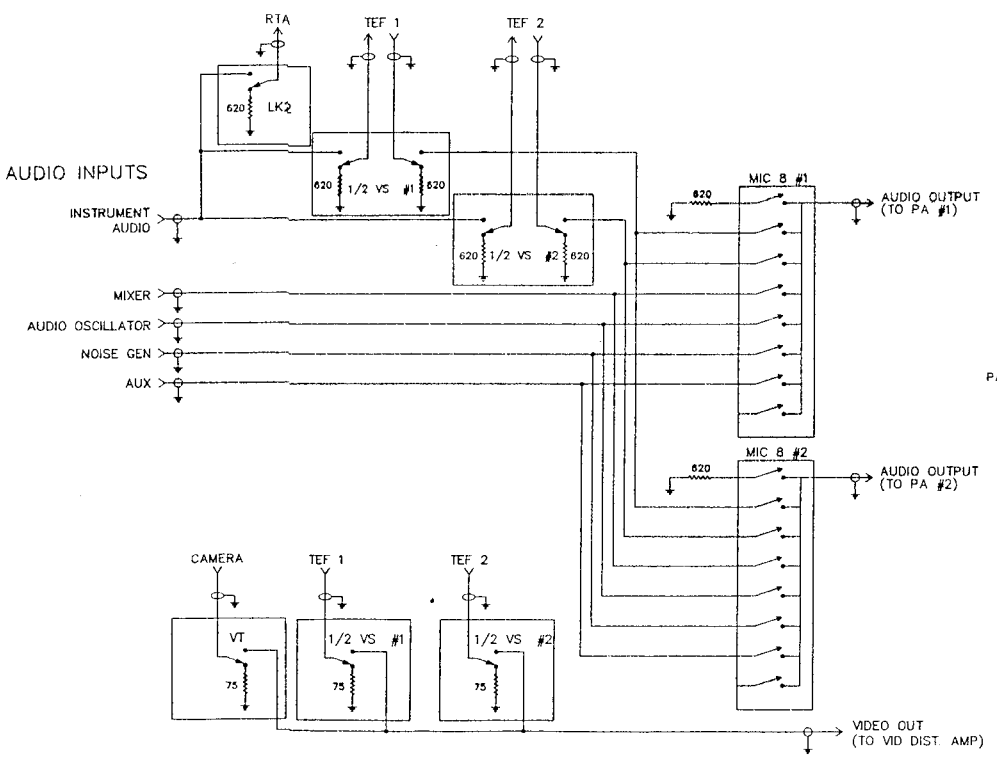
This controller at the push of a button switches our sound level meter to the input of whatever analyzer is chosen, the test source to the appropriate amplifier and the video outputs to our distribution amplifier.

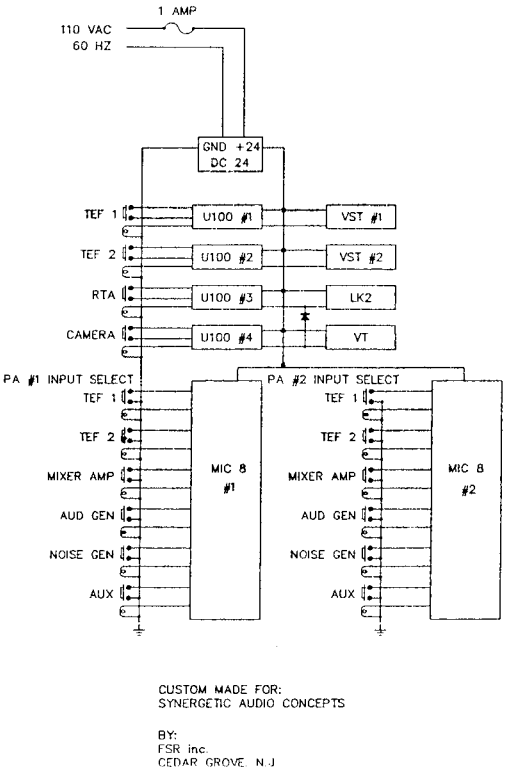
We can now have the same test viewed rapidly at the push of a button to:

(A) The time domain in TEF
(B) The frequency domain in TEF
(C) The real time analyzer
(D) Or, the mixer so we can talk test it.

This means the class can have more demonstrations in the same amount of time or, if desired, less time spent on present demonstrations.

The top plate is plexiglass so that the class can see the modular layout and how efficiently FSR was able to use their





standard components to design a "one of a kind" custom unit for us.

Custom Engineering

The custom engineering department can handle everything from a custom panel to sophisticated microprocessor systems as is evidenced by the unit they built for Syn-Aud-Con.

Combining Systems

For those of you involved in complex conference systems or large "creative rooms" be sure to check out the DL-64 conference control system. This unit eliminates large difficult-to-maintain multi-pin connectors between system elements (just 4 wires -- 2 for power and 2 for data.

I'd hate to have to try to do a large system today with out a resource the equal of FSR.

FSR, Inc. is one of the country's leading suppliers of audio and video control equipment, including everything from individual control modules to complete hotel audio combining systems and boardroom control systems.

Founded in 1981

Founded in 1981 by William G. Fitzsimmons, FSR has filled a need in the industry for both the contractor and the client. Systems that are reliable, simple to install and easy for the client to operate are their primary concerns. Their products reflect the status and decor of the boardrooms, classrooms, and hotels,that they are installed in.

The FSR digital control systems are operating in some of the finest boardrooms and conference rooms in the world---TRW, NY Times, NY Life, Equitable Life, IBM, Lucky Gold Star (Korea), and Nebraska Law School.

Their hotel audio combining systems are being specified by the Marriott Corporation throughout the U.S. and Canada. They are also either installed or being specified by several Hilton, Westin, Omni, and Sheraton Hotels.

Jeff Loether & The Marriott Hotels

The March issue of S&VC included an article by John Linde and Mel Smith on the Marriott's Orlando World Center Resort and Convention Center Ballroom Combining System. The hotel required the combining of 45 separate rooms covering an area of 225,000 square feet. Quoting from the article

"This system provides what past systems have failed to accomplish. The ML-132 elimates the need for skilled operators and can be used by our own staff with minimal instruction."

Jeff Loether's articles in S&VC are must reading for the sound contractor. Part I appeared in the September issue and the second part will be published soon. Jeff sent us an advanced copy. Quoting from Part II.

The combining control sysrtem is the second most costly component in the system. After two years of surveying catering and conference managers, audiovisual operating companies, sound contractors and consultants, and eight months of research

and development with consultants, contractors, and manufacturers, a final configuration has emerged and is being manufactured (by FSR, Inc) to our specifications. Modular in design and using a specialized computer with a five-year, failure-free track record, this system offers off-the-shelf availability and service at a reasonable cost....

The basic functions performed by this system are: combining of mixers when adjacent rooms are used together, controlling selection of local inputs , and controlling groups of ceiling speakers above selected head table locations. The interaction of all of these functions are being carefully intergrated to avoid problems inherent in other systems and enhance the reliability, flexibility, and ease of use of the system...

The connecting of adjacent rooms' sound systems is the most important function performed of this system....

The new combining control system simply requires the operator to touch a single button for each room being combined. All other system configuring functions are performed automatically.

FSR New Syn-Aud-Con Sponsor

Is it any wonder that we were delighted when FSR asked us about Syn-Aud-Con sponsorship. FSR is what we look for in a sponsor: a company that is listening to the audio industry and with an engineering staff that knows what to do with the input from the field. We like to be part of that input and we like to help spread the word to those that haven't heard about the company.

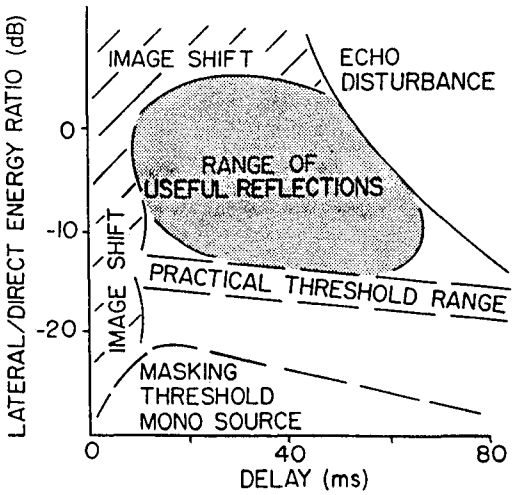
We often use the cover of our Newsletter to introduce a new sponsor. This issue we asked Janice Sandri if we could use the front cover for Richard Heyser to which she readily agreed. FSR announced their new wireless equipment at the New Orleans NSCA in April. We will have their new equipment on the front page in an upcoming issue.

ANAHEIM FEBRUARY 3-4, 1987

LEVEL AND SIGNAL DELAY EFFECTS

The illustration shown here is redrawn from one M. Barron original produced. The practical threshold for a stereo source was added by Marshall and Hyde. Peter D'Antonio used this version to illustrate one of his talks at the last Dallas LEDE® workshop.

While nothing in psychoacoustics is a hard and fast rule, the parameters shown here have been remarkably confirmed by TEF measurements and actual listening experience in both LEDE rooms and large reverberant concert halls. This chart combines the older Doak and Bolt data, the Haas effect, the Kuttruff effect, and new data for stereophonic sources.



USEFUL REFLECTIONS FOR MUSIC

Illustration re-drawn from Barron[20] showing the affect of reflections on the perception of music. The practical threshold was added by Marshall and Hyde[21] for a stereo source.

Courtesy of Peter D'Antonio.

We feel that the area marked "Range of Useful Reflections" is violated at the user's risk and will almost always lead to a perception of something not sounding right. Note particularly that image shifts are due to very small delay differences, the kind that come from failure to converge acoustic centers, hard surfaces near loudspeakers, or the arrival of two distant reflections that are but a few milliseconds apart.

Image shifts occur when reflections are over 20 dB below the direct sound and with less than 10 ms of delay.

A really careful study of this illustration can be most useful in understanding why one ETC is better than another.

SAN FRANCISCO FEBRUARY 11-12, 1987

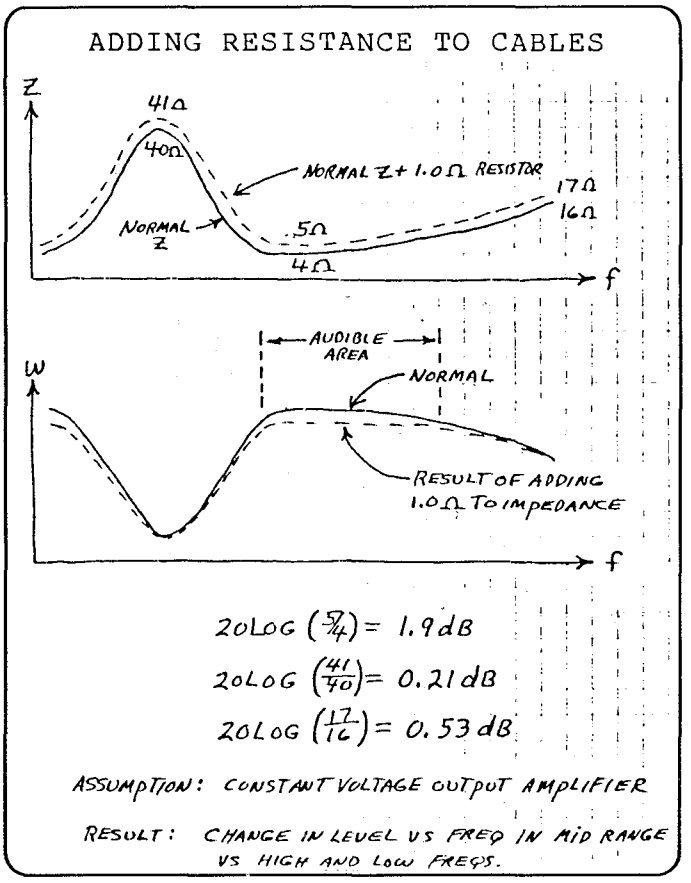
ADDING RESISTANCE TO CABLES

During our San Francisco class we had the privilege of visiting at some length with Ed Long, the designer of Time Align® loudspeakers and the holder of that patent as well as the basic PZM patent. We truly enjoy Ed as he ranks as one of the most talented loudspeaker engineers in the world and can discuss the most complex processes with a sense of humor that has to be experienced to be believed.

Over the years we have learned to be attentive around Ed because many a fundamental engineering truth may be presented as a pun to see if you're really there.

One of the discussions this time revolved around what listeners actually hear when comparing different cables. Ed used the illustration of two cables whose only difference is that one of them has 1.0Ω more dc resistance. If we run two impedance curves, one for each cable, we can typically get a plot like that in the upper half of the illustration. Note that the vertical axis is impedance Z and the horizontal axis is frequency f. Some typical impedance values are shown for what could be considered a "normal" cone type driver.

The bottom half of the illustration is the power drawn vs frequency. Here the vertical axis is in watts W and the horizontal axis is in frequency f.



Because we normally use constant voltage amplification in today's systems, the power drawn varies with the varying impedance. Where the impedance is high to begin with, such as at the cone's resonant frequency, then adding one more ohm to it has a negligible effect.

Where the impedance present is relatively near the same value as the added dc resistance, then over that frequency range a noticeable level change can occur. Note particularly that the frequency span over which this can occur in a normal cone type loudspeaker is fairly wide, hence fairly audible.

We tend to believe that simply adding a resistor to a loudspeaker cable can make as much difference as a tone control adjustment over a fairly wide range. Certainly it's not hard to deliberately make one cable sound different than another when listened to over loudspeakers, but immeasureable when measured electrically (so far as frequency balance is concerned).

As usual, Ed Long's visit with us resulted in our gaining much good insight into how really bright guys examine problems.

1987 SYN-AUD-CON SCHEDULE

ATLANTA, GA.
The Presidential Hotel
April 22-23, 1987

LOUISVILLE, KY.
Holiday Inn Southwest
May 19-20, 1987

FRAMINGHAM, MA.
Holiday Inn
June 17-18, 1987

LANSING, MI.
Ramada Inn
August 26-27, 1987

CHICAGO, ILL.
Holiday Inn - Oakbrook
September 15-16, 1987

DENVER, CO.
Holiday inn - Airport
September 29-30, 1987

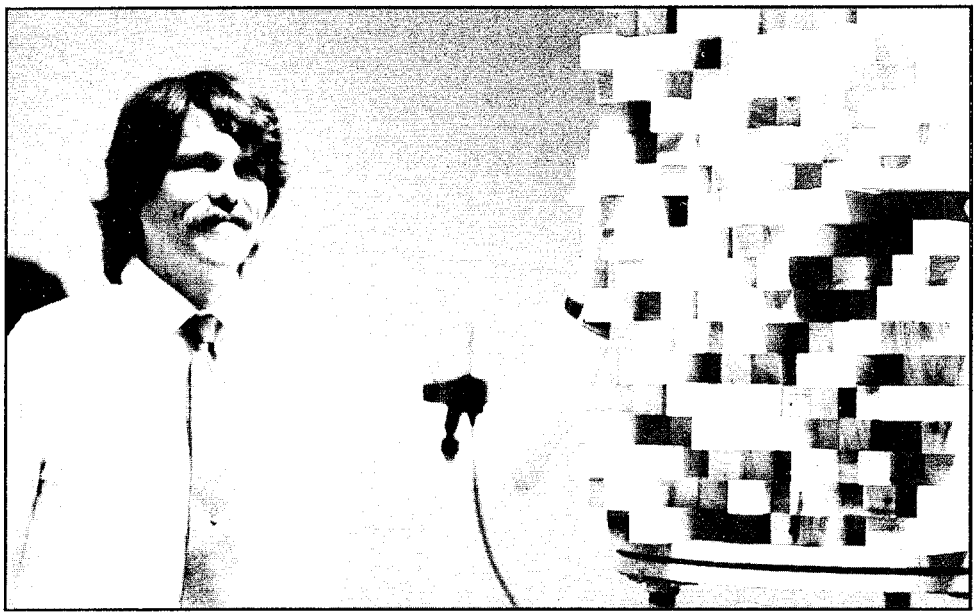
KANSAS CITY, MO.
University of Missouri
October 6-7, 1987

NEW YORK, NY.
Hartz Inn - Secaucus, NJ
October 14-15, 1987

WASHINGTON D.C.
Tyson's Corner
October 27-28, 1987

NUMBER THEORY IN SCIENCE AND COMMUNICATION

This is the new second edition by Manfred R. Schroeder published by Springer - Verlag. The first edition was an astonishingly useful volume and the second extends its usefulness still further. Here is Schroeder at his best. *"Physicists working in* **Deterministic Chaos** *have been touting the transform?*



Tom Paddock and his two dimensional diffusor

golden ratio g as the most irrational of irrational numbers; and now they gladden us with yet another level of new number: the noble numbers, of which g is (how aptly named) considered the noblest."

Want to know the mathematical fundamentals behind code breaking, spread spectrum, diffusors of all sorts, dividing a circle scientifically , or the fastest way to do a Fourier

Under the chapter heading "Some Crazy Mappings" is this illuminating statement, *"while, true enough, everything in the real world can be adequately described by rational numbers, it so happens that a* modeling *that distinguishes between different levels of numbers is not only extremely useful, but catches the true (perhaps hidden) spirit of a physical phenomenon".*

This is the very essence of Gabor's analytic signal and the way it led Heyser to his Energy Theorem. There are some very special illustrations in this new edition that truly show the beauty and order of even disordered events.

One strange oversight is the listing of name and subject indexes under the chapter headings but failure to include them in the book. The subject index is listed as starting on page 367 and my volume ends on page 348. I trust the publisher will supply the rest later.

Application of Schroeder's Theory

Tom Paddock in San Francisco has built one of Schroeder's diffusors for two dimensional uses (vertical and horizontal at the same time). We measured them and they seemed to work very well. Listeners hearing sound diffused by it felt it worked remarkably well. Tom intends to use these in a studio he is working with in the Bay area.

TELEPHONE AND THUNDER STORMS

Why not to use the telephone during thunderstorms is clearly explained in a Letter to the Editors of **IEEE Spectrum** by Robert E. Beeson of Birmingham, Al.

Living at our farm in Indiana for the summer has reminded us of the puny power of atomic bombs compared to a cold front meeting tropical moist air over a 1,000 mile front.

OF LINES AND LIGHTNING

The seeming paradox of a shielded telephone line still being hazardous [G.Kinal, February, p. 6] is explained by the two distinct courses of events that can cause electric shock to a person holding a telephone during a thunderstorm.

In the first scenario, lightning strikes the telephone wire, enters the building, and follows the telephone cord to the victim. In the second case, a lightning bolt of 20,000 amps strikes a building that has a 5.0-ohm ground, "measured to remote earth"; the building's electric potential rises to 100,000 volts, measured to remote earth; the telephone line is grounded at the central office, which is some distance away. The person holding the telephone is standing on a floor at 100,000 volts holding a wire at zero volts.

In both cases the floor and the telephone simply swap voltages. IEEE Std 80-1976 (2) describes the hazards of a transferred potential (the second case).

A point-of-entry protective device will minimize the hazard in either case. Only a fiber optic telephone line or microwave link can eliminate shock hazard without using protectors, although alternatives have been tried.

Robert E. Beeson
Birmingham, Ala.

ALTEC

In traveling from Indiana to the California classes in February the weather allowed us to stay north and go through Oklahoma City, the new home of Altec. We stopped by the Altec plant on the Western outskirts of the city and visited with Gary Rilling, vice president of Marketing, and Ed Rusch, vice president of Engineering. Altec is concentrating on restoring the highest possible quality control to their present line of products. Product redesign and initiation of new designs is now underway.

We are impressed by the top management. They are carefully perfecting their assets -- loyal distribution, a fine modern manufacturing facility, and key personnel of integrity and talent in marketing, manufacturing and engineering.

Three men moved from the Altec plant in Anaheim to Oklahoma City: Gary Rilling, Ted Uzzle and Gayle Campbell. They had to be motivated by a fierce love of the old Altec (there was very little left of the proud company called Altec which was dumped on the floor in the University plant in Oklahoma City from a few semi trucks.) These men had a vision that a fire would rise from the ashes of the destruction wrought by LTV.

We were especially pleased to meet with several of their engineering staff who were busy using their TEF analyzer to generate their latest specification sheets. As the whole world knows by now, it is our belief that only TEF measured products are worthy of serious professional consideration because only then can you directly confirm or deny their validity.

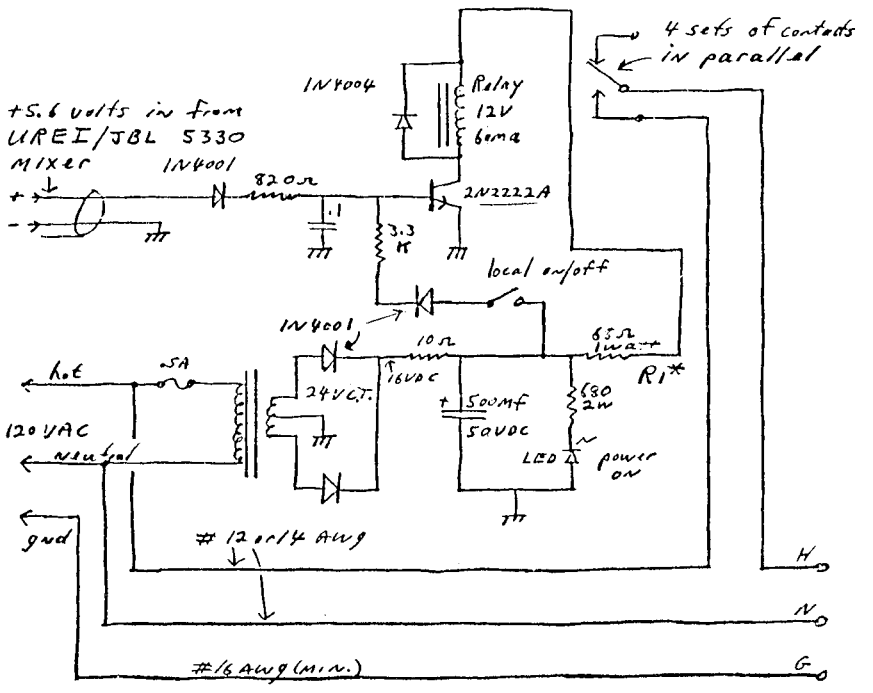
Our short stop reassured us that Altec's footsteps are once again firmly planted in a progressive path.

AC POWER REMOTE CONTROL

Charles P. Townsend is a skilled engineer who works for the state of Florida. He recently designed a circuit for a remote ac power control which he developed for a church job. He used the new JBL/UREI 5330 mic mixer. The mixer has a +5.6 volt output which comes on when the power switch on the front is operated. The 5.6 volts run through a spare cable back to the rack housing the equalizer and amplifiers. At the rack the ac control circuit operates and turns on the entire system - all activated by the switch on the mixer.

Townsend suggests that for a Shure M-267 the blocking diode going to the dc jack should be jumped with a 5.6k resistor.

AC Power Remote Control



Notes: 1. R_1 is selected for approx. 10-11 VDC across relay coil to reduce heating over long periods.
2. Relay is AMF/P+B KH series, or equiv. 12/86 CPT

Handbook for Sound Engineers

Our copy of the **Handbook for Sound Engineers - The New Audio Cyclopedia** edited by Glen Ballou and published by Howard W. Sams and Company just arrived- all 1247 pages of it.

This volume was conceived of in 1976 during a visit by Glen Ballou to our farm in Indiana. We went together to Sams and discussed Glen being the editor. While it took over a decade to produce, partially because Ballou doesn't compromise on anything and partly because of corporate changes on a major scale at Howard W. Sams. Our hope is that now that the format is developed the authors will continue to up date this reference at least every three years. The industry is moving that fast.

Our first judgement after a quick perusal is that it is a most useful reference volume.

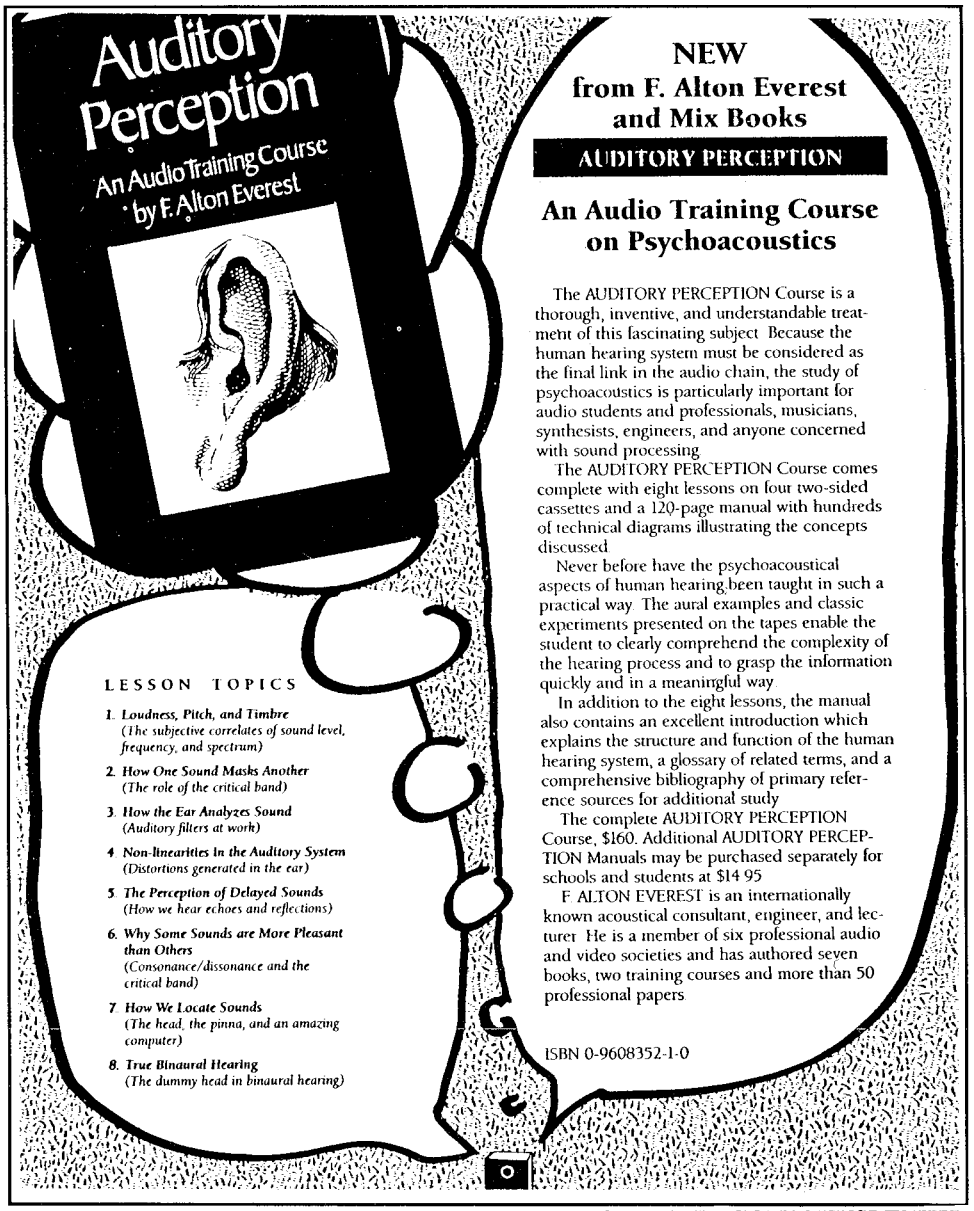
We like the format of the book as it lets us evaluate the accuracy of the information against a known source--the author of that particular section. (In the first edition, it was not known to the reader who the author was of the different sections of the book.) We believe that there are few questions on audio that you won't find either a good answer to or a reference cited where the answer is available.

This $79 volume, which if looked at as $ per pound or better yet, as information needed and at hand, represents an audio bargain.

AUDITORY PERCEPTION

F. Alton Everest has developed a new audio training course that is being distributed by the **Mix Bookshelf,** 2608 Ninth St., Berkeley, CA. 94710. Ph 800-233-9604, CA 800-642-3349. The flyer reproduced here gives an outline of the course and offers Syn-Aud-Con grads a 10% discount.

The tapes are professionally made excellent quality cassettes. The manual is beautifully organized, illustrated, and covers a difficult subject with clarity and authority. As psychoacoustic effects take on increasing importance in our audio industry good basic source material such as this is welcome and needed.



PETER D'ANTONIO & JOHN KONNERT

After our class in Phoenix we spent an evening with Peter D'Antonio and John Konnert. John had, up to this point, been a mystery man whose name appeared on diffusor papers and whose mathematical ability was evident in several of the papers co-authored with Peter D'Antonio. He and Peter are both PhD's. They were working on an advanced experiment with the special electron microscope enshrined at Arizona State University, ASU.

What strikes us the most about these two is their genuine scientific ability undampened by the wet blanket academia can often lay over any display of enthusiasm. These two guys are involved, innovative and ingenious. In a day when a great deal of so-called scientific work has to be looked at with care because of the frequency of altered data and falsified claims, it is a genuine pleasure to be in the presence of two real scientists with a humorous self-depreciation that can't hide the gold beneath.

When Peter and John listen to one of my hard sells on an idea I may be currently enamoured with, I know that they'll keep an open mind till the facts are in. Then whatever is actually true will get the nod. They ask the kind of questions that make you grow or go.

As Don Keele said at the Intelligibility Workshop *"Syn-Aud-Con is where you get your questions answered and your answers questioned."*

CALL FOR HELP

Don Plunket, director of AES, has agreed to publish the complete writings of Richard Heyser. To support this vital committment by the AES, we want to turn in a complete list of audio related articles. Gene Pitts, editor of **Audio** Magazine, where Dick wrote loudspeaker reviews for 13 years, will make available all the Heyser **Audio** Reviews.

John Prohs, 233 S Orange Grove, Pasadena, CA 91105. Ph 818-304-6047 has agreed to collect all Dick's papers for publication.

Ken Wahrenbrock, 9609 Cheddar St, Downey, CA 90242. Ph 213-803-6047, has agreed to be the collector of all Heyser's audio cassettes and video tapes.

If you have audio cassettes of Heyser-conducted Syn-Aud-Con Workshops, AES Section meetings, or any other function that Heyser addressed, please let Ken know. He will complile a list of all cassettes available and notify you if your cassettes are needed to complete the library.

Richard Jamieson made a video of our first Heyser Workshop in 1979. John Prohs made a video of the TEF Workshop in Pasadena in 1983. Do you know of any other video cassettes?

YOU CAN HELP!

ED LONG & POLARITY SWITCHES

Ed Long has polarity switches on his MDM monitor loudspeakers. We discovered that a CD sampler we have requires polarity on both channels to be changed for every piece on it. If you didn't, the alternate pieces sounded like they were coming out of two holes in the wall. When switched the music spread between the two loudspeakers and instruments stayed remarkably in place at all points in between.

Ken Wahrenbrock decided Syn-Aud-Con needed a multichannel polarity switch and built a beautiful one for use in upcoming classes. All classes now hear on both speech and music what out-of-polarity between channels sounds like, both channels out of total polarity, misaligned channels, and properly aligned and polarized channels.

Building loudspeaker arrays requires careful analysis of:

1. The total impedance of the array
2. Its total polarity
3. Its signal convergence (see article elsewhere in this is sue on "alignment or convergence")
4. Its proper acoustic level
5. Its overall polar response.

It's important to recognize problems in each of these areas instantly by ear.

TEF DIRECTIVITY MEASUREMENTS

Useful directivity measurements once the prerogative of manufacturers possessing large anechoic chambers is now easily done by sound contractors in the field using the TEF analyzer and the J.W. Davis turntable. It is absolutely astounding how much you can find out about how a loudspeaker will sound and what kind of troubles it will cause in a difficult room simply by measuring its directivity performance.

Just as important is the ability to see the changes in directivity patterns that occur as you connect different crossover networks or use signal delay devices in connection with a large array. Experience has shown that just selecting a fine driver and a high quality horn doesn't guarantee that you know what the directivity pattern actually will be when they are combined with the woofer and crossover network or they suffer reflections from the woofer cabinet or parts of the mounting area. The directivity is affected also by nearby similar devices operating at the same or different levels in an overlap zone that combine in such a way as to dramatically degrade the otherwise excellent individual device. Alertness to changes in the directivity of a device whose individual characteristics are well known to us are often the first clue that something in the system is causing a problem.

3-D POLARS

The basic tool is the 3-D polar response. This is 32 or 36 individual frequency responses each made at some chosen angular increment (usually either 5, 10 or 15 degrees).

Once the 3-D data is gathered it can be post processed into normal polars either one frequency at a time or overlaid as a series of frequency steps.

Another way to process the data is to use the frequency time curve FTC disc as a frequency vs. angle curve FAC. This is essentially an overhead view of the 3-D with axis of frequency (horizontal) and angle (vertical). Contours reveal level changes.

Other options are to display the frequency range either logarithmically or linearly. Also any chosen curve can be made the normal with all other curves compared against it.

HOW TO READ A POLAR PLOT

The conventional polar plot (so called because its grid resembles a polar view of an earth globe) is a series of circles of differing radius so that larger radi indicate higher audio levels and smaller radi indicate lower audio levels. The angular scaling has zero degrees as on-axis, 180° as the rear of the device and so forth. Loudspeaker coverage angles are assigned by starting on-axis and going around the angular scale until the level has dropped 6dB. As can be seen from the displays show here some loudspeakers put out substantially less level on-axis than they do off-axis. Many home hi fi type devices make coverage angles , Q, and similar measurements impossible as they essentially do not have control over these parameters.

Coverage angle is one parameter badly needing a more useful definition and as a first suggestion I believe that doing overlaps such as we have done here and including the plus or minus variation in angle as part of the specification. For example the second speaker shown would have a coverage angle = 180° ± 90°. The first loudspeaker shown would have a coverage angle = 40° ±2°. Tolerances of this type would be a real aid in deciding "or equivalent" in specifications.

Reading frequency vs. angle curves FAC is even easier than conventional polars but they were strange at first because not used in the past. In these we see at a glance the frequency dependency of each chosen level increment we dial in. The contours can be any decibel value we choose. In the examples shown here we chose 6dB increments as coverage angle is normally determined on the basis of the 6dB down point at each frequency.

We sincerely hope that the displays shown here will trigger constructive thinking on all of your parts in terms of choosing better devices, protecting them by meaningful specification, and being alert to when they are degraded by circumstances not related to the device itself.

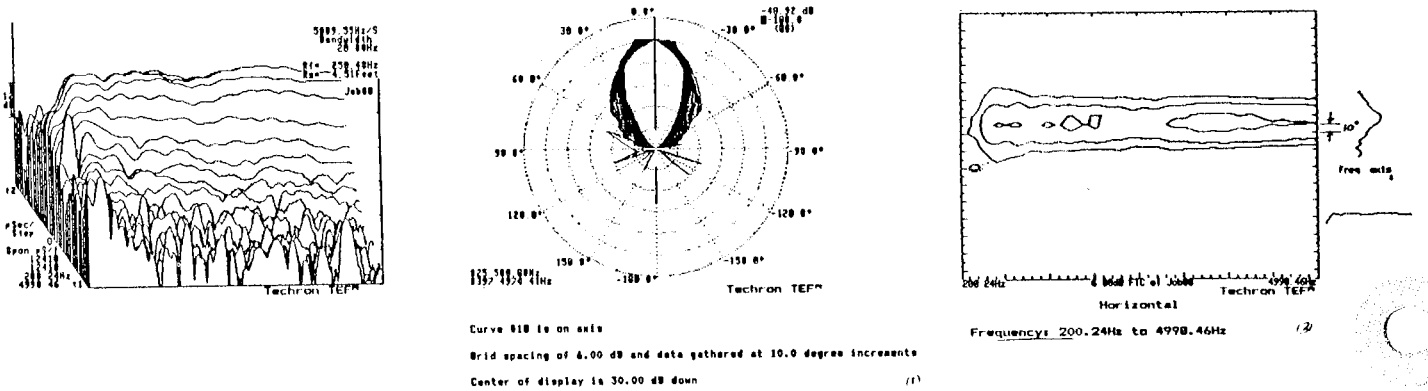


Fig. 1 3-D, Polar, and FAC of a really well controlled constant directivity horn and driver.

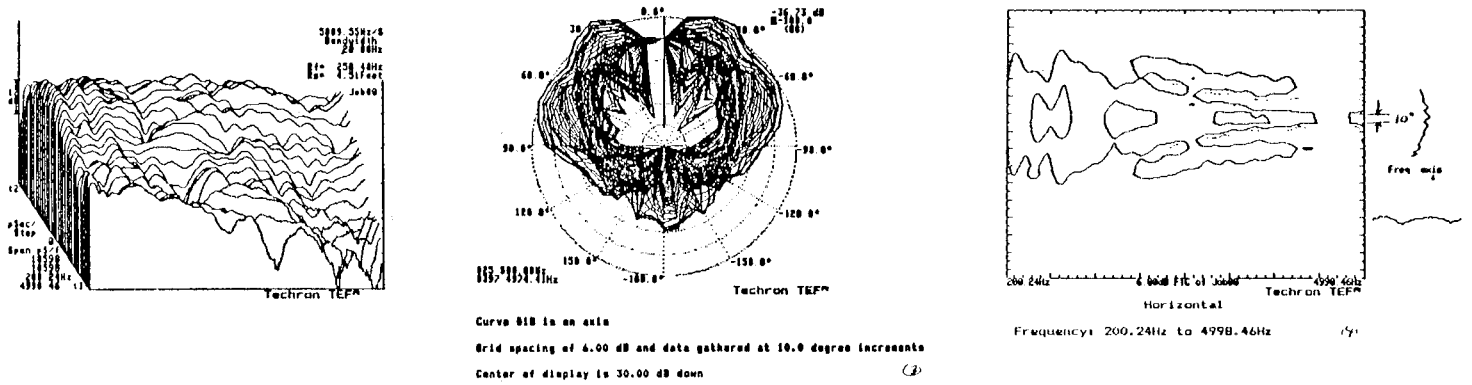


Fig. 2 3-D, Polar, and FAC of a not so well controlled directivity pattern. This is a multidriver system that starts out well with a lower "on axis" response (desirable) but ends up as three very sharp lobes.

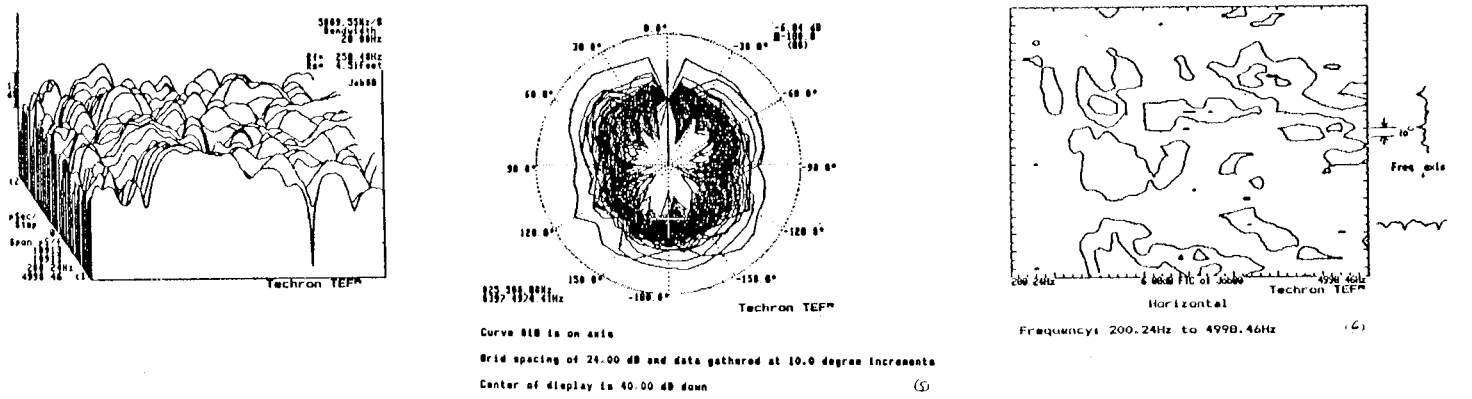


Fig. 3 3-D, Polar and FAC of a nearly omni device but with widely varying levels relative to the "on axis" reference point. The FAC of the loudspeaker in Fig. 3 reveals no orderly pattern to this polar response but does indicate that any frequency some angle will contain high energy levels.

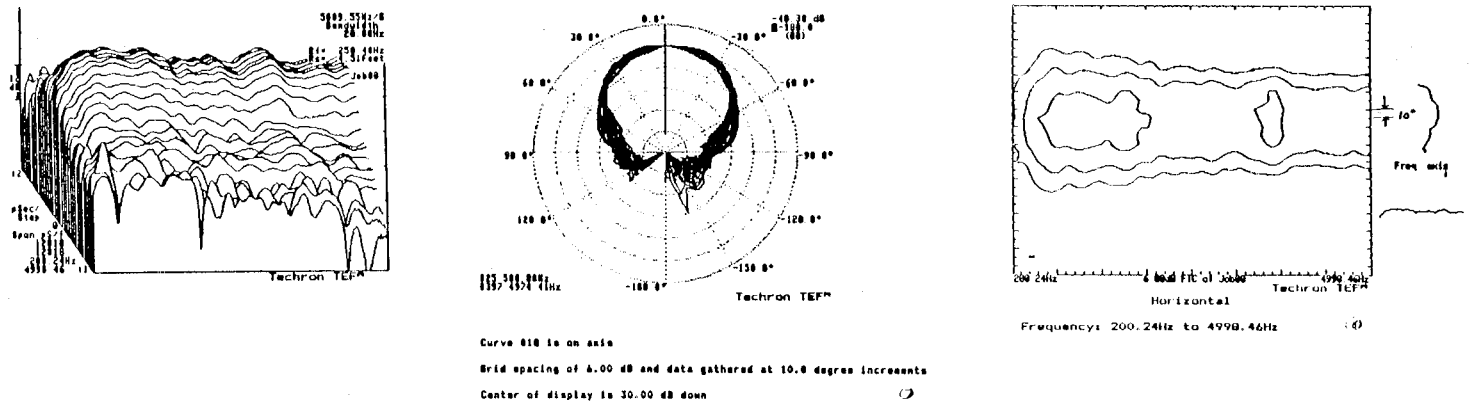


Fig. 4 3-D, Polar and FAC of one I'd like in my home system (so far as directivity is concerned) Roughly a $C_{\angle}$= 90° ±2°. The FAC of the loudspeaker in Fig. 4 reveals a truly beautiful constant directivity pattern that allows a wide range of frequencies to be controlled over a wide range of angles. Note that the 12dB down is just as useable as the 6dB down.

Note: FAC contour lines are 6dB.

CAROLYN "PUDDIE" RODGERS

Lest we forget -- it was Puddie who first saw the link between loudspeaker comb filtering and Pinna comb filtering and led us to an alertness to other than tonal change, namely, imaging affects. How logical it all is now that we can see the polar response lobing that causes the very real source relocation at some frequencies and the psychoacoustic effects that cause the image to appear elsewhere than where it is at other frequencies.

Others have carried on her work notably Doug Jones of Electro Acoustics Inc. in Evanston and Gary Kendall and Bill Martens of Northwestern University. The lightening flash of insight that came to Puddie at that TEF class of long ago helped many careers in LEDE work. For us, we'll always remember the picture of Dick Heyser and Puddie staring at a display on Dick's analyzer with Dick's usual expression of "yup" and Puddie's wide-eyed moment of discovery. No one knew that at the time the picture was taken a very special moment was captured.

How many important new concepts are but awaiting an alert observer to see what the blase pass by.

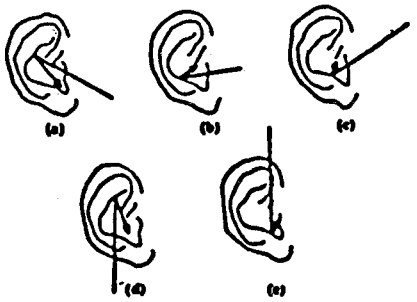


Fig. 7. Drawings of a pinna showing the path of the first major coherent reflection for sound sources at various elevations.

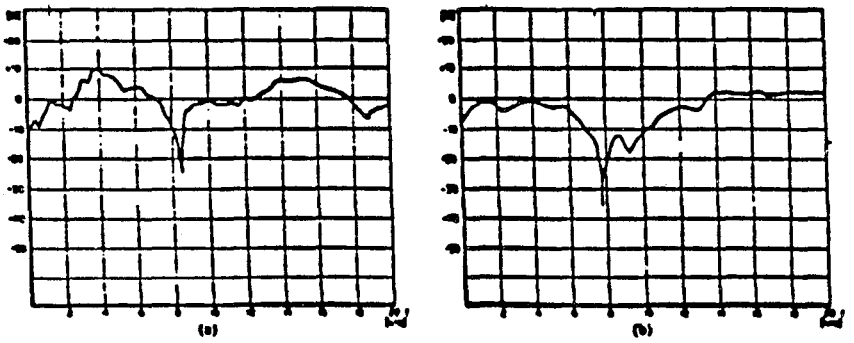


Fig. 12. (a) Pinna response for a sound source at ear level and 45° azimuth. The response is similar to the response shown in Fig. 9 except that the peak at 4 kHz is more pronounced. (b) An example of special aberrations that occur when two drivers are misaligned. In this case the acoustic center of one driver was approximately 1 in (25 mm) behind the second driver.

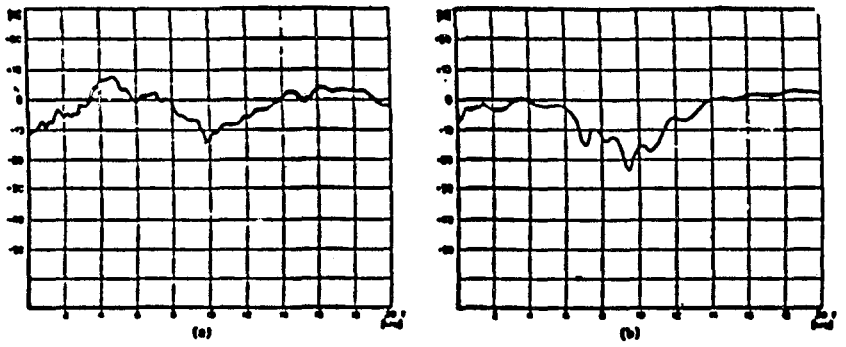
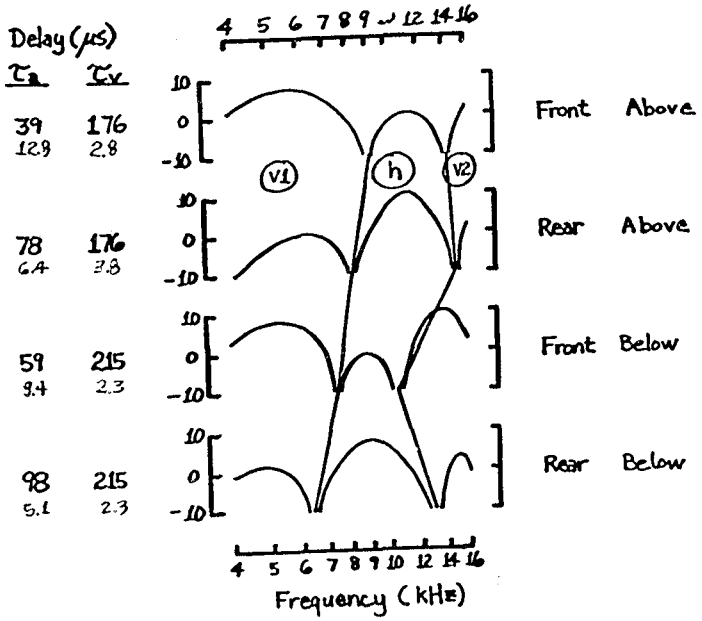


Fig. 13 (a) Pinna response for a sound source above ear level and at 45° azimuth. (b) A spectral minimum created when the acoustic center of one driver was approximately 0.7 (18 mm) behind a second driver. A delay distance of 0.7 (18 mm) minimizes the pinna response for a sound source above ear level at 45° azimuth.



AN INCORRECT LEDE ARTICLE

Audio Magazine published two articles on what was purported to be an LEDE® design listening room in their December 1986 and January 1987 issues. Unfortunately, the author of these two articles described a conventional high fidelity show room to which he had added absorption. This writer, one William R. Hoffman, treated this showroom as if it were a reverberant space and spent a great deal of each article incorrectly discussing the charateristics of some absorptive panels he had built. **Audio** was courteous enough to include the notice shown here in their letters to the editor for the March 1987 issue and we have now sent them a correct article on what LEDE is all about.

LEDE® Article Not Authorized

Dear Editor:

The two articles entitled "Build a Live End/Dead End Listening Room" in the December and January issues of *Audio*, authored by William R Hoffman, constitute significant damage to the good name, trademark, and technical reputation of my client, Mr. Don Davis.

Mr. Hoffman is not an accredited Live End/Dead End℠ designer He has no connection with either Mr Davis, Syn-Aud-Con, or any accredited LEDE® designer

The article describes conventional absorption techniques and mislabels them LEDE The techniques described are not LEDE design techniques and do not meet published LEDE criteria

In the first article, in addition to the improper use of LEDE, each caption to each illustration is incorrectly labelled Also, the room labelled "an LEDE demonstration room" is not remotely qualified

We believe this is a case of trademark counterfeiting

We request that *Audio* publish in equally prominent editorial space a full refutation of these articles as having anything to do with legitimate LEDE design

We wish to reiterate that these articles constitute serious damage to our client's worldwide classes on LEDE by presenting a totally false picture of the design process

Richard H Montgomery
Montgomery, Elsner & Pardieck
Seymour, Ind

Editor's Note: Mr Davis has promised a full refutation of Mr Hoffman's article for publication in a future issue—*E P*

CHARLES BILELLO
T.E.F.tm Analyst
258 FAIRLAWN AVENUE
WEST HEMPSTEAD, N.Y., 11552
(516-489-7463)
Live-End/Dead-End Design Sound System Design Hearing Conservation Noise Abatement

January 16, 1987

Don Davis
Synergetic Audio Concepts
PO Box 1239
Bedford, Indiana 47421

Re: AUDIO Publishing articles by
W. R. Hoffman
"Build a Live End/Dead End Listening Room, Part I & II"

Dear Don:

I would like to call your attention to a two-part article that appeared in AUDIO (December/January) called "Build a Live End/Dead End Listening Room". I am appalled by the recklessness of Mr. Hoffman's using the L.E.D.E. trademark to describe his philosophy and the forum provided by the editing oversight of such a fine publication as AUDIO. Such presentations are detrimental to my clients and students, and can only serve to misinform readers of AUDIO.

Beware of the potentially adverse effects articles like this could play on the credibility of your future Studio Designer Workshops.

Please notify AUDIO about these articles for the sake of science, to clarify the L.E.D.E.tm design criteria, and to maintain the integrity of all accredited Live End/Dead End designers.

We received many phone calls and letters regarding this article and we wish to thank all of you for alerting us to this infringement.

As all of you who subscribe to the newsletters know there is a long and distinguished list of those who have attended the many LEDE workshops and the concept has benefited greatly from the willingness of all these qualified participants to share hard won improvements on the original ideas. We hope that all qualified designers will discuss LEDE frequently in articles and continue to share ideas in all available forums. What we feel does harm is to use the term LEDE simply because it helps sell something and the something doesn't remotely qualify.

SMILE

GABIROL'S OBSERVATION: The wise are pleased when they discover truth, fools when they discover falsehood.

B & K POCKET HANDBOOK

We just received the new "Pocket Handbook" from Bruel & Kjaer. It now includes data on noise, vibration, light, and thermal comfort. A sort of sub title is an illustration on the front cover of five books- **Frequency Analysis, Acoustics, SI Units, Vibration, and Underwater Sound.**

The photometric illustrations have useful Q equations applicable to loudspeakers. An excellent "Glossary of Acoustical Terms" is included as well as SI conversion units. It contains 1/3 octave band limits (called "third" octave in this handbook). We will be handing them out in Syn-Aud-Con classes starting with New Orleans until the supply is exhausted.

ARTICLE BY DR. PATRONIS

Dr. Patronis has written an informative descriptive article of the new sound system at the Fox theater in Atlanta, *Rehabilitating the Fox*. This system is one of the few at the present time to effectively utilize the large J.W. Davis PA 150 Pataxials (12 in all). To prove he's not prejudicial Dr. Patronis used Meyer subwoofers and JBL super tweeters as well as Turbosound monitors and EV 4020 long throw constant directivity horns. The Fox is an excellent acoustic environment. Syn-Aud-Con held a session in it during a TEF class a few years back.

The article appeared in the January 1987 issue of **Sound and Video Contractor.** We have reproduced the article as Tech Topic with permission from S&V.

NEW TEF OWNERS

Rick Talaska
Kirkegaard & Associates
P.O. Box 186
Downers Grove, IL 60515

James Yerges
Yerges Acoustics
5209 Lee Ave
Downers Grove, IL 60515

Dave Wojtowicz
CPC Engineering
Eng- Bldg #L-1780
3003 Van Dyke
Warren, MI 48090

Bob Syle
Robert Syle Electronics
3415 N. Washington Blvd
Arlington, VA 22201

Mr. Moses Gabboy
Boston Acoustics
247 Lynnfield
Peabody, MA 01960

Will Grant
Georgia Southern College
Physics Dept
Landrum Box 8031
Statesboro, GA 30460

Timothy Landry
Pratt Landry Assoc
530 S. Jefferson Davis
New Orleans, LA 70119

Robert Davis
Yamaha International
6600 Orange Thorpe Ave
Buena Park, CA 90620

Franklin Krakowski
Sheer Sound
3027 Lincoln St
Lorain, OH 44052

STUDIO DESIGNER'S WORKSHOP

We have held 5 Studio Designer's Workshops (early workshops were called LEDE Workshops): Hosted by Tres Virgos in San Fransisco (Chips Davis-Designer); Dallas Sound Lab (Russ Berger-Designer); Acorn Studios in Nashville (Bob Todrank-Designer); StarMusic in Hamburg (Chip Davis-Designer); and Tele-Image in Dallas (Russ Berger-Designer).

Our next workshop will be at MasterSound Astoria (Charles Bilello-Designer). Charles Bilello & Peter D'Antonio are preparing a feast. They have each attended 3 previous Studio Designer's Workshop and they have learned from each of the outstanding workshops. They have enormous talents of their own from which to share.

As good as our staff is, the most valuable aspect of the workshop for each attendee will be the interaction and sharing among themselves.

We know that when that much talent comes together in one place, it is a powerful synergetic learning experience.

STUDIO DESIGNERS WORKSHOP

MASTER SOUND/ASTORIA

JUNE 12-14, 1987 **NEW YORK, NY** **FEE: $600.**

STAFF:

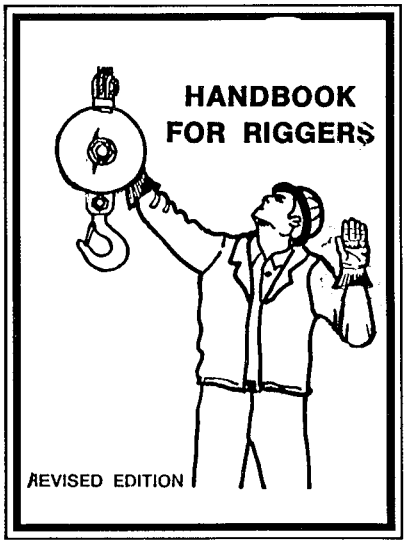
Charles Bilello
Charles Bilello & Associates

Peter D'Antonio
RPG Diffusor Systems

HOSTS: Don & Carolyn Davis
SYNERGETIC AUDIO CONCEPTS

MARK MICELI OF TUCSON

Mark Miceli of Tucson brought his software for his 1/3 octave analyzer into our Phoenix class to see how it compared to the Crown RTA. Our only thought was that when considering measurement software--beware. This particular program, which shall remain nameless, was not a good program.



Mark did present us with a most useful tool written by a relative. It is the **Handbook for Riggers** revised edition written by W.G. (Bill) Newberry. It is superb. How to select, handle, and apply wire rope, synthetic rope, tie knots, do splices, timber and plank strengths Crane operations, Helicopter signals, terms used in rigging and a great deal more all in a handy shirt pocket size. The ISBN number is ISBNO-9690154-1-0.

PHOENIX FEBRUARY 18-19, 1987

AN ODE TO ROOM ACOUSTICS

The Acoustical Society of America has had a number of prominent women members, fellows, etc. We predict that we heard a future successful acoustician give a paper at the Anaheim meeting in December. Miss Punita Singh from the Central Institude for the Deaf in St. Louis gave a paper entitled "Transition Loss: From the Practice Room to the Concert Hall" by A. F. Niemoeller and P. Singh. Her theme was that artists have to make sometimes difficult adjustments to some halls. Miss Singh presented recordings of some before in the practice room and after in the concert hall.

Unfortunately time for the paper ran out before she had concluded and only those of us who took the time to talk to her afterward were rewarded by getting a copy of a poem that she had written for her conclusion. We'd like to share it here with the comment that we wish flaws in halls were as clearly understood by the concert hall designers.

...the oboe had tuned
all Hertz in accord.
For musicians " the concert"
was the ultimate reward.

The applause was loud
and clear and expectant,
the performers were eager
to even reach the most distant

the strings were bowed,
sound filled the air
but oh, not equally
from "here" to "there".

The music was whole
as it really should be
but the room was not equitable
to each frequency.

This was an "ensemble"
or so it was meant,
but from reflection, diffraction
the sound got quite bent

with the varying absorption
the sound played hide and seek,
with a dead spot here
and over there a peak.

From the horns in their section
to the seat in the hall,
the sound changed direction
as if coming from the wall...

and from podium on stage
to the side in the rear,
the softness the rage
not really that clear.

and alas for microphones
and loudspeakers in the ceiling,
-- perspective shifted upward
a most peculiar feeling.

Playing to oneself
in the silent seclusion
of a practising room
can be quite an illusion

for the technique is perfected
till one sounds one's best
to retain that in the hall
is the critical test...

Is the hall then an instrument
with it's own tuning pattern
-- but unlike the others
not conducted by the baton?

It's happened before
time and time again,
sacrificing the features
for lucrative gain.

A room for a concert,
for a play, for a game
they want it all in one
but it's really not the same....

Designing and building
are both art and science,
shield sound from the free field
in "square law" defiance.

To achieve that crucial transfer,
invariant and alive
-- with all that one knows,
one can only pray and strive

So strategies change,
halls are renovated
and music continues
to play on unabated...

What is good, better, best
or "clear" and "distinct",
are the meters to judge that
or listener instinct?

Can there ever be standards
-- criteria that relate
the objective to the subjective,
or are "good acoustics" just fate?

Are there optimum dimensions,
perhaps a special kind of wood...
that could be the magic factor
in making things sound good.

...the mystique is slowly vanishing
as man is quick to learn
-- to think and to create
from trial and error to discern.

So here's to auditoria,
musicians and engineers,
acousticians and architects,
toward elimination of all the fears...

SIM™ *OR* SDM

Hellmuth Kolbe flew all the way from Switzerland to the Intelligibility Workshop. He came particularly to see Bruel and Kjaer do a signal dependent measurement SDM™. Unfortunately, due to problems not under our control, such demonstrations were carried out only once at a site and time where Hellmuth was not present. John Bareham of Bruel and Kjaer has been kind enough to send us the data taken during that test. This data was dependent upon the test loudspeaker using the Dynastat word tests. We'll let John's letter and data speak for itself. If you use a high quality dual channel FFT, and we believe Bruel and Kjaer has the highest quality one available on the market today, you can do "one port" measurements using any available source as a test signal. That is not new or anything unusual. It does require rigorous control of the ambient noise level and a great deal of signal averaging. What we do maintain is that many claims being made about "one port" measurements aren't backed up by the kind of facts John has presented here.

Bruel & Kjaer Instruments, Inc.
185 Forest Street, Marlborough, Massachusetts 01752-3083 / (617) 481-7000

November 11, 1986

Mr. Don Davis
Syn Aud Con
P O Box 669
San Juan Capistrano CA 92693

Dear Don:

I thought you might be interested in measurements made in the NIU concert hall using the B&K 2032 Dual Channel Analyzer. The "test signal" was the pre-recorded speech cassette used for subjective intelligibility tests.

Channel A was the sound system electrical output; Ch. B was from the microphone in the balcony. The "Frequency Response" measurement therefore included the response of the speaker (EV 60x40) + room, over a very long time window. The "Impulse Response Magnitude" was calculated from that frequency response. (It is like an ETC.) The "Coherence" shows the measurement to be valid from about 360-3800 Hz. Outside this range, there was not enough speech energy in the system on which to measure. That is why the frequency response curves are X'ed outside this range.

Note that the "Impulse Response" of P.2 has a peak at 65.124 ms which does not appear on P.1. After seeing this result, I found out that there was a man sitting right behind the mic during the P.2. measurement.

(I do not know what the peaks at 80 ms are on P.1, but they could be reflections from another person or, more likely, reflections from a nearby part of the hall which was blocked by people in the measurement on P.1. Unfortunately, I didn't notice it at the site, so I am unable to be sure.)

Besides demonstrating some possibilities of the 2 Channel FFT method, there is another implication of these measurements. In principle, a 2-Channel digital recording can be made on site, using speech or music as the source. At the office, the room impulse response can be obtained by the 2-Channel FFT method, from which either % AL_{cons} or STI can be calculated. Since the recording was made on site, the true reverberation characteristics of the occupied room are accounted for. Additional development needs to be done to made this technique a simple "cookbook" procedure, but the possibility is interesting.

Best regards,

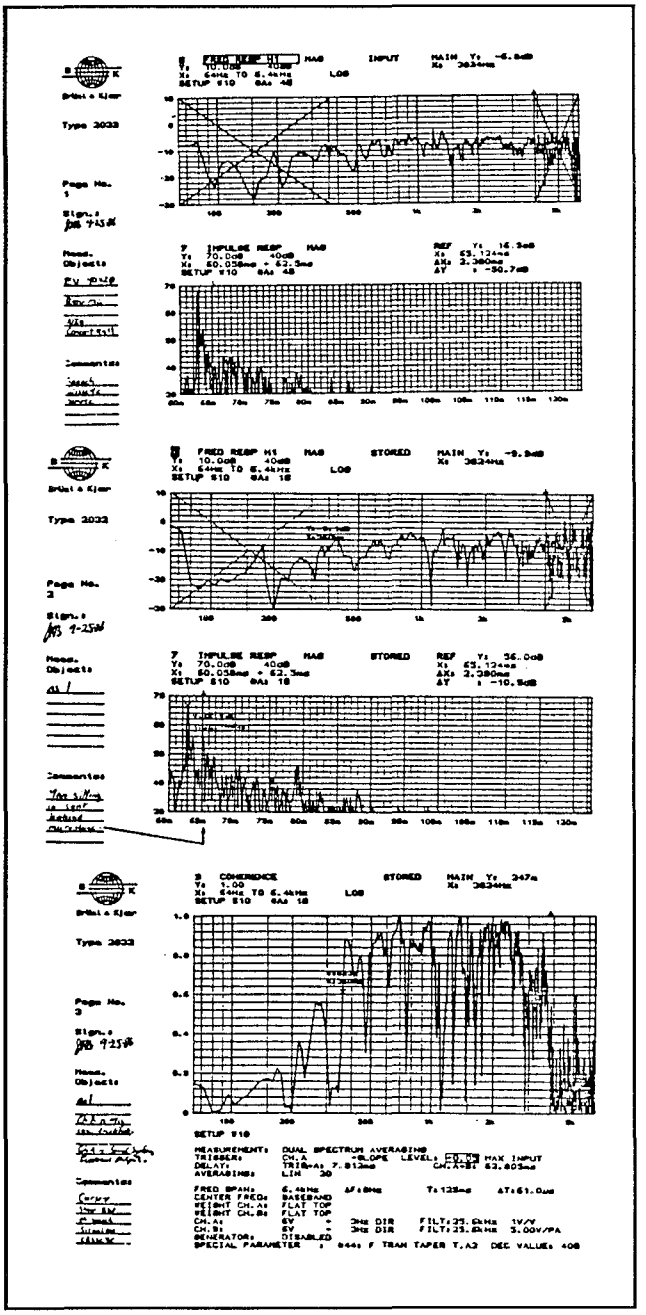
BRUEL & KJAER INSTRUMENTS, INC.

John R. Bareham
Applications Engineer

JRB/css
Enclosure: as stated

Specialists in Sound & Vibration Data Analysis Instrumentation

Regional Offices: MA (617) 481-7000 ext. 139; NJ (201) 227-8100; MD (301) 948-0484; GA (404) 951-0115; MI (313) 522-8600; IL (312) 358-7582; TX (713) 645-0167; CA (714) 978-8066, (415) 574-8155; WA (206) 625-1112



SMILE

FOSTER'S LAW: The only people who find what they are looking for in life are the fault finders.

LOUDSPEAKER DESIGN CLASS?

We would like to put together a Loudspeaker Design class with Gene Patronis, Ed Long, Don Keele, and Cliff Hendrickson as staff. To do this properly requires two inputs from those who would like to attend the class.

1. Who would be interested in the class?
2. What subjects would you like the class to stress.

If you fall in Category 1, please send us your version of Category 2. If sufficient interest is shown we will schedule such a class this year.

Since, in our opinion, the staff indicated here represents the outstanding talent on this subject, the program they would produce would look like a modern version of Olson's *"Acoustical Engineering"*.

We sincerely hope that those of you truly wanting to know how loudspeaker drivers really work and how to optimally house them will participate in this class.

CONVERGENCE VS ALIGNMENT

Charles C. Baxley of Carey Associates in Nashville, TN. works with Syn Aud Con poet laurete Jim Carey and there is evidence that Jim's malady is catching. They have come up with what we feel is indeed a better, more accurate, and far more descriptive set of terms for what we have been calling signal alignment. We believe their term "signal convergence' will more than likely prevail given half a chance. We are adapting our terminology to include it in our discussions on the subject.

Charles Baxley writes:

"The main contention is that the term 'alignment' has been used at one time or another to describe practically every procedure known to man or woman. We feel this terminology is weak and potentially misleading when used to specify or describe bringing a cluster of six or a dozen horns into the proper relationship.

Before the thought disappears forever from my mind, I have looked up the definition of the words in question in the Merriam-Webster's Third New International Dictionary, Unabridged. (This is a two-man book!).

ALIGN, verb (first sense of the word): to adjust or form to a line (as in: the tents were aligned in two rows): bring into line or alignment (as in: align set type); (second sense of the word): to put two or more parts of a machine or structure, especially parts that should be parallel or in line with each other into proper relative position (as in: align the wheels); (third sense of the word): to make semipermanent adjustments in a piece of electronic or radio equipment in order to obtain optimum performance.

ALIGNMENT, noun (first sense of the word): the act of aligning, or the state of being aligned.

CONVERGE, (the first sense of the word): to tend toward one point: approach nearer together: move toward a single point: come together. (the second sense of the word): to come together, meet or join so as to form a single product, or come to bear on or conclude in a single thing or place.

CONVERGENCE, (the first sense of the word): the act or condition of converging: tending or moving toward union or uniformity: coming together or joining so as to bear on a single object or conclude in a single product.

COHERE, verb, (second sense of the word, third definition): fit together naturally and consistently with suitable order, proportion, and similarity of tone without jar or wrench.

COHERENCE, noun, (first sense of the word) systematic or methodical connectedness or interrelatedness.

Based on these definitions, it would appear that 'align' and its derivatives pertain to being parallel or in a line. On the other hand, 'converge' and its other forms are indicative of a single point, or the coming together to form a single product.

THEREFORE; We humbly submit that in order to bring about coherency, the devices in question must be 'converged,' and the act of so doing be known as 'convergence.'

In case you're not sure this came from the Boys in Nashville, I have attempted to emulate Jim as follows:

ALIGNMENT:

A sound tech came on consignment,
With speakers to do some alignment.
So as hard as he could go,
He put 'em all in a row,
Now speech?...no one can find it!"

ELECTRONIC SIGNAL ALIGNMENT

If it seems that we are over-emphasizing this subject, bear with us because it is about to become one of the most active areas in sound system adjustment.

The increasing attention being devoted to "packaged" loudspeaker systems means that when a good one is chosen, electronic signal delay will increasingly be used to bring their acoustic centers to convergence.

To maintain the inherent directional virtues of a given loudspeaker package when they are used in multiple numbers, the name of the game is to get all their acoustic centers to converge at the same point in space when viewed from a seat in the audience area. When that is accomplished, then the individual polar responses will be undegraded even when used in multiples. Often the problem encountered is that physically we want to place the loudspeaker here to "see" the audience area it is to cover, but we'd like it acoustically over "there" for acoustic center convergence ACC. (Or should it be acoustic convergence electronically ACE)?

Using a Precision Signal Delay.

First of all, when we use the word "precision" we mean that it can be adjusted in increments as small as 10 µsecs. Viewing a very typical case, the energy time curve ETC shows two signals sitting 300 µsecs apart. This is determined by first placing the cursor in the peak to the left and converting it to time zero. Moving the cursor to the second peak (to the right) we read 300 µsecs. Note the level of the two non-converged signals (See Figure 1).

Now let's dial in exactly 300 µsecs on the source that is in front (the left hand peak) and again make the ETC measurement. Note that now there is a single energy peak located exactly where the second loudspeaker peak had been, but now with a level 6dB higher (See Figure 2). The two signals have converged acoustically by having one delayed electronically relative to the other.

Figure 3 shows the before and after amplitude response. We are not as concerned with the amplitude response as we are with the fact that the polar response lobes severely when not converged and is whatever the device is inherently capable of when the two signals are converged.

I hate to think how often all of us reached for an equalizer when a signal delay was what the doctor ordered. If audio malpractice was fatal, sound systems would be the leading cause of death. Failing to keep an array in convergence is like sewing up the patient with the instruments still inside.

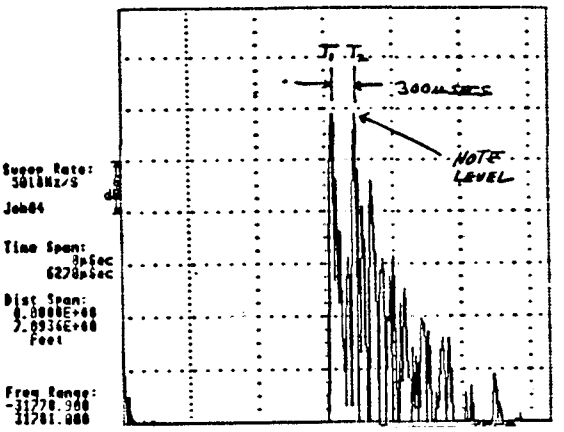


Figure 1. Signal from two speakers out of alignment by 300 microseconds.

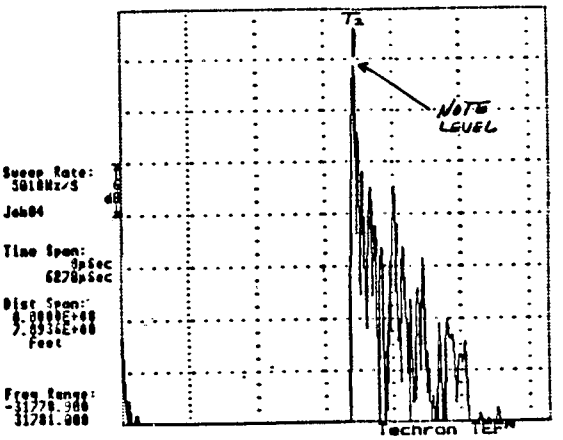


Figure 2. The two signals have now converged electronically. Note the level increase of 6db.

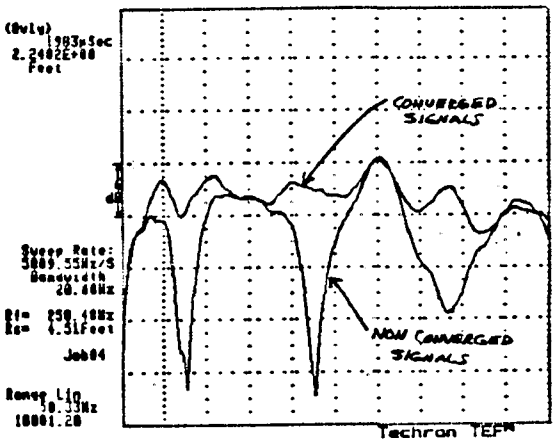


Figure 3 shows the before and after amplitude response of the two speakers in and out of alignment.

SPECIFYING INTELLIGIBILITY MEASUREMENTS

We are interested in Tom Bouliane's viewpoint on specifying intelligibility requirements. All that Tom says is true, but we believe that the purchaser of the system, upon hearing such measurements are possible, will insist that his designer include them in the specification. It is not hard to imagine that the specification where such measurements are left out will quickly be the cause of visits from competitive bidders to the prospective owners pointing out the facts of life. The designer-specifier won't "control" the situation long if another source of design says "I'll write in the specification a guarantee of intelligibility".

We appreciate the thought and time that Tom expended to participate in this dialogue and we hope many of you will contribute your thoughts as well. The next few years will be the testing ground as to what viewpoint prevails.

THOMAS G. BOULIANE, Audio Engineer

19 Woodworth Street, Boston MA 02122 (617) 825-4548

December 8, 1986

Mr. Don Davis
SYNERGETIC AUDIO CONCEPTS
P. O. Box 1239
Bedford, Indiana 47421

RE: Request for Intelligibility Workshop input, 11/25.

Dear Don,

Thank you for inviting comment on items which might be included in the detailed Intelligibility Workshop report. You mention in your letter that a model specification for sound system intelligibility requirements is something you're trying to include. System performance requirements imbedded in bidding specifications are something which have troubled me for some time.

The bidding process divides responsibilities between the system designer (also presumably the specifier) and the executing installer.

The system designer/specifier controls the composition and configuration of the system and the resulting effects of the system with its environment and its listeners. The designer/specifier defines the installed system and its results through the bidding documents, the project's specifications and supporting drawings.

The bidding documents legally constrain the installer to the supply of materials and the provision of labor to only that defined by the designer/specifier. These constraints are reinforced by the fiscal and interpersonal implications of the bidding process.

The factors contributing most to system intelligibility and other performance parameters (or their lack) are those determined and enforced by the system designer/specifier. Those factors remaining for the installer beyond the constraints of the specification have much less influence.

The responsibility for achieving an anticipated level of intelligibility must remain with the designer/specifier and any responsibility lying with the installer must be restricted to only those elements over which he has the freedom and resources to control. Any freedom given the installer is influence taken from the designer/specifier. Any resources allowed the installer must be paid for by the buyers of the work.

It is unlikely that these added freedoms and resources will be willingly surrendered by the designer/specifiers or buyers of systems, especially under the well accepted prescriptive specification formats common in our industry and the strong financial forces resulting from competitive bidding.

If the designer/specifier wishes to control the performance of his sound systems, he must thoroughly define all the comprising elements of the system -- materials, installation and adjustment, rigorously enforce the provisions of his specification and definitively accept the responsibility of his design. The buyer must accept the costs of the specified system to whatever extent the designer/specifier has defined them. If the designer/specifier wishes to publish his anticipation of system performance and then measure the performance for which he remains responsible, more power to him.

Thomas G. Bouliane

FEEDBACK FROM ROBERT MURRAY

Robert J. Murray of City Sound Service, Michigan City, IN reads the Newsletter and the Lab Manual with real care. Item 1 regarding sine wave average was corrected sometime ago when Glen Ballou called us and pointed out we had slipped a cog when we put in .5Ap instead of the correct 0.637.

The second item is dealt with in a most interesting fashion and we reproduce it here. Mr. Murray is our idea of a real student. He doesn't take anyone's word for it but works it out until he understands it. We admire that type of person. Don Keele said it best at the Intelligibility Workshop, "Come to Syn-Aud-Con to get your questions answered and your answers questioned".

ADDITIONAL COMMENTS FROM GENE PATRONIS

Gene Patronis in reviewing Mr. Murrays analysis suggested this approach. Ignore impedances and say okay the loudspeakers are on the 70 volt line. (i. e., set the taps on the transformers so that their total equals the desired wattage, in this case 80 watts.) Now look for the combination of taps that offers the best chance of using the remainder of the power available. In this case, 100 watts minus 80 watts equals 20 watts still available.

If we were to connect our 8Ω speaker across the 16Ω and 8Ω taps the voltage would be 40.0v at the 16Ω tap minus 28.3v at the 8Ω tap or 11.7v across the 16 & 8Ω taps.

$$W = \frac{E2}{R} = \frac{(11.7)2}{8} = 17.11 \text{ watts}$$

which is as near to 20 watts as any of the connections available will allow.

All this shows that there is indeed more than one way to approach a problem, some better than others.

CITY SOUND SERVICE

704 Dewey Street
Michigan City, Indiana 46360
(219) 872-9063

November 29, 1986

Synergetic Audio Concepts
Atten: Don & Carolyn Davis
P. O. Box 669
San Juan Capistrano, CA 92693-0669

Dear Don and Carolyn:

Enclosed are copies of two items that have errors in them from Lab Manual and a recent issue of the Newsletter.

The first is from Lab Manual page 27 (a copy included). The AVERAGE value of a sine wave is normally specified over a half cycle, since average over a full cycle is zero. The half-cycle Sine Wave AVERAGE is equal to 0.637 (2/Pi) · Peak. This is most likely been corrected in current Lab Manual, since I attended over two years ago.

The second is more serious, being about use of 70 V line output and voice coil taps on the output of a Power Amplifier at the same time. Both taps can be used at the same time, but EACH must have its Impedance adjusted in terms of Power ratios.

Please see the attached two sheets which detail both the thinking process involved, and the calculations are shown on the sheet with the schematic diagram and transformer ratios.

Thank you for considering these item for a future Newsletter.

Sincerely,

Robert J. Murray

CITY SOUND SERVICE
Robert J. Murray, Owner

FROM ROBERT MURRAY

When I first read the Summer 1986 issue of the Syn-Aud-Con Newsletter, I just made a mental note about Page 14's reference to using both the 70 volt and Voice Coil taps on a power amplifier. Later, when I went back and studied the article in detail, I could not make the recommendations work using the example given. I then spent some time going over the Dr. Patronis process as written out in words. They most certainly can be made to work, but not with the Example given. It not only was incomplete, but has a couple of serious errors.

The process I used is as follows: Assume we deal with the same 100 watt amplifier of the original article. Also that it has outputs for the common 4, 8, and 16 ohm Voice Coil connections as well as the traditional line output called 70 volts. All of the values normally associated with such a Power Amplifier were determined. They are shown on the attached sheet, with a. Impedance, b. Voltage, and c. Current marking for each output terminal. Voltage ratio is the square root of the Impedance ratio as pointed out in the original article.

First step would be to use the values in the example and confirm that they worked or didn't. They didn't - details on attached sheet. Secondly, I would use process learned during the proof done above to consider two (2) possible alternatives. The workability of those two choices would have to be proved or disproved.

Since we are going to work with the 70V line and 8 ohm taps of the 100 watt Power Amplifier, let us find the ratios between 70V & 8 ohms. The Voltage Ratio, E_{ratio} = 70V/28.28V = 2.5. Impedance Ratio, Z_{ratio} = 50ohms/8ohms=6.25 =$(2.5)^2$.

A. If 8 ohm tap is set to 12.65V, then 70V tap gets 31.625V.

$P_8 = (12.65V)^2/8ohms = 20$ watts

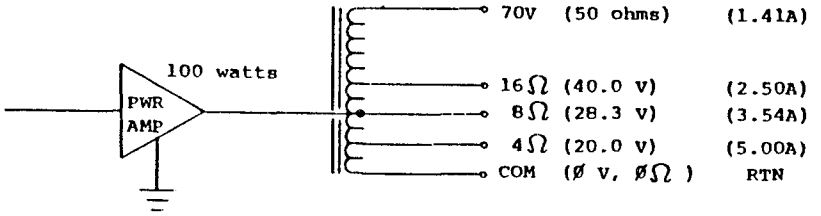
$P_{70} = (31.625V)^2/62.5ohms = 16$ watts

Now P_{total} is equal to Only 36 watts (not desired result)

B. If 70V tap is set to 70V, then 8 ohms tap gets 28.28V.

$P_{70} = (70.7V)^2/62.5$ ohms = 80 watts

$P_8 = (28.3V)^2/8$ ohms =100 watts P_{total}=180 watts (OVERLOAD)



C. Use original article 3. and set value of $R_{L_{8\Omega/20W}} = \frac{P_T}{P_8} \cdot 8$ ohms which gives R_{L_8} = 40 ohms. A xfmr is now required to transform 8ohms into 40 ohms.

$P_8 = (28.28V)^2/40$ ohms = 20 watts

$P_{70} = (70.71V)^2/62.5ohms = 80$ watts

Now P_{total} is the required 100 watts, Also $Z_{8tap} = 40\Omega \| \frac{62.5\Omega}{6.25} = 8$ ohm Everything fine, workable solution.

D. We might try to put an 8 ohms spkr on the 8 ohm tap, and limit the voltage at the 8 ohm tap to $\sqrt{PR} = \sqrt{20W \cdot 8\Omega} = 12.65$volts. That also sets via xfmr ratios, the V_{70tap} to 31.625 volts. Now to get 80 watts on the 70V tap, we need $R_{L_{70,80W}} = (31.625V)^2/80W = 12.5$

$P_{70} = (31.625V)^2/12.5ohms = 80W$. $P_8 = (12.65V)^2/8ohms = 20W$

We now seem to be OK, since P_{total} is 100 watts, but at the 8 ohm tap we have an impedance of $8\Omega \| \frac{12.5\Omega}{6.25} = 1.60$ ohms. The 8 ohm tap is designed to deliver 3.54 amps, but in our case must deliver a current of 7.91 amps (Ohm's Law Calc's). Somewhat doubtful that an amplifier can deliver twice its design center current value. (UNWORKABLE !!!)

A. and B. - Unworkable from Original Assumptions

C. The Workable Method D. Doubtful Method

The example starts out OK, with determination of the lowest load Impedance that can be placed on the 70 volt line output, to be driven at a Power level of 80 watts. This Impedance is 62.5 ohms. In the Example, we are (during the voltage calculations) lead to believe a 8 ohm speaker is connected to the 8 ohm output terminals.

However, if we use either of the voltage values at the end of the article, two very different results will be obtained. Setting the maximum voltage on the 8 ohm terminal at 12.65 volts will cause a significant UNDERloading of the amplifier. No danger to the amplifier, but certainly not very efficient. On the other hand if the voltage amplitude on the 70v line terminal is set to an actual 70 volts, we will experience a drastic Overload of the amplifier. Both of these two (wrong) procedures, are detailed on the attached.

Since I spent some time proving the Example to be in error, I must in good faith - show the correct process. Two possible choices are listed - even though ONE is correct. You might consider choice D., as I did, but in the end it is not really workable. Details of the process described above are attached.

Summary of attached sheet, is:

A. - From Original Example /V 8 = 12.65 v
B. - From Original Example /V70 = 70.71 v
C. - Correct / Workable Method
D. - Highly Doubtful Method (see details)

ERRATA

1. Tech Topic Vol 14 No 3, *Spreadsheets for Sound System Design.* We did not include David Marsh's phone number. After David had sent us his spreadsheet material PMI changed their address.

If you wish to contact him regarding his work on Spreadsheets, write: David Marsh, PMI, 14131 Midway Rd, Suite 500, LB7, Dallas, Tx 75244-3608. Ph 214-960-766.

2. Newsletter Vol 14 No 2 pg 14, 2nd paragraph, 2nd sentence in *Farrel Becker's Measurements* should read: With this information it becomes apparent in Farrel's measurement that the reflection is hiding in the doublet.

CLASSIFIED

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GENRAD FFT 2512, original price $13,000. No serious offer refused. Will trade. **Russ Berger, Joiner Rose Group, 4125 Centrurion Way, Dallas, TX 75234. 214-392-7800**

EDITORS: Don & Carolyn Davis

Design & Production: John and Jean Odum

We have received many comments on the improved quality of the Newsletter and Tech Topics. The credit for this belongs to John and Jean Odum of Elkton, Ky. They have brought us into the world of McIntosh and desktop publishing.

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