AUGUST 1974
VOLUME 5 NUMBER 4

Recording engineer producer

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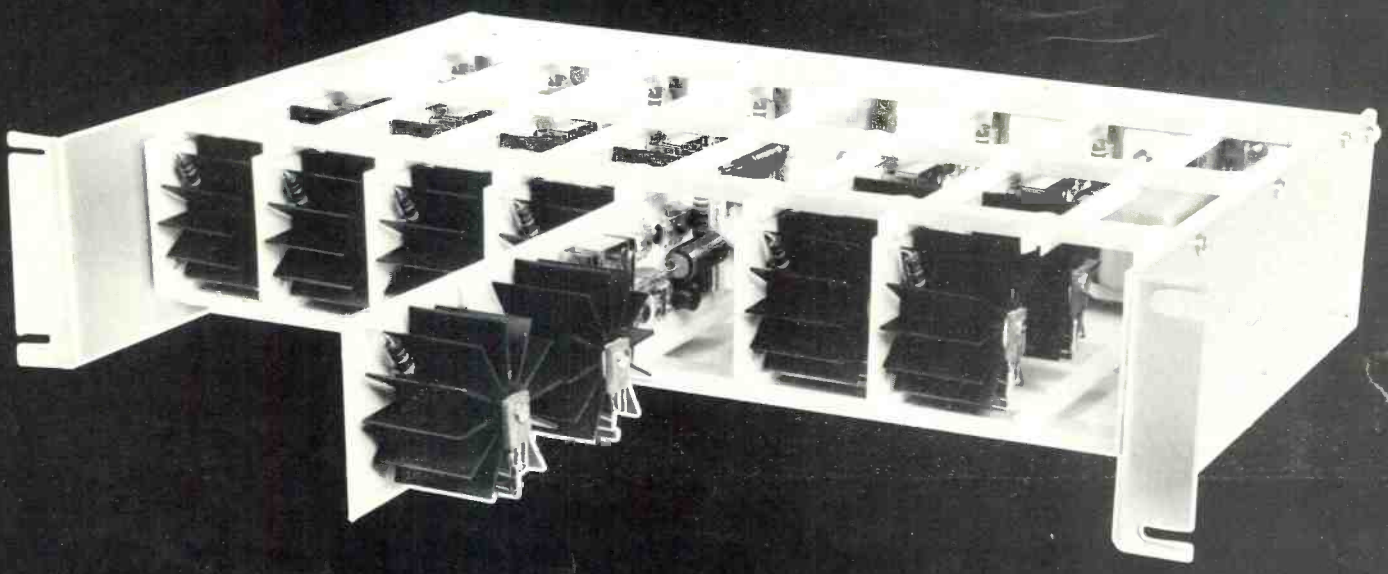

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engineer/producer

– the magazine to exclusively serve the recording studio market . . . all those whose work involves the recording of commercially marketable sound.

– the magazine produced to relate . . . RECORDING ART to RECORDING SCIENCE . . . to RECORDING EQUIPMENT.

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AUGUST 1974
VOLUME 5 – NUMBER 4

THE COVER: Roy Orbison's U.S. RECORDING STUDIO (Nashville) . . . a view looking across the MCI 24-16 Console into the multi-level studio. String and horn loft is above; rhythm floor below.

Acoustical design and construction: STUDIO SUPPLY COMPANY. Photo: Dave Harrison

Last year, we offered you Studer's tape recorders.

This year, Telefunken's.

What happened?

The answer is on page 3 of our catalogue.

In the "Statement of Principles" bi-annually published there — exactly as we wrote it seventeen years ago.

Since then, we've always vowed that, before we changed a word of that credo, we'd rather see the list of our companies change.

And this has now happened.

As our credo makes clear, Gotham prefers to represent "equipment made in limited quantity for a discriminating worldwide clientele."

This was Studer's orientation when we joined forces with them many years ago. A tiny company — only a handful of people — dedicated to serving a *limited* professional market.

But no more. Over the years they have expanded enormously. Requiring mass marketing goals.

It is a perfectly legitimate development we can respect. But. . .

The credo, remember.

Ah, you say. But the credo also stresses Gotham's interest in representing companies that are personally-run by men who *"devote their lives to the fulfillment of their dreams."* Surely, you say, the gigantic Telefunken operation can hardly be described as personally-run.

No, it can't.

But the tiny enclave that we represent *can*.

For, within Telefunken there is a separate department of about 45 people. Autonomous, because they are completely apart — independently handling *all* the development, manufacturing, and marketing of the M12 and M15 "Magnetophon" professional recorders.

These people have a high and unique responsibility — because it was Telefunken, after all, who invented the tape recorder in 1942.

And how they do their job conforms precisely with our credo. Because, to them as to Gotham: *"Not price but excellence, craftsmanship and serviceability are the criteria"* that count.

Some reasons why the M12 "Magnetophon" is in a class by itself:

1. A 19" rack mountable 10½" reel ¼" tape recorder incorporating an optional 4-input mike/line slide fader mixer. Mike inputs are Phantom® powered, of course, ready for Neumann fet 80 microphones.
2. Heads made of ferrite and sintered ruby tape guides; materials so smooth and hard we guarantee them both for the life of the machine (15 years).
3. Ingenious tape tension control on *both* sides of the capstan; no reel size switching.
4. Weighted Peak Flutter typically ± 0.02% at 15 ips; 3¾ ips speed available.
5. Price range: $3500 to $4500.

And after the technicalities, there is also the matter of experience:

For over five years now, our experience with the "Magnetophon" in Neumann's tape-to-disk transfer systems has been eminently satisfying.

Satisfying? Superb!

And we look forward to the same kind of results with Telefunken's M12 and M15 "Magnetophon." For ourselves and for you.

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Letters & Late News

From: MICHAEL RASFELD
CHIEF ENGINEER
ACME RECORDING STUDIOS
CHICAGO, IL.

I felt your article on "Visual Mixing" was superb.

Far from being in left field, the author described a way of talking about an aesthetic that is very difficult to put words on. His way of describing a mix is very much how I think of it and I'd be curious to hear some of his work.

From: ED GIESE
SOUND CONSULTANT TO
MILWAUKEE WORLD
FESTIVAL INC.
MILWAUKEE, WISCONSIN

Perhaps the following feedback may be of interest to your readers.

My father used to tell me that it doesn't pay to be a sensitive soul and that I'd have fewer ulcers if I let some things go over my head. But there are two details in . . . "The California Jam" article that prompted me to ignore dad's good advice.

Examination of excess attenuation at differing frequencies and distances tells us that the maximum distance that can be reached with a flat acoustic response, in an outdoor environment, and with a 12dB boost at 10,000Hz, is approximately 125 feet. It will also be seen that 10,000Hz has an excess attenuation of 45dB at 500 feet. The nominal distance for flat acoustic response at 3,000Hz is 500 feet, and this also has to include a 12dB boost through the hardware. What this boils down to is that it's a waste of money to include 075's or similar tweeters in high-level systems. Try taking a house curve somewhere beyond 500 feet at your next outdoor concert. Boost your high end to its maximum. Then take another response curve at something closer to the source, say 250 feet. Compare the two curves and you'll see the kind of monster you've created. I've taken well over a 1000 sound surveys of outdoor sound systems and I'd appreciate hearing from anyone who knows of a way to overcome this problem without resorting to a distributed system.

Then there's one other small detail that disturbs me, and I've heard the same thing too many times from other sound contractors to let it go over my head again. And that's Mr. Gamble's statement, . . . "the prevailing Westerly winds would carry the sound . . ."

Common sense should tell us that something speeding along at 770mph could hardly be carried or blown by something going along at say 25 to 40mph. The fact is that surface winds cause temperature gradients which create slight changes in sound velocity. The resulting effect causes sound waves to be focused downward when wind and sound are moving in the same direction and focused upward when sound and wind meet head on. So, let's end the misconception and start talking about how the wind focuses the sound.

My apology to Mr. Gamble for picking on a few bones in an article filled with all that meat to chew on.

From: HUGH S. ALLEN, JR.
EXEC. VICE PRESIDENT
GOTHAM AUDIO CORP.
HOLLYWOOD, CA

On behalf of the NEUMANN Company and the many users of NEUMANN lathes and cutting systems who may read your June issue, I object most strenously to statements made by Kent Duncan as interviewed by Gary Davis.

There are numerous mis-statements of fact concerning the NEUMANN VMS-66 and VMS-70 computer controlled lathes and VG-66S cutting electronics owned by Kendun and many others in the Los Angeles area as well as elsewhere in the world.

The sum total of these mis-statements gives rise to two erroneous impressions. Firstly, the NEUMANN disk cutting equipment, as delivered, requires extensive modification for optimum results. Secondly, that all other users of NEUMANN equipment can't achieve such optimum results.

Being completely familiar with the Kendun NEUMANN systems, the truth is that "Redesigning and modifying of the lathe computer section" is a gross exaggeration of a minor modification made to two input amplifier boards in an older NEUMANN VMS-66 lathe. In total there are 22 plug-in boards involved in the system. No modifications whatsoever have been made to the newer VMS-70 lathe. Such modifications are neither approved or reparable by Gotham Audio or NEUMANN.

The completely erroneous statement is made that "The output stage of the NEUMANN cutter amplifier was modified to develop a little more than twice the power of the stock amp."

This erroneous statement resulted from an attempt to explain the effective increased amplifier power reserve when the NEUMANN VG-66S cutter driving electronics are used with the new SX-74 cutterhead instead of the SX-68, with which most of these systems were delivered.

The NEUMANN SX-74 cutterhead is 1.4dB more sensitive than the SC-68. This could be interpreted as equivalent to 1.4dB more power reserve. However 1.4dB represents about 35 watts more, not 100 watts which would be double power.

The block diagram pictured, although not labeled as such, is essentially the NEUMANN SP 272 tape to disk transfer console with additional outboard equalizers.

Other errors regarding the RIAA curve and the problem of tracing distortion would take too long to refute and explain. Further these subjects are well covered in the technical literature.

It is a well known fact throughout the world, that the NEUMANN Company thoroughly understands disk recording requirements and technology. For over 40 years it has built equipment eminently suited to this purpose, without the need for clients to make further modifications.

During the 46 year dedication of the NEUMANN Company to the recording and broadcast industries, it has innovated new designs and has steadily injected new

HOWARD S. HOLZER

1928—1974

The professional audio world has been greatly saddened by the news that Howard Holzer had failed to survive the injuries he suffered in an airplane accident which occurred during take-off from Cuernavaca, Mexico on July 28, 1974.

Holzer, a fellow of the AES; awarded for "outstanding contributions to the industry," in 1966, was the principal of Holzer Audio Engineering Co. (HAECO) the firm he founded in 1961. Among the many innovative products he provided to the audio world were the early SC-1 stereo disc recording head followed by the SC-2, a moving coil, dynamic feed-back cutter; the CSG-2 compatible stereo generator; the CSG-4 quad generator; the SD-240 stereo-driver Amp. Additionally Holzer designed, constructed and installed complete recording and mastering systems throughout the world.

HAECO will continue in business, headed by MARCUS HOLZER who had been working with his father for the past 3 years.

improvements within the life of each product. It should not be surprising that a VMS-70 lathe would perform better than a VMS-66 lathe, as a VMS-66 outperforms an AM 32B.

NEUMANN's latest innovation, the SAL-74 disk cutting logic with six times the power of the VG-66S system, includes the TS-66 tracing simulator and many other system innovations. Two of the independent mastering systems mentioned in the interview, Sterling Sound in New York and Artisan Sound Recorders in Hollywood already use this equipment, as does United Sound Recorders in Burbank.

It is indeed unfortunate in our industry, that such erroneous information is disseminated by your publication. I can only suggest that, to avoid criticism and the natural association of such misinformation with your publication, you take one simple step. In the future preface each of such recorded interviews with words to the effect that "this is a verbatim transcript of a recording of the following interview." Further the transcript should be submitted and approved by those interviewed prior to publication.

KENT DUNCAN'S REPLY TO MR. ALLEN:

I am delighted at the interest sparked by my interview. To me, the most interesting part of this industry is the learning made possible by exchanges between those of us who make records daily.

Mr. Allen has written an expected letter disagreeing with two points I made: modification of the computerized lathe to produce better groove geometry, and cutting power of the Neumann cutter amplifier.

Mr. Allen suggests he is "completely familiar with the Kendun system." I can attest to that fact because about a week after writing his letter to the editor he dropped by to see just what we had done. Before that, his familiarity with our operation included helping install our initial system (leaving installed a factory shorting plug which resulted in less than optimum performance of our system for some time) and a telephone conversation with one person, not a Kendun employee, who participated in some of the evenings spent re-thinking our equipment.

Basically, we are delighted with our Neumann equipment. As a matter of fact, in my interview I lauded Neumann for the continual updating of equipment that is so necessary in our profession. However, anyone can purchase this equipment and essentially cut the same thing. This leaves only engineering expertise as the difference between studios. We have simply gone one step further and extended our engineering to include modification of existing equipment to make it better.

It is absolutely true that we attribute part of our success to the fact that better

results can be obtained with lathe modifications. We did not say that no one else can achieve these results, however, to our knowledge, no one has successfully accurately cut identical pairs with two different model Neumann systems.

We do believe that best results can only be obtained by modifications of both the VMS-66 and VMS-70 lathes. It is hard for me to fathom why it is so holy for Neumann in Germany to update and improve the equipment and a sin for Kendun in Burbank to attempt the same thing.

An open door policy has always existed at our studio resulting in a virtual parade of competitors (Sterling, Artisan, Mastering Lab, USR, LRS), label engineers and executives (RCA, CBS, Capitol, Motown) and interested parties (JVC, JME, Westlake, CF) all to investigate what we do and how we do it. Certainly this policy extends to people who are interested in determining what actually we have done as outlined in my interview audibly, electrically, or mechanically.

Let me explain our changes in a little more detail. One of Kendun's lathes is a VMS-66. When we attempted to cut identical pairs, we found that the VMS-70 outperformed the older model. After many trying nights we came up with modifications to the two boards Mr. Allen mentions. Basically what was involved is the alteration of the existing time constant circuits resulting in improved groove geometry. Our only trouble then was that it outperformed the stock VMS-70. Mr. Allen states that nothing was done to this system, which is not true. We applied the same idea to the VMS-70 to achieve results matching our modified VMS-66. As of this writing, we are still experimenting with different value components to find a combination that best performs for all types of music.

After achieving such dramatic improvements, we offered to Gotham this information at our cost so it could be distributed to all owners of the VMS-66. Gotham's response was negative.

Then comes the subject of power. Kendun Recorders was the first or second studio in the country with an SX-74 cutterhead. As a matter of fact, when it was delivered we were surprised, as we had ordered an SX-68. Because we had no information on the new head, we contacted Gotham in New York and were told that using the stock VG-66 cutting system with the new SX-74 cutterhead, we would develop 180 watts instead of the 100 watts developed into the SX-68. We are now finalizing a modification (including additional power supply capability) with some 22dB more power. Thus, our claim of slightly more than twice the power (22dB added to stock power of 180 watts). Mr. Allen now states that only 135 watts is available stock. Therefore, we must apologize to the reader for passing on information supplied by Gotham without checking it out.

Upon reflection, it seems that the 180 watt figure is excessive.

Mr. Allen states that the block diagram pictured in the article "is essentially the Neumann SP 272 tape to disk transfer console with additional outboard equalizers." The following items shown on our block were *not* included in the Neumann SP 272 console:

1. Studer A-80 preview machine
2. DBX noise reduction
3. Dolby noise reduction
4. Burwen noise filter
5. Haeco CSG
6. 2nd set of equalizers for A/B switching
7. A/B switching module
8. Crossfade control
9. EMT Limiter/Compressor/Expander
10. Studer copy/machine
11. Disc cutting lathes
12. Quad/Stereo speaker selection/switching
13. Quad decoders
14. Monitor rack and filters

The block diagram graphically demonstrates the options available to clients in our cutting chain for instance, switching seven knobs of EQ in and dropping seven others out instantaneously.

Additional equalizers and switching between pairs with a cross-fade control to

smoothly change to a new equalization are a requirement in a modern disc cutting operation. Mr. Allen has told us Neumann is studying these suggestions for inclusion in future disc consoles.

I must say, however, that the most dramatic improvements in cutting technology recently have been made by Howard Holzer at Haeco Audio. He recently developed a cutting system and head capable of cutting far greater power resulting in usable records with tremendous clarity and excellent geometry that are most impressive. It is a loss to us all that Mr. Holzer's tragic and untimely death may slow the acceptance of his system in the industry.

From: STEVEN A.GUY
LOCATION RECORDING SERVICE
BURBANK, CALIFORNIA

The June, 1974 edition of Recording Engineer-Producer contains an interview with mastering engineer Kent Duncan, in which Mr. Duncan discourses, in a rather self-serving manner, about several aspects of disk recording with which he seems unfamiliar, in view of the quantity of erroneous information he presents.

We already have enough confusion about disk recording among many in the industry, with no need for Mr. Duncan to add to it.

Some comments and corrections may be in order:

1. In this interview, we are given a general impression that Messrs. Cecil and Margouleff visited several cutting rooms in the Los Angeles area, all of whom were unable to properly cut the "Innervisions" material.

Casual conversation among several of us who operate well-known independent cutting rooms has disclosed that none of us ever had this album in for cutting. We are not saying that other cuttings were not made in the Los Angeles area, but we would certainly like to dispel the prevailing tone in Duncan's remarks, that no company but his could properly cut this album.

2. Mr. Duncan states that the output stages of his Neumann cutting system have been modified to produce, "A little more than twice the normal power." This would be an impossible modification, because the standard output stages of his Neumann cutting system can already make full use of the supply capability.

We will state flatly that Mr. Duncan is cutting with a standard Neumann VG-66S amplifier system, having no significant increased power capability, and will challenge him to produce measurements taken by an impartial, competent engineer, to prove his claims.

3. Mr. Duncan's opinion of the storage duration of the Neumann lathe 'computer' is in error. He says he thinks that control information is stored for six-quarters of turntable revolution.

Stated as briefly as possible: Information requiring a change in depth-of-cut, or information dictating a change in cutting pitch (lines-per-inch) as a result of flank modulation, is stored for more than two-quarters, but not more than three-quarters of turntable revolution. Information dictating a change in cutting pitch only in order to accommodate an increased depth-of-cut, is stored for more than four-quarters, but not more than six quarters of turntable revolution.

4. Mr. Duncan tells us that, "Cutting a 10kHz tone will use something like ten times the power of a 1kHz tone." We only wish it were true! The absolute figure would depend on the specific cutterhead involved, but, to cut those two tones at identical levels will entail a power difference of several hundred times.

5. The statement that, due to the Vinyl shortage, "Some (pressing) plants have gone to Styrene," is a little bit naive. You don't simply 'change to Styrene.' The use of Styrene entails a completely different process, with completely different (and very, very expensive) equipment. It would take months for a record manufacturing plant to set up for, and change over to Styrene, even if they could eschew the great cost involved.

6. We are advised in the interview that reference tones on a Dolbyed master tape should be "Regular N.A.B. and stretched Dolby." This advice appears to be self-contradicting.

As a matter of convention, ref tones on Dolby tapes are usually recorded with the Dolby N/R switched 'out,' and there is a good reason for it: At normal tone levels, the A-type Dolby displays, in the record mode, a slight rise in response at either end of the audio spectrum. This is cancelled by a reciprocal droop when in play mode. If the Dolby N/R is not switched 'out' when laying down ref tones, these boosts and dips will be observed on the meters of the tape machine, thus giving inaccurate indication of tape recorder performance.

The statement that Kendun's Dolbys vary in frequency response by ±2dB indicates an immediate need for maintenance. Hopefully, Kendun will receive an offer of help from the Dolby organization.

Mr. Duncan also comments that Dolby is, "A 2 to 1 situation." That statement is incorrect. DBX is a 2 to 1 situation. Dolby is not.

7. Mr. Duncan makes a statement which connects centrifugal force with inner-groove distortions.

Centrifugal force has nothing to do with the matter, and even centripetal force has, in most cases, relatively little to

do with this problem.

The physics of inner-groove distortions are quite complex, and have been treated in various technical papers. Putting the matter as simply as possible, the prime causes of it are:

A. The playback stylus radius being larger than the modulation radius.

B. Plastic deformation of the modulation.

C. Correct lateral axis of playback stylus motion not being tangent to groove.

D. Improper vertical modulation slant in cutting, or improper vertical tracking angle of pickup cartridge.

E. Contact area of playback stylus changing with modulation.

As a point of interest, item 'E' is the distortion component which is corrected by the use of tracing simulation in a cutting channel.

Finally, we must say that spending two or three days presetting a computerized lathe to cut flat from a tape is a bit far-fetched.

When set up precisely to factory standards, (and these procedures do include a simple change for 'pop' music) the unusual and costly procedure described in the interview will not be needed. As proof, consider this:

At least two independent cutting studios, Artisan and LRS, obtained copies of the "Innervisions" album, dubbed them flat to tape, then dubbed the tape back flat to disk, and with no changes in our standard Neumann systems, obtained, on the first cutting, a ref disk that was essentially identical to the pressings with respect to level, sound, groove geometry and ending diameter.

The "Innervisions" album is indeed superb in its music, recording, production and mastering. It is unfortunate that the mastering engineer lucky enough to cut it, could not accept his honors with the same aplomb as did Cecil and Margouleff.

KENT DUNCAN'S REPLY TO MR. GUY:

Mr. Guy suggests that it is a bit far-fetched to spend 2 or 3 days to cut an album flat with a computerized lathe. I agree. However, to explain the confusion in his mind I should note that the first day was used in studio playback and doing test cuts with various EQ settings before deciding to cut it flat. The second day was spent cutting some 8 or 10 ref dubs (16 to 20 sides) for the producers and the label. After ref approval, we then began to cut lacquers, some 28 sides. It should not be hard to understand that it takes more than one day to cut some 50 LP sides. It was during the cutting of these refs that experimentation with the lathe took place. In addition, it is Bob and Malcolm's policy to inspect the groove from start to finish on each ref and lacquer, resulting in a wait between sides of up to one hour while their inspection took place. While I make no comment on that procedure, with that kind of time available, what engineer wouldn't take the opportunity to futz with the material?

Incidentally, kudos should go to Guy Costa and Motown Records for their efforts in the area of quality control. Before lacquers are cut, their QC Department carefully inspects the master ref and very specific requirements must be maintained by the cutting channel. Level, EQ, and groove geometry of test pressings are checked back against the master ref before pressing. Notations of instantaneous peaks together with a test pressing accompany EQ tape copies that go to foreign countries for mastering. Checks are then made to assure the cutting matches U.S. parts. Continuous checking such as this is the only way to assure uniformity of quality worldwide.

Mr. Guy goes on to intimate that he is not sure that there were other cutting rooms who failed to cut the album. In fact, we were the fourth cutting room to attempt the album. I will not list the other three as it would serve no purpose, except to point out that all four rooms were delivered essentially identical Neumann equipment, and we attribute our success to the way in which we utilized our system.

. . . Continued on page 30

SOMETHING REVOLUTIONARY,

SOMETHING A LITTLE REVOLUTIONARY

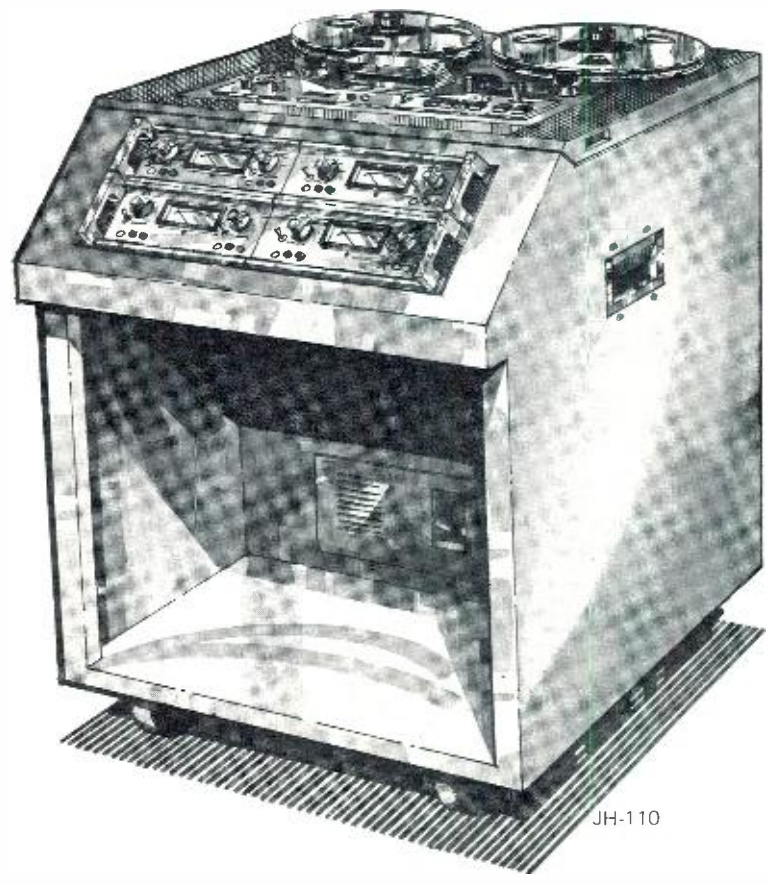
...AND SOMETHING YOU CAN BETTER PUT YOUR FINGER ON.

ALL FROM MCI

REVOLUTIONARY: That's the word for the JH-110 series quarter- and half-inch recorder, which we believe is the most sophisticated recorder of its type (available in mono, two- and four-track models). With a simple switch change, it can be operated on any-type electrical source in the world. Check out the specs for yourself, and we think you'll agree the JH-110 series *is* revolutionary.

JH-110 TRANSPORT AND ELECTRONICS SPECIFICATIONS

REEL SIZE: 3" to 11¾"
TAPE TENSION: 4 oz., Supply and Take up Servo Controlled—Constant All Speeds and Reel Sizes
CAPSTAN DRIVE: Phase Locked D.C. Speed Variable 5 to 45 I.P.S. or 2.5 to 22 I.P.S. Dependent on Capstan Diameter
FIXED TAPE SPEEDS: 3¾, 7½, 15, or 7½, 15, 30 (dependent on capstan diameter)
FLUTTER AND WOW: .05% DIN at 15 I.P.S.
START TIME: .2 Seconds at 15 I.P.S. on 7½, 15, 30 I.P.S. Capstan
REWIND TIME: 85 Seconds for 2,400 Feet
FREQUENCY RESPONSE AT 15 I.P.S.: Reproduce: 30 Hz-16KHz ±2 db; Cue: 30 Hz-16KHz ±3db; Record: 30 Hz-16KHz ±3 db
SIGNAL TO NOISE (30 to 18 KHz): 2 Track Reproduce: 62 db Below +4 dbm; Cue: 60 db Below +4 dbm; Record and Erase Less Than 4 db Noise Added to Bulk Erased Tape
DEPTH OF ERASE: Greater Than 75 db Below 0 VU
ELECTRONICS DISTORTION: Less Than .1% THD at 1 KHz, Less Than .2% IM 60 and 6000—4:1
INPUT: Level -15 to +24 dbm for 0 VU Impedance 10,000 Ohms Balanced
OUTPUT: Level +4 dbm for 0 VU, Source Impedance 50 Ohm Balanced Maximum Output at Clipping, +24 dbm
EQUALIZATION: 3 Speed NAB Internally Switchable to CCIR
BIAS AND ERASE FREQUENCIES: 120 KHz
BIAS ADJUSTMENT: Separate Bias Adjustment for Each of Three Speeds
RECORD HEAD-ROOM: Greater Than 20 db at 1 KHz at 15 I.P.S.
CUE: Switches Automatically to Input When Entering Record
POWER REQUIREMENTS: 100V—220V Selectable 50—60 Hz. Current Requirements for 120V Operation, 4 Amps.
HEIGHT: 35"
WIDTH: 25¼"
DEPTH: 26"
SYSTEM WEIGHT: 190 Pounds



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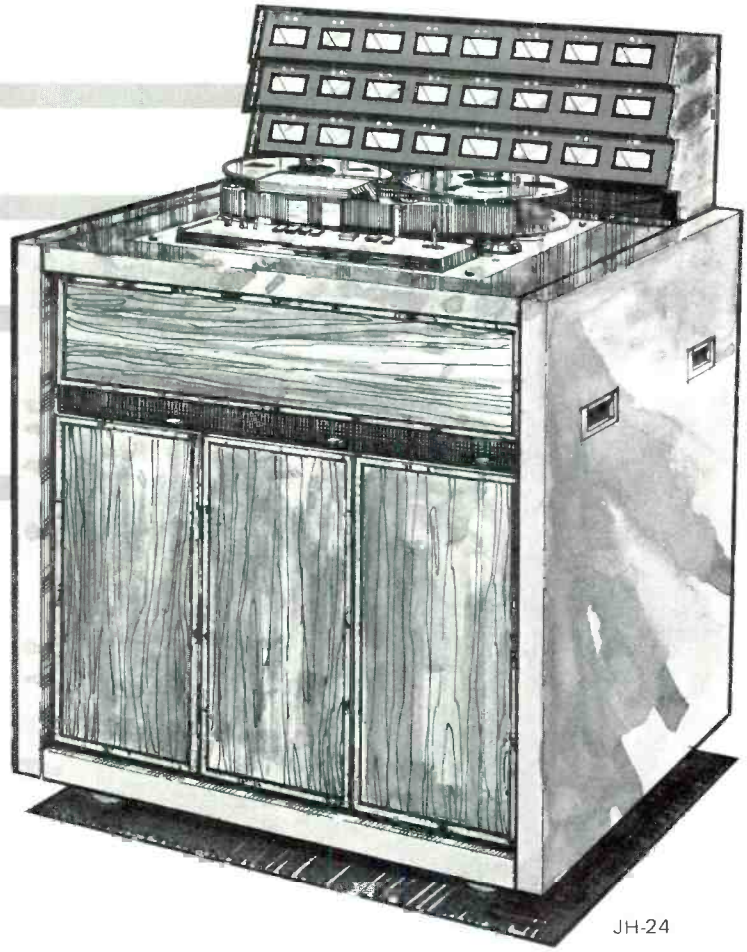

JH-24

A LITTLE REVOLUTIONARY:

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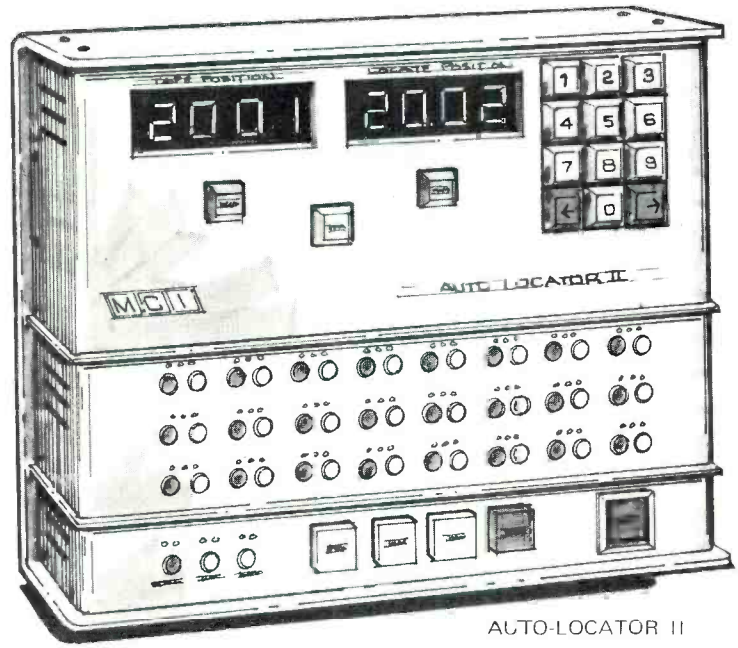

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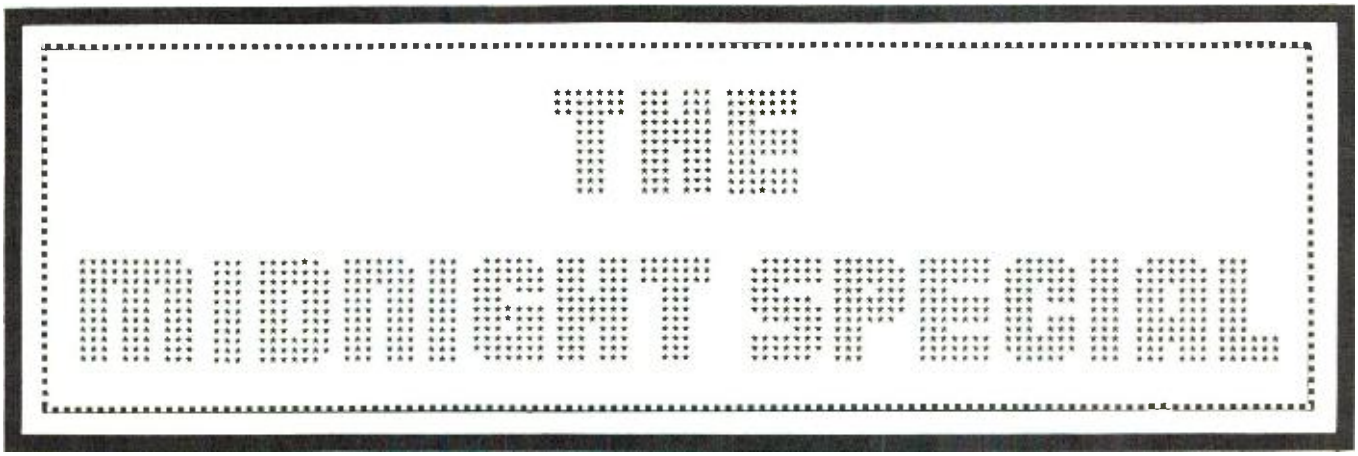

BY GARY DAVIS

The first broadcast of The Midnight Special marked the beginning of a strong new direction for the music business. Prior to that show in January, 1973, there had been no regularly scheduled rock and roll television show with top quality audio. In successfully merging a variety of elements from record recording, live stage performance and television production, Burt Sugarman Productions broke new ground. Joe Ralston, NBC's audio engineer who works on the show, told us that The Midnight Special was the network's first real "series" rock show. The NBC staff, in cooperation with the staff of Midnight Special, learned a lot of new techniques. They rented and eventually built or purchased new equipment, and they developed an approach that has pleased not only the viewing audience, but the performers and the studio audience, too. We wanted to learn all we could about how the show is put together, what makes it work, and how it compares with record recording. Stan Harris, the show's producer and director, very cordially explained his job and told us about the many facets of this television production.

The producer/director is the man who has the last word in matters of talent booking, script content, set design, lighting, video composition, and audio quality – in other words, everything that comprises the show. Stan has a competent staff to assist him with the substantial task of planning, taping and assembling the weekly shows. As we sat in his tastefully decorated office, high above Sunset Boulevard in West Hollywood, Stan discussed the concept behind the show. Originally, the show was to be television's answer to AM radio's top forty format. To keep the music current, there could be no reruns or summer replacements. Although the scope of the show has widened to embrace blues, folk, country and even comedy, the main fare is still predominantly rock.

AN OVERVIEW OF THE PRODUCTION

Unlike some music programs which do little more than photograph and record a concert, The Midnight Special is deliberately created to be a television program. That means that the video, as well as the audio, is given full consideration in the planning and execution of the show. While Stan told us that sound is probably the more important element, he demonstrated his concern that the video be clean, interesting, and appropriate to the performance.

The taping is done with a large studio audience, so the show has a genuinely live feel. Full sound reinforcement facilities were established to provide separate stage monitor and audience mixes, and to deliver clean sound with precise coverage. The stages are similar to concert stages, yet there are obvious differences between the taping we attended and a true concert or club performance.

Often the tunes are taped out-of-sequence. Occasionally the performance is interrupted so a technical adjustment can be made, or simply because the artist wants to take it from the top. Unlike record recording, however, very little overdubbing is done. In fact we learned that only twice in the show's history has a vocal overdub been added, and then only to lay down a harmony part for a female vocalist who had used a similar effect on her album. Overdubbing not only multiplies the production costs, it detracts from the live and authentic quality of the show. Stan feels so strongly that the television audience should be treated honestly that he has ruled out lip sync audio. As a result, the show is taped with surprising smoothness and continuity.

Smoothness and continuity – a good phrase to describe the entire process of making The Midnight Special. We observed the taping of a show hosted by Randy Newman, with Ry Cooder, Dr. John and Maria Muldaur. The Turtles were to be taped the following week and added to the program. We saw numerous reminders that everyone does his homework, and the taping was painless, if not enjoyable, for the performers, staff, and even the studio audience. A detailed script is prepared in advance. It includes all lyrics, the approximate length of each tune, the stage arrangement schematics for each act, notes on camera placement, mike placement, video switching, and more. In order to make the performers as comfortable as possible, they are asked about preferences for stage arrangement and miking before the final diagrams are prepared. Actual arrangements are developed by the show's staff to provide adequate audio separation, pleasing visual composition, good camera access, and to meet the need for one performer to see and hear another. This planning is all part of the process called pre-production.

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video control booth (foreground) separated by sliding glass door the audio control booth . . .

THE PRODUCTION SCHEDULE

The actual production begins the day prior to taping. This is the setup day, when all instruments and amplifiers are brought into the studio. Lighting and sets are arranged on four stages which surround a central floor space (the audience will sit here). At this point, roadies may be helping with the setup, although NBC people will complete the job. Union conflicts apparently pose no real problem. The average setup day runs between 12 and 14 hours.

The day of the taping, rehearsals begin just after noon. Only one act at a time will rehearse, so people don't have to sit around waiting. The first part of a rehearsal is the audio runthrough. This gives the performers an opportunity to loosen up while the audio engineers and technicians get their levels, balances, equalization, and so on. Stan will use this time to walk around the stage floor, get a feel for the sound, and suggest any last-minute changes he may want. Often a representative of the act, the manager, producer or record company engineer, will go upstairs to the audio control booth; while union regulations prevent him from touching the console, he can suggest ways to get the sound that the act would want. Joe Ralston, who has been the show's chief audio engineer almost since its inception, seems to fully enjoy the music. He will listen to the records of any act he doesn't know so that he can get a feel for the right sound.

After the audio runthrough, which may take 1/2 to 3/4 hour, there is a video runthrough. At this point, Stan is in the video control booth; he is busy telling the cameramen what he wants and advising Jerry Weiss, the technical director, what video switching and effects to use. There are several intercom systems for communication with stagehands, camermen, the lighting booth, and the remotely located video tape recorders (VTR's). In addition, a studio talkback system feeds monitor speakers, and a 2-way radio is used for exclusive communication with the stage manager. A lot is going on, and Stan's assistant director, Ron Cates, helps in several ways. He is most helpful in keeping Stan's place in the script, timing the musical passages, and anticipating video or audio transitions. It is really an important job because Stan's attention is riveted to the five B&W camera monitors and the three color program monitors in the video control booth. Stan is also responsible for dealing with the performers, and production assistant Ellen Brown makes that job considerably easier. It is also no accident that there is a close working relationship between Stan and Joe Ralston, so the audio tends to sound the way it should with a minimum of direction. During the actual taping, when things are most hectic, associate producer Jacques Andres closely supervises the audio.

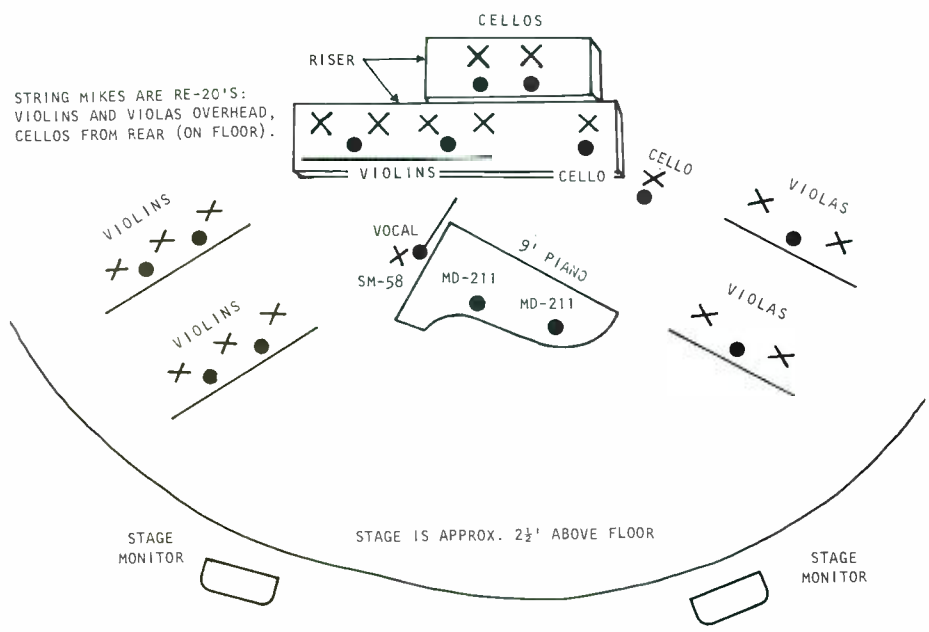
During the video runthrough, Joe has another chance to polish up the audio, note some level and equalization settings, and help the engineer in charge of sound reinforcement (which they call PA). The reinforcement is done with a separate console on the studio floor, but the feeds to that console must be patched from the audio control booth. We'll describe this system elsewhere in the story.*

When the first group has completed the audio and video runthroughs, the next group immediately begins. There is a lunch break around 4:00 pm, for an hour, and then additional rehearsal until the taping at 7:00.

WHAT IS THE TELEVISION SOUND AND WHERE IS IT?

The Midnight Special is broadcast with a monaural soundtrack. The producers would like to use stereo sound, but NBC does not have an affiliated FM radio network, so stereo is impractical. Besides, Stan points out that the show's simulcast competition charges around $18,000 per minute of commercial time to cover about

*We would also like to describe the video effects, switching, and recording in considerably more detail, but it would take a hundred pages. Suffice it to say that the video booth is where what you see on the screen is basically determined, and this is done in real time while the show is taped.



set up for the Randy Newman segment . . .

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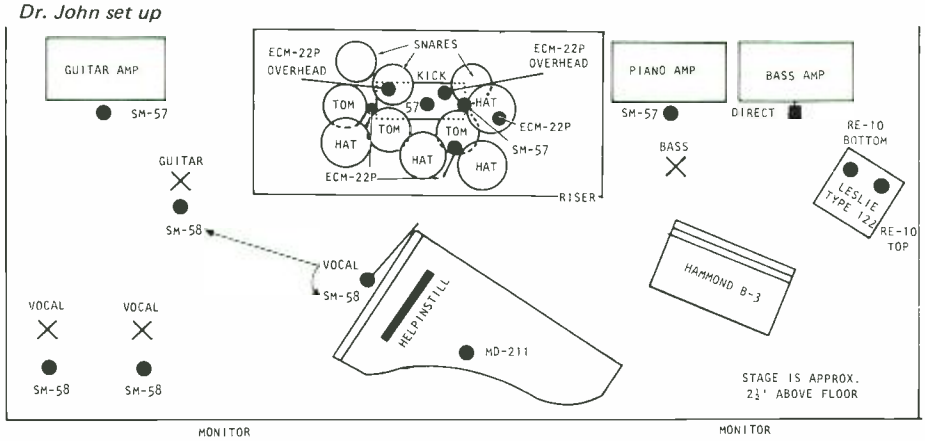
Dr. John set up



the same audience that The Midnight Special reaches for some $9,000 per minute. Stan wishes that television itself were stereo, like his Sony videocassette machine, and he philosophically conjectures that if the people who invented video tape machines had provided two audio channels, we would have stereo television today.

The monaural soundtrack is stored on a small portion at the edge of the 2" videotape. The tape runs at 15ips past several head stacks. The first head is the master erase head. Then the vacuum-assisted video head scans the tape at some 1500ips (actually 4 heads evenly spaced on a rotating drum diagonally sweep the tape). Past the video head is a pair of audio heads with three channels. But only one channel is for the actual soundtrack; the others are for an EECO time code and for cues. Recording electronics are adjusted so the audio input peaks at OVU (+4dBm). The frequency response and noise level are comparable to standard professional tape machines. One further note about the video tape machine is that the line frequency is 59.9+Hz instead of 60Hz, so any auxiliary recorders must be equipped with resolvers to run at the correct speed.

During the taping, the audio engineer, Joe, will send a mono program feed down to the VTR room where it is recorded with the video program. Prior to the recording, a test tone is used to calibrate and align all tape machines, and is placed at the head of each tape. Known as multi-tone, this complex signal is piped throughout the NBC facility. The video tape engineer, not the audio engineer, is responsible for the alignment of the heads on the video tape recorder.

MIKING

The miking is done with great care, using a wide variety of condenser and dynamic mikes. Placement is governed by video and audio needs. For example, Randy Newman was accompanied by 18 strings. If each had a mike on a floor stand, a music stand, and an instrument, there would have been a terribly cluttered stage. So the decision was made to try hanging the mikes by their cables from the 42' high grid. It worked well. If possible, a mike is placed so that at least two cameras can get a clear shot of the vocalist's face. Yet mikes can't be located very far away.

Tight miking must be used to avoid feedback from stage and audience monitors. Studio techniques, such as baffles or physical distance, are unsuitable when TV cameras are there. Tight miking also reduces any leakage, leakage which could degrade the mono mix. Stan and Joe like the close-mike sound, and there are a few EMT's available to put back the lost ambience.

Mikes are chosen for their sound. Performers are given their preference if they voice a strong opinion, and mikes will be rented if necessary. But NBC has purchased many mikes since the show began, so they are pretty well equipped. Joe says that the SM-57 is the basic all-purpose mike. SM-58's are commonly used for vocals, MD-211's are piano favorites (stuck in the sound holes), and ECM-22P's for the drums. The ECM-22P gives a crisp drum sound, an important consideration for the small television set speaker. RE-10, RE-20's, MD-421's and other mikes have been used often. Direct boxes are fitted to some electric instruments, and mikes are used for others. Barcus-Berry, Countryman and Helpinstill piano pick-ups are used occasionally: usually at the request of the performer, and usually to reduce monitor feedback but not to feed the program mix.

When we looked at the stages, the miking could have been for a typical multi-track recording session. While the show is broadcast in mono, parts are well separated and fully miked. Besides the leakage and feedback factors we cited, there is the advantage of precise balance and equalization control, and the acts can have exactly the stage monitor feeds they need.

THE AUDIO SYSTEM USED FOR THE PRODUCTION

The accompanying flow diagram illustrates the complex audio paths involved in the production of The Midnight Special. All mikes are brought through low impedance lines directly to a 980-point patch bay adjacent to the console. These are patched into preamplifiers in the console, and are multed to the input channels. The mult outputs can be patched through unused mike lines down to the

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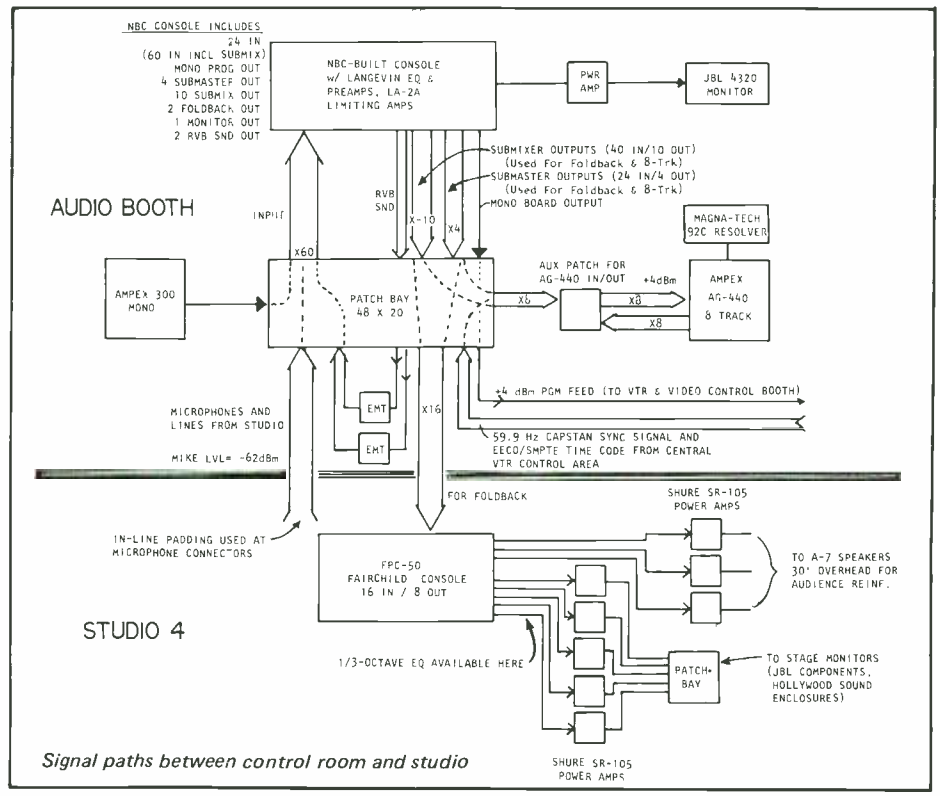
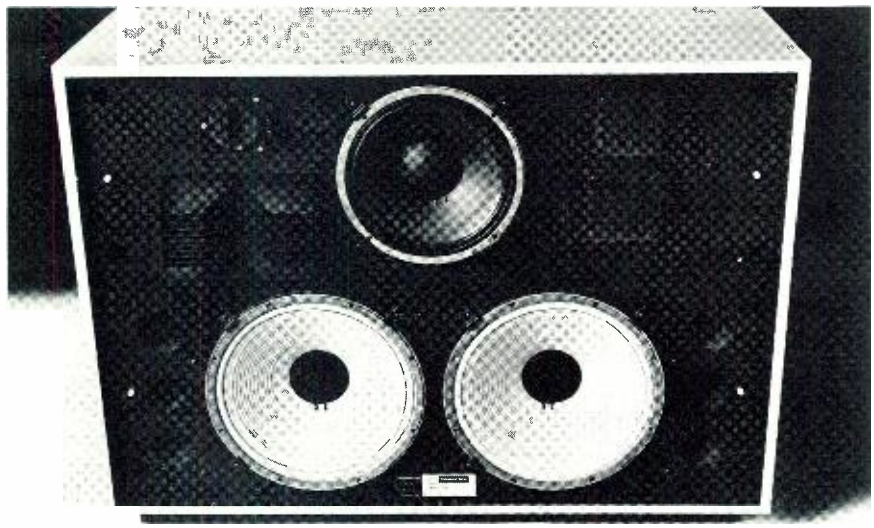


Signal paths between control room and studio

Nobody ever made a monitor that could match this sound.



Type of System	4-way
Components	(2) 15" low frequency loudspeakers (1) 12" midrange loudspeaker (1) High frequency compression driver with horn lens (1) Ultra high frequency compression driver
Frequency Response	30 to 20,000 Hz ± 3dB
Sensitivity (SPL at 30' lmW)	46.5 dB
Power Output (SPL at 10 ft. in a room volume of 2000 cu. ft. with 1/2 rated power input —150 watts)	110dB
Crossover Frequency	250, 1100 and 9000 Hz
Size	35"x48"x20"
Net Weight	243 lbs (110 kg)
Configuration	Bi-amplification only
Price	Utility finish shown $1314 Walnut finish $1464

The 4350. Three years ago JBL's technical staff was asked to produce the best studio monitor that technology and artistry could create. That was their total assignment. Considerations of cost and monitor size and studio application were secondary. The search was for a sound. The name was 4350. Its birthday was April 13, 1973. And, from the day it was born, it was the best sounding studio monitor money could buy:

A virtually flat frequency response from 30 to 20,000 Hz. Minimum phase shift throughout the entire band pass. Extraordinary response to onset and transient signals. Carefully controlled, semi-diffuse dispersion pattern throughout the frequency range. Uniform sound characteristics from *ppp* to *fff* dynamic markings. Extremely low transducer distortion within the recommended dynamic range values of more than 90dB. High sensitivity for maximum conversion efficiency.

But, wait. A spec is not a sound. Come hear the 4350 and see how far sound can go.

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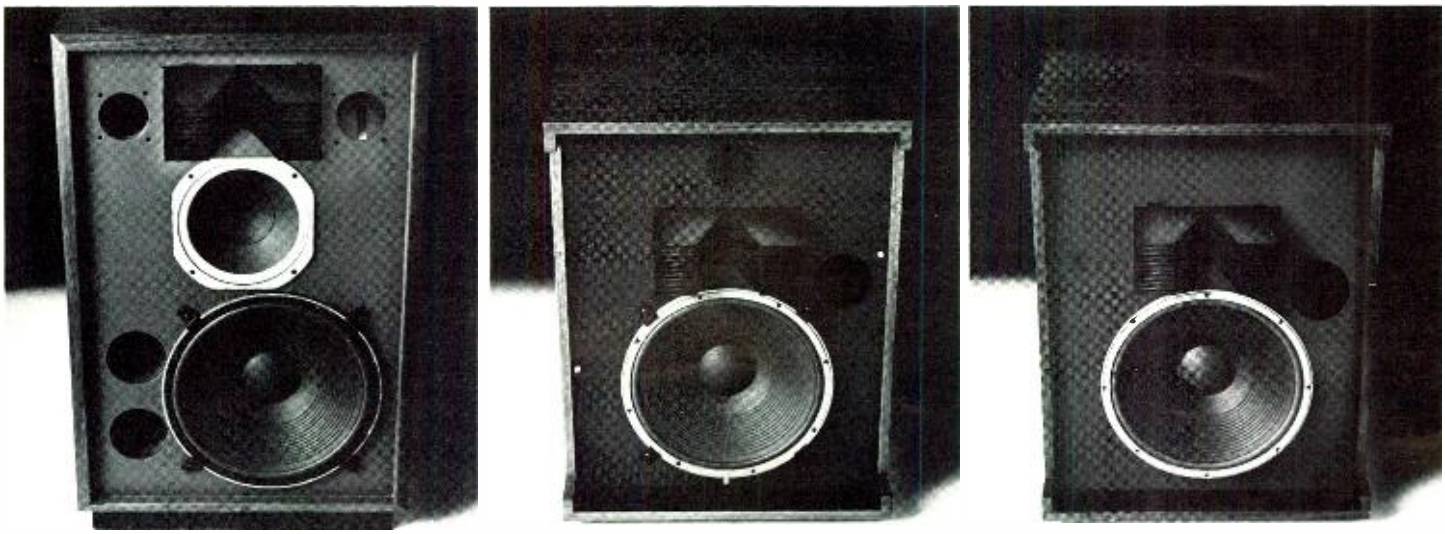
Until now.



	The 4340/41	The 4332/33	The 4330/31
Type of System	4-way	3-way	2-way
Components	(1) 15" low frequency loudspeaker (1) 10" midrange loudspeaker (1) High frequency compression driver with horn lens (1) ultra high frequency compression driver	(1) 15" low frequency loudspeaker (1) High frequency compression driver with horn lens (1) Ultra high frequency compression driver	(1) 15" low frequency loudspeaker (1) High frequency compression driver with horn lens
Frequency Response	35 to 20,000 Hz ± 3dB	35 to 20,000 Hz ± 3dB	35 to 15,000 Hz ± 3dB
Sensitivity (SPL at 30' lmW)	44dB	44dB	44dB
Power Output (SPL at 10 ft in a room volume of 2000 cu ft with 1/2 rated power input—37.5 watts)	101dB	101dB	100.5dB
Crossover Frequency	250, 1250 & 9500 Hz	800 and 8500 Hz	800 Hz
Size	38"x24"x20"	30"x24"x20"	30"x24"x20"
Net Weight	179 lbs (81 kg)	121 lbs (55 kg)	96 lbs (44 kg)
Configuration	for bi-amplification or with high level network	for bi-amplification or with high level network	for bi-amplification or with high level network
Price	to be announced	to be announced	to be announced
Availability	June 1974	June 1974	June 1974

Four monitors. Virtually one sound. A matched set: you could record on one, play back on another, mix on a third and master on a fourth.

Four monitors. Their only differences are acoustic output, cost and size.

Hearing is believing. Come hear what you can do.

JBL

Circle No. 113

Re/p 23

. . . Continued from page 21 . . .

reinforcement console on the studio floor. In addition to these microphone feeds, submixer and submaster outputs are sent to the reinforcement console. This arrangement is used because the booth can accommodate all the mikes from all four stages, but the reinforcement board has only 16 inputs.

There are two tape machines. An Ampex 300 is loaded with a mono tape of Johnny Rivers' Midnight Special Theme, with and without vocal. This machine is used according to cues in the script. Adjacent to the 300, an AG-440 8-track is loaded with Scotch 206 tape for a continuous multi-track recording during the taping; some five full reels were used for the show we attended. One track of the AG-440 is reserved for the EECO time code, the same code required for the VTR, and another track is for the 59.9Hz sync signal. A Magna-Tech Model 92C playback synchronizer is used to resolve the sync tone and drive the capstan motor. Both the time code and the sync tone are generated in the VTR room and fed to the audio booth.*

The console, like all consoles at NBC, is custom built in house. It is ruggedly designed, with heavy aluminum panels and color-coded anodized aluminum knobs machined at NBC. While the board is similar in some respects to recording consoles, it has many more levels of sub-assignment. The 24 1½" wide modular input channels have linear faders, Langevin EQ-251B equalizers, and an unusual bus assignment system. The channel can be assigned to any of four submaster channels, two foldback chanels, or two reverb send channels.

Each submaster and reverb channel is equipped with an LA-2A limiting amplifier with front-panel controls mounted in the module and the balance of the electronics mounted in the back of the console. Following the limiter, a large rotary level control and an additional equalizer are part of the submaster channel. The submasters can be used as board outputs, and some are. But assignment switches allow them to be routed through either or both of two rotary level controls; designated Music Master and Cast Master, they provide a single-handed way to balance vocals and instruments. The Music Master and Cast Master are routed to a board master, which then provides the mono program feed. But there is an additional type of sub-group.

10 of the 24 input channels are provided with submixers. The submixer is a set of four individual rotary level controls, followed by a group level control. These are used to mix four inputs into one input channel. So the ten submixers actually add 40 inputs to the board. Since four stages are used, the submix groups can be used to feed the same instrument on the various stages to the same channel of the console. This avoids confusion in mixing. Also, the inputs of one submixer may be the mikes from one drum set, so that input channel simply becomes the drum channel. The submixer output is normalled to the input fader of that channel, but it can be patched to any point, including the 8-track recorder and the reinforcement console.

Four VU meters are calibrated with 0 VU=+4dBm levels, and three of these have rotary selector switches to provide VU metering for additional board outputs. Adjacent to the meters are a pair of small B&W video monitors. One is the program feed (the show being taped) and the other is the preset bus (the camera or effect about to be selected for program). These B&W monitors are duplicated with larger, wall-mounted monitors. And, as a result of Midnight Special requests, a color monitor sits atop the console. Sound is monitored with a JBL 4320 hung on the wall about 5' in front of the mixer's chair, and a 5" speaker is mounted in the console for reference to the average TV set speaker.

DETAILS OF THE AUDIO MIX

Relatively little equalization is used: about 6dB of boost or cut was the most we observed, and many channels used none. There is some additional low end to cut through the small speaker. And because most small speakers have a peak near 5kHz, the vocals must be held down somewhat with respect to a good balance on the 4320. Because the mono, once mixed, is difficult to equalize, nearly all equalization is done during the taping.

Compression is held down to only 3 or 4dB, and mike levels are padded to prevent clipping distortion. Later, when the show is broadcast, we asked whether additional compression would be used. Apparently it is held to a minimum, at least among the NBC owned and operated stations. However, quality control of the broadcast audio is difficult. Phone lines are commonly used to transmit the audio, and one midwest market receives the broadcast audio via lines from Chicago, tapes the video and audio, and then rebroadcasts it later. So the only thing Joe can do is to provide the best possible audio and hope that it will get to people's living rooms without losing too much quality.

While the mono mix is being recorded on the VTR, the AG-440 is recording a multi-track mix on six tracks. This tape is usually not mixed down. However, if something is drastically wrong with the mono mix, or if an album is to be made, the 8-track can be used.

POST PRODUCTION MEASURES

The first thing that is done after the show has been taped is the video editing. To completely arrange and assemble the 90-minute program, only about 4-8 hours are required. Electronic editing is used, rather than splicing, due to the nature of the video recording. But a nice feature of the electronic editing is that the edit point can be precisely adjusted, frame by frame, until it is just right (1/30 second increments). And the time code gives an editor the exact point for logging the edit.

. . . Continued on page 29

. . . audio control booth consol

*The EECO code is essentially the SMPTE time code, a digitalized method to tab the exact elapsed time of any point on the tape. Special decoders can provide digital readouts, and these can be displayed in a box on the television monitor. The divisions are hours : minutes : seconds: frames (30 frames/sec.).

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Westlake Audio is the only studio designer-builder offering detailed, written guarantees of acoustical performance to clients who entrust Westlake with full responsibility for their projects — from acoustic design to downbeat. This guaranteed performance is one major reason why so many hundreds of Gold Records have been recorded in Westlake installations.

Westlake provides a complete "package" including unequalled skills and experience for turn-key "gold record" installations: pre-planning, site evaluation, acoustic design, construction, equipment selection and supply, financing, technical electronic interface, training of personnel and studio management consultation. From 2 to 24 track, for live recording, mix down, remote or mastering.

On the next two pages you will find the performance specifications which are guaranteed when Westlake assumes complete responsibility.

Westlake Audio

Guarantee of Acoustical
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I. Control Room

Acoustical and Geometric Design by Westlake Audio

A. Frequency Response

± 3 dB upon installation, 31Hz-16KHz measured with B & K, ⅓ octave, pink noise source.

B. High Frequency Dispersion

± 2 dB maximum @ 10KHz across a minimum 10 foot horizontal plane at the console (from left of the mixer to the right of the producer or vice versa) **from any one of the four monitors,** measured with pink noise source.

± 2 dB maximum @ 10KHz across a minmum 5 foot horizontal plane front to back of the mixer or producer **from any one of the four monitors,** measured with pink noise source.

C. Power

116 dB SPL minimum, linear scale, with broadband pink noise source from one monitor measured at the mixer's ear. The control room potential with four monitors is a minimum of 128 dB SPL.

What the above really means is that as the mix is being created, the mixer and producer will accurately hear the same music timbre balance.

II. Studio

Acoustical and Geometric Design by Westlake Audio

A. Room Character

The characteristic "room sound" which results from recording in a three dimensional area is eliminated by the utilizatic of an active ceiling providing a minimum of 50 dB attenuatic @ 40Hz. This, in effect, produces an infinite third dimension such as would be present in an amphitheater.

B. Decay Time

Multiple decay times of various frequencies may be incorporated into the studio design. Thus a tight rhythm sound may be achieved in one area while a bright string sound is obtained in another.

erformance Specifications
ke Audio *

C. Multi-track Separation

Active traps are built into the studio walls which allow "in-studio" vocals, eliminating the usual need for vocal booths. 40 dB of isolation can be provided between the band and a vocalist only 10 feet away resulting in 40 dB of isolation @ 40Hz or tuned to selected frequencies.

D. Drum Isolation

A drum cage is provided, either built into the structure or on a movable platform. Again an infinite third dimension is achieved through an active ceiling design. The highest sound pressure level (SPL) are generated by the bass drum at 90Hz and the stick on the cymbal at 8KHz. These are attenuated a minimum of 24 dB measured one foot outside the drum cage. If desired, the cage may be built to project mid frequencies into the studio to give the musicians a better "feel." The "character" of the drum cage may also be designed for bright, dim or variable results.

E. Bass Traps

Bass guitar traps are incorporated into the design to provide 24 dB of attenuation at 40Hz with an SPL of 116 dB exciting the trap.

F. Piano Trap

A piano trap is also included for the purpose of rejecting unwanted sound from the studio to the piano microphones. The broadband rejection to the piano trap will be in excess of 20 dB.

III. Live Quad Echo Chamber

Acoustical and Geometric Design and Active Components by Westlake Audio

A. Timbre

Variable control of low frequencies from section to section of the chamber.

B. Decay

Individual variable control of decays from all four chamber areas.

C. Echo Mix

Variable mix of echo content, parent to decay.

D. Depth

A three dimensional effect in echo content thru the use of two MS stereo return (4 channel).

E. Stereo

If stated prior to construction, the quad chamber may be used as two independent stereo echo chambers.

Which other professional studio design company will guarantee in writing these features and specifications, prior to construction?

*On all jobs commencing March 1974 or later.

Kent R. Duncan, President, Kendun Recorders, Burbank, California: "The new room has been in operation for six months now and our success is as much a tribute to Westlake Audio and Tom Hidley as it is to our long hours and attention to detail (and possibly some good engineering). Our Westlake room made us a 2 studio operation but instead of just doubling our gross, we went from $12,000 a month to $60,000 a month. The incredibly accurate planning of our Westlake turnkey installation resulted in completion exactly on time, response precisely as promised, all equipment functioning within one day of installation, and all within budget! In the past six months we have mastered such acts as Stevie Wonder, Bob Dylan, America, Buddy Miles, Fleetwood Mac, Rick Nelson, Tower of Power, Livingston Taylor, Isley Bros., Rod McKuen, Nitty Grity Dirt Band, Emitt Rhodes, Richard Greene, El Chicano, Nana Mouskouri, Cleo Laine, Bola Sete, San Sebastian Strings, Jo Stafford, Maxayn, Pharoah Sanders, Archie Shepp, Ballin' Jack, Vickie Lawrence, Maureen McCormick & Chris Knight, Don McLean, Vikki Carr, Bill Medley and even Rodney Allen Rippy. Over half these acts were recorded on Westlake monitors in various studios around the country, attesting to the fact that truly, you are *the* professional."

Christopher Stone, President, Record Plant Recording Studios, Los Angeles: "As you know, we have used Westlake Audio and yourself since the inception of the company for all of our studio design, construction, electrical interface and implementation. During the past four years you have designed and implemented eight studios for us in New York City, Los Angeles and Sausalito. Obviously we are known as a Westlake-designed operation. We have built our total reputation around your studio design and have always been happy with our decision to utilize you on an exclusive basis for all our acoustical requirements and equipment consultation. The success of your design speaks for itself in the form of our success as an independent studio operation."

John Sandlin, Vice President A & R, Capricorn Records, Macon, Georgia: "All of the work done was of a quality that is almost non-existent today. The people from Westlake *cared,* and saw to it that their work was of the highest standards. The carpentry work is incredible. The complete construction and equipment interfacing went more smoothly than can be expected in such a major undertaking. Westlake's delivery dates were either on time or before the time they were promised. The real test, however, is in the performance of the control room. Our room sounds great and objectively measures great. Also, the room is comfortable and easy to work in. It is really a pleasure to work with people of the integrity and abilities of Tom Hidley and Paul Ford and the rest of the Westlake personnel."

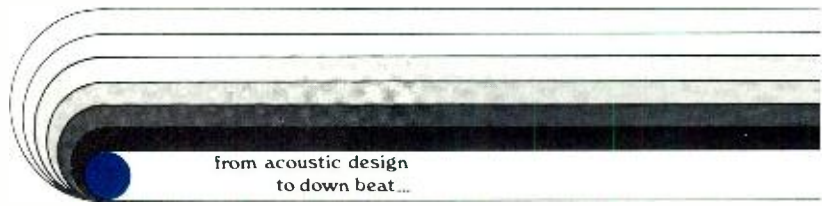
Michael Nemo, Independent Recording Engineer: "My clients and I have found that the closest approach yet to a true standard is the integrated concept of speaker and room acoustic control found in studios built by Westlake Audio. What a pleasure to go from one Westlake installation to another and not have to be concerned about compensating for too much or too little bass, or high frequency response.

John Boylan, John Boylan, Inc., Hollywood, California: "First of all, this is my third project in a row to be mixed on your monitors and once again it looks like we have a winner — a record that sounds as good at home as it did in the control room. From a producer's nontechnical viewpoint, this ability to trust a studio monitor and come out with even results is extremely satisfying. Secondly, the Westlake Monitor never seems to vary in any substantial way from studio to studio, in the control rooms that you've designed. So I have no worries about consistency in today's widely dispersed recording scene."

Edward J. Green, Director of Engineering/General Manager, MGM Recording Studios, Los Angeles, California: "The studios and the control rooms have been completely successful for MGM Records from the time they were finished. Our mixers have, for the first time, the kinds of 'acoustical tools' that are needed for contemporary recording. That is, multitrack recording with all but complete isolation of elements whose parts can be later mixed or deleted and replaced. In the control room, the mixer and producer must be able to accurately monitor the recording so as to make technical and artistic judgements. Your booth design and particularly the Westlake monitors have proven themselves thoroughly workable and accurate. It is to your credit that these recording systems have withstood this test of time, particularly during the last three years, and that we wish to make no changes in studio or control room design in the immediate future."

Robert M. MacLeod, Jr., Artisan Sound Recorders, Hollywood, California: "Now that we have been in our new building for a couple of months, I thought you might like to know how it is working out. About all I can say is fantastic! We have had nothing but good reactions to the monitoring systems, and the acoustics of the mastering rooms are superb. Almost everyone who comes in comments on the quality of the workmanship. We have encountered no problems at all, and we find it a joy to cut records without the constant noise of the vacuum system in our ears. Producers seem to agree, and I am sure these beautiful new facilities will put us in a far stronger competitive position in the industry. In today's world of shoddy workmanship, it is really a delight to see the results of such painstaking care."

Complete, unedited photocopies of these and many other testimonial letters are available on request from Westlake Audio.
Phone or write direct to Tom Hidley, President.



Westlake Audio
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Los Angeles, California 90048
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MIDNIGHT SPECIAL

. . . Continued from page 25

After the video tape is edited down to a 90 minute program, the audio has abrupt transitions. Since the order of tunes may be changed, commercial breaks and station breaks are inserted, and noises may be present, a process of sweetening the audio is required.* Sweetening is the term that television originally used to describe the insertion of laughs or applause to a comedy show. It now refers to the broader range of cleanup and smoothing of the audio track.

The console in the post production audio room is similar to the production console, but with additional submaster channels and with monitor solo for all faders. A MacKenzie cartridge machine is loaded with up to 10 cartridges of audience reaction that have been derived from Midnight Special performances. These may be clapping, applause trailing off, applause building, laughter, and so forth. The mono VTR track is transferred to 4 tracks of an AG-440 as follows: track A has the 59.9Hz sync tone at -10 VU, track D has the EECO time code at -7 VU, and tracks B and C have redundant mono dubs from the edited VTR (peaking at 0 VU).

The sweetening process begins when the VTR rolls and the picture is viewed on one of two color monitors in front of the console. The 4-track is run in sync with the VTR, and the music is re-recorded onto the videotape. Joe simultaneously mixes the audience effects onto the videotape. A cough may be used to cover a noise, and the output of the 4-track can be switched off momentarily while the MacKenzie cartridge is running. Assistant operators man the MacKenzie machine and the 4-track, while the director or associate producer work with Joe on the mix. Essentially, the whole sweetening process is done in real time, laying the sound back onto the same edited reel of videotape that was used to make the 4-track dub. So the finished videotape has second generation video and third generation audio. Still, the audio sounds excellent.

What amazed us is that the whole sweetening process (exclusive of the 4-track transfer time) is usually completed in between 2 and 4 hours! It is this type of efficiency that make it possible for the 90-minute color program to be produced for a budget well below the average 12" LP album.

PROBLEMS AND SOLUTIONS

The process of taping four or five acts can take a lot of time. To hold it to a minimum, four stages are arranged around a central floor area and are set up in advance. The studio audience arrives just prior to the taping, grabs padded floor mats, and sits right in the middle of the studio area. In this way, the groups have only to wait for a few patches to be made and the cameras to roll into position, and they can proceed one after the other. The audience will be given the opportunity to stand up, stretch, and then sit down facing the next stage. It works surprisingly well.

A common problem arises with groups who are used to big concerts. They crank up their amplifiers so far that the sound has leaked through the studio wall, a row of dressing rooms, across a hallway, through another row of dressing rooms and a wall, and into the next studio. In extremely loud cases, the video can be modulated by the audio due to microphonics in the camera tube. To get around the problem, a good stage monitor system was installed, one which beams the sound directly to the performer who wants to hear it. And the acts are asked to keep the levels down as much as possible without being uncomfortable for them.

Sometimes the amplifiers brought in by an act will be in need of maintenance. Hums, buzzes and crackles won't be tolerated, so the show has back-up equipment on hand. There are even a couple of Leslies, drum sets, and a Steinway piano.

Stan tells us that in the early days of rock and roll television, many groups were visually dull. Many special effects, gimmicks, light shows, and so forth were used to enhance the video and keep the show interesting. But this problem has taken care of itself in recent years. Exemplified by people like David Bowie, Alice Cooper and Leo Sayre, a number of groups have become 100% entertainment oriented. Generally the musical scene is more polished, so fewer visual gimmicks are now needed.

WHAT AN ACT GETS OUT OF DOING THE SHOW

You won't make a pile of money from an appearance on The Midnight Special. Just like The Tonight Show and other shows, the pay is scale. But the exposure is something else. The sets are usually stark, with black backgrounds and the performer's name in 5'-high illuminated letters. Neilson ratings indicate there are a lot of people watching, and the many gold records on Stan's wall support the value of an appearance on the show. When a very successful group feels the exposure is superfluous, Stan persuasively argues that they owe it to the people who made them famous to appear. Yet there is no arrogance around The Midnight Special office. They bend over backwards to satisfy the performer, and a friendly atmosphere surrounds the whole production. This is reflected by the hosting format of the show, which helps bring out the personalities of the people in front of the cameras.

THE MAN BEHIND THE SHOW

As a child in his native Canada, Stan Harris was fascinated by a relatively new medium – television. Stan played several musical instruments, and enjoyed all of them. But as he matured, he realized that it would be difficult to attain excellence as a performer because his interests were so diverse. So he resolved to become a director, and when he got out of school, he went right into Canadian television. He was producer and director of The Cross Canada Hit Parade. When rock and roll caught on, in the mid-1950's, his show successfully bridged the transition. Apparently there was a certain open-mindedness and flexibility that the show's U.S. counterpart, The Lucky Strike Hit Parade, just didn't have.

producer/director
STAN HARRIS

Stan has since been involved in many areas of television production. He worked for a while in England, doing heavy drama. He also lived in New York prior to settling in Los Angeles. He has been associated with The Bob Hope Show and The Jack Benny Show, and more recently, with The Smothers Brothers Show. The Smothers Brothers had a musical act, usually rock, once a week.

Now, with the success of The Midnight Special, Stan has been characterized as a musical show director/producer. He half-heartedly objects, but he admits that with The Midnight Special, he is really more in the music business than in television. Music trades, not TV trades, are sent to his office, and Stan likes to listen to music. He was with his stage manager one day when Stan remarked, "Isn't this great. Here we are getting paid to sit and listen to music we love." Stan added, "It's very nice to be in that situation."

*Actually, the breaks are simply blank audio and black video on the master tape. The advertising and station identification are inserted at air time.

LETTERS & LATE NEWS

. . . Continued from page 13

I am not surprised that LRS was able to test cut Innervisions acceptably. Innervisions was the first album ever cut at Kendun Recorders and as stated in our article we have since cut it in the same fashion with more level and better geometry.

Steve (Guy) has taken a number of points out of context to deal with, so let me address them in order. In regard to cutting power, he states that no more power is attainable. I can only refer him to Mr. Allen above who tells us at least 35 more watts can be achieved if LRS would care to update their SX-68 cutterhead to the state of the art SX-74.

Steve more fully explains my statement concerning six quarters storage duration in the computer, however it appears he agrees with me and contradicts himself.

Regarding Steve's sentence on power requirements to cut various tones, he echos all our sentiments "If only it were true," and his explanation is correct.

The quality advantage of using virgin vinyl over Styrene has been lessened somewhat by today's use of extenders. How Steve translated that to mean plants were changing to Styrene escapes me. The plants that use Styrene have been doing so for some time. The producer should also be aware of the shortcomings in quality due to injection molding done at some plants as opposed to compression molding.

Steve then states that "centrifugal force has nothing to do with the matter" as I speak about playback tracking error. It is a shame so many turntable manufacturers have wasted all their time coming up with systems to eliminate tracking error unnecessarily (according to Mr. Guy). The point I was making however, is that it is more desirable to cut records to end at a larger diameter so that you avoid distortion which is caused by these various problems. The point is not to get in there at all.

We are then supplied with a brief discussion of the reasons why inner groove distortion occurs. All of these are valid and the reader can find more detailed information in several of the issues of the Journal of The Audio Engineering Society.

It is interesting to note that virtually each person who wrote taking issue with my opinions said they felt education in the disc mastering field was long overdue. I get just a little tired of these Monday morning quarterbacks sitting back and firing off their petty little rhubarbs at someone trying to initiate just what they complain is missing.

As regards Dolby, Steve is lost. He tells us that A-type Dolby displays in record a slight rise at the ends of the audio spectrum, and this is cancelled by a reciprocal droop in playback. This is absolutely false. In fact, after properly doing a set of tones which should be done with the Dolby in function but NR Out (never in check tape) when the NR is put in level will actually drop about½dB (not rise) and a reciprocal rise in playback will exhibit itself.

Additionally, this level change is broadband and not at the ends of the spectrum. The largest error generally encountered in the mastering studio is when a studio will record at elevated level, say +3, and you will find the Dolby tone and the 0 level tone at the same level. This shows that the Dolby and machine were not properly interfaced. If it had been done correctly, the Dolby tone would be at 185 nanowebers and the frequency run would be 3dB above that.

Steve's description of droop in playback at the ends of the spectrum suggest errors in termination in his chain and he should investigate and correct this problem as it is the most common error by Dolby users.

Steve then brings up the ratio of noise reduction. The Burwen system is a 3 to 1 system and the DBX is a 2 to 1 system. The Dolby is a 1 to 1 system from levels -20 to 0 but a 2 to 1 system below -30, acting essentially as a DBX below that level. Also, frequency response errors show up most at these levels due to the 2 to 1 situation.

ED: Additional letters supporting the substantive points Mr. Guy projects (and which Mr. Duncan answers) were also received from other members of the Los Angeles disc cutting community; namely Glen Glancy and Bruce Leek of UNITED SOUND, Bob Mac Leod of ARTISAN SOUND RECORDERS and Douglas Sax of THE MASTERING LAB.

From: **BOB BERKOVITZ**
HEAD OF ADVERTISING
AND INFORMATION
DOLBY LABORATORIES INC.
NEW YORK, NEW YORK

We found Kent Duncan's discussion of Dolby unit alignment obviously well-intended, but we were unable to understand most of it. What came through clearly, however, was the incorrect statement that Dolby noise reduction units typically have significant frequency response errors. By allowing this mistaken idea to go into print, RE/P has done a grave disservice to its readers and to our company.

Our overall – that is, the full encode/decode process – factory specification for all units is ±1dB, and it is comfortably met by all of our equipment. I have just looked at the records of a number of units, taken at random from our files, and all fall within +0.15, −0.45dB. As Mr. Duncan correctly points out, there are no adjustments which could affect response. Every check we have made of field stability indicates that our equipment is at least as reliable as anything else in the record/replay electronics chain of a studio. We must therefore view the simultaneous response errors of all eight of Mr. Duncan's units as a surprising and unique coincidence – or an error in his technique or understanding.

As to the "suspicions" and "theories" which Mr. Duncan claims to have confirmed in communication with our company, they cannot possibly be correct if they have led to the misunderstandings expressed in his interview. There is no Dolby system action at or near NAB level, so that the circuit, even in the case of a single unit (say) in the record mode, is essentially bypassed at NAB level, and is therefore extremely unlikely to introduce a response error. Any slight variation which might occur, which would in any case be less than 0.5dB, would be cancelled in normal usage by the complementary action of the unit in the play mode following.

We have, at times, explained to engineers that an error of as much as 2dB in alignment is unlikely to produce noticeable changes on most program material, and it is possible that Mr. Duncan has misunderstood this statement in some way, and expanded upon his misunderstanding. Users of Dolby equipment will know, of course, that the most important statement in Mr. Duncan's interview is that "there really is no substitute for a flat machine and a flat tape." The best way to use Dolby equipment is to align it according to the instructions supplied with it, switch it on, and forget about it.

KENT DUNCAN'S REPLY TO MR. BERKOVITZ:

The purpose of contributing to periodicals such as REP is to further the education of the people involved. Of the people who did not agree with our points of view, only Dolby came to us directly and said let's find out what is what and get it right. I was extremely impressed by the fact that Mr. Steve Katz of Dolby Labs visited our studio to follow up on our interview.

It is true however that Dolby has

allowed, by poor directions, the misuse of their product. The "silence" card of alignment instructions is complicated and hard to understand. Indeed, it is a rare engineer who professes understanding of it. None of their literature has ever mentioned the droop in record level when NR is put in and the compensating boost in playback although this is uniform in all units. This has complicated the comprehension of the operation of the unit. Additionally, although elevated level recording has been with us for at least two years, I dare say few studios properly align for elevated level with Dolby.

In all of this, Dolby has remained aloof personified by Mr. Berkovitz's statement of "switch it on and forget it."

What Dolby needs is a clear, concise printed procedure of alignment for all studio personnel such as accompanies their test unit for CAT 22 cards, taking into account all the varieties of tapes and level in today's recording (and possibly some more level marks on the Dolby meter).

Basically, Dolby relies on the fact that cancellation of most error occurs when replaying the stretched material through the channel used in recording. This ignores all situations where a different Dolby is used for decoding such as where a tapeis mixed at a different studio, tapes used for disc cutting, copies sent to other countries, or those sent to cassette and cartridge manufacturers for production. I would venture to say that it is more often than not that a Dolby signal is decoded through a channel other than the one used to encode that signal and this is when error in frequency response (or alignment) can be additive.

It is interesting to note that this "technical" response is written by the Head of Advertising for Dolby (ED: Mr. Berkovitz is Head of Advertising and Information.) and not the engineering department. That fact and the outrageous suggestion that an error of 2dB in alignment is not noticeable is indicative of the aloofness of Dolby Labs. Such a suggestion to a *professional* engineer is so appalling I will simply not grace it with a comment.

It is such a pleasant change to be confronted with a Dolby representative who is interested and in touch (Mr. Katz), that I can only say to Dolby a logical move would be to open an L.A. office to be more accessible.

A truly brilliant discussion of noise reduction systems (Dolby, DBX, Burwen) appears in the Feb/Mar '74 issue of Studio Sound Magazine where not only bench tests, but field tests of the units were made by Aengus McKenzie and I recommend that as further information on the subject.

From: MICHAEL EDSON
RECORDING DEPT.
SUPERVISOR
CAPITOL RECORDS, INC.
HOLLYWOOD, CA

. . . Due to the thorough manner in which Mr. Guy and Mr. Allan have corrected the technical mis-statements propounded in the interview, we will add little more to the technical aspects of reply other than to correct the ill-concealed inference that the majors adhere to out-dated cutting parameters and employ engineers who "when they get a tape that's hard to cut, they'll make it easy to cut, either by taking the level down or making it mono, etc., etc." In answer to the above, we must comment that our studios also employ the Neumann VG-66S cutting system, the TS66 tracing simulator and the VMS-66 Lathe, and we were among the first group of studios on the West Coast to convert to the SX-74 head. Twice each day, we make sweep-frequency measurements, (recorded on a GR graph-recorder) of the entire cutting channel and check the condition of the cutting stylus by means of a high-power shadowgraph examination of a wax impression of the groove cut on a lacquer. Needless to say we hold to very tight tolerances.

On behalf of our engineers we must comment that the derogatory remarks made are completely unfounded and in bad taste. Our policy is always to use whatever equipment and techniques are necessary to make the best record possible, and to transfer to disc the artistic result that the artists and producers have worked so hard to create. We are sure that this expresses the feelings of the other major labels and the many fine disc-cutting studios throughout the country.

We master our fair share of certified gold records at Capitol. These are not all Capitol records and many are mastered here because of producer preference. We do an excellent job on many more that don't gain fame for other reasons. Our engineers take pride in the quality of the work they perform and for someone to say that belonging to a union prevents excellence in cutting is the height of absurdity.

WESTLAKE BOWS NAS

Due to increased dem.
sultation and design service.
ville area, Westlake Audio an
opening of a Nashville offic.
15, 1974.

The office will be headed by J
Gardner, formerly chief engineer of t .s-
ville Sound Studios in New York and currently with Westlake's Los Angeles headquarters.

Construction of the new permanent quarters is now underway. Offices will be temporarily located at 3250 Dickerson Rd.,Suite 206, telephone (615)228-1353.

ELECTRONIC MUSIC WORKSHOP SET FOR NOVEMBER 11-22, 1974.

As announced by BEEP (Boston Experimental Electromusic Project) this non-mathematical, non-academic approach to Electronic Music is designed to give producers, performers, composers and technicians the opportunity to learn about and gain practical experience with electronic music.

Fee for the workshop is $75.00.

Complete information may be obtained from: Mr. Robert Creely, BEEP, 33 Elm Street, Brookline, MA 02146.

IRBY JOINS STUDIO SUPPLY

Tom Irby has joined the "professionals" at Studio Supply Company, Nashville, Tennessee. The announcement was made by Dave Harrison, Studio Supplys' President, and Claude Hill, Vice President, Sales.

Tom, a native of Paris, Tennessee, brings to Studio Supply additional experience in the field of magnetic recording gained at 3-M Company's Mincom Division and Pertec, a prime digital recorder firm in Chatsworth, California.

Tom has a B.S.E.E. degree from the University of California at Santa Barbara. Tom's responsibilities at Studio Supply include systems design, acoustical consultation, and sales.

ALTEC LOUDSPEAKER ENCLOSURE DESIGN MANUAL NOW AVAILABLE

Altec Corp., Sound Products Division, has produced a fully illustrated 32-page publication entitled "Loudspeaker Enclosures – Their Design and Use."

Priced at $2.00, the publication was created to provide an easy to digest source of data for use in designing and constructing enclosures of predictable and satisfactory performance when used with Altec's quality loudspeakers.

The publication covers the entire gamut of building enclosures, with topics including the function of the enclosure, loudspeaker design theory, the various types of enclosures – from infinite baffle and bass reflex enclosures – to tuning the bass reflex port.

. . . Continued on page 68

very

PROFESSIONAL AUDIO EQUIPMENT

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From initial design to final checkout *Studer* Audio equipment is subjected to rigorous quality demands that insure continuing "Swiss" performance.

For information on our tape mastering equipment (from one to twenty-four track), condenser microphones and quadraphonic consoles, contact WILLI STUDER AMERICA INC., 3916 Broadway, Buffalo, N.Y. 14227— phone 716 681-5450. (In Canada: WILLI STUDER CANADA LTD. 416 423-2831)

WILLI

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AMERICA

Circle No. 117

Re/p 32

EQUALIZER PERFORMANCE REVISITED

BY

BOB EASTON
360 SYSTEMS

BOB ORBAN
ORBAN/PARASOUND

There is a great deal of mysticism in many peoples' minds regarding "phase shift" and "ringing" in equalizers and filters. Mysterious differences in sound quality are blamed on these phenomena. Mixers are understandably sensitive to variations in the performance of these devices, and with good reason; most tracks will be digested within their circuits at least once during the production of a tune. A brief what's-what of filter/equalizer theory follows, as food for thought during discussion of several different design approaches for these devices. Consideration of these more theoretical elements produces some interesting conclusions about why certain designs have become favorites, while others hide on the back shelf and gather expletives . . .

Provided that an equalizer is operated below its clipping point, its performance can be described very well by linear system theory. Two results of this theory are of particular interest to the inquisitive individual:

1. Given the response of an equalizer to a step input, (a very low frequency square wave will do) it is possible to find the amplitude and phase response with great accuracy. Conversely, knowledge of amplitude and phase responses describes behavior to step inputs. And the amount of ringing caused by an equalizer is directly implied by its frequency response and phase shift.

2. Practically every filter or equalizer encountered in studio situations belongs to a broad class called *minimum phase networks.* Conveniently, the frequency response of these devices uniquely specifies the phase shift present, and vice-versa.

From principles (1) and (2) we can conclude that for practical filters and equalizers used in studio sound, both the phase shift and ringing (transient response) can be deduced entirely from the frequency response of the device. We find that equalizers using inductors are more likely to ring due to stray capacitance within the windings, than is the case with those constructed entirely of resistors, capacitors, and opamps. Stray inductances in the latter tend to be inconsequential. "So what?" we may say . . . well (1) and (2) above indicate that ringing will also manifest itself as glitches in the frequency response of the device. Differences in sound quality are far more likely to be caused by irregularities in frequency response (to which the ear is extremely sensitive) than to small differences in phase or transient response.

Then what effect does phase shift have on program material? Much fear and trepidation may be relieved by listening through a phase shifter that has been carefully verified to have flat frequency response throughout the audible spectrum. (Not a phase-cancellation device as used for special effects). For most material it is impossible to tell whether the phase shifter is in or out. The findings of footnote (2) may assuage the fears of readers interested in the minutae of subjective phase shift experimentation. Very large amounts of phase shift resulting in time delays (greater than 2 milliseconds has been suggested) produces distinctly audible timbral changes, as will phase shift so rapid that appreciable shifts occur within a single 1/3 octave "critical band." It seems that very rapid phase changes are associated with ringing once again, and are visible as sharp peaks and dips in the frequency response of any equalizer exhibiting such behavior. Since such resonances are very

1. Part I appeared in Vol. 5 No. 2 of R-e/p: **The Equalizer, Audio Superstar** by Jerry Milam of Milam Audio, Inc.

2. **On Aural Phase Detection,** by Villy Hansen and Erik Rorbaek Madsen, J.A.E.S. vol. 22 p. 10.

noticeable in their own right, once again the case for placing blame purely on phase shift disappears.

FILTERS & EQUALIZERS

One of the primary differences between filters and equalizers in the practical sense is the complexity of the networks involved. Filters are often called on to pass one portion of the audio spectrum, while sharply rejecting another band. This requires a network of a fairly high *order.* For practical purposes, the order of a network is equal to the number of inductors and capacitors in use at one time, excluding coupling capacitors and the like. As the order of a network increases, it becomes more touchy to design. It can ring at many different frequencies simultaneously . . . which most sharp cutoff filters do. Figure 1 illustrates two filters having the same cutoff frequency.

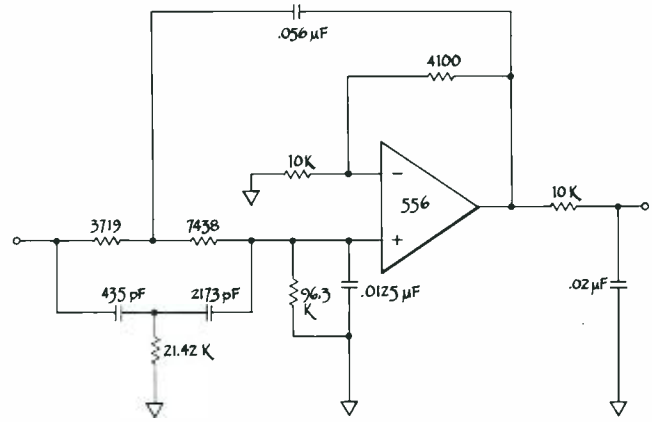

Figure 1A Elliptic Function 1KHz Low Pass Filter

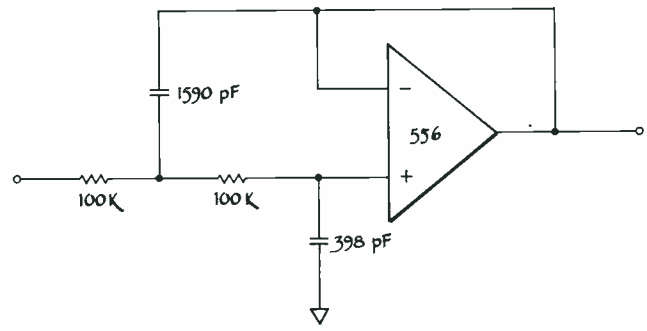

Figure 1B Butterworth Function 1KHz Low Pass Filter

Filter A is very effective in supressing outband signals, and rings like crazy. It is often relegated to use in digital audio delay systems and similar chores where steep slopes are essential. Filter B doesn't ring excessively, but doesn't cut off as sharply either. It has been accepted as the lesser of evils for

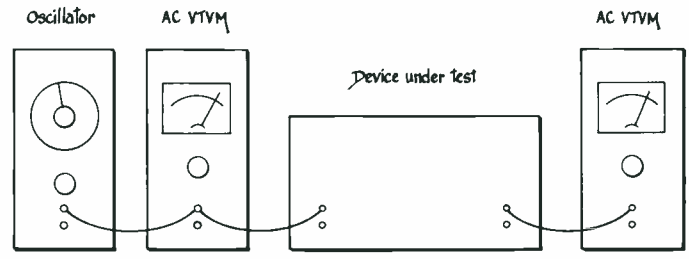

Figure 2 The usual frequency response Test Set

a majority of audio filtering chores, because it has little coloration effect on sound and modest stopband rejection.

Practically all equalizer designs are based on second order networks, which are the simplest networks that can provide peaking and dipping functions. ("Tone" controls are essentially first order, with shelving characteristics and a slope not exceeding 6dB/octave.) Figure 2 shows the standard technique for measuring the frequency response of anything. Tests performed by either this method or that outlined in paragraph 1 should show no added dips in a peaking type equalizer, and no added peaks in a dipping equalizer. If these problems show up when only one band is used, it often implies that it has been sloppily designed or manufactured; stray capacitances are getting into the act and the order of the network has been unintentionally raised.

GRAPHIC EQUALIZERS

A graphic equalizer is designed to provide peaking and dipping equalization at roughly equal increments of bandwidth throughout the frequency spectrum. In contrast to conventional equalizers, all of the frequencies are available simultaneously. Each frequency is generally assigned its own slider control; the sliders are placed side-by-side, going from low to high. Thus the mechanical position of the sliders provides a *graphic* approximation of the frequency response of the equalizer. Commercially available graphics range from two-octave wide controls (like the BSR Metrotech) to 1/3 octave wide controls (UREI, Altec, DuKane, Dolby, etc.). The 1/3-octave graphics vary widely in design (some can dip only) and are designed principally for "tuning" sound reinforcement and monitor installations for ideal response.

The frequencies offered in graphics for studio work are generally spaced at octave intervals, which is a manageable design if equalization is to be done by ear rather than with instruments. The fact that the center frequencies are spaced at octave intervals does not necessarily mean that the filter characteristics maintain octave bandwidths as the amount of peak or dip is varied. Bandwidth versus peak/dip characteristics are responsible for the variation in subjective qualities of different graphics. (Figure 3)

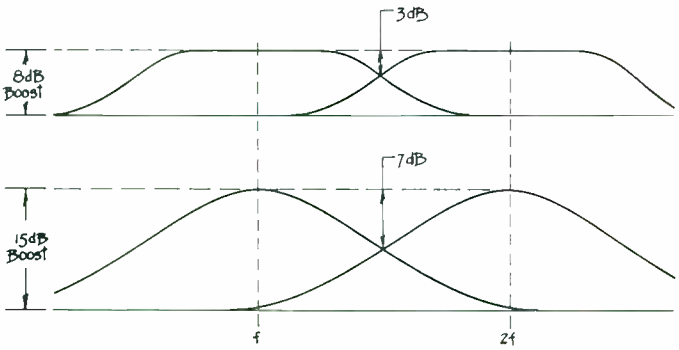

Figure 3 Bandwidth Vs. Peak-Dip Response

In addition, one band can interact with its adjacent neighbor in unpleasant ways, perhaps causing unexpected dips in the response. Graphics that are constructed along the lines of Figure 4 are particularly prone to this problem; in fact, it is an unavoidable weakness of this sort of design. In addition, it is difficult to adjust this sort of design for truly flat response, unless the bandpass filters are designed in an unusual way. There have been several construction projects for this type of graphic; their subjective performance has left us somewhat underwhelmed. This type of construction does have one virtue that we can think of: as the amount of EQ is increased, the "Q" (sharpness of the peak) does *not* increase, so one can use large amounts of equalization freely without increasing ringing.

The circuit in Figure 5 is a considerable improvement over Figure 4, and is the basis of a number of commercial graphics.

It uses both inductance and capacitance as well as an opamp.

Unlike Figure 4, the equalization curves are *reciprocal:* the boost curve for any frequency will be a mirror image of the dip curve. This allows one to precisely "undo" any equalization that might have been performed earlier with the same equal-

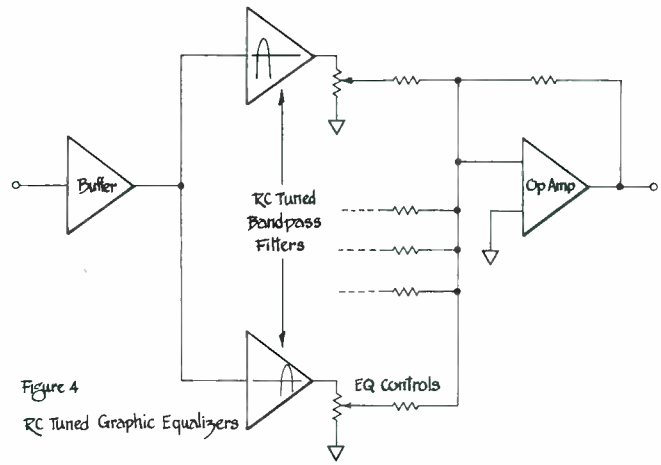

Figure 4
RC Tuned Graphic Equalizers

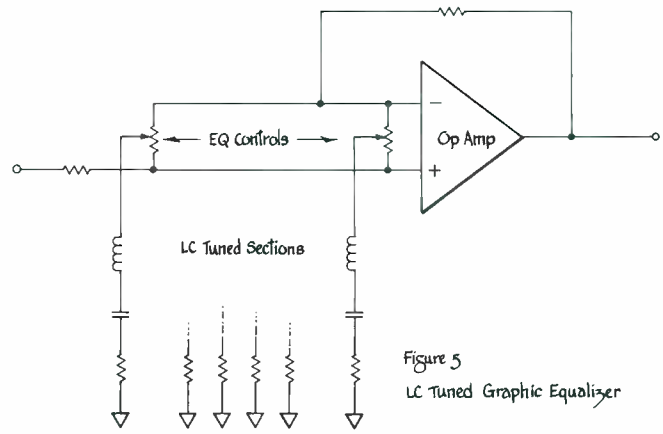

Figure 5
LC Tuned Graphic Equalizer

izer. For example, at mixdown the producer might have second thoughts about EQ built into the original multitrack tape during the session. An important feature of the design of Figure 5 is that when all EQ controls are centered, the response is perfectly flat, with no phase shift, since the circuit is minimum-phase. This type of graphic is highly useful in practice, permitting the mixer to approximate a large variety of equalization curves in a very straightforward manner. This circuit does have several pitfalls however. The "Q" varies greatly as the amount of equalization is changed; large amounts of boost will produce a very colored ringy sound that may be highly objectionable with many kinds of musical material. Also, the various bands will interact, and this may result in phase cancellation problems between adjacent bands . . . particularly when the amount of equalization is increased.

AND NOW, THE PARAMETRIC

Unlike the graphic, which has a long history in the movie industry, the parametric equalizer is a development of the past few years. (The impetus for its design as a studio product may well stem from the Moog No. 904 and the ARP No. 1047, long used in synthesizers.) As used in the professional audio industry, the term *parametric* has come to mean an equalizer whose three basic parameters, frequency, bandwidth, and amount of boost or dip, are independently adjustable by means of three non-interacting controls. In most designs these controls are continuously adjustable; however, units for mastering facilities have been provided with step switches for repeatability and unit-to-unit tracking.

Figure 6 illustrates the action of the controls:

In Figure 6a the *frequency* control is adjusted. The shape of the curve remains the same, and is moved along the frequency scale. Figure 6b shows the effect of the *bandwidth* control. Note that this is *not* the same as a "Q" control. If the "Q" were adjusted, the gain at the response peak would change. The bandwidth control leaves the gain at the response peak the same, regardless of its setting. Gain at the response peak is adjusted by an *equalization* control, as in a conventional equalizer. Figure 6c illustrates this parameter. The equalization control does not necessarily produce reciprocal peak and dip curves, but reciprocal curves can be generated by readjustment of the bandwidth control as necessary.

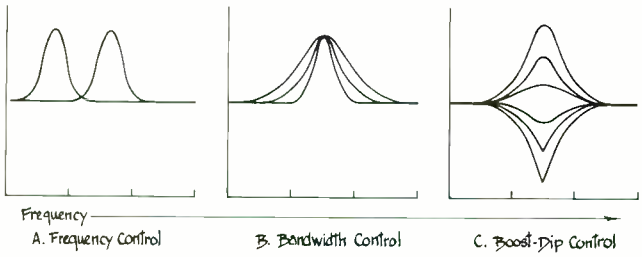

Figure 6 Parametric Equalizer Functions

Parametrics often provide many advantages over other forms of equalizers. Very broad bandwidths results in equalization totally without ringing – useful for making broadband response corrections, such as an overall boost of the high end of a track. In contrast, a graphic requires the use of several high frequency controls to perform the same task. And, since the bandwidth of a graphic's controls are narrower, there is a strong tendancy for ringing to be produced. Control interaction of the graphic may result in frequency response irregularities, which the wideband-adjusted parametric does not exhibit.

Because there is no standard terminology in the field, a *parametric equalizer* may take a wide variety of forms. Some units are manually operated, while others may permit voltage control of one or more parameters. And sometimes the variable bandwidth provision is eliminated, or a choice of two bandwidths only is provided. Continuous tuning of the center frequency may be the only "parametric" feature offered. Some equalizers offer both peak/dip and shelving, while others may be limited to 12 dB or so.

Typical parametrics offer three or four frequency bands, each with continuously adjustable parameters. Because the number of bands is small compared with a graphic, it is possible to wire the bands in series – eliminating the possibility of interaction. Parametrics also open some new doors: Narrowband equalization can give "effects" EQ, such as telephone simulations, "old time" recordings, etc. Sweeping the center frequency of a narrowband peak produces useful phasing-like effects. And narrowband dip can remove hum or fixed-frequency interference with almost no audible effect on the program material. Some parametrics even provide "infinite-depth" dips for this purpose, while others may be limited to 12dB or so.

The only potential problem with parametrics is the requirement for familiarization caused by an "embarassment of riches" in the control department. Experience has shown that familiarization is quite painless, and that experienced parametric users are completely flummoxed when forced to go back to less versatile equalizers.

It's often said that the quality of a sound is the measure of a technical products' worth. Well, equalizers can't be bought on that basis from data sheets; but clearly, some have musical abilities that others don't possess. Evaluation of the versatility and truthfulness of claimed specifications, together with some study of a device's abnormalities, can reveal a lot about the musical worth of an equalizer's design.

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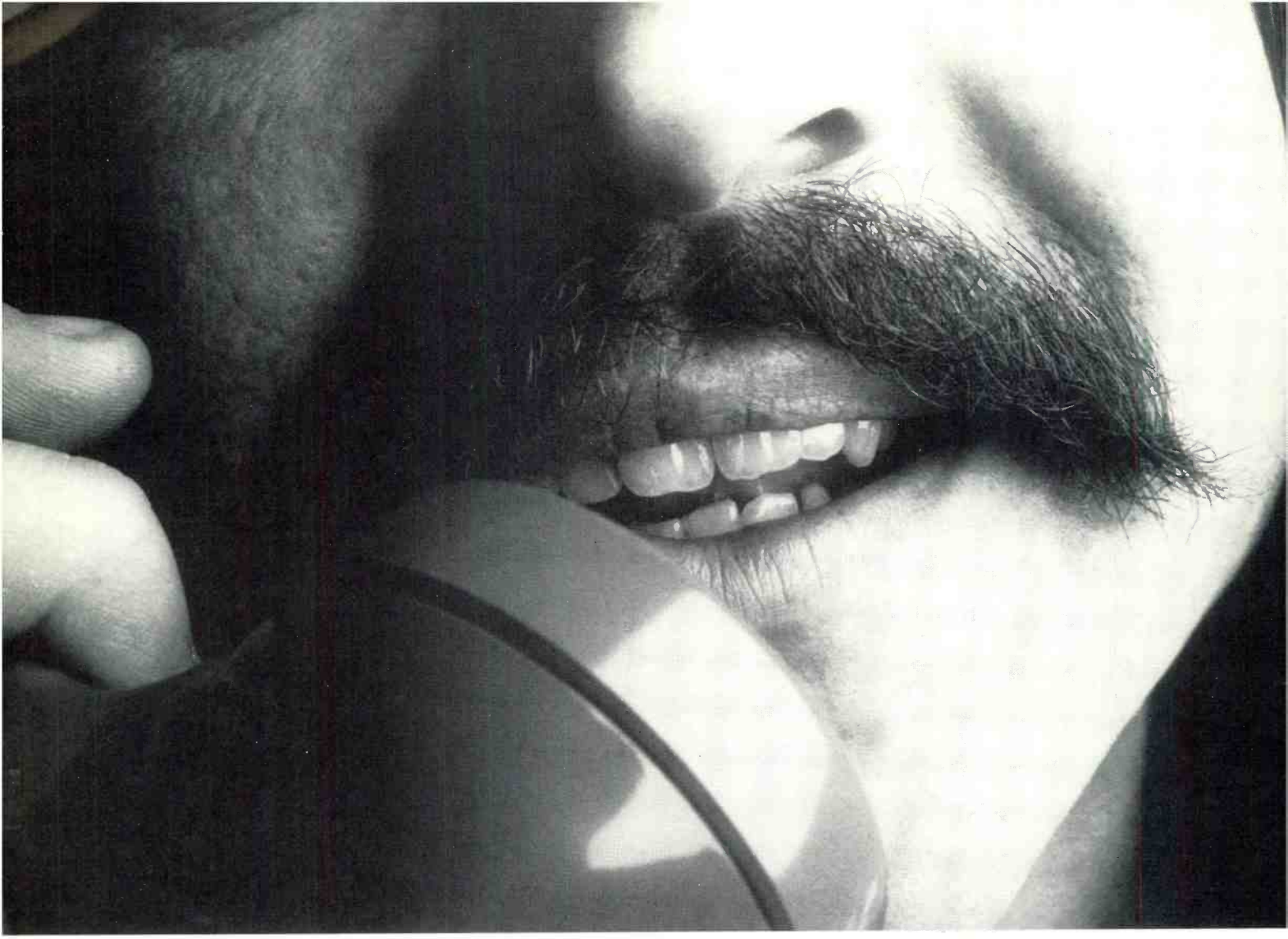

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Circle No. 123

MUNDANE APPLICATIONS OF THE FLUX LOOP

BY PETER BUTT
SUPERSCOPE TAPE DUPLICATING

The flux loop is a much ignored piece of inexpensive hardware that can shed considerable light on the behaviour of a magnetic reproduction system. I'll have to admit that I've been one of those ignoring it until recently. Although aware of the applications of the device in connection with analog and digital data recorders and reproducers for some time, I just never felt the need to actually go through the process of constructing one and calibrating it for use. Since that need has finally captured me, I thought some of my fellows might be interested in its possibilities as well as some of the limitations.

A flux loop is, most simply, a coil of wire through which an alternating current is passed for the purpose of inducing the resulting magnetic field into a magnetic reproducing head and its succeeding amplification system. The general idea behind doing this is to gain some sort of insight into the behavior of the reproducing system exclusive of the mechanical factors of tape-to-head contact, tracking, wow and flutter, azimuth, or fringing.[1] The elimination of these influences permits a more accurate appraisal of the purely electrical behavior of the play-back system.

By inducing a test signal directly into the reproducing head, the entire recording mechanism is eliminated as a source of uncertainty obscuring the precise behavior of the reproduction system. Distortion, transient response, output polarity, phase shift and dynamic range are all factors that can be evaluated with precision unrealizable if the record process is relied upon as the mechanism of excitation. It is granted that many of these applications are of greater interest to the research and development oriented. The power of the technique, relative ease and low cost of the device make it attractive for routine use in multi-track reproduce systems alignment and analysis, even if the more esoteric users are of no immediate interest.

My recollections of using the device were awakened while listening to a paper on the subject presented by Alistair M. Hazelitt at the 45th Audio Engineering Society Convention in Los Angeles.[2] More recently, the problem of verifying play-back system response in cassette and 8-track cartridge players caused me to re-investigate the merits of the flux loop response evaluation technique because of the uncertainty of alignments performed using standard tapes loaded into cartridges and cassettes. Experience with use of the device in these areas caused me to investigate the applications it might have at the higher speeds more typical of the industry.

The results of experimentation with the flux loop with multi-track reproduction systems proved to be rather gratifying. For example, given a loop with a sufficiently large coil, not only are the frequency response characteristics of all of the tracks covered by the field easily checked against each other simultaneously but phase shifts from track to track may be compared using either a phase meter or an oscilloscope Lissajous display. The phase relationships of multi-track reproducer outputs is not only a factor in simple stereo-mono compatibility, but

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also can have serious effects on material destined to be processed as a quadraphonic matrix.

Driving the flux loop with a pulse and observing the play back circuit response with an oscilloscope will give some indication of the transient response of the system. Consider also the convenience of being able to check response flatness by merely sweeping an oscillator rather than rewinding an alignment tape and patiently waiting for it to play through again.

Consideration of the interactive nature of reproducer equalization adjustment controls will reveal the time advantage gained when successive checks are necessary to optimal alignment. Further, a given signal can be fed to the systems for as long as desired without running out of tone or tape.

Figure 1 shows an elementary schematic of a flux loop system. The series resistors serve to act as current limiting resistors so that the current through the windings of the loop is directly proportional to generator output voltage. The playback head is sensitive to magnetic flux intercepting its gap which is, in turn, proportional to the number of Ampere-turns of the flux loop coil.

In the case of flux loops I have recently built, the value of the resistors involved has been invariably 604 Ohms, ±1%. The reason for choosing precision resistors is purely one of electrical stability. Precision resistors are generally available at moderate cost and their non-inductive properties tend to minimize unexpected frequency-dependant behavior that could inject unnecessary uncertainty into the circuit performance. It is also felt that stability over a long period of time is desirable as well.

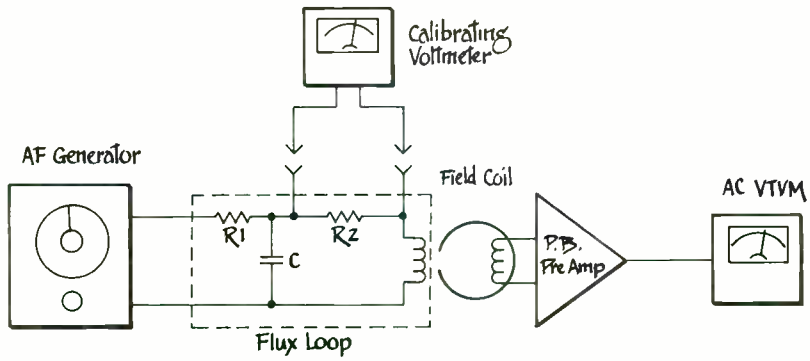

Figure 1 The Flux Loop in Calibration and Application

Test points are provided across R2 for the purpose of measuring the voltage drop across that resistor and thereby determining the current through that resistor and through the flux coil itself. The reason for this facility will become apparent later.

The capacitor, C, is not mandatory but it makes routine application of the loop a good deal easier than without. If the capacitor is used, it will shunt a portion of the generator current output away from the field coil itself, resulting in a reduction in flux seen by the head as frequency increases. If the value of C is carefully chosen, the rate of field reduction with frequency can be made to closely approximate the inverse of one of the playback system response curves in wide use.[3]

That takes care of the high-frequency portion of the reproduce response curve. The low-frequency boost necessary to generate the inverse of the low-end boost incorporated in the N.A.B. characteristics used throughout the United States, is a problem sufficiently awkward to solve in practice, for the case of a physically compact, passive, low impedance network, for me to have abandoned. The proper

TABLE 1

REPRODUCING AMPLIFIER RELATIVE OUTPUT FOR CONSTANT FLUX IN THE CORE OF AN IDEAL REPRODUCING HEAD

FREQUENCY Hz	PHILLIPS SPEC.* 1 7/8 in/s (4.76 cm/s) OUTPUT dB	N.A.B.* 3¾ in/s (9.53 cm/s) OUTPUT dB	N.A.B.* (15 in/s) (38.1 cm/s) 7½ in/s (19.05 cm/s) OUTPUT dB	CCIR** DIN STUDIO 7½ in/s (19.05 cm/s) OUTPUT dB	CCIR** IEC DIN 15 in/s (38 cm/s) OUTPUT dB	CCIR** IEC DIN 30 in/s (76 cm/s) OUTPUT dB	AMPEX** 30 in/s (76 cm/s) OUTPUT dB
32	– 10.4	– 5.5	– 5.4	0	0	0	0
40	– 8.7	– 4.2	– 4.1	0	0	0	0
50	– 7.1	– 3.2	– 3.0	0	0	0	0
63	– 5.6	– 2.3	– 2.1	0	0	0	0
100	– 3.1	– 1.1	– 1.0	0	0	0	0
125	– 2.2	– 0.8	– 0.6	0	0	0	0
250	– 0.6	– 0.2	– 0.1	0	0	0	0
400	0	0	0	0	0	0	0
500	+ 0.3	+ 0.1	+ 0.1	+ 0.1	0	0	0
1000	+ 1.8	+ 1.1	+ 0.4	+ 1.0	0	+ 0.1	0
1500	+ 3.4	+ 2.2	+ 0.9	+ 1.7	+ 0.3	+ 0.3	0
2000	+ 5.0	+ 3.4	+ 1.4	+ 2.6	+ 0.9	+ 0.9	+ 0.2
4000	+ 9.9	+ 7.7	+ 4.1	+ 5.4	+ 2.4	+ 2.4	+ 1.0
5000	+ 11.7	+ 9.4	+ 5.4	+ 6.9	+ 3.3	+ 3.3	+ 1.4
6000	+ 13.2	+ 10.6	+ 5.9	+ 8.7	+ 4.0	+ 4.0	+ 1.8
8000	+ 15.6	+ 13.2	+ 8.6	+ 10.6	+ 5.0	+ 5.0	+ 2.6
10000	+ 17.5	+ 15.0	+ 10.4	+ 12.7	+ 6.7	+ 6.7	+ 3.2
15000	+ 21.0	+ 18.5	+ 13.7	+ 16.1	+ 9.8	+ 9.8	+ 4.9

*Data adapted from "Standards for Magnetic Tape Records" RIAA Bulletin E5, July 15, 1965, Rev. Feb. 7, 1969.

**Data interpolated from "Absolute Flux and Frequency Response Characteristics in Magnetic Recording: Measurements, Definitions, and Standardization" J.G.McKnight, J'our.of A.E.S. July 1967, Vol. 15, No. 3 pp 264, 265, 267.

response of a reproduce circuit excited by a properly calibrated loop is very flat above a 400Hz reference frequency. Keeping this in mind, it's not too hard to remember that the output should drop 3dB at 50Hz for the N.A.B. 3¾, 7½, and 15 ips reproducer characteristics. The response should drop 7dB in the case of a Philips Standard cassette characteristic.

Table 1 gives the relative reproducer output in decibels for each of the curves mentioned above.[4] EIA and CCIR characteristics as well as the 30 ips Ampex mastering curve have no roll-off in their low frequency regions and are therefore flat, ideally, to 0Hz.

Construction of a flux loop should take a fairly short length of time for those interested. The values of Figure 1 resistors R1 and R2 were chosen as 604 Ohms because the output impedance of the signal source to be used to drive the loop happened to be about 600 Ohms. The extra 604 Ohm resistor, R1, was provided as an after thought in the event the loop was to be driven from a 50 Ohm source. In the case of lower source impedances, the effective value of the capacitor needs to be somewhat higher than for the 600 Ohm generator case, causing some uncertainty in its deviation from the ideal characteristic.

The flux coil itself is wound on a coil form made from a piece of perf board with two small notches filed into it. The coil wire, number 36 enameled wire, is wound in an oval path for about 30 or 40 turns. For the case of a loop wound large enough to cover a two-inch head, this represents a length of about 160 inches. This worst-case situation adds about 34 Ohms[5] to the value of R2. For smaller coils, the contribution is less.

Table 2 shows standard values for the time-constants and transition frequencies for each of the reproducer characteristics widely used. Also given are the ideal values of capacitor C that should yield proper high-frequency characteristics for each curve. The formula used to compute C is

$$C = \frac{t}{R}$$

where: C is in microFarads
t is the time-constant in microseconds
R is taken as 600 Ohms in this case.

Precise values of C will depend on the accuracy with which the resistances are known and the resistance contribution of the individual loop windings involved. Empiricism is encouraged in this respect.

For best performance, the flux loop coil should be wound on the perf board in such a manner so as to be capable of being placed in very close proximity to all reproduce head gaps to be excited simultaneously. The coil should also be sufficiently wide and straight to ensure that all of the tracks on the head of interest will be included within the windings. Potting the coil will enhance mechanical stability.

The currents passing through the loop will not be of enormous magnitude in general application. The magnetic flux field produced will necessarily be rather weak and it will be advantageous to obtain the closest coupling possible to the prospective reproduce head to maximize system output. The coil, then, should be wound as close to the edge of the perf board edge as practical without unduly compromising mechanical stability or risking possible damage to the fragile windings in routine use.

The remainder of the perf board will serve as a foundation for the mounting of the resistors and the capacitors. The constructor should plan the initial layout of the circuit with the expectation that some trimming of the value of the capacitor will likely be necessary. He should also provide a means of strain relief for the connecting cable for the external signal source. A five-to-ten foot length of a light, flexible co-axial cable such as RG-174 will suffice in most cases. This completes most of the construction operations. It may be attractive to the builder to consider the inclusion of a switch for selecting more than one capacitance value. This will permit wider application of a given assembly than if only one time-constant were available.

The calibration process for a flux loop is fairly straight foreward. The loop is driven in the manner shown in Figure 1 with an AC voltmeter connected across R2. A reference reading on the voltmeter is taken at a frequency of 400Hz and then the generator is set to the turnover frequency, f_h, from Table 2 for the characteristic desired. The value of capacitor C is then trimmed to yield a voltmeter reading 3dB below the 400Hz reference reading.

For a frequency twice the transition frequency, the voltmeter reading should drop 6dB below the reference reading and for four times that frequency, 12dB. The response characteristic should be checked at several points along the high frequency end of the characteristic so that its response will be determined to be uniform and in sufficiently close agreement with the ideal to satisfy the needs of the user. Agreement to within ½dB of specification has proved to be adequate for requirements that I have had.

Circuit constants having tolerances of ±5% or worse are fairly common in reproducer equalization circuits generally in use. I find that my confidence in the

TABLE 2

SPEED		TRANSITION FREQUENCIES (Hz)		EQUIVALENT TIME CONSTANTS (μ sec)			VALUE OF "C" (For R2 = 600Ω)
cm/s	in/s	F_l	F_h	T_l	T_h		(μF)
76	30	0	9,000	∞	18	(AMPEX)	0.0300
		0	4,500	∞	35	(CCIR)	0.0583
38	15	50	3,150	3,180	50	(NAB)	0.0833
		0	4,500	∞	35	(CCIR)	0.0583
19	7.5	50	3,150	3,180	50	(NAB)	0.0833
		0	3,150	∞	50	(EIA)	0.0833
		0	2,240	∞	70	(CCIR)	0.166
9.5	3.75	50	1,250	3,180	120	(EIA)	0.200
		0	1,600	∞	100	(EIA)	0.166
		50	1,800	3,180	90	(NAB)	0.150
4.76	1.87	50	800	3,180	200	(AMPEX)	0.333
		100	1,250	1,590	120	(DIN)	0.200

Data derived from "Flux and Frequency Measurements and Standardization in Magnetic Recording" J. G. McKnight, Journal of the SMPTE, Vol. 78, p. 464

end results of work performed varies directly with the stability and accuracy to the measurement tools used. This is the reason for taking some care in establishing the accuracy of the flux loop inverse characteristic to a precision limited by voltmeter accuracy and generator output frequency.

Comparison of measured response of the loop as indicated by the voltage drop across R2 with the appropriate data given in Table 1 should yield adequate confidence in the conformance of the loop network response against the standard.

In application, the flux loop assembly is positioned in such a manner that the field coil rests against the reproduce head, the axis of the track gaps being wholly within the coil winding to maximize the field intercepted by the reproduce gaps. The positioning is most easily accomplished while the loop is being driven with a 1 to 10 volt rms input at about a 1kHz frequency. The best position is that which corresponds to maximum output from all tracks of interest. The entire assembly may be held in a stable geometry through use of a rubber band or two.

The performance of this arrangement is not terribly sensitive to separation but a quick sweep to 15kHz will serve to confirm that the magnetic coupling is adequate over the band of interest. Generally, a level indication of -5 to -15dB will be observed at the reproducer outputs. Individual channel gains may now be adjusted to a convenient reference indication and readings noted with respect to frequency. Playback response may now be adjusted for optimal flatness over the frequency range above 400Hz.

The low end roll-off incorporated in N.A.B. standard reproducers will, as mentioned earlier, not respond in a flat manner due to the lack of provision for low-end boost in the flux loop network. The observed response at the reproducer outputs should ideally follow the characteristics shown in Table 1. The flux through the head will be uniform with frequency below 400Hz, and therefore the roll-off will be directly observable. If the reproducers were excited by a flux loop not compensated by inclusion of capacitor C, the output observed, for a correctly aligned reproducer would agree closely with the positive and negative decibel values given. This is because the tabulations are based on a constant short-circuit flux induced in an ideal reproducing head.

This description fairly well covers the routine playback response adjustment using the flux loop. J.G. McKnight reports that frequency response measurements performed using a flux loop agree closely with measurements obtained using variable speed techniques.[7] He reports agreement between constant flux injection, constant flux plus inverse network, and the variable speed method, to be within ¼dB, his limit of experimental error. He concludes that the over-all response of an Ampex 351 reproducer using a commercial head is flat to within ½dB to 15kHz, dropping to 1½dB at 20kHz. That, as the saying goes, ought to be good enough for government work.

All of the foregoing neglects the variations in reproducer output response when magnetic tape is used as the source of excitation flux. McKnight, in the same publication, concludes that significant losses in the magnetic tape case were almost entirely due to wavelength effects.[8] Since it is my expectation and hope that reproduce heads have improved somewhat since circa 1960, I feel reasonably secure in reliance upon the flux loop technique for calibration of reproducer response characteristics.

Empirical verification of the response of a given reproducer using a 7½ ips N.A.B. alignment tape and a flux loop shows agreement between methods within 2dB, above 250Hz. Fringing effects distort the data below that frequency. This correlation is shown in Figure 2. I think it is fair to mention that the alignment tape in question had seen several weeks of daily use at the time of the comparison and could conceivably have lost some of its accuracy at the shorter wavelengths. Even a carefully handled alignment tape will have a loss of from 0.5 to 2dB at 0.5 mil wavelength after 50 playings and about 3.5dB loss after about 100 playings.[9]

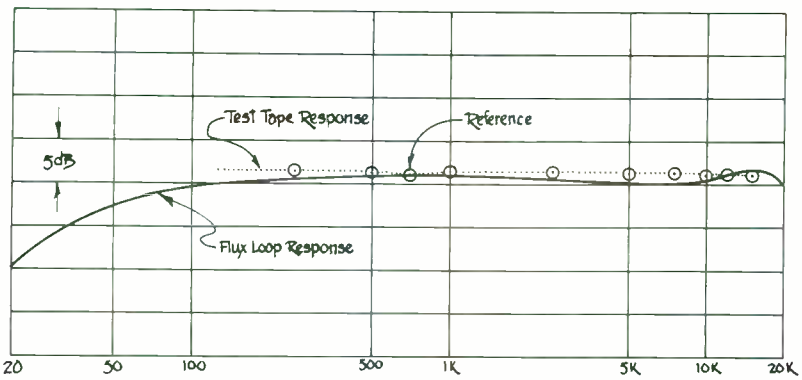

Figure 2 Comparative Response of Standard 7½ IPS Test Tape and Flux Loop

The flux loop is not a replacement for standard alignment tapes, however. It is a tool that, when used within its limitations, can provide useful information regarding the dynamic responses of a tape reproduction system. It cannot, however, reveal defects in the system due to factors such as head grooving, tape path instability, azimuth error, poor tape-to-head contact, or excessive gap length. Clearly, it cannot serve as a flux level standard, being as geometry sensitive as it is.

Its value is greatest in the case of the lower tape speeds where fragility of alignment tapes and variations in cartridge and cassette plastics introduce considerable uncertainty regarding the true nature of the 8-track cartridge and cassette reproducer. The major benefits realized from use of the method have been accrued in the areas of these consumer format products, as far as my experience is concerned. A DIN cassette alignment tape is such a fragile entity that I am led to distrust it after only 3 or 4 uses. This includes the slewing back and forth to re-verify previously observed points on the reproduce characteristic. At a cost of about $50 per cassette tape, it's not hard to see how fiscal expediency can severely restrict scientific objectivity.

As an illustration of this, I had been experimenting with application of the "B" Dolby [C] and DBX noise reduction processes to high-speed duplication of music program material earlier this year. I was continually frustrated by the inability of the decoded cassette to compare favorably with the quarter-inch source copy. Notably, the high-frequency portion of the duplicated spectrum seemed to suffer from the encoding/decoding process after duplication. This was true without regard to the noise reduction system used. From the best data obtainable, there was cause for belief that the mastering and duplicating system were flat from 50 to 15,000Hz, ±2dB. A flux loop determination of the evaluation cassette player response showed that what had been presumed to be a flat reproduce characteristic, referred to a DIN alignment tape, was in fact a 3 to 5dB boost at 10kHz and a similar drop at 5 to 8kHz. Re-adjustment of the cassette player response and re-evaluation of the experimental music samples verified the validity of data determined independently.

Both noise reduction systems performed creditably through the rigors of the high-speed (32:1) duplication process. The cassettes using either noise reduction system were very difficult to distinguish from their 7½ ips, quarter-inch sources when sychronously A-B compared.

This experience brings to mind the widely held and perverse contention among audio professionals that noise reduction systems, the Dolby processes, are most frequently mentioned, somehow color, or unacceptably compromise the

quality of the recordings processed. I will admit to holding reservations regarding this aparent problem, (falling a good deal short of outright hostility, however). I think that if maximum benefit is to be derived from use of any noise reduction process whatever, greater care in establishing truly flat recording system response over the bandwidth of interest is necessary. After many years, I have begun to observe that realization of this has been expressed more frequently.

Variations in play-back equalization of the 2 to 4dB magnitude are audible to a critical listener, whether noise reduction is used or not. Under close scrutny, the effective change in Dolby decoder drive level over the range of equalization disparity is indeed audible when compared against results obtained for flat reproduction. How significant such differences are to a consumer who has no access to the master tape must remain an open question for the present.

It is my suspicion that the complaints regarding alteration of noise-reduction processed program quality may be attributable, in large measure, to cumulative variations in recording and reproduction system frequency response, probably resulting from over-reliance upon alignment tapes as absolute flux and frequency standards beyond their truly useful life. I can recall observing master tapes, Dolby-ized, DBX'd, and flat N.A.B., that showed considerable variance with standards to which machines under my control are customarily maintained. Most notable among the variations, other than simple azimuthal and level mis-matches, for which I make corrections without comment, is a 2 to 4dB rise in response in the 5kHz to 8kHz region which is not easily correctable on playback equipment with which I normally deal.

I feel fairly confident of the accuracy of the response of equipment under my control for two reasons. The first is that the real-time record/reproduce characteristics of any given quarter-inch machine repeatably fall within a $\pm$1dB tolerance, typically less, and that different machines will respond within this tolerance to a tape prepared on another. Second, comparison of flux loop response against standard alignment tape response reveals an error of less than $\pm$1.5dB as shown by the curve of Figure 2. I further believe that closer investigation of the relative condition of alignment tapes versus flux loop response versus record/reproduce response may yield some beneficial information to the industry at large. It may be that alignment tapes are being used without due regard to their fragility, potential for aging degradation, and/or the condition of the tape-to-head contact mechanism upon which the entire magnetic recording process depends. The obscure flux loop is offered as a means for verifi-

cation of reproduction system response that is repeatably verifiable with regard to calibration accuracy.

I think that flux loop techniques used to establish system reproduce response, to tighter limits than are generally considered necessary, to be instrumental in preserving spectral quality of processed program material. I believe that experience has provided sufficient evidence as to the utility and benefit of both the Dolby and DBX processes as applied to the magnetic medium in both professional and consumer applications. The dependance of any noise reduction system, with which I am familiar, on a very flat frequency response characteristic throughout the program channel should not be minimized as much as it apparently has been in the past.

My enthusiasm for the flux loop method also stems from my inability to establish slow speed reproduce system performance with more widely relied upon techniques. This enthusiasm is supported when more difficult reproduce measurements such as total harmonic distortion and intermodulation distortion are attempted. The uncertainties due to contributions of the non-linearities of the recording process involving tape saturation, residual noise, and modulation noise make true reproducer contributions to the measurement difficult to assess. Add to this wow and flutter effects and the situation is further complicated.

As far as dealing with the many reproducer response characteristics considered standard throughout the world, there should be no serious need to maintain either a complete inventory of flux loops or alignment tapes for each one. J.G. McKnight has published a set of correction curves showing proper response differences between IEC/CCIR machines responding to an N.A.B. alignment tape and a N.A.B. machine responding to an IEC/CCIR alignment tape.[10]

For those interested in more detailed descriptions regarding the history and application of the flux loop, this information may be found among the following publications, although I do not represent my research as exhaustive. The earliest mention of the flux loop technique is given by J.D. Bick in 1953.[11] Daniel and Axon rely on the method prominently in determination of core losses in a ring-type reproducing head.[12] R.L. Wallace used a field coil, apparently wound completely around the test head, for the determination of core losses in 1951.[13]

The flux loop is also briefly treated in several published volumes. H.G.M. Spratt describes the eddy current loss measurement[14] while W.E. Stewart[15] goes over the same ground. Later date publications cited above should be consulted for more rigorous exposition of the applications described in this article.

A final caveat in use of either the flux loop or the standard alignment tape in routine practice may be in order. I have noted on several tape machines, of reputable and respectable manufacture, that the V-U meter indication may not be as flat with respect to frequency response as we might ideally suppose it to be. In many cases, direct observation of reproduce output level with a high accuracy, wide-band indicator such as the Hewlett-Packard 3400A AC voltmeter will show that the panel V-U meter response drops noticeably in the range above 10kHz. I have noted as much as 2dB difference at 15kHz on certain individual machines. This observation considers any absolute calibration deviation from the +4dBm: 0 V-U relationship.

1"Tape Reproducer Response Measurements With a Reproducer Test Tape" J. G. McKnight, Journal of the A.E.S., April, 1967, Vol. 15 No. 2, p. 152

2"The Use of Flux Loops for Calibration of Magnetic Reproducers" Alistair M. Hazelitt. Presented May 16, 1973 at the 45th A.E.S. Convention, Los Angeles. No pre-print available.

3Hazelitt, Ibid.

4"Standards for Magnetic Tape Records" RIAA Bulletin E5 July 15, 1965, Rev. Feb. 7, 1969

5"Reference Data for Radio Engineers" Howard Sams & Co. 5th Ed. P. 4-50

6"Flux and Flux-Frequency Measurements and Standardization in Magnetic Recording" J. G. McKnight, Jour. of the SMPTE June, 1969 Vol. 78 P. 464

7"Frequency Response of Magnetic Recorders for Audio" J. G. McKnight, Jour. of the A.E.S., July 1960, Vol. 8 No. 6, p. 148

8Ibid. p. 153

9"Reproducer Test Tapes: Evolution and Manufacture" R. K. Morrison Jour. of the A.E.S. Vol. 15, No. 2, p. 161

10"Measuring a Tape Reproducer with IEC-Response, Using an NAB-Response Tape" J. G. McKnight, Jour. A.E.S. 1969, Vol. 17, No. 5, p. 572

11"Methods for Measuring Surface Induction of Magnetic Tape" J. D. Bick, Jour. of the A.E.S. Jan. 1953, Vol. 1 No. 1, p. 4

12"The Reproduction of Signals Recorded on Magnetic Tape" E. D. Daniel and F. E. Avon, Jour. of The Institution of Electrical Engineers, 1953, Pt. III, p. 157

13"Reproduction of Magnetically Recorded Signals" R. L. Wallace, Jr., Bell System Tech. Jour., Oct. 1951, Vol. 30, p. 1145

14"Magnetic Recording" H. G. M. Spratt, MacMillan, 1958, p. 95

15"Magnetic Recording Techniques" W. Earl Stewart, McGraw-Hill, 1958, p. 78

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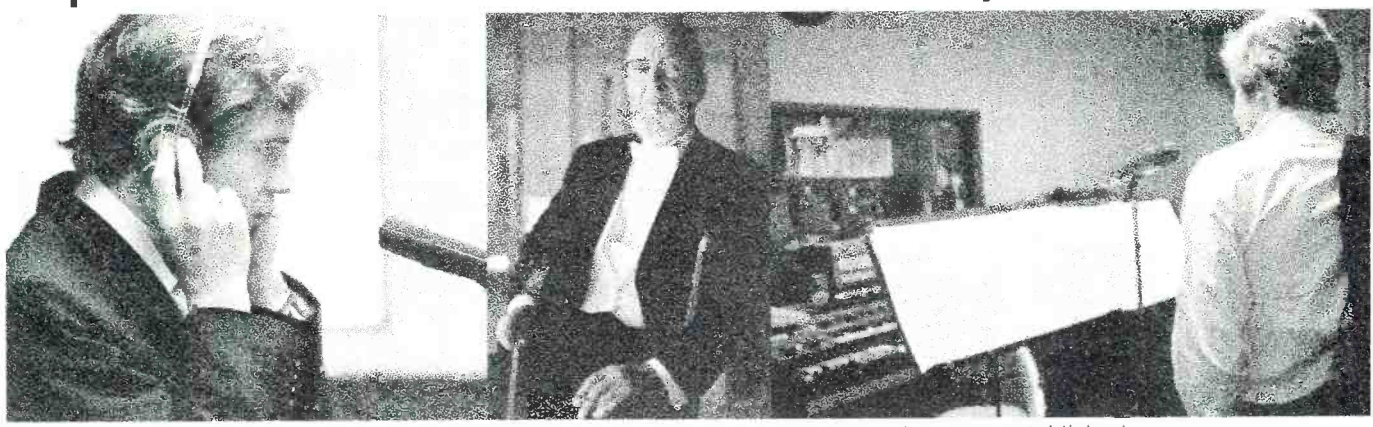

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THE MYTH OF THE MAGICAL STUDIO

BY DAVE HARRISON
STUDIO SUPPLY CO.

Surely each and every one of us in our career has heard about, or worked in some recording studio that was well known to produce superb product acoustically, even under the most adverse conditions. Quite frequently these studios are reputed to have some magical quality about them that for one reason or another can't be explained.

This generally occurs after somebody, somewhere, without extensive studio design experience tries to duplicate the performance of the room with careful measurement of dimensions, attention to detail, and lots of back breaking work. The results of these efforts to "duplicate" the excellent acoustics usually end up as a dismal failure, and it's at that point that the original studio begins to develop its reputation as "The Magical Studio."

It just isn't so! That studio is magical only to the person who does not understand totally the physical and acoustical mechanisms at work in that particular room.

That studio is no more magical than television or air travel, both of which would be attributed to some mystical power by an Aboriginal Indian as yet unexposed to the tools and toys of contemporary society.

A recording studio fundamentally is a physical plant, the purpose of which is to convert some form of original performance into final recorded product.

A studio which carries with it a reputation for excellence generally has that reputation because of the final product it produces. Good product is the result of the people, the room, and the gear.

Of these, the most important is the people factor. Without good mixers, producers, artists, players and writers, the best studio in the world can't produce good product. There is, however, compensation in the fact that good people tend to gravitate to good facilities to do their work. That being the case, it is critical to the commercial studio that they offer the best possible acoustics and the most complete complement of equipment consistent with the fiscal limitations.

Profitable operation is the goal of almost every studio venture. Profit in any business is the difference in what you take in and what you payout.

It is here that the services of a competent studio design engineer are critical. His skill and experience in the design and construction phases of a project can minimize the building cost and maximize the acoustical performance of the finished studio. And he can accomplish all this with the secure knowledge that the performance of the studio will be as anticipated in advance; eliminating the costly and time consuming process of working with and changing the room until the desired results are obtained.

A thorough integration of equipment recommendation, systems design, and acoustical design consistent with the budget and performance requirements of the client is critical to insure the financial success of the studio. It is here, as well, that the experienced studio designer performs a most valuable function.

A recording studio with lavish acoustics and accommodations but inadequate or incomplete systems design is just as bad as a complete selection of the best gear available installed in some warehouse, basement, or ballroom where there has been little or no thought given to proper acoustics.

Studio operating personnel, no matter how skillful they may be at mixing, maintenance, mastering, etc., as a general rule do not necessarily make good studio designers. This is not because they are not as smart as the studio design engineer, but it is a simple matter of fact, that the person who is engaged in an activity day in and day out, year after year, can more skillfully and expediently complete the work at hand, usually at a lower overall cost.

The recording studio design engineer is primarily guided in his work by three constraints; budget, site, and client requirements.

As a first step, I almost always enter into a series of discussions with a potential client to determine what type of product will be recorded in the completed facility, what his personal likes and dislikes are in the studios we have built, what the budgetary requirements are, and perhaps most importantly draw out from him any prejudices he may have as to decor, acoustical characteristics, or equipment selection.

This is critical to insure that the studio will become an accurate extension of the philosophy and personality of the people who will own and operate it and not just of myself. This does not mean to say that we *must* have this input from the client, or on the other hand that we will let him get into trouble in any way. It's just that we would like the finished studio to reflect something of him and of us.

As we are determining the likes and dislikes of a client, we are simultaneously gathering financial data from him so that we can understand the total budgetary requirements of the project and quite frequently assist him in obtaining the necessary long term financing. In today's climate of high interest rates and tight money-lending policies, we can frequently guide a client to a financial institution that has extensive experience with recording studios and the music industry in general. Often we find that local financial institutions are hesitant to get involved in loans or leases to an industry such as ours where their historical experience is limited or non-existant. Fortunately, there are organizations that do have extensive experience in the music industry and are aware of the extremely low failure rate and good payment record of most recording studios.

Frequently the site of a studio is a predetermined quantity if a client already owns a building or piece of property. Designing and building a recording studio into an existing building that was not constructed originally to house such a facility presents special problems to the designer, but they are almost never insurmountable. The increased construction cost of working with an existing structure that is not ideal may well be offset by the fact that the building or space is already bought and paid for.

Almost any building site available is suitable for a recording studio. Extremely noisy locations, both electrically and acoustically, simply require a more complex design and attendant higher construction cost. These are facts that must be openly and without bias presented to the client because in the end the choice must be his.

Continued . . .

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The greatest sin we have seen any studio owner commit, and it's happened to us more than once, is to call in the studio design engineer *after* construction of the building has begun. It's one thing to work in a building that has existed for some time and was built and used for something different than a recording studio, you can't help that. But if you are building a structure specifically for a recording studio it doesn't seem to make any sense to begin before complete plans are laid out. You just lock the acoustical designer into things that severely limit his effectiveness, in addition to the probability that you'll have to spend more on construction.

It's virtually impossible to give a prospective studio owner a complete course in studio design, just as it's impossible here in one article to present in depth all factors that go into a contemporary acoustical and systems design for a recording studio. However, I for one find it very beneficial if the client is programmed with as many facts as possible, and has as complete an understanding as possible of all the acoustical mechanisms at work in the design.

Armed with this information, the studio owner can take a real and active part in the design of the studio that he will live with for a long time. He should never feel that anything is being forced upon him. But rather, he should be free to accept or reject any design feature or detail after he has been given a total and impartial briefing on its importance in the final acoustical performance of the facility.

As it is in most complex tasks, the design of a recording studio must be broken down into many little subsections which when combined yield a completed project.

The control room and the studio proper must be considered totally independantly as to the desired acoustical performance. A room whose characteristics are ideal for recording would in almost all cases be a catastrophic failure as a monitoring room. The reverse is also true.

The first real part of the studio design engineer's job, once he has his input from the client, is to determine exactly what the final acoustical characteristics of the control room and studio will be when they are completed.

General design goals for a control room and studio that would apply in almost all cases have been developed after years of work and the experience gained from building many studios. These goals are not arbitrary but each has a real place in the scheme of things, and is important to the final acoustical performance of the facility.

CONTROL ROOM:

Dimensioning of the control room is critical and each of the dimensions plays an important but independant role in the final acoustic performance. The length (front to back) is critical to the warmth of the room and should be between 20 feet and 24 feet. This warmth comes from the ability of the room to support a full wave in the 50Hz range. While it is possible to "tune" an improperly dimensioned room with monitor equalization to obtain the measured response in this register, such response feels shallow and to the human ear lacks the reality and warmth of normal room modes. I should quickly explain that this mode is not allowed to become predominant in the sound of the room as, it is heavily trapped. It is however, not trapped so heavily as to completely remove its warming effect; but only to the extent needed to insure even monitor characteristics in the room.

The side to side dimensions of the control room should be between 12 feet and 16 feet with 14 feet to 15 feet being ideal. A room that is too narrow hinders placement of equipment and movement of people in the room. Additionally a room that's too narrow makes it more difficult to generate even monitor characteristics for all operating positions.

If the control room is made too wide a great deal of monitor efficiency is lost, particularly in the low mid range and bottom regions. Also there is a lack of the intimacy that is beneficial in mixing product that will relate well in its final use.

The beginning height of the control room before treatment should be at least 10 feet, with the ideal being about 11 feet. This will allow an 8 inch to 12 inch raised area in the middle and rear portions of the room, giving the mixer and producer better visibility into the studio, and lowering the vertical angle from the monitor positions to the center of the monitors.

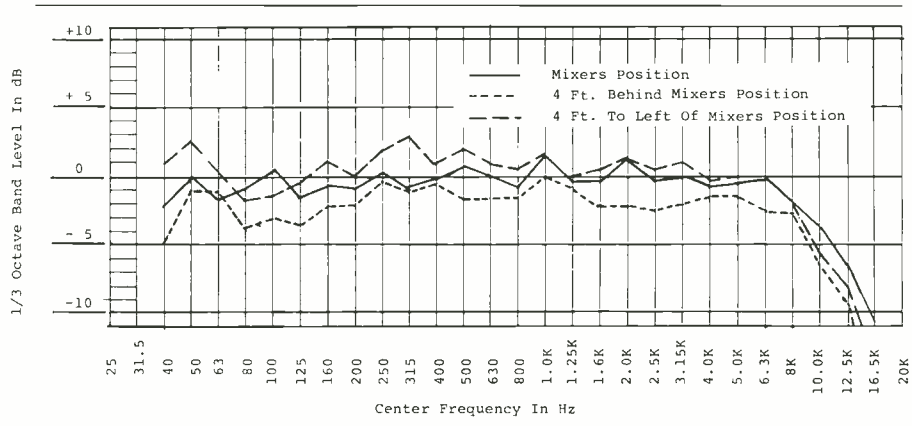
A trapped false ceiling is installed approximately 8 feet above this platform to totally attenuate the vertical mode of the room. A 16 to 18 inch depth in this trap is generally sufficient to satisfy the requirements of this vertical mode trap.

Sidewall construction is such that there is a high order of lateral dispersion that is accurately calculated to generate even monitor characteristics in the critical areas of the room. These even monitor characteristics are a result not only of evenly dispersing the different frequency ranges, but also must take into account the fact that there must be a random phase occurrence to prevent phasing and notching effects in the middle ranges which can occur on coherent center channel information.

Front wall construction is generally desigend with downward deflection to prevent slap from the rear monitors back to the prime monitoring positions. This downward deflection is also useful in quad monitoring, in getting the rear channels into the observer's area in front of the console. An upholstered couch and carpeted floors in this area help trap this information and keep it from coming back into the room.

The control room rear wall is trapped to the extent necessary to properly control the front back mode of the room. As previously stated, it has been found undesirable to completely trap this mode, and the trapping here is in the nature of accurate control and not elimination.

Windows in any acoustical environment are always a problem as they present large flat surfaces to bounce sound without benefit of useful dispersion. It is desirable to keep the window area as small as possible consistent with good visual communications. The lower boundary of the window is set so that observers on the couch can see on at least a horizontal



LEFT FRONT SPEAKER — MUSIC MILL, MUSCLE SHOALS, ALABAMA

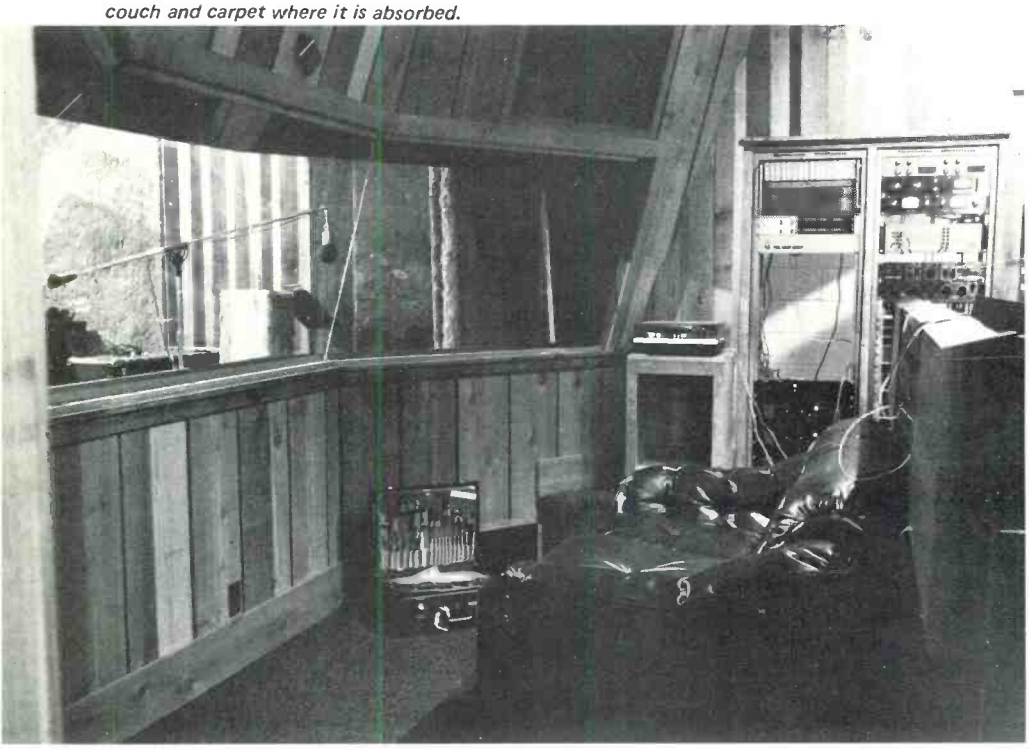
Response curves at mixers position and extremes of a 4' x 8' area indicate the excellent dispersion and consistency of monitoring within this area. Top end roll off conforms to the Studio Supply house curve which relates accurately to final product.

plane out into the studio. This is usually 3 feet from the floor. The upper limit of the window is set so that a person of normal height, standing at the mixer's position can see eye to eye with another person of normal height, standing at the far end of the studio. This dimension varies slightly with the elevation of the mixer's position, but is generally 6 feet. Width of the windows is set by the necessity to see into as much of the usable studio as practical.

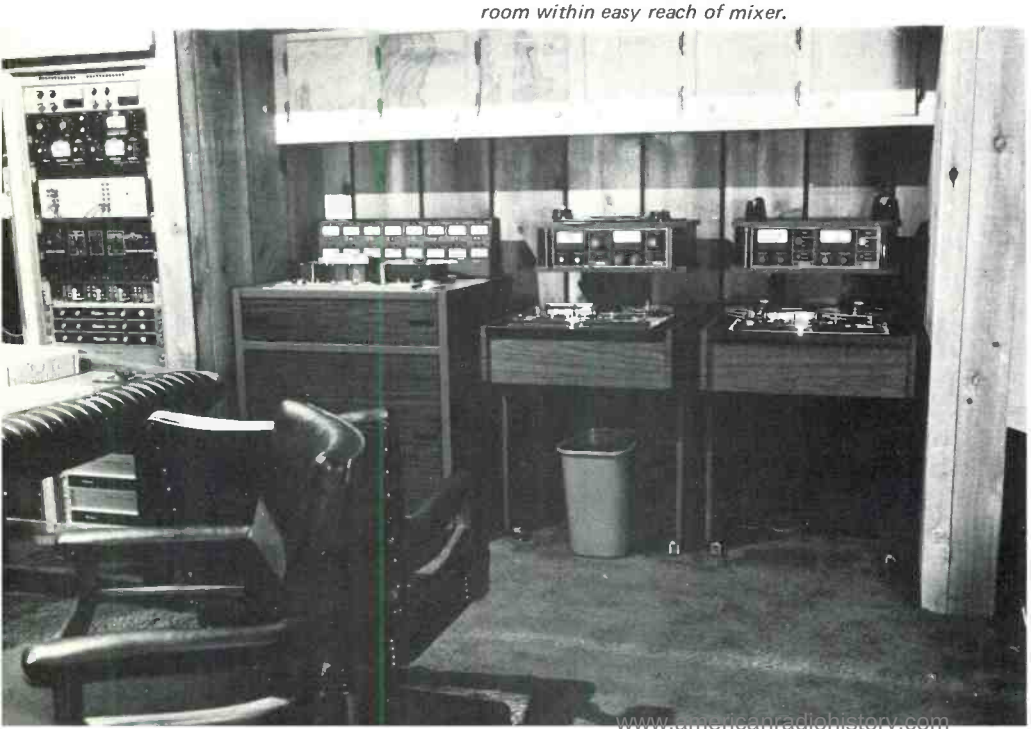
It is highly desirable that space be available on both sides of the control room. On one side this will be used as a sound lock and musician's lobby. On the other, it will be used as an equipment room allowing the racks to be built into the side wall and sometimes allowing machines to be recessed into niches. This helps keep gear out of traffic patterns and helps attenuate fan and motor noises from the machines.

An absorbant carpet on the floor is beneficial to the warmth of the room, and the back of the console should not be high enough to disturb the acoustical field from the monitors and upper side walls.

Front control room wall slants to deflect rear monitor information into couch and carpet where it is absorbed.



At Music Mill in Muscle Shoals, Alabama machines and rack are recessed into side wall of control room within easy reach of mixer.



STUDIO:

The studio proper in today's contemporary facility is far different than the historical studio you will find in the reference books. The laws of physics haven't changed, but the required performance of the room has.

With the advent a few years ago of stereo product and multi-channel recording, there was a trend, fortunately now reversed, to extremely dead rooms with little or no beneficial reflection. These rooms, known in some circles as *sound suckers*, were built by people with little or no knowledge of the necessity that there be a number of early reflections in the acoustic field. These early reflections (within 25-30ms of the original sound) *do not* add a noticable ambience or room sound to the recorded material. Reflections which have the general character of and follow the original sound within this time frame are perceived as a part of the original sound. They are necessary for good apparent loudness, good apparent transient response, and a natural realism, particularly in unamplified acoustical instruments.

Acoustical instruments generate a sound field with components going out more or less in a spherical pattern. The acoustical energy radiated on an individual axis of this sphere very seldom contain all the components necessary to represent the true accurate sound of the instrument. Our preconceived notion of how an individual instrument sounds is based upon our listening experiences. Most of these listening experiences have not been under extremely dead or almost anechoic conditions, but rather under circumstances of livelier acoustics where we had an opportunity to hear a more representative composite of the total acoustical energy. This is why these early reflections from various directions in the recording studio are so critical to accurate recorded instrument sound.

The mixer burdened with the job of trying to get good sound on instruments under extremely dead circumstances has historically had a few corrective tools to work with (equalization, reverb, double track, etc.), but even after extensive processing such material lacks those qualities that we have come to expect from a proper recording environment.

Good apparent loudness and transient response when recording in an acoustic field rich in early reflections, is the result of the increased total energy content of the transients caused by random transient repetition within a 25ms-30ms period. Transients repeated very far outside this time frame are heard as distinct and separate sounds and unless they are part of some sought after room sound or ambience, are generally considered to be undesirable.

It is readily apparent to the most casual observer that most sound sources in the recording studio occur in an area from the floor to four feet above the floor, and microphones in contemporary recording practice are generally placed no higher than 5 or 6 feet above the floor. More likely than not, they are placed in the general horizonal plane of the sound source. With this in mind, it then becomes obvious that the most beneficial reflections that would occur would be those that had good horizontal dispersion with limited vertical dispersion. Such is the case in actual practice.

Another design goal of the contemporary recording studio is that of separation; that is, minimum leakage of one instrument's sound into another instrument's microphone. All the reasons for good separation such as improved control, minimized undesirable room ambience, and having the opportunity to replace tracks without ghosting from other tracks recorded at the same time, are well known, so we won't go into that here.

In the normal studio, there are a great many things filling in this space from four feet down. Chairs, people, music stands, pianos, organs, amps. etc.

With vertical dispersion limited, we have to a certain extent contained a great deal of the acoustic energy generated within this bottom slice of the room where it can be disipated and absorbed by the usual clutter of things occupying the studio.

In order for a room of this design to work properly, however, it is absolutely essential to completely trap the ceiling to eliminate the possibility of bounce back, which would totally destroy the beneficial effect of the horizontal dispersed sound field we have generated. Ceiling bouce is detrimental primarily in two ways. The first is that ceiling bounce is about the only mechanism remaining to spoil separation other than direct sound from closely spaced instruments that don't have intervening dispersing or absorbant items. The second relates to the first in that these reflections will in almost all cases be separated from the original sound in time by more than the specified 25-30ms. Therefore, they will be heard as a separate sound and as such are undesirable in contemporary recording.

Many people believe that the degree of separation you can get in a room is a function of how dead it is. While this can be a general truth in rooms without carefully planned and executed acoustics, I think I have made it clear that intelligent thought and proper design based on a great deal of experience can generate a room that has all the advantages of a relatively dead room, without the detrimental effects.

. . . Continued

In the studio, it is very desirable to have some areas more live than others so that the mixer may vary the density and strength of the early reflections by proper placement of personnel.

In my designs the livest area is generally at one end and the deadest area at the other with a fairly smooth transition. The end of the studio with the control room is generally designed to be the live end as the undispersed reflections from the glass are less detrimental there.

Dimensioning of the studio is less critical than the control room. That's not to say there are no restrictions, but the restrictions are not as critical acoustically. It is important that there be a minimum of coincidence in room modes. These are well trapped laterally as well as vertically, but if the modes are coincident they must be trapped more.

Parqued wood floor in live area gives warmth to the sound of instruments.

Bass trapping is done on an overall room basis rather than at specific instrument locations. Low frequency energy in a room is a function of the dimensional modes of the room. It is very critical that the room be considered a resonant system at these frequencies and that the design include measures to properly dampen these resonances. With the room resonances properly damped, the free low-frequency energy in the room is limited to such an extent that individual bass traps are not necessary.

Drum booth is placed at dead end of room as shown. Laterally dispersing sections can be seen on wall.

The dependance upon bass traps without proper control of the room as a total system can create many problems for the mixer. Versatility of the room is severely restricted if players can only be placed in one position. Bass energy from specific instruments may be attenuated in a local area of the room, but if the room as a total entity is not properly controlled, the small amount of energy that does escape can, through undamped resonances, cause severe problems in other areas. The general effect of these faults is an occasional lack of sparkle and definition in the mix and a general low frequency cloud under the whole thing. It can sometimes be very difficult to diagnose this problem as other problems often accompany it.

ISOLATION BOOTHS:

Most experienced mixers and players will agree that isolation booths are to be used only when absolutely necessary. It's true they help separation under marginal conditions of acoustics and player balance, but they are detrimental in many ways.

Players or vocalists working in a booth tend to lose the intimate contact with their fellow performers that is critical to a spontaneous and "free" feeling performance. Most isolation booths also have many of the undesirable acoustical characteristics of a very small room. Lack of density in the dimensional modes frequently make a booth sound "boxy," making instruments recorded in those booths sound radically different from instruments recorded in the open room.

Gwnerally a drum booth is the only booth necessary in a recording studio of good contemporary design. The same care should go into its design as goes into the design of the studio and the considerations are almost identical.

ISOLATION:

Acoustic isolation of rooms in a recording studio is important to satisfactory performance and versatility. Isolation (absence of harmful sound transmission), between the control room and studio is in my opinion the most critical; although isolation between production and office areas, and isolation from the outside world, follow closely.

Sound traveling from one room to another is either airborne or structureborne. Airborne transmission is the easiest to control, but in improperly designed and constructed facilities, is the most frequent offender. Careful attention to design and construction details can virtually eliminate airborne transmission without excessive building cost. Structureborne sounds are more difficult to control, especially in pre-existing buildings. They too can be dealt with but it sometimes involves complex expensive construction.

In the design of recording studios, we at Studio Supply Company attempt to stay with standard construction practices and materials as much as possible. There is a very good reason for this. If a set of construction plans calls for exotic materials and construction techniques, then it can only cost the client more money to build, particularly if identical results can be obtained with standard materials and practices. When contractors are asked to deal with materials they are unaccustomed to, and methods of construction their people are not familiar with, they tend to inflate bids to give themselves a margin for error. Additionally, some designs are so complex that the use of an on-site construction foreman, supplied by the designer, is necessary to insure faithful

execution. While in some cases it may be necessary, and we do have people available, I don't hink it's fair to lock a customer into this when the studio can, with no compromise, be designed in such a way that almost any competent professional contractor can handle the job.

I think a word about monitors is called for. Monitor speaker systems cannot be taken and evaluated meaningfully by themselves. They are a component in a monitoring system that also includes the monitoring room, the power amps, the tuning, and the ears of the operating personnel. The prime purpose of a monitor system is to accurately tell us what is on a tape or is coming through the console and how it will sound when the final product is later played and hopefully enjoyed by the consumer. The total monitor chain should be highly linear, exhibit no colorations, generate sufficient sound pressure levels, and have proper dispersion to insure the accuracy of the sound field at any critical listening position.

There is no one monitor system that performs best in all applications and all rooms. When we have the opportunity to build a control room the way that we prefer to, we have our favorite monitor system. As the purpose of this article is a discussion of acoustics in recording studios and not an ad for speakers, I prefer only to say that the system we use performs to our total satisfaction only when used in a room properly designed for it. This is the case with any speaker system.

It is just as proper to design a monitor system for an existing room as it is a room for an existing monitor system. This is often the case where total control of the room is not possible.

We at Studio Supply Company are proud of the studios and control rooms we have designed and the complete facilities we have built. We work just as hard to bring an older existing studio up to contemporary standards as we work in designing a brand new turn-key installation. We have the same pride in the work we do for the client with a small budget as the client with unlimited funding. Most importantly, we have never had to make apologies for any job we've been involved in, even those with very limited funds. If a client has only a limited construction budget, we know that we're going to help him get the best studio possible within the confines of that budget.

The proof is in the pudding, and I guess the bottom line is being able to sit down and listen to the product produced in the studios we've built; and to know that we have had a real part in making that product good and competitive by sharing the knowledge gained through many years of hard work and experience.

SEMINAR SERIES

Registration: A $5.00 registration fee includes all four Seminars. Only those who register for Convention Technical Sessions or Exhibits may attend.

The purpose of these four initial seminars, conducted by the Audio Engineering Society, is to introduce interested members in the practical methods and techniques employed in audio engineering. The Society is trying in this way to better serve the whole membership by offering an educational service that may aid in improving the understanding of current-day audio technology and its application.

Monday — Sept. 9 — Astor Gallery
THE DESK TOP COMPUTER IN COMPUTATION & DESIGN

SEMINAR I — 2:00 — 5:00 pm
INTRODUCTION TO PROGRAMMING (D)

A primer of programming with application to the desk top computer. This seminar will introduce the rudiments of machine language programming step-by-step, so that the attendees will be capable of using a simplified machine language OP CODE to program a problem. This first session will aid participants in the evening seminar in practical applications.

SEMINAR II — 7:30 pm
APPLICATION OF THE DESK TOP COMPUTER TO AUDIO ENGINEERING (F)

A discussion and demonstration of current day hardware and software. Particular emphasis will be given to unique applications in audio engineering. This seminar will be divided into three general areas: (1) Demonstration and application of the latest equipment manufactured by Hewlett Packard Co. (2) Discussion of available stock software as well as specialized programs. (3) Discussion of application of the hardware and software to specific design problems.

Tuesday — Sept. 10 — Jade Room
RECORDING STUDIO TECHNOLOGY

SEMINAR III — 10:oo am — Noon
TAPE RECORDER ALIGNMENT — WHY, WHAT AND WHERE (H)

Although the studio technician may satisfactorily perform routine tape recorder alignment procedures, his understanding of the various adjustments is often based largely on rote training. The complete record playback system includes a series of compensations; some fixed and others adjustable. A better understanding of the tape recorder as a system will enable the user to better realize its full potential. In this session, Mr. McKnight will discuss, and demonstrate, the significance of each step in the alignment procedure.

SEMINAR IV — 2:00 — 3:45 pm
PRACTICAL STUDIO ACOUSTICS (J)

The working recording engineer will seldom be called upon to specify the acoustic treatment of the studio in which he works. However, some acquaintance with elementary acoustic principles will help him in using his studio to better advantage. Especially in the case of separation, acoustic materials are often badly misapplied, and an improperly designed baffle may actually do more harm than good. Mr. Hansen will briefly cover the basic principles of sound transmission, and discuss the practical application of acoustic materials in the studio.

Directly following this seminar, Session K, a Panel Discussion on Studio Design will be held.

SESSION A
AUDIO IN BROADCASTING

MONDAY, SEPT. 9, 9:30 AM
JADE ROOM
Chairman: **Orville J. Sather, WOR—Radio, New York, N.Y.**

A-1 INTERMODULATION DISTORTION, BROADCASTING AND THE FCC
A-2 AUTOMATIC NOISE FILTER FOR TELEPHONE LINES
A-3 A BROADCAST MONITOR LOUDSPEAKER OF SMALL DIMENSIONS
A-4 RESTORATION AND PRESERVATION OF DISC RECORDINGS
A-5 TRANSMITTER LIMITATIONS IN ACHIEVING HIGH AMPLITUDE MODULATION PERCENTAGES
A-6 STATUS REPORT OF THE JCIC AD HOC COMMITTEE FOR THE STUDY OF TELEVISION SOUND

SESSION B
AUDIO IN MEDICINE

MONDAY, SEPT. 9, 9:30 AM
ASTOR GALLERY
Chairman: **Philip Kantrowitz, New York, N.Y.**

B-1 LANDMARK TECHNIQUE FOR IDENTIFYING ULTRASONIC CARDIAC ECHOES
B-2 LONG-TERM MONITORING OF IMPLANTED CARDIAC PACEMAKERS
B-3 BIPHASIC HEARING INSTRUMENT SYSTEM
B-4 A MINI CARDIAC DYSRHYTHMIA DETECTOR
B-5 MEASUREMENTS OF PHYSIOLOGICAL SIGNALS IN THE AUDIO SPECTRUM
B-6 ACOUSTIC ENERGY TRANSFORMATION IN THE HUMAN AUDITORY SYSTEM
B-7 A WEARABLE MASTER HEARING AID

SESSION C
ARCHITECTURAL ACOUSTICS AND SOUND REINFORCEMENT

MONDAY, SEPT. 9, 2:00 PM
JADE ROOM
Chairman: **David L. Klepper KMK Associates, White Plains,N.Y.**

C-1 A STAGE MONITOR FOR ROCK PA
C-2 AN AUDITORIUM WITH NATURAL VARIABLE REVERBERATION
C-3 EQUALIZATION SIMPLIFIED
C-4 AUTOMATIC MICROPHONE MIXING
C-5 LOUDSPEAKER DRAWING BY COMPUTER GRAPHICS PROGRAMS
C-6 HIGH FIDELITY SOUND SYSTEM EQUALIZATION BY ANALYSIS OF STANDING WAVES
C-7 SOUND FACILITIES AT THE EDYTH BUSH THEATRE

SESSION E
BROADCASTING AND MUSIC RECORDING ABROAD

MONDAY, SEPT. 9, 7:30 PM
JADE ROOM
Chairman: **Derek Tilsley Rupert Neve & Company Ltd. Melbourn, Royston, England**

E-1 MULTITRACK RECORDING OF LIVE PERFORMANCES WITH SIMULTANEOUS FILMING
E-2 TELEVISION AUDIO IN GREAT BRITAIN

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E-3 PHILOSOPHIES EMPLOYED IN THE DESIGN OF BROADCASTING CENTRE, JOHANNESBURG
E-4 NEW RTE RADIO CENTRE IN DUBLIN
E-5 SOUND IN BROADCASTING AND MUSIC RECORDING IN FRANCE

SESSION G
TRANSDUCERS, LOUDSPEAKERS AND MICROPHONES
(Part One)

TUESDAY, SEPT. 10, 9:30 AM
JADE ROOM
Chairman: **John R. Gillion Buchanan Spider Works Buchanan, Mich.**

G-1 APPLICATIONS AND DESIGN CONSIDERATIONS FOR A HIGH-QUALITY UNIDIRECTIONAL LINE LEVEL MICROPHONE
G-2 ULTRASONIC CAPSULE FOR REMOTE CONTROL PURPOSES
G-3 DEVELOPMENTS IN BINAURAL RE-CREATION: CONCEPTS, SYSTEM REQUIREMENTS, APPLICATIONS
G-4 ELECTRO-ACOUSTIC TRANSDUCERS WITH PIEZOELECTRIC POLYMER FILMS
G-5 VIBRATION SENSITIVITY MEASUREMENTS ON SUBMINIATURE CONDENSER MICROPHONES
G-6 HORN THEORY AND THE PHONOGRAPH

SESSION I
TRANSDUCERS, LOUDSPEAKERS AND MICROPHONES
(Part Two)

TUESDAY, SEPT. 10, 2:00 PM
JADE ROOM
Chairman: **John R. Gillion**

I-1 A NEW TYPE OF TWEETER HORN EMPLOYS A PIEZO-ELECTRIC DRIVER
I-2 A VARIABLE DIRECTIONAL AXIS DIPOLE LOUDSPEAKER

RING SOCIETY

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F EVENTS
Astoria
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ATION
4:00 pm to 8:00 pm
8:00 am to 9:00 pm
8:30 am to 9:00 pm
9:00 am to 5:00 pm
9:00 am to 8:00 pm

HOURS
1:00 pm to 9:00 pm
11:00 am to 5:00 pm

I-3 SMALL VENTED ENCLOSURE LOUDSPEAKER SYSTEMS FOR SPEECH REINFORCEMENT
I-4 A NEW SET OF SIXTH-ORDER VENTED-BOX LOUDSPEAKER SYSTEM ALIGNMENTS
I-5 LOUDSPEAKERS AND ACOUSTIC DAMPING

SESSION K
STUDIO DESIGN, SYSTEMS AND STRUCTURE
(A Panel Discussion)

TUESDAY, SEPT. 10, 4:00 PM
ASTOR GALLERY
Chairman: **Erik Porterfield**
CBS, New York, N.Y.

A question and answer discussion of the design of modern pop recording studio installation.

SESSION L
The New York Section Presents
SYNCHRONOUS SOUND SYSTEMS FOR DISNEYLAND PARADES
(No registration fee for this Session)

TUESDAY, SEPT. 10, 7:30 PM
JADE ROOM
Chairman: **Albert B. Grundy**
Institute of Audio Research
New York, N.Y.

This system, and the parade, will be described with slides and an audio demonstration by Mr. Shawn E. Murphy of Disneyland.

SESSION M
SIGNAL PROCESSING

WEDNESDAY, SEPT. 11, 9:30 AM
JADE ROOM
Chairman: **Irving L. Joel**
Joel Associates, Teaneck, N.J.

M-1 APPLICATIONS OF THE TWO QUADRANT TRANSCONDUCTANCE AMPLIFIER/MULTIPLIER IN AUDIO SIGNAL PROCESSING
M-2 A VOLTAGE PROGRAMMABLE PARAMETRIC EQUALIZER FOR AUTOMATION AND REMOTE CONTROL
M-3 PRACTICAL CONSIDERATIONS IN ACTIVE FILTER DESIGN
M-4 EFFICIENT DIGITAL CONVERSION OF AUDIO SIGNALS
M-5 MINIMIZING MEMORY REQUIREMENTS FOR MEMORY MIXING CONSOLES AND SYNTHESIZERS
M-6 IMPEDANCE TAILORING VIA FEEDBACK
M-7 THE EFFECTS OF SHUNT OR SERIES MIXED FEEDBACK ON STATIC AND DYNAMIC DISTORTION IN DIFFERENTIAL AMPLIFIERS
M-8 DESIGN CRITERIA OF A UNIVERSAL COMPANDOR FOR THE ELIMINATION OF AUDIBLE NOISE IN TAPE, DISC, AND BROADCAST SYSTEMS

SESSION N
MAGNETIC RECORDING

WEDNESDAY, SEPT. 11, 2:00 PM
JADE ROOM
Chairman: **Arthur E. Gruber**
AEG Associates,
East Rockaway, N.Y.

N-1 SPEED, PITCH AND TENSION REVISITED
N-2 PROFESSIONAL 1/4" CASSETTE AND ITS RANGE OF APPLICATION
N-3 OPEN-CIRCUIT VERSUS SHORT-CIRCUIT TAPE FLUX MEASUREMENT
N-4 NOISE MEASUREMENTS IN AUDIO

SESSION O
FORENSIC AUDIO ENGINEERING
(The application of audio engineering knowledge to questions of civil and criminal law.)

WEDNESDAY, SEPT. 11, 4:00 PM
JADE ROOM
Chairman: **Stephen F. Temmer**
Gotham Audio Corp.
New York, N.Y.

Papers presented by both lawyers and engineers will be followed by a panel discussion and questions from the audience.

SESSION P
DISC RECORDING

THURSDAY, SEPT. 12, 9:30 AM
ASTOR GALLERY
Chairman: **Daniel Gravereaux**
CBS Laboratories
Stamford, Conn.

P-1 PERFORMANCE TRADEOFFS IN DISC RECORDING
P-2 A NEW ELECTROSTATIC PHONOGRAPH CARTRIDGE
P-3 MEASUREMENT OF RECORDED LEVEL AND CHANNEL SEPARATION ON PHONOGRAPH DISCS USING OPTICAL INTERFEROMETRY TECHNIQUES
P-4 100dB DYNAMIC RANGE DISC RECORDING
P-5 DEVELOPMENT OF COMPOUND FOR QUADRA DISC
P-6 ADVANCE HEAD-LESS VARIABLE PITCH/VARIABLE DEPTH LATHE CONTROL SYSTEM

SESSION Q
AUDIO INSTRUMENTATION

THURSDAY, SEPT. 12, 2:00 PM
ASTOR GALLERY
Chairman: **Edward J. Foster**
By-Word Corporation,
Armonk, N.Y.

Q-1 DESIGN OF A DIGITAL CONTROLLED AUDIO LEVEL INDICATOR
Q-2 FREQUENCY-SWEEP TEST TAPES: DESIGN AND USE
Q-3 A HIGH SPEED AUDIO TAPE DROPOUT COUNTER
Q-4 STEADY STATE AND TRANSIENT RESPONSE OF LOUDSPEAKER SYSTEMS
Q-5 MEASUREMENT OF SOUND POWER AND ENERGY DENSITIES

SESSION R
QUADRAPHONICS

THURSDAY, SEPT. 12, 4:30 PM
ASTOR GALLERY
Chairman: **Leonard Feldman**
Audio Consultant
Great Neck, N.Y.

R-1 A METHOD OF ANALYZING THE QUADRAPHONIC SOUND FIELD
R-2 DEVELOPMENT OF THREE IC CHIPS FOR MATRIX DECODING AND SYNTHESIZING
R-3 FOUR-CHANNEL SOUND IN HISTORICAL PERSPECTIVE
R-4 SOUND IMAGE LOCALIZATION OF THE SQ SYSTEM
R-5 THE DEVELOPMENT OF A NEW QS QUADRAPHONIC SYNTHESIZER

THURSDAY, SEPT. 12, 12:00 NOON
JADE ROOM

ELECTRONIC MUSIC CONCERT
performed by
The Electronic Music Ensemble of the University of Colorado at Denver
conducted by Roy Pritts

SESSION S
ELECTRONIC MUSIC

THURSDAY, SEPT. 12, 2:00 PM
JADE ROOM
Chairman: **David Friend**
ARP Instruments

S-1 LIVE ELECTRONIC MUSIC PERFORMANCE IN QUAD
S-2 SOUND ANIMATION BY DYNAMIC FILTERING
S-3 A PROGRAMMABLE CONTROL DEVICE FOR ANALOG SYNTHESIZERS
S-4 RECORDING SYNTHESIZED INSTRUMENTAL MUSIC
S-5 ELECTRONIC RHYTHM UNITS HUMANIZED
S-6 MAN/MACHINE COMMUNICATIONS AND COMPUTER MUSIC SYNTHESIS

SESSION T
HOW VALID ARE HI-FI EQUIPMENT TESTS?
(A Panel Discussion)

THURSDAY, SEPT. 12, 7:30 PM
JADE ROOM
Moderator: **Larry Klein**
Technical Editor Stereo Review

Keep on Trackin'

Multi-trackin, that is, with Stephens Electronics professional tape recorder/reproducers. Our superbly designed and engineered machines are available in a variety of standard formats, from 4 to 24 tracks, or you can keep on trackin with Stephens' unique 32 track and 40 track 2-inch machines.

Pictured (front-to-rear) are the 4-track, 40-track and 24-track machines.

Battery powered portable units are also available.

STEPHENS ELECTRONICS, INC

3513 Pacific Ave., Burbank, Calif. 91505 Phone (213) 842-5116

Re/p 58

Circle No. 135

NEW PRODUCTS

NEW AKG PROFESSIONAL ELECTRET CONDENSER MICROPHONE SYSTEM IN MODULAR FORMAT

Mr. Andrew A. Brakhan, Manager AKG Products, North American Philips Corporation, recently announced the introduction of a new Modular Professional Electret Condenser Microphone System.

The units use a gold-vapored Teflon diaphragm, that makes the unit impervious to humidity and insures against deterioration due to climatic conditions and ageing. The electret element carries a regular full year warranty.

Said to be extremely stable under unfavorable climatic conditions, the AKG Professional Electret Condenser Microphone Modular System consists of: one basic powering module, 4 interchangeable capsules, and accessories.

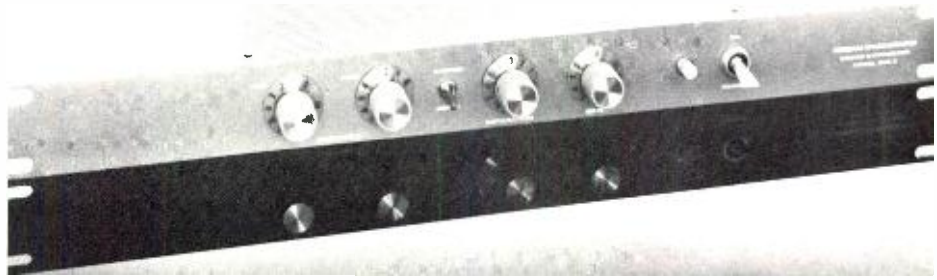
POWERING MODULE SE-5E incorporates: Battery compartment for 5.6 volt (Mallory PX-23) battery; unique on-off switch function moves battery within compartment, thereby continuously cleaning contact points; 550 hours of continuous operation can be expected from one battery; suitable for phantom powering off DC supply, available in mixer or tape recorder.

INTERCHANGEABLE CAPSULES: CE-1 Cardioid capsule, includes condenser microphone preamplifier. CE-2 Omnidirectional capsule, includes condenser microphone preamplifier. CE-5/1 Cardioid capsule with integral suspension and wire mesh windscreen. Includes condenser microphone preamplifier. CE-10 Miniature lavalier condenser microphone attachment with integrated FET preamplifier.

Each component, plus accessories, may be obtained individually immediately, or added to the system later.

Three combination systems are available: CE-501 for Cardioid Operation – consisting of CE-1 cardioid capsule, SE-5E powering module, SA-11/1 stand adapter and W-3 windscreen, in attractive case.

CE-505 for Cardioid Operation – with integral suspension and windscreen – consists of CE-5/1 capsule, SE-5E powering module and SA-11/1 stand adapter, in case.



CE-510 for Lavalier Operation – consists of CE-10 lavalier element and SE-5E powering module, in case.

The Electret Condenser Microphone System will be available for shipment August 1974.

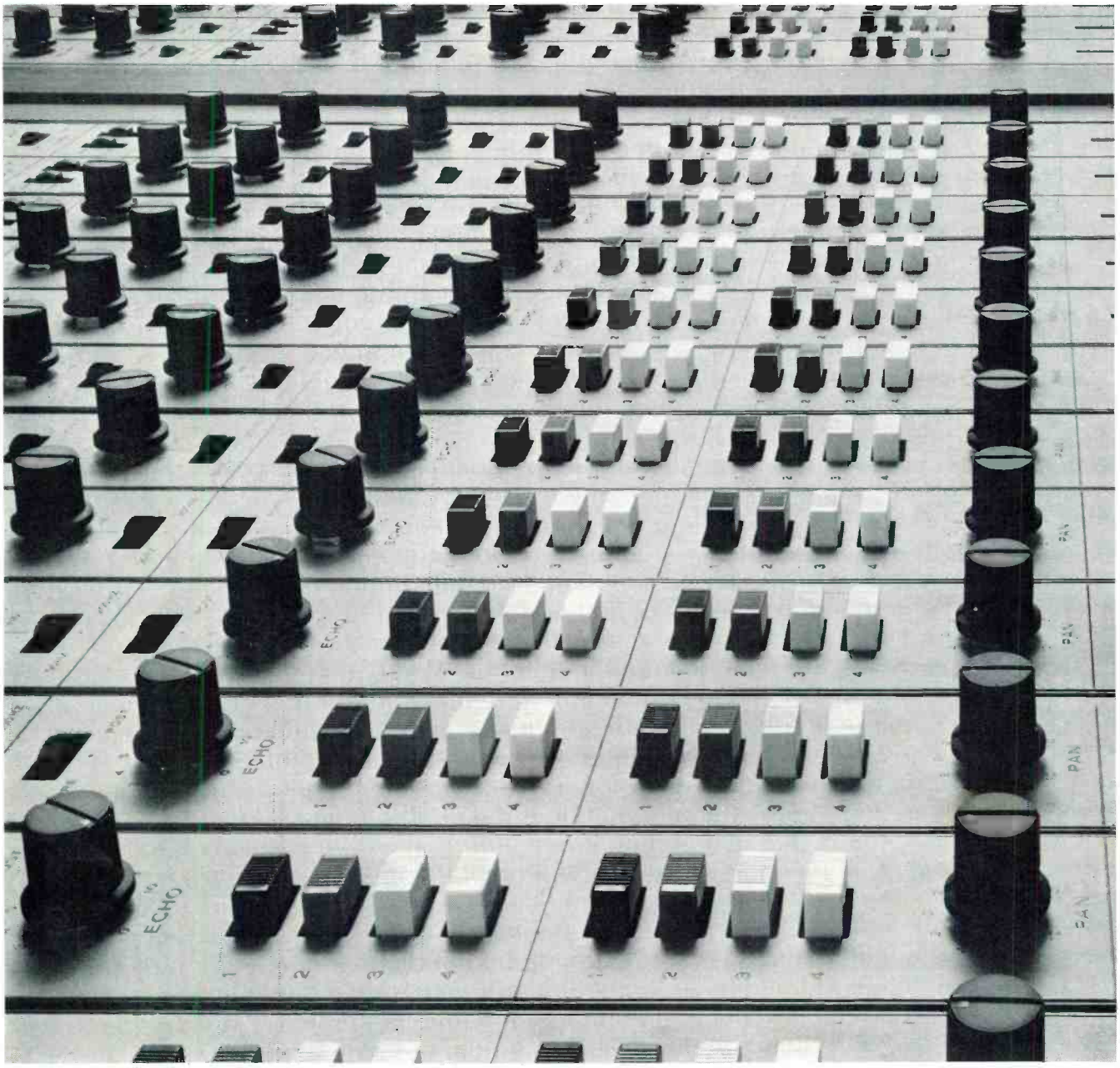
AKG, 100 EAST 42 STREET, N.Y., N.Y. 10017.

Circle No. 136

ORBAN/PARASOUND STEREO SYNTHESIZER

ORBAN/PARASOUND announces the availability of a new model Stereo Synthesizer. The STEREO SYNTHESIZER, Model 245E has been designed to take any mono signal and create lifelike pseudo-stereo. Unlike many other techniques, the patented ORBAN/PARASOUND stereo synthesis technique, according to the company, causes no change in spectral balance, does not blur the transient definition, and adds not the slightest audible noise or distortion to the mono original. The stereo output sums back to the original mono for total mono/stereo compatibility.

The STEREO SYNTHESIZER creates a stereo effect by dividing the mono source signal into five frequency bands. Three of these bands are placed in one stereo output channel; the remaining two are placed in the other channel. The filters are synthesized so that the sum of the two output channels is identical to the mono input. In addition, the sum of



The Model 10 Mixing Console
When you've got more talent than money

Any mixing console is simply a creative tool. Getting the most out of it calls for imaginative insight into music and skill in the practical application of sound.

If you've got the talent but you don't have the money, you're exactly who we built this board for.

The basic 8-in, 4-out board starts at just $1890. From there you can go to 24-in, with options and accessories enough to fill a studio.

The TASCAM Model 10. It gets your inside outside.

TASCAM CORPORATION

5440 McConnell Avenue
Los Angeles, Calif. 90066

Re/p 60

Circle No. 138

the powers in the left and right output channels is equal to the power in the mono input signal, guaranteeing that the stereo will have the same perceived frequency balance as the mono source.

The STEREO SYNTHESIZER is now available in standard 19" rack mount and requires 1 3/4" rack space. Price of the unit is $299.00.

PARASOUND, INC., 680 BEACH ST., SAN FRANCISCO, CA. 94109

Circle No. 139

GATELY PROKIT II MIXING SYSTEM

Gately Electronics announces introduction of its new Prokit II mixing system. This mixer, available in kit or factory wired, features slide attenuators and pan pots on all six inputs. Each input is switchable from mike to line input. The mike preamp gain is switch selectable and each mike input has a switchable 20dB pad. The professional VU meters are backed up by LED overload indicators.

Components used in the Prokit II are from the most prestigious manufacturers including slide pots by Duncan, rotary pots by Allen Bradley, indicator type push button switches by Schadow and input transformers by Jorgen Schou of Denmark. Other features include optional transformer output and optional +48 volt microphone powering.

GATELY ELECTRONICS, 57 W. HILLCREST RD., HAVERTOWN, PA 19083.

Circle No. 140

AMBER MODEL 4550 AUDIO SPECTRUM DISPLAY

The Amber Audio Spectrum Display provides a real time presentation of the spectral energy content of an audio signal.

This information, previously available only by using expensive lab quality analysers, is now available in a low cost, compact instrument for applications where the conventional VU meter provides insufficient information.

The device incorporates a solid state display and uses a digital time-sharing technique to achieve an inexpensive and light weight instrument. The display divides the audio spectrum into 10 octave-width segments, giving a total coverage of 10 octaves (20Hz to 20kHz). Each octave is displayed on a vertical column of 10 light emitting diodes. The total 10 x 10 matrix thus gives a real time display of spectral energy content of the audio signal.

Included in the device are two accumulative memories, useful when it is desired to retain frequency distribution for later evaluation or comparison. Each memory has a MEMORY ENTER switch and an ERASE button. In addition, a SAMPLE button allows short duration (effectively instantaneous) samples to be memorized. Four audio inputs can be accommodated and selected in any combination by front panel push buttons. A step type attenuator varies the input sensitivity in 2dB increments to accommodate a wide range of audio levels.

Applications for the device include analysis of program information prior to media processing, evaluations of room acoustics, comparisons of audio programs, frequency response testing and noise and signal study.

High speed cassette duplicators and disc mastering facilities will find the information the display gives about master tapes useful in spotting potential problem areas caused by excessive energy in a particular portion of the spectrum. FM and Television broadcasters will find a similar application in identifying the source of high end distortion.

The instrument is supplied in a portable enclosure and accessory hardware is available to permit rack mounting where desired. Variations in certain parameters such as filter frequencies, response and decay time and sensitivity are available on special order.

AMBER ELECTRO DESIGN LTD. 613-100 FRANCOIS, MONTREAL QUEBEC, CANADA H3E 1G2

Circle No. 141

LEXICON ANNOUNCES NEW 90dB DIGITAL DELAY SYSTEM

Lexicon, Inc., Waltham, Massachusetts, has announced a new family of digital delay systems featuring a 90dB dynamic range for recording studio, sound reinforcement and laboratory applications.

A second generation system, the new Delta T Model 102 Series has up to five delay outputs, each independently adjustable on the front panel. Additional slave units (up to 50 outputs) may be cascaded for long delay requirements with no degradation of audio output. The new

Meet The Family

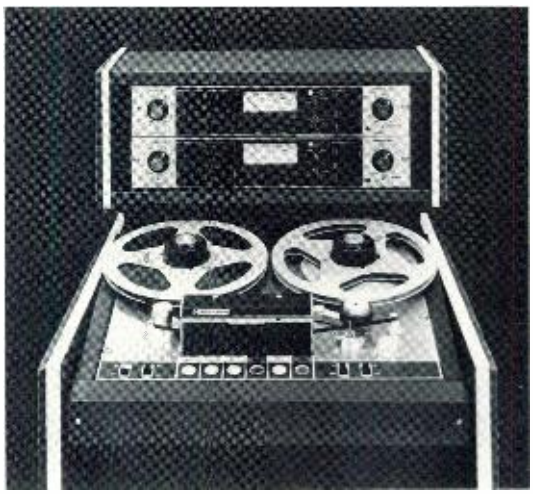
Swiss Performance

Electro Sound's new ES-505 series recorder/reproducers have a heritage of classic design and precision performance. They've been engineered specifically for broadcasters, recording studios, and other professional users.

European or American—no other machine has more significant "Operator Engineered" features. Disappearing headgate, built-in audio oscillator, optical motion sensing, continuous bias monitor, differential disc brakes, optional edit third reel, fully lighted controls and much more .

The ES-505 is available in ¼" or ½" versions, with one, two or four channels of electronics in console, portable or unmounted configurations.

Performance specs—we match or beat the best! And at American prices.



The ES-505

The ES-6000

We Repeat

Electro Sound builds professional, high speed audio tape duplicating systems. The ES-6000 is our 240 ips version. Long lasting, versatile hardware.

We're noted for sophisticated state-of-the-art designs that produce a finished tape of unquestioned high quality. That's what pays off in operating profits for our customers.

And Electro Sound is the only single source for duplicators, loading racks, QC reproducers, mastering devices, cartridge and cassette winders and splicers.

Whether you duplicate retail music, broadcast syndications, or "spoken word" cassettes, we have a system for you. After all, the giants who pioneered the pre-recorded tape industry, as well as those just joining it, are using Electro Sound systems in 30 countries.

ELECTRO SOUND

725 KIFER ROAD, SUNNYVALE, CA 94086
(408) 245-6600 TELEX: 346324 LECTROSND SUVL

Circle No. 143

system offers up to 320 ms of total delay per main frame in 5 ms increments in economical 40 ms modules (or up to 128 ms delay per main frame in 2 ms increments in 16 ms modules). The Delta T offers extensive options for both studio and sound reinforcement applications. Its fully modular construction permits convenient field expansion and maintenance.

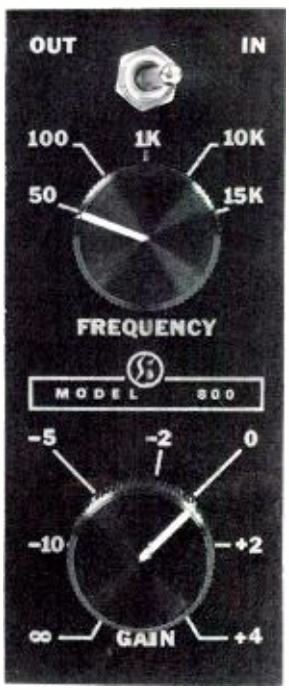
Features include a five-position LED headroom indicator to verify correct operating settings. Transformer coupled inputs and outputs are standard and all units are manufactured with computer quality components and construction for high reliability.

Complete specifications covering all within the Model 102 series are available from: **LEXICON, INC., 60 TURNER ST., WALTHAM, MA 02154.**

Circle No. 144

SPECTRA SONICS SIGNAL GENERATOR

The SPECTRA SONICS Model 800 Signal Generator has five selectable frequencies (50Hz, 100Hz, 1kHz, 10kHz, and 15kHz) and a controllable level of signal output from -74dBM to +4dBM. The signal generator is designed so that it may be turned on or off without introducing transients into the circuitry.



The Model 800 is solid state and its compact size (3½" x 1½" x 2-7/8") makes for easy installation. All controls are located on the front panel. Some operating specifications are: frequency tolerance ± 10% of selection; THD less than .05%, 100Hz to 15kHz, .1% at 50Hz.

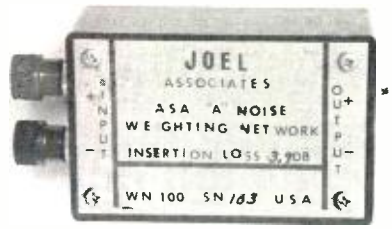
The SPECTRA SONICS Model 800 is available for immediate shipment, reasonably priced at $84.00.

SPECTRA SONICS, 770 WALL AVE. OGDEN, UTAH 84404.

Circle No. 145

WEIGHTING NETWORK FOR NOISE MEASUREMENTS FROM JOEL ASSOCIATES

This unit is designed to be placed between the device whose noise is to be measured and a high impedance audio volt meter. The curve obtained is based on the "A" curve, ASA standard S1.4-1961, and adopted by the NAB in 1965. It is also the curve recommended by Ampex and other tape recorder manufacturers in making weighted noise measurements.



A weighted noise measurement is designed to give a response curve similar to the ear at low volume levels and is intended to give a more useful indication of the subjective signal to noise ratio then unweighted measurements.

The unit measures 1 1/8 x 3 1/4 x 2 1/8 with banana type plugs and 5 way binding posts on standard 3/4 inch centers.

Available from stock $34.50.

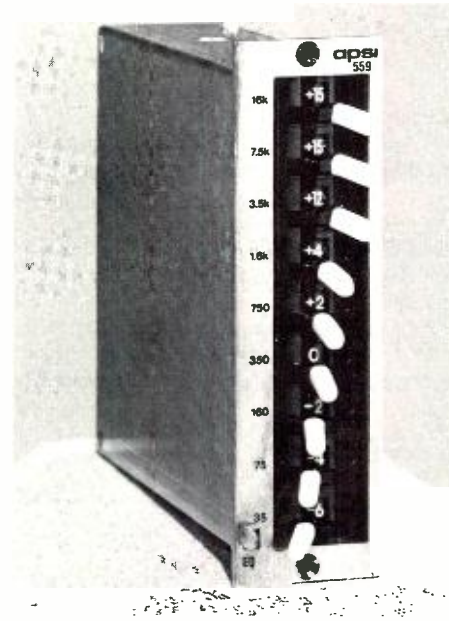
JOEL ASSOCIATES, 528 RIVER ROAD, TEANECK, N.J. 07666.

Circle No. 146

NINE-BAND GRAPHIC EQUALIZER MODEL 559

The Audio Processing Systems Model 559 Equalizer provides nine-band graphic equalization in a compact console- or rack-mountable module. Using leverwheel switches to provide 12dB of cut to 15dB of boost in bands centered at 35Hz, 75Hz, 160Hz, 350Hz, 750Hz, 1600Hz, 3500Hz, 7500Hz, and 16kHz, the Model 559 allows the user control over virtually all portions of the audio spectrum simultaneously.

The Model 559 is capable of generating an almost inexhaustible number of frequency contours; it can duplicate the curves of standard peaking-type equalizers as well as produce a variety of curves beyond their means. The device permits highly selective control of the different elements of timbre; interaction between bands is minimal. The contour created by the switch levers during operation serves as a visual indication of the frequency contour created.



A pushbutton switch, LED-illuminated, activates the equalization circuits. Size is 1½" wide by 5¼" high by 6" deep; noise is -90dBm and distortion at full output (+24dBm) is less than 0.25% THD. The Model 559 is available direct from **AUDIO PROCESSING SYSTEMS, INC.,** and through **AUTOMATED PROCESSES, INC. MELVILLE, NEW YORK,** and is fully compatible with Automated's Model 550A Equalizer.

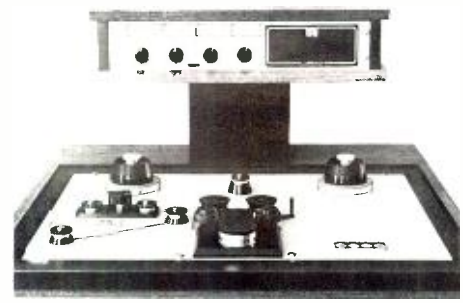
AUDIO PROCESSING SYSTEMS, INC. 98 WOODLAND RD., SOUTHBOROUGH, MA. 01772

Circle No. 147

L. J. SCULLY INTRODUCES THE "PREVIEW MASTER"

L.J. Scully Manufacturing Company of Bridgeport, Connecticut has announced that the Preview Master is now available at a cost of $4525 f.o.b. Bridgeport.

Utilizing solid state, logic control circuitry, the Preview Master is a versatile



machine for disc cutting companies interested in updating old systems or adding new equipment.

The Preview Master operates with the L.J. Scully closed loop drive which substantially improves wow and flutter. Other L.J. Scully features incorporated into the Preview Master are NAB/CCIR equalization, ability to accommodate most preview times, and cue modes for easy loading.

The Preview Master can be ordered for use on a standard rack or to be mounted on their specially fitted, hinged-top formica console. The additional cost of the waist level console is $503.

L. J. SCULLY, 138 HURD AVENUE, BRIDGEPORT, CT 06604.

Circle No. 148

HAECO 'VP-1000' COMPUTERIZED SYSTEM FOR DISC RECORDING LATHES

HAECO introduces its VP-1000, the first completely digitally computerized

Variable Pitch/Depth System for disc recording lathes. A major breakthrough in Mastering technology, this unique control system employs a specially designed wide-range, low noise, high output, dual 300 millisecond Audio Delay Line, thereby eliminating the need for any preview channels. The new unit, according to the manufacturer, was developed to significantly improve the performance of all lathe systems, regardless of vintage. Aside from permitting more time, with better geometry, the VP-1000 provides total automation of all lathe functions.

HAECO, 14110 AETNA STREET, VAN NUYS, CA 91401.

Circle No. 149

MODULAR PLUG-IN DESIGN, MANY OPTIONS ADD FLEXIBILITY TO NEW API AUDIO CONSOLE

A new audio control console, Model 1604, from Automated Processes, Inc., 80 Marcus Drive, Melville, N.Y. 11746, offers great flexibility to the audio professional. Performance options can be selected from among plug-in modules, and a variety of interchangeable equalizers is also available.

The relatively low cost of this console makes it suitable for use for either fixed or remote recording, and by broadcasters as a production or on-the-air console. It will accommodate 16 inputs, 4 echo channels, 2 foldback circuits, 4 output channels, 4 submasters, 4 speaker monitoring, slate, tone and intercom circuits, and audition and cue facilities. For broadcast applications, the 1604 console has

the necessary foldback, audition, intercom and program interlock features, and may be equipped with optional modules offering remote control of tape machines and turntables, or remote input pre-selection.

All external connections are plug-in to allow rapid installation.

The Model 1604 may be tabletop mounted or free standing, and optional features may be added at any time, since all are factory pre-wired, permitting easy field installation.

For additional information and catalog, contact **AUTOMATED PROCESSES, INC. 80 MARCUS DRIVE, MELVILLE, N.Y. 11746.**

Circle No. 150

DUAL EQUALIZED REVERB UNIT FROM MULTI-TRACK

Multi-Track of Hollywood, California has announced the introduction of the new Dual Spring Reverb Unit. Each of its channels has input-delay time control, L.E.D. overload indicator, low and high frequency shelving equalization, and output drive level control. The electronics

and the springs are complete in one rack mount package. The front pannel is black annodized with silver dial markings for long life and the knobs are aluminum with EZ grip knurling and indicator line.

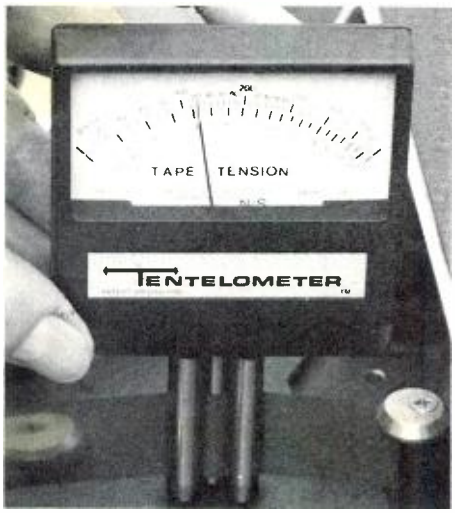
A special input gain stage has been added to the unit so it is compatible with the Tascam Series Mixers.

The dual unit will sell for $550.00. MULTI-TRACK, P.O. BOX 3187, HOLLYWOOD, CA 90028.

Circle No. 152

NEW LOWER COST MAGNETIC TAPE TENSION GAGE OFFERED BY TENTEL

TENTEL of Campbell, California, has introduced a new tape tension gage for audio, video, and computer tape transports. TENTEL offers hand-held instruments that quickly and accurately measure dynamic or static tension on magnetic recording tape of all widths.



Tape tension on video machines can be accurately set while the machine is operating; thus eliminating time base errors due to tape stretch. Head wear is optimized and transient problems can be detected. The unit is self contained, requires no external power, operates in any orientation and reads both in ounces and grams of tension. Models are available in 5, 12, or 20 ounce full scale ranges.

Prices start at $179 complete with fitted carrying case.
TENTEL, 1210 CAMDEN AVENUE, CAMPBELL, CA 95008.

Circle No. 153

TWO CHANNEL RECORDER FOR EIGHT-TRACK MASTERS

The Audio/Tek Model 511 eight-track, one inch recorder is specifically designed to prepare duplicator work masters.

The Model 511 is comprised of two single channel reproduce/record amplifiers, a compact 7 1/2-15ips transport, and an eight-track, two channel shifting head assembly.

The shifting head assembly on the Model 511 eliminates the need to use a conventional eight-track studio recorder for duplicator work master production.

The two channel operation of the Model 511 minimizes service and production cost. The Model 511 is also more compact than most conventional eight-track recorders. The solid state circuitry and tape transport are housed in a durable attractive case. For user convenience the Model 511 is available in a table top cabinet or a floor console unit.

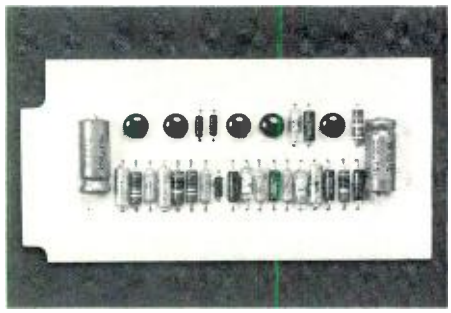
The Audio/Tek Model 511 is the first in a series of professional studio recorders.

Price: floor console unit $4,950, table top unit $4,850.
AUDIO/TEK INC., P.O. BOX 5012, SAN JOSE, CALIFORNIA 95150

Circle No. 155

SPECTRA SONICS IMPROVED AUDIO AMPLIFIER – MODEL 110

SPECTRA SONICS has developed an improved version of the time proven Model 101 Audio Amplifier. This new audio amplifier is designated the Model 110 and like the Model 101 is unconditionally guaranteed for two years. The Model 110 fills the need for an audio amplifier of professional calibre with increased output (+24dBm) for use with bi-polar (±24 VDC) power.



Typical of SPECTRA SONICS quality, the Model 110 is guaranteed to be superior to any other audio amplifier in such critical functions as noise, distortion, frequency response and peak-overload. Some of the specifications are: Output noise, not over an input equivalent of -127dBm, unweighted 20Hz to 20kHz, input terminated 600 ohms; total harmonic distortion (+21dBm, 20Hz to 20kHz) unmeasureable, less than 1/100th of 1% (measurement residual); frequency response (+21dBm) within .1dB from 10Hz to 200kHz; peak-overload, 1000%, recovery time, 1 microsecond.

Some applications are: microphone pre-amplifier, booster amplifier, mixing amplifier and etc.

Solid state, contained on a printed circuit card (2¼" x 5" x ½"), the Model 110 is available from stock.

Price – $72.00.
SPECTRA SONICS, 770 WALL AVE., OGDEN, UTAH 84404.

Circle No. 156

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Circle No. 157

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UNITED AUDIO RECORDING, the audio marketplace. Sales and Service for Scully/Metrotech, and Neuman, EMT, Electro-Voice, Shure, Quad Eight, Spectra Sonics, DBX, Interface Electronics, MicMix Masterroom Chambers and others. **(512)684-4000, 5310 JACKWOOD, SAN ANTONIO, TX. 78238.**

SPECTRA SONICS CUSTOM 22-in/8-out remix console, $3,950. 8 Altec 9846-8A, $350 each; 8 JBL 4320 components, $250 per system; Ampex 440, full-track, $1050; Scully 280, full-track, $1125; 3 DBX 157, $375 each; 1 DBX 187. $1450. **SOUND 80, MINNEAPOLIS, MN. (612) 721-6341.**

10½" Reel Specialists: Boxed 10½" NAB ¼" reels $3.00@ flanges $1.25@. 10½" Precision reels $6.50@, flanges $2.25@ Heavy duty or Tapered. Wanted: used ¼" NAB & Precision hubs. **SOUNDD INVESTMENT CO., POB 88338, ATLANTA, GA. 30338.**

MARK-A-TRACK WRITE-ON STRIPS are now available! End the guesswork during basics or remix with custom made write-on panels that fit right above the faders. Specify color desired, number of faders, and width of individual fader.
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Nashville, Tenn. 37207

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LETTERS and LATE NEWS . . . .
continued from page 31 . . . .

Since Altec is a major producer of raw frame loudspeakers, several suggestions are made for incorporating one or more Altec speakers into a new enclosure. For example, Altec provides enclsoure construction dimensional drawings for using the famed 604, 15-inch duplex speaker, "Voice of the Theatre," systems, and other speaker system combinations for smaller enclosures.

Much detail is given to selection of materials for the enclosure, including the type of board, acoustic damping material, stiffeners, and the grille.

Other useful material found in the publication includes a chart of common sound pressure levels, frequency ranges of musical instruments, and a glossary of audio terms.

The publication can be ordered by sending $2.00 to Altec Corp., 1515 S. Manchester, Anaheim, CA 92803. Page size is 8½ x 11".

LA SALLE AUDIO EXPANDS

Cindy Guzzo, General Manager of La Salle Audio announces the addition of Jon Hanson as Sales Engineer. Mr. Hanson was formerly Chief Technical Engineer at db Studios in Chicago and, prior to that, a Systems Engineer for Dukane Corporation in St. Charles, Illinois. La Salle Audio is moving to a larger facility, 740 N. Rush Street, Chicago, Illinois 60611 as of September 1. The new office will afford complete demonstration capabilities for the convenience of their customers.

'LOGICAL LOOK AT LEASING' DISCUSSES ITS ADVANTAGES

"A Logical Look at Leasing," a new C.I.T. Leasing Corporation booklet, describes the advantages, alternatives and "how's and why's" of one of the most widely used forms of acquiring equipment and machinery — leasing.

Although leasing is not new, its growth as a source of capital has been especially rapid over the past ten years. Essentially, leasing is a way of obtaining the use of equipment without the need to buy it, and differs from other forms of financing in that it is designed for those who realize it is not the ownership of equipment that contributes to profits.

The new booklet describes the two basic types of leases available, and discusses a true lease and the IRS, end-of-lease alternatives, and balance sheet and cash flow effects.

"Probably the most important single reason for leasing is to conserve working capital," the booklet states, but it points out and discusses many other advantages.

Copies of "A Logical Look at Leasing" may be obtained by writing to Harold A. Post, assistant vice president, C.I.T. Leasing Corporation, 650 Madison Avenue, New York, N.Y. 10022.

MARSHANK PRO-AUDIO DIVISION TO BE HEADED BY HEADRICK

Marshank Sales Co., 10455 W. Jefferson Blvd., Culver City, CA 90230 is pleased to announce the establishment of a Professional Audio Division to be headed up by Marvin Headrick.

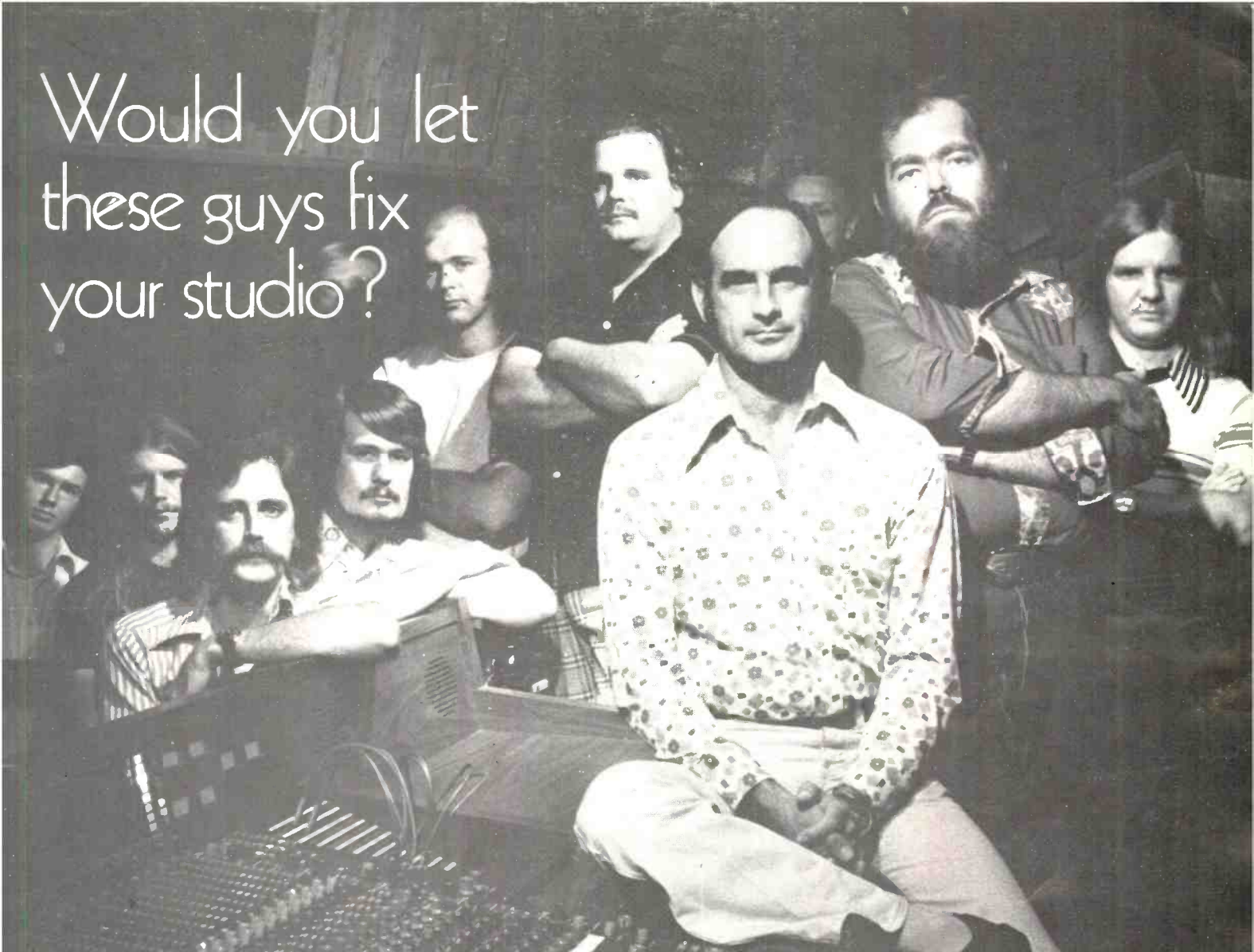
Headrick, for the past two years, has been Western Regional Sales Manager for McMartin Industries covering Broadcast, BGM, and Sound Contractor Markets.

Prior to this time, he was Marketing Manager for Quad-Eight and Sales Manager for Longevin Co.

Marshank Sales Co. is celebrating its 54th year in business.

Circle No. 161

Would you let these guys fix your studio?



Studio Supply Company's enviable reputation as turn-key recording studio builders and designers is well-known and respected, so we won't tell you about something you know about.

Let's talk about something that most studio builders make you ask about—what happens after you've got your studio and we've got your money. SERVICE!

Studio Supply Company unconditionally warrants any turn-key studio installed by us

—total system and individual pieces of equipment
—parts, labor and travel expenses for a period of 90 days from completion, over and above any manufacturers warranty

This isn't new—it's been that way since Day One. When manufacturers parts and labor warranties exceed this, we back them to the hilt.

Of the two major turn-key studio builders in the United States, only Studio Supply Company has complete service staff, spares, and full in-house bench and field support for every item we sell. We have even been asked to (and are glad to) fix gear the other guys have sold.

From the day we take our first look at a new product, to determine its performance, suitability and reliability, our service guys are reading the manuals, talking with the designers, and intimately learning all circuits and systems to insure that from the first piece installed, service is timely and competent.

Our people have more experience, knowledge, and expertise in the service of our systems and the gear we sell than any similar organization. Each prime field service man has over 150 hours of intensive classroom training and our guys collectively have well over 100 years of professional service experience.

The reason we accept long term service responsibility for the studios we build is. . . .

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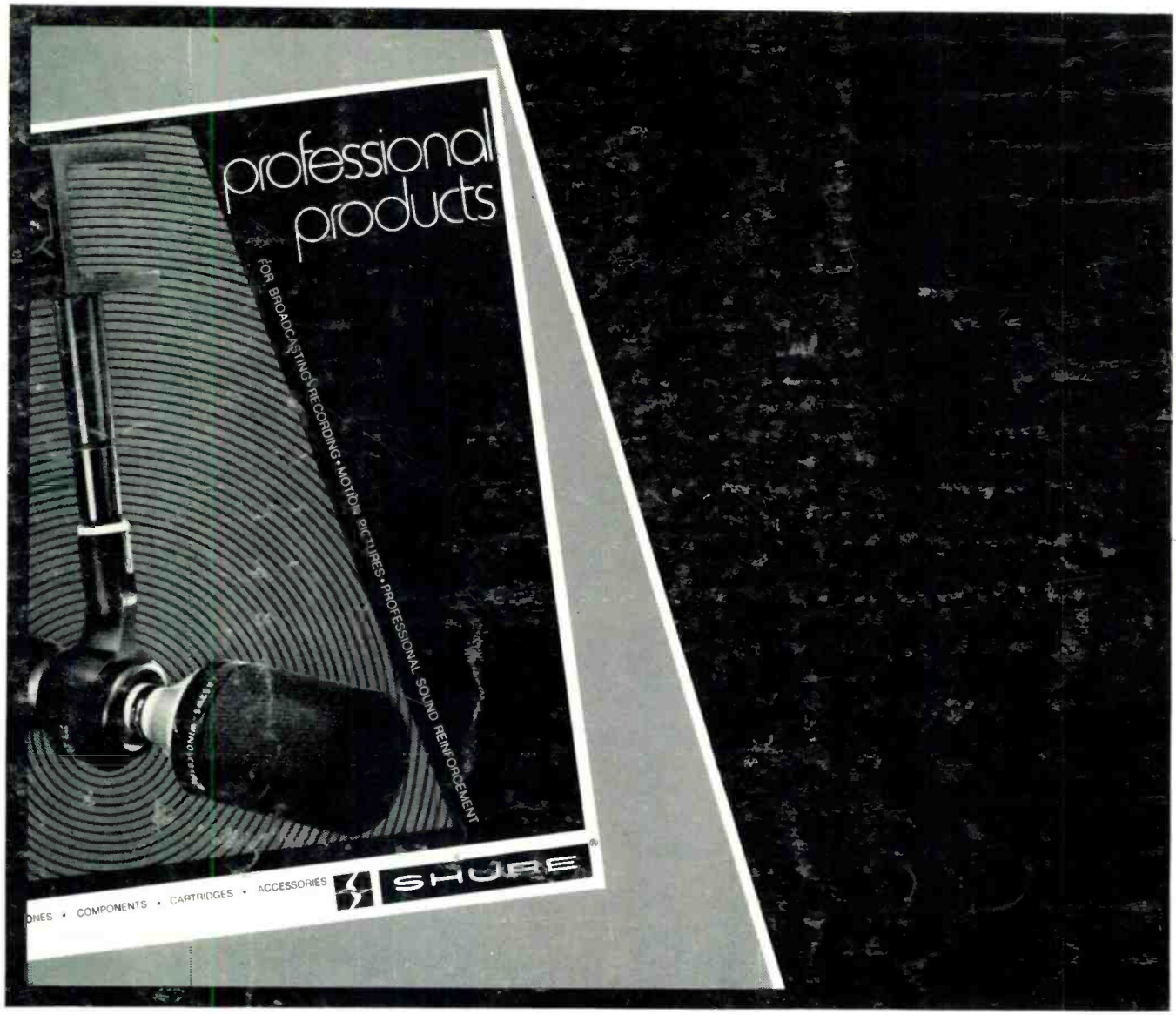
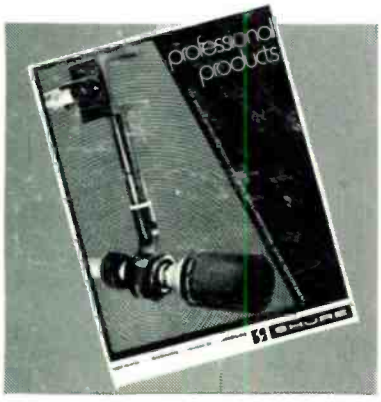


Studio equipment home shopping guide



In the world of the professional sound engineer, advance follows advance, and new product follows new product. Bring yourself up-to-date with the *Shure Professional Products Catalog*, 24 pages of Shure products to make your job easier: the *SM61 Microphone*, beautiful to look at and virtually immune to noise in hand-held applications . . . the *SM7 Microphone*, with built-in, visually monitored, response tailoring . . . the ultra-versatile *SM53 Microphone*, with its own system of accessories . . . *the SE30 Gated Compressor/Mixer*, for "hands-free" gain riding . . . the *SC35C Phono Cartridge*, the first cartridge optimized in design especially for on-the-air playback . . . and the incomparable *V-15 Type III Phono Cartridge!* For your own copy of the catalog No. AL 312, write:

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