MAY / JUNE – 1973
VOLUME 4 – NUMBER 3
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RECORDING engineer/producer

relating recording science • to recording art • to recording equipment

DIFFERENTIAL MICROPHONES

PAGE 13

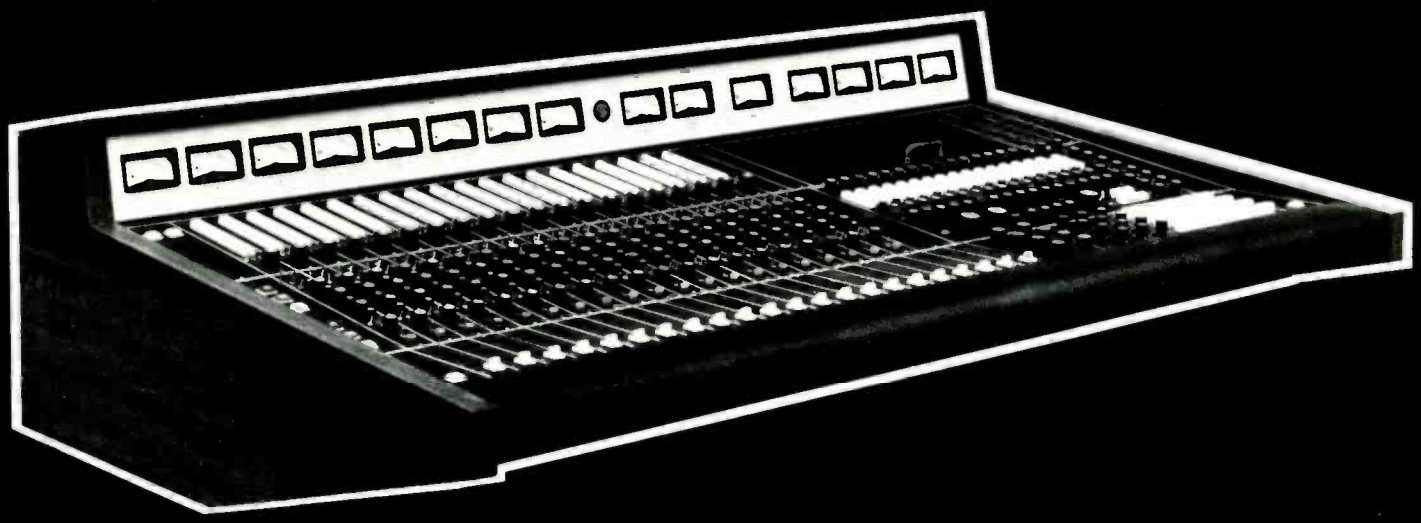
A SURVEY OF RECORDING STUDIO MONITORING PROBLEMS...

PAGE 19

AUTOMATING TRANSPORT CONTROL

PAGE 33

ULTIMATE



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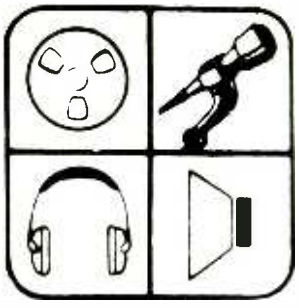

MAY / JUNE – 1973
VOLUME 4 – NUMBER 3

RECORDING
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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Microphone Techniques . . .
DIFFERENTIAL MICROPHONES — 13 — Jim Coe

A Survey of RECORDING STUDIO MONITORING PROBLEMS — 19 — John Eargle & Mark Engebretson

AUTOMATING TAPE TRANSPORT CONTROL — 33 — Jim Furman

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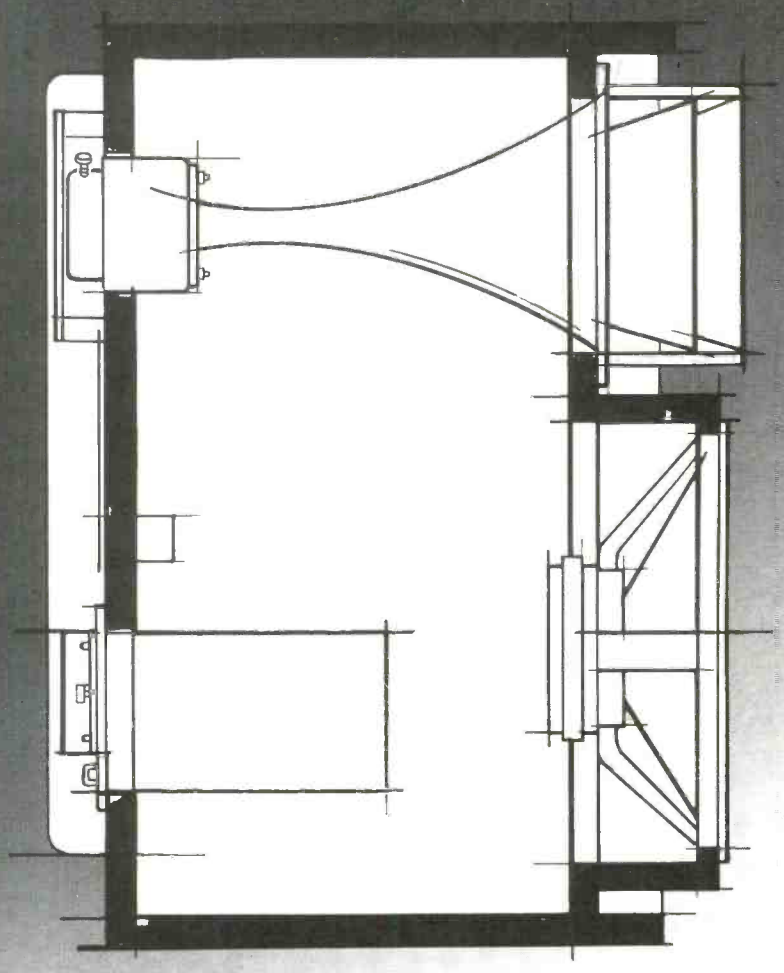
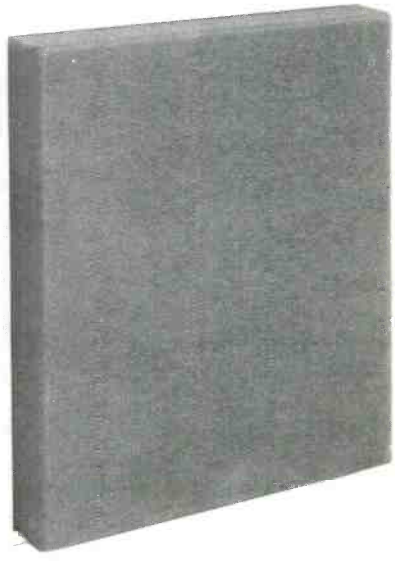


Maximum acoustical output:	112 db SPL @ 4 ft., equalized for flat response (pink noise), 40 to 15,000 Hz, in a free field.
Dispersion:	40° vertical x 90° horizontal.
Biamplifier:	Altec Model 771 B. Input sensitivity: .5 VRMS-60 Kohm unbalanced input for full output. .1 VRMS-600 ohm balanced input for full output.
Crossover:	500 Hz, 12 db/octave.
Noise (both sections):	80 db below rated output.
LF section:	60 watts, continuous sine wave power, 0.3% THD.
HF section:	30 watts, continuous sine wave power, 0.3% THD.
Dimensions:	26.5″ wide, 31″ high, 23.5″ deep.
Weight:	112 lbs.
Finish:	Grey epoxy with black grille fabric.



The New Altec 9846 Biamplified Studio Monitor Speaker System

If stereo disk cutters go down to 30 Hz, shouldn't the monitors?

Yes. Because the music goes down that far.

You should hear everything when you're laying down tracks or you might not really know what you've got. Why wait till you play a test cut to find out what's at the low end? You don't have to with our new monitors.

What have we done differently to get that low end? First of all we're using sealed boxes. No more ports or bass reflex cabinets. We've gone to a very high-compliance speaker with a big magnet structure. It's well damped so that it responds accurately to signals down to 30 Hz. There's very little distortion. You can't get this with ported boxes.

Above 500 Hz things are different too. There's far more smoothness than in previous designs. Notice the proximity of the woofer and the HF horn. They're within inches of each other. This creates a smooth transition from one source to the other as you go up the spectrum.

Have you ever wondered why good monitor systems are two-way systems? It's because they guarantee transient accuracy. They don't have the inevitable problem of source displacement that occurs in systems with separate tweeters. And they don't burn out, as tweeters in most 3-way systems are prone to do, with the super highs present in much of today's music. Few drivers are capable of such a wide frequency range. Because so few speaker builders use the kind of phasing plug which makes this possible.

To make the system work, power has to be delivered. Biamping is the only solution. So we built a biamp right into the enclosure. It provides more than enough power to make the components produce more than enough sound. Depending on the music, the 90 watts of available power may be equivalent to three or four times that amount when compared to single amplifier systems.

This is truly a new recording tool.

Write for further information on the 9846 Monitor Speaker system. Altec, Professional Studio Products, 1515 South Manchester Avenue, Anaheim, California 92803.

PROFESSIONAL STUDIO PRODUCTS

ALTEC

Circle No. 102

LETTERS and LATE NEWS

FROM:
Claude Hill, Jr.
V.P. Marketing & Product Development
M.C.I.
Ft. Lauderdale, Florida

In light of a second major audio industry supplier bankruptcy (ed: FLICKINGER ASSOC.) during the past few months the letter to the editor from Mr. Bill Evans, owner of the Studio In The Country, which appeared in the March/April issue of RECORDING engineer/producer, seems to us to subtly contain a much more significant message than just the praise which is certainly due WESTLAKE.

The fact is that supplying the audio market there are examples of another kind of exemplary company. Specifically, these are the companies whose sound engineering, operational and financial bases precludes the need for any third party to have to protect the deposit, or down payment, or progress payment of any customer.

We at M.C.I. are indeed proud to be among those manufacturers, small or large, supplying the audio industry whose records of accomplishment, customer commitment, and delivery are unblemished.

From the READERS

An editorial material rating of the most useful feature article, as gathered from the Reader Service Cards received prior to press time.

MARCH / APRIL ISSUE:

SELLING A MASTER 31.18%
by Errol Carmel

MICROPHONE TECHNIQUES 30.65%
by Bill Lazarus

GROUNDING 38.17%
By Don Foster

WESTLAKE CITED BY 3M FOR SALES ACHIEVEMENT

Westlake Audio of Los Angeles, recording studio acoustical designer, has been initiated as the charter member of the "3M Pro Audio Million Dollar Sales Club."

HIDLEY *BURNETT*

A plaque was presented to Westlake Audio President T.L. Hidley in recognition of its sales achievement as a dealer of 3M professional audio recorders and accessories. In making the presentation, Robert F. Burnett, marketing manager, 3M professional audio products, noted that Westlake "has proven time and again its ability to represent 3M products with vigor, determination, cooperation and integrity, resulting in a sales milestone of which both companies can be proud."

He also noted that "quality studio design and equipment installations throughout the U.S. and Mexico have earned Westlake an unequaled reputation as the industry's leading turnkey dealer."

SECOND ANNUAL NASHVILLE RECORDING ARTS SEMINAR – AUGUST 22-26.

Co-sponsored by Nashville's Fanta Sound, and Nashville Record Productions the second annual Seminar, expecting record registrations, will move to larger quarters at the Nashville Sheraton Motor Inn.

The four day meeting will present expert panelists and speakers on a wide range of recording subject matter, including recorder maintenance, acoustics, music publishing, recording techniques, as well as financial aspects of studio operation and equipment acquisition.

Cost of registration is $35 for the seminar.

Additional information and requests for registration forms should be addressed to: NASHVILLE RECORDING ARTS SEMINAR, 1811 DIVISION STREET, NASHVILLE, TN. 37203.

'ASD' NEW AUDITRONICS DISTRIBUTOR DIVISION

Auditronics, Inc., Memphis based manufacturer of electronics for recording studios, announces formation of a new distributor division and addition of executive offices at 207 Summit Street, Memphis.

The six year old firm formed the new division to handle sales of Auditronics consoles and systems and support equipment from various manufacturers beginning May 1, 1973.

"The additional 2,400 sq. ft. of office and display space is necessary to accommodate the company's growth resulting from nationwide acceptance of their recording studio products and systems," according to a statement by Auditronics President Welton Jetton.

Manufacturing operations will continue in the 180-B So. Cooper Street building, while sales, distributor operations and executive offices will be in the new facility. The new division phone number is 901/272-9641.

BOZAK APPOINTS MORRIS SALES MANAGER

The appointment of Nick Morris as National Sales Manager has been announced by Rudy Bozak, President of Bozak, Inc., South Norwalk, Connecticut 06854.

With over twenty years varied electronics experience, Mr. Morris is probably best known to the audio industry as co-founder of C/M Laboratories, Norwalk, Connecticut.

As National Sales Manager for Bozak, Inc., Mr. Morris will be responsible for the marketing of Bozak consumer and professional audio equipment (loudspeakers and electronics), designed and manufactured at the Bozak facility in South Norwalk.

L.J. SCULLY FORMS NEW COMPANY

Lawrence J. Scully, formerly president of Scully Recording Instruments Company, has announced the formation of L.J. Scully Manufacturing Company in Bridgeport, Conn.

Mr. Scully, a fellow of the Audio Engineering Society and holder of that society's Berliner Award for outstanding contribution to the audio industry, is well known as the designer and manufacturer of the famed Scully Lathe for disc recording.

The new company will concentrate on the development and production of professional audio devices for the recording and broadcast industries. The first of the new products is the extended play tape reproducer, primarily designed for utilization in the growing broadcast automation field.

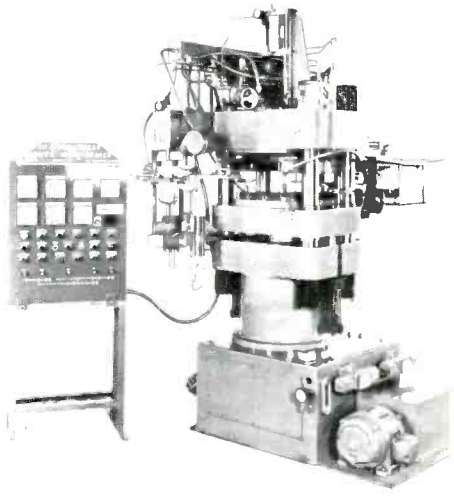
Introduction of a preview head tape reproducer for tape to disc transfer applications is planned for early summer. This new unit will accommodate all current automatic feed systems in the recording industry, including the JVC Quad discrete system. A new recording lathe is anticipated by late fall '73.

"I have personally worked with all of the employees in our new company for many years," states Mr. Scully, "and can therefore be certain that the traditional Scully reputation for quality will be maintained." Joining the new company in management and engineering capacities are Jerry Scully, John Curtis, Dan Politi and Richard Havanec.

SOVIETS BUY U.S. MADE RECORD-MAKING SYSTEMS

Lened, Inc. of Elizabeth, New Jersey has announced the receipt of a $360,000 contract to supply 12 complete, automated record-pressing systems to Melodia, the Soviet Record Company.

This is the second contract the company has received from the Soviets and additional follow-on orders for up to 200 complete systems are expected within the next five years.



The company's first shipment of six automated record systems have been installed at the Melodia pilot plant near Moscow which started producing records in October, 1972.

Since its inception in 1957, Lened, Inc. has become the leading producer of automated record-pressing systems with more than 250 complete systems in operation throughout the U.S., Canada, Europe, and Japan.

The company now produces complete, pre-packaged systems for high speed production and packaging of 7-inch and 12-inch records.

The Lened systems are said to be the first of their type to completely automate the entire record-making production process – from extrusion of the plastics – to pressing, trimming, and insertion into protective sleeves. All operations are controlled from a single control console.

Lened is currently negotiating with British and French for sales of automated systems in those countries.

ARP INTRODUCES NEW COLOR CATALOG AND DEMO RECORD AND REPORTS FACILITY EXPANSION

ARP Instruments has recently introduced a new 8-page full color catalog showing the complete line of ARP Synthesizers. The new catalog shows detailed 8-1/2 x 11 color photographs of each of the ARP synthesizers along with full specifications. The new catalog was prepared for ARP by Learning Unlimited.

A new Demo record prepared by two great synthesizer artists, Dave Fredericks and Roger Powell, entitled "The ARP Family of synthesizers," is also being distributed to ARP dealers. The new ARP demo record appeals to all audiences and includes both popular and jazz/rock selections performed on ARP synthesizers.

ARP has recently occupied their new 16,000 sq. foot corporate headquarters and manufacturing facilities.

Free copies of both pieces are available from the ARP Instruments Literature Dept. 320 Needham St., Newton, Mass. 02164.

MAZE CORPORATION OF BIRMINGHAM, ALABAMA ANNOUNCES NEW OFFICES AND WAREHOUSE FACILITIES.

This dynamic young company began its operation only six years ago with just two employees and has grown to what is now said to be, the nation's largest independent supplier of new and used broadcast and recording equipment, as well as being the South's largest supplier of custom built professional sound systems for the performing artist.

Under one roof are executive and sales offices, a 6,000 square foot warehouse with loading ramp and drive-in facilities, another 12,000 square feet of space for future expansion, a studio type tuned showroom filled with professional products and components, shop and lab facilities for repair, maintenance, and fabrication of custom installations plus a design and engineering department in which broadcast and recording consoles are designed.

In addition to being one of the industry's prime sources for used equipment and technical assistance, Maze stocks and sells over thirty major new equipment product lines such as Ampex, AKG, Altec, JBL, Mincom, Scully, and UREI, just to mention a few. As an example of the company's ability to produce sales, Maze sold over seventy-five thousand dollars for a major recorder line their first year as a distributor.

MAXELL ANNOUNCES REALIGNMENT OF EXECUTIVE RESPONSIBILITIES

Mr. T. Okada, Executive Vice President of MAXELL Corporation of America, 130 W. Commercial Avenue, Moonachie, New Jersey today announced a realignment of corporate executive responsibilities.

Under the new organization plan, Mr. Gene La Brie, National Sales Manager, will now have the responsibility for professional studio sales and O.E.M. – audio products added to the Consumer Products Division he headed.

Please don't dance on your tape recorder!

We've seriously gone about the business of designing the best possible loudspeaker for monitor use. With computers, and anechoic chambers, and all the rest. And, having gained a monster new insight into bass speaker performance, we've come up with what looks like a winner. The Sentry III.

We've run all the curves that prove, in a most scientific, sober fashion, that the system is really quite good. We've got polar graphs, and frequency response curves, distortion measurements, total power output curves, power handling test results, and SPL data galore.

But what happens when we demonstrate the Sentry III? Leading engineers (whose names we hesitate to divulge—but you know them) leap about in their control rooms DANCING for heaven's sake! Snapping their fingers and feeling the sound, and reveling in the sensory pleasure of a clean first octave. And last octave too, for that matter.

And they run from one side of the studio to the other trying to find holes in the distribution of the highs . . . and they can't . . . and they LAUGH! It's very unseemly (but secretly quite gratifying). So we try to thrust our good numbers and graphs at these serious engineers, but they'd rather listen and compare and switch speakers. And make rude remarks about their old monitors.

Who will stand still long enough to heed our technical story? Perhaps you're the serious-minded, sober-sided engineer we're looking for. If so, by all means write us. We've got quite a stack of strait-laced, objective literature describing the new Sentry III monitor loudspeaker just waiting to be seen and appreciated.

And after you've read our story, perhaps we can arrange a demonstration of this new speaker for you. The Sentry III. Bring your tap shoes.

New SENTRY™III Monitor Loudspeaker

a Gulton COMPANY

Electro-Voice®

SENTRY III Frequency Response 40-18,000 Hz ± 3 dB; Sound Pressure on Axis at 4' with 50 watt input 113 dB; Dispersion 120° horizontal, 60° vertical; Size 28½W x 20½D x 34½H; Weight 156 lbs. $600.00 suggested professional net. SEQ active equalizer extends response to 28 Hz, $60.00.

ELECTRO-VOICE, INC., Dept. 631RP, 674 Cecil St., Buchanan, Michigan 49107

Circle No. 107

Microphone Techniques:

DIFFERENTIAL MICROPHONES

by JIM COE
"SOUND"
JEFFERSON AIRPLANE
HOT TUNA

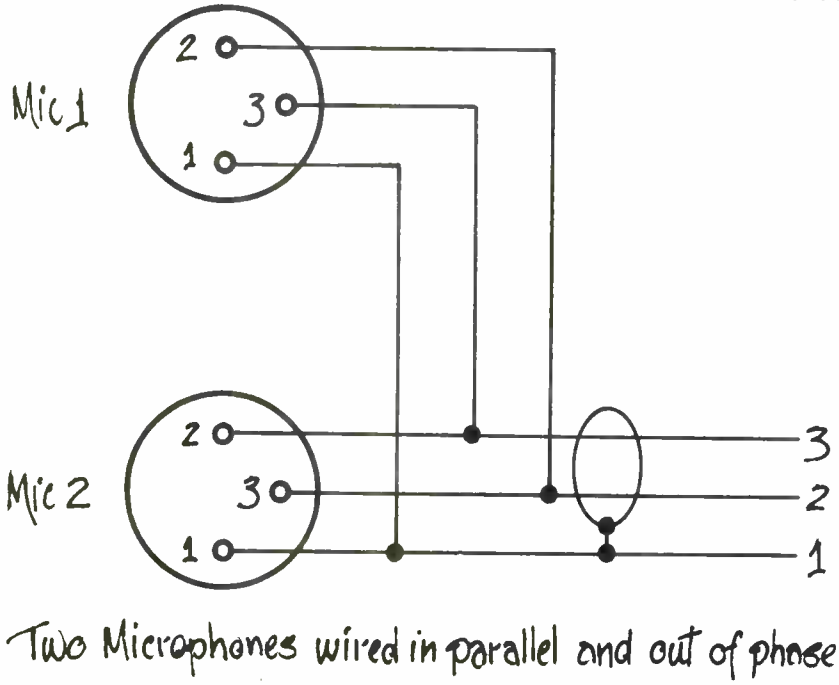
Have you ever been able to hear intelligible vocals at a loud "*rock 'n roll*" concert? The difficulties you have probably experienced are traceable to some interesting technical phenomena, and they are likely shared by the audience, the musicians (especially the singers), and perhaps an engineer trying to record the show in a remote van behind the building.

We know these problems well. The bands I work with commonly create a sound field of 115-120 dBc ('slow scan') on stage, and we project a field measuring 100 to 115 dBc in the center of a 10,000 seat hall. At these levels most single vocalists will be drowned out by the ambient level of drums and amplified instruments. To thicken the plot, the instrument amplifier system is relatively insensitive to acoustic feedback problems and so, can deliver much greater sound levels to the singers' ears . . . which is also the microphone position.

So, we have a situation in which the vocal is buried in the ambient level, and amplifying the vocal also amplifies the band leakage into the vocal as well. The vocal amplification is then severely limited by acoustic feedback. Aesthetic and acoustic trauma arguments aside, how can a 'vocal image' be projected above these ambient levels realistic enough for the singer to stay in key, the audience to *get-off* and the record company to sell?

Until recently, the approach was to attempt an electronic 'tuning' of the stage area and the monitor system with a 1/3 octave filter set. This is expensive and time consuming, often resulting in an unstable system which can 'come

FIGURE 1



Two Microphones wired in parallel and out of phase.

MCI has made two goodies even better.

Models Courtesy of
MAI-KAI
Restaurant, Ft. Lauderdale, Fla.

MCI listens to its customers—because our customers know their business. That's why we've responded to them by incorporating the following features in MCI's stock JH-416 board and JH-100 transport:

JH-416 RECORDING CONSOLE NOW HAS . . .

Improved conductive plastic faders by Penny and Giles, Ltd. • Illuminated channel mute switch with channel number • Monitor mute switch • Full reciprocal midrange equalization-boost or cut of 14db • EQ in/out switch • Mike input pad and new higher gain preamp to accommodate the full range of professional microphones (I.M. distortion @ ODBM input less than .15%) • Full quad panning, both L-R and F-B for 360 degrees of quad positioning on all input modules and echo returns • 48 additional tie-lines and jacks on patch bay.

The MCI JH-100 transport replaces the JH-10 transport in MCI's JH-16, JH-8 and JH-24 8-,16-, and 24-track recorders. The JH-100 combines state of the art electronically controlled tape handling and other unique features, so that:

JH-100 TAPE TRANSPORT NOW HAS . . .

D.C. capstan servo drive; super-accurate, crystal-controlled fixed tape speeds 15-30 ips (7.5 ips available) • Stable variable speed operation from front panel for special effects and speed corrections • Wide range external speed programing for inter-machine sync, audio/video or audio/audio remote speed control, special effects • "Piano proof" flutter; typically .04% 15 ips DIN weighted, .06% 15 ips DIN unweighted • All mode reel tension control system; constant tape tension; high speed accuracy anywhere in reel; consistant tape packing • Full manual velocity programing for cueing, editing, special effects • Totally "relay-less" design with full TTL deck logic • New "Mark II" auto locator; full bidirectional operation; keyboard entry; readout and operation in real time; no overshoot—controlled approach speed • New decor and trim.

ALL THESE IMPROVEMENTS AT ONLY A VERY SLIGHT INCREASE IN PRICE (the 16-in, 16-out console is still under $20,000!)

WANT TO KNOW MORE? Call Claude Hill today: (305) 566-2853.

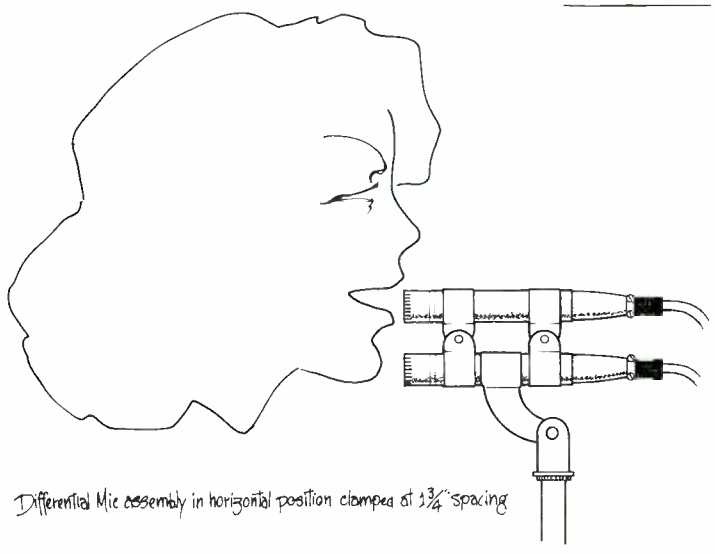
MCI

4007 NE 6th Ave. / Fort Lauderdale, Fla. 33308 • TELEX: 514362

Circle No. 108

FIGURE 2A

FIGURE 2B



untuned' in the middle of a show because of such effects as a major change in air temperature. Heavy notch filtering puts the system at the mercy of all the variables of an environment. Additionally, notch filtering does nothing about the problem of microphone leakage.

An electronics engineer faced with similar *'signal to noise'* problems would likely turn to the notorious DIFFERENTIAL AMPLIFIER. For those who are unfamiliar with this popular gain block, an ideal differential amplifier could care less about signals which are common to both its two inputs, since they are delivered to its single output 180° out of phase with each other. They are effectively cancelled and only the *difference* in voltage between the inputs is amplified. Differential amplifiers with common mode rejection greater than 90 dB are numerous.

In the same manner, two microphones connected in parallel, but out of phase, will mutually cancel signals common to both mikes. An output is obtained only from an input applied to one or the other, but not both mikes.

To return to the problem of vocals: the band level comes from a broad source more than 15 feet from the vocal mikes. The vocalists are a "point source" less than an inch away from the microphone. So by having the vocalists sing into one microphone (quite close) while both microphones receive the ambient level, and summing the two inputs, out of phase, we have a differential microphone. (Figure 1)

The author was initially exposed to the differential microphone concept while attending a Lou Burroughs "Medicine Show,"(1) and have since put the concept to the test in several simulations of actual stage use and two concert tours of twelve concerts each.

ADVANTAGES

The inherent advantages of an ideal differential amplifier are:

1. Cancellation of ambient (common mode) signals including, mechanical vibrations, acoustic feedback, leakage, etc. With a practical differential microphone this is equivalent to increased 'head room' between ambient level and the upper limitations imposed by amplifier and speaker distortion on acoustic feedback (not to mention the pain threshold).

2. Freedom from restriction to cardoid microphones for stage use . . . with their inherent proximity effect and generally poorer frequency response.

3. Freedom from constraints in speaker placement caused by acoustic feedback.

DISADVANTAGES

Disadvantages inherent in a differential microphone are:

1. The microphone must be driven by an approximate point source (vocalists must work close to the mike, and must sing only into one mike of the pair).

2. Microphone cost is doubled.

3. "Sight Lines" are disturbed, to a degree, by the use of two microphones in front of the performers head.

4. Differential microphones are difficult to hand hold.

5. Frequency response and sensitivity matching of microphone pairs is desirable.

THE PRACTICAL DIFFERENTIAL MICROPHONE

To date, we have used three types of circuits in our tests (two of these circuits have been tested during actual performances, each with two different microphone spacings). FIGURE 2. In all cases the Sennheiser MD 211 omni-dynamic microphones were used.(2)

The most elementary circuit simply uses a "Y" cord to sum the two microphone outputs, with one leg of the "Y" wired out of phase with the other. This circuit results in some electrical interaction of the two microphone elements, causing somewhat "peaky" frequency response, but it is certainly usable.

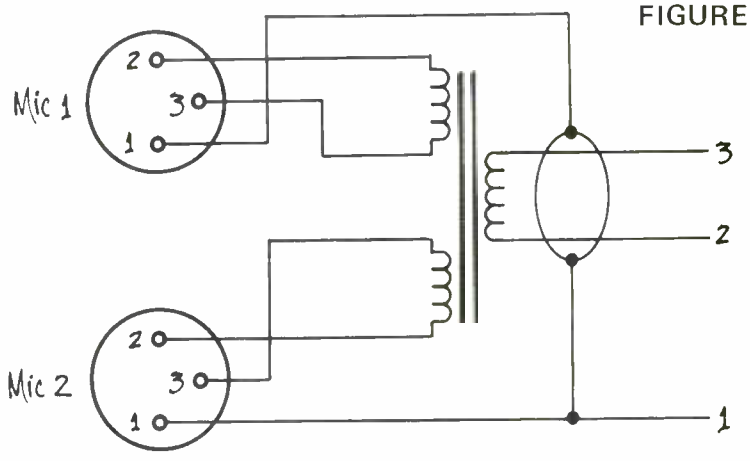
Electrical isolation between the microphone elements was attempted in two ways: a transformer with a split and balanced primary was used to sum the mike outputs, one mike of course out of phase. FIGURE 3A To date, this technique has not resulted in quite as good a common mode rejection as the first method, but provides good electrical isolation while maintaining balanced lines and using simple reliable components. The other isolation method, which is the third circuit and which has yet to be used on stage is currently being studied. A differential amplifier is used to isolate the two microphone elements and provide a method of *nulling* the individual microphone output levels for best common mode rejection.(3) A popular differential instrumentation amplifier circuit is used. FIGURE 3B This circuit requires gain stages and a power supply onstage and is inherently less reliable.

MICROPHONE PLACEMENT

The highest frequency the differential microphone is able to cancel depends of course on the distance between mikes. (FIGURE 4) In the first use of this technique, the mikes were simply taped together, pointed straight up, and the vocalist was asked to sing

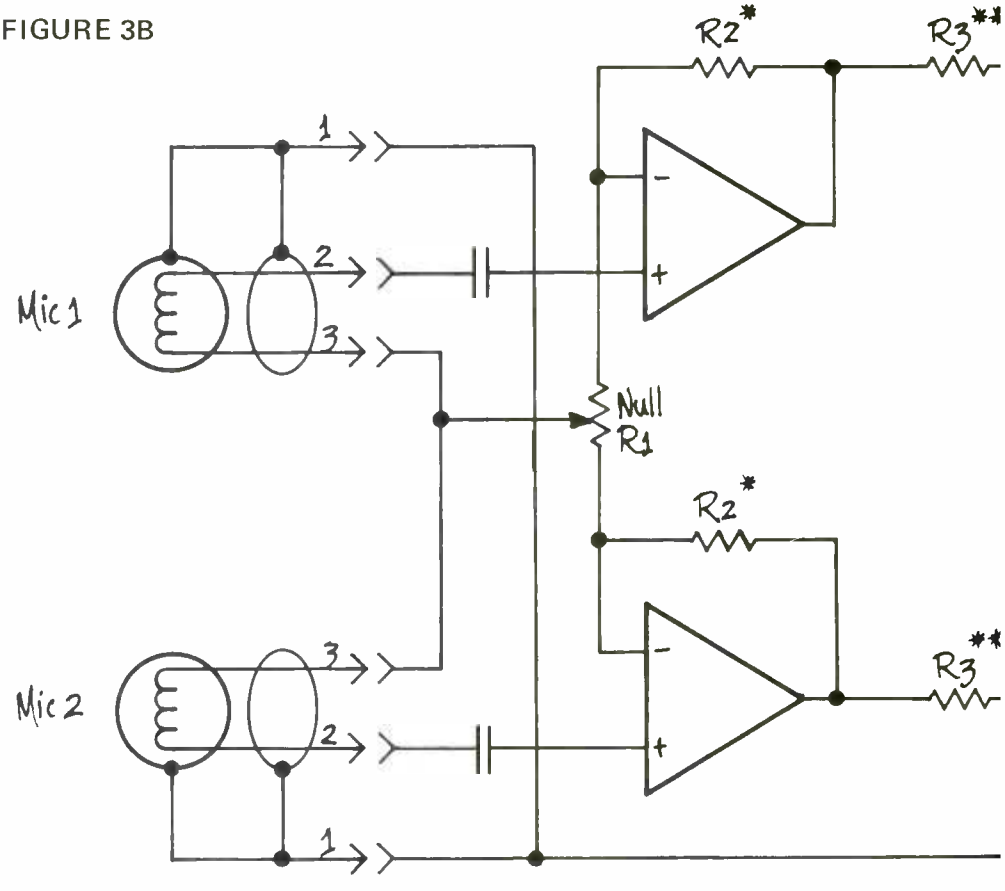
across the top of the pair with one microphone at his lips and the other behind the first. (FIGURE 2A) Later, when pink noise simulation of the live performance demonstrated the best trade-off between mike spacing distance and higher frequency cancellation a distance of 1-3/4" was used. Now, the mikes are horizontal, with one pointed at the singers lips and the other below the chin. (FIGURE 2B) Used in this way the differential microphone yields an isolation or gain in dynamic range between vocals and ambient level of from 12 to 16 dB depending on the room acoustics.

FIGURE 3A



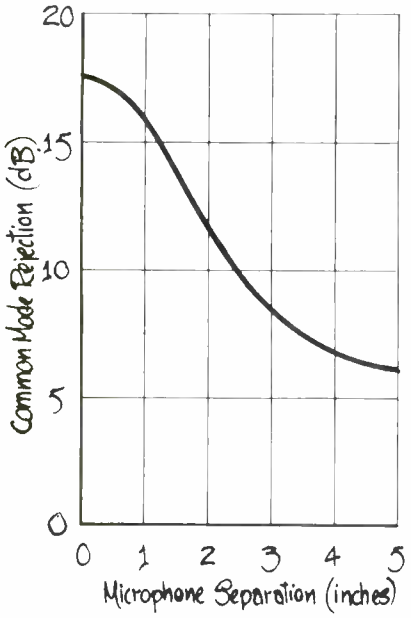
Transformer isolation reduces interaction of microphone elements

FIGURE 3B

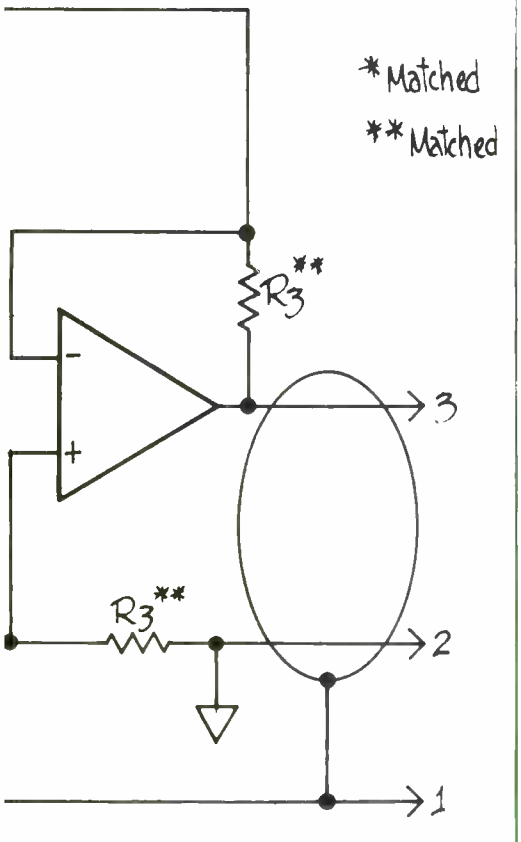


Simplified Schematic of an Instrumentation Amplifier adapte

FIGURE 4



Microphone Separation vs Common Mode Rejection of Pink Noise



Differential Microphone Use

On-going experiments show that 25 to 30 dB of common mode rejection is now practical. This will effectively isolate the vocal section of a sound system from the room acoustics almost entirely. Future work will determine what difficulty vocalists may have adjusting to this type of microphone and whether the need for frequency response matched pairs remains a necessity and what maintenance problems this incurs.

ACKNOWLEDGEMENT

I'd like to thank all those who helped me with ideas and advice, including: Paul Stark, Carl Countryman, Sennheiser of New York, Alembic and the Greatful Dead.

FOOTNOTES

1. *"Make a Quality Differential Microphone"* by Lou Burroughs db Magazine, Jul '72.

2. Special thanks to the men at SENNHEISER'S New York office, who were most helpful in locating well matched pairs of their fine MD211 microphones.

3. The circuit of Fig. 3c is an adaptation of one appearing on page 207 of *"Operational Amplifiers — Design And Applications"* from Burr Brown by McGraw Hill 1971.

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A SURVEY OF RECORDING STUDIO MONITORING PROBLEMS...

by JOHN EARGLE
MARK ENGEBRETSON
ALTEC CORP

In today's new world of pop recording, monitoring remains a chronic problem. While tape recorders, amplifiers, and disk cutters have achieved high degrees of consistency, monitoring is still subject to a wide variety of tastes, prejudices, and habits. In this paper, we will examine the many factors which bear upon this problem; we will consider the esthetic demands of the control room and its environment, the optimization of its physical characteristics, the optimization of the loudspeaker's characteristics as well as electrical equalization of the monitor system and practical power handling calculations.

INTER–RELATION BETWEEN THE LOUDSPEAKER AND THE CONTROL ROOM

It is ironic that so many of the esthetic demands of the monitoring environment are antithetical to the acoustic demands of good listening. Control rooms are often too small for good low-frequency propagation, and the usual location of the engineer and producer toward the middle of the room surrounded by equipment only intensifies this problem. The hanging of loudspeaker enclosures from the ceiling, often done in an effort to arrive at a more intimate loudspeaker-listener relationship, usually results in very erratic low-frequency response due to cavity resonances between and behind the enclosures. The trend toward built-in loudspeakers has certainly done a good deal in alleviating this problem as well as affording a more pleasing appearance.

The creative environment should be intimate; this calls for lots of carpet and absorptive wall and ceiling treatment. More and more, producers want to be located well within the "direct field" of the loudspeakers; they want to minimize the local effects of control room reverberation in an effort to hear only the ambience they are attempting to record.

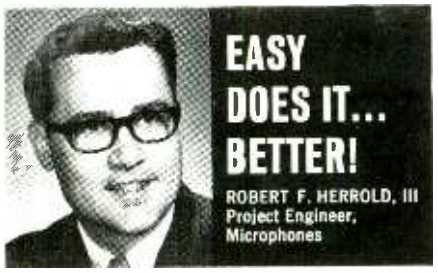
Given the limitations of the size of the control room, every attempt should be made to insure that absorption is uniform with respect to frequency. This calls for considerable amounts of high-frequency absorbers as well as fairly resilient boundary structures at mid and low-frequencies. This often poses a problem as regards unwanted transmission into neighboring rooms, but it is essential.

Adequate baffling should be provided for the loud-speakers in order to minimize peaks and dips in the mid-range response. And this is important whether they are housed in the manufacturer's enclosures or actually built into the environment. Care should be taken to insure that there are no highly reflective surfaces in proximity to the loudspeakers which could provide interferences at mid and high frequencies. Acoustical absorption coefficients should be held to the 0.5 - 0.7 range across the bandwith, and there should be no perceptible reverberation in the environment.

Control rooms vary in size from the confines of a mobile recording van

*Originally presented at the 44th AES Convention

One of a series of brief discussions by Electro-Voice engineers



In past columns in this series we reported on a novel concept for improved distant sound stage pickup that involves locating the microphone quite close to the floor. Further experiments by a number of engineers have fully proven the validity of the idea.

Briefly, the technique is designed to eliminate pickup of out-of-phase sound reflected from the floor which degrades level, frequency response, and gain before feedback. However, to work properly, the microphone head must be within ¼ inch of the floor surfaces, yet isolated from it to reduce mechanical noise.

The success of the "floor wave" concept gave rise to the need for suitable microphone stands. And while the purpose can be served with traditional hardware approaches, a simpler method has been devised to solve the problem.

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The final result is a 2"—high mound of charcoal grey foam with a cable extending from the back. Its inconspicuous appearance has earned it the informal nickname of "stage mouse." Despite its simple nature, the foam has several advantages over more complex hardware approaches. It provides an integral windscreen, plus protection against dust from the floor, while shielding the microphone from accidental impacts from performers.

Foam characteristics are carefully chosen and controlled to offer no acoustic barrier, while supporting the microphone at a uniform distance from the mounting surface and offering excellent isolation. The "mouse" is washable, and has no moving parts to adjust, wear or break. Its large contact area makes it unlikely to creep or bounce, and it can be stuck to the floor (or even a vertical surface) with double-sided tape. It can be used on desk tops for talk shows or news programs. And there is no gleaming metal or complex shape to distract the audience.

Finally, because it is simple to manufacture, the cost is low. The Model 411, designed exclusively for the Electro-Voice RE10 and RE15 Super Cardioid Microphones, is less than $10.00 to professional users.

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up to rooms, say, 20' x 25' x 11'. Rooms larger than this lose their feeling of intimacy, but they certainly have advantages for low frequency propagation. In the smaller enclosures, significant musical information may lie below the lowest normal modes of the enclosure, and of course the nature of sound propagation will be quite different from that encountered in the larger rooms. Electrical equalization will invariably be called for here. Also, one should not stint on loudspeaker power handling capabilities at low frequencies in such enclosures; the response can be surprisingly good if the power capability is there.

DIRECTIVITY OF MONITOR SPEAKERS

Q is defined as the ratio of the sound energy at some distance along a specified axis for a given radiator compared with an isotropic, omnidirectional radiator of the same efficiency along an axis of the same length. Thus, a hemipherical radiator has a Q of 2, while a loudspeaker radiating into a dihedral 90° corner has a Q of 4. An omnidirectional speaker located in a 90° trihedral corner would have a Q of 8.

Detailed discussions of Q (1, 2, 3, 4) describe the radiation characteristics of practical devices, and this has been found particularly useful in sound reinforcement work. Q is related to directivity index (DI) as follows:

$$DI = 10 \log Q$$

DI is a convenient measure of the "apparent gain" of a radiator in a specified direction over an equivalent isotropic radiator.

Another concept closely related to Q and DI is Critical Distance (D_c). This is the distance at which the direct field and reverberant field in a normal environment are equal. Again, the concept is most useful in sound reinforcement work, but it may have its consequence in some monitoring situations. D_c is arrived at by equating the two terms in the following equation, which gives the relative attenuation of sound with respect to distance (r) away from a radiator:

$$\text{Relative Attenuation (r)} = \left[10 \log \frac{Q}{4\pi r^2} + \frac{4}{R} \right]$$

R is the "Room Constant" and is given by:

$$R = \frac{Sa}{1 - a}$$

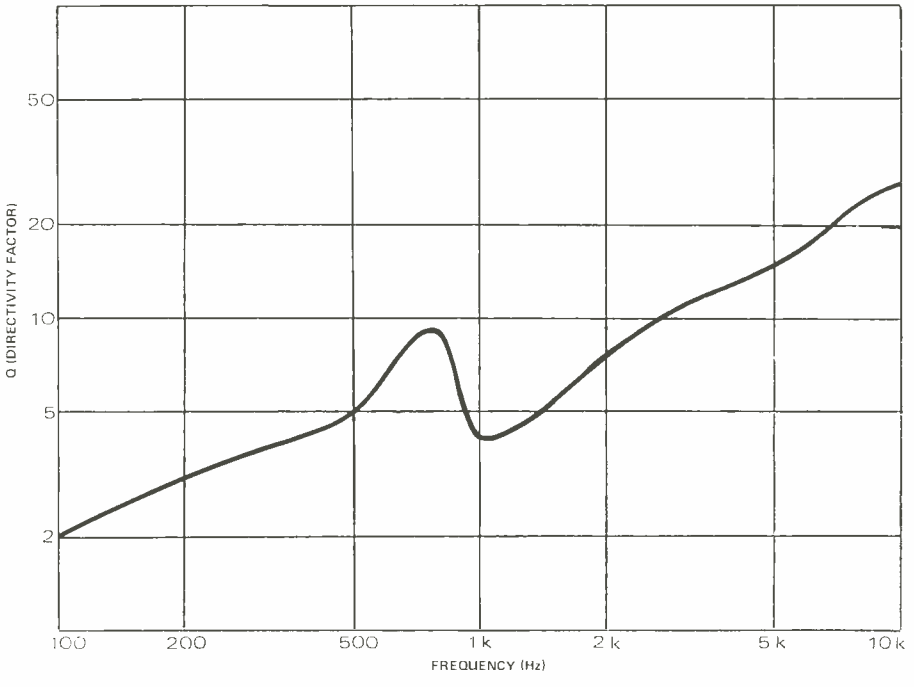
S is the boundary area, and a is the average absorption coefficient in the room (4).

The first term on the right side of the equation expresses the familiar "inverse square" relationship of the direct field. The second term relates to the constant reverberant field level. Equating the two terms gives the value of critical distance:

$$D_c = .14 \sqrt{QR}$$

While a precise determination of D_c may by unnecessary in most monitoring situations, it can become important in certain "live" environments at middle and low frequencies. Any attempt to monitor or play back a recording in any room other than a well-designed control room must certainly pay attention to the relation

FIGURE 1. "Q" Characteristics of Altec 9846B Monitor System



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between Q and R inasmuch as monitoring should always be done in the direct field of the loudspeaker.

Let us look at some practical examples: Figure 1 shows the mean Q for the Altec Model 9846B Monitor System. At low frequencies, the Q is, as we would expect for flat baffle mounting, equal to two. Beyond 500 Hz, the sectoral horn takes over, and the Q rises substantially. The bump in the curve is caused by the considerable Q difference between the woofer and HF horn in the crossover region. Note that a Q of 4 at 1 kHz and a Q of 30 at 10 kHz represent a difference in directivity index of 6 dB. This means that for flat energy output between 1 kHz and 10 kHz there would be a rise of 6 dB in the on-axis response at 10 kHz relative to 1 kHz. Figure 2 shows the Q of an Altec 604E loudspeaker mounted in a Model 612C enclosure. Here, the differences in Q between 1 kHz and 10 kHz result in a directivity index of less than 1 dB between those frequencies. Between 2 kHz and 5 kHz however there is a change in directivity index of 3 dB.

Q is important in determining the ratio of direct-to-reverberant sound at the listener. If this can be maintained fairly high from, say, 500 Hz to 10 kHz, then variations in Q are relatively unimportant; what then becomes important in a more practical context is *horizontal angular coverage.* Figure 3 shows the effective horizontal coverage angles for the two loudspeaker systems examined in Figures 1 and 2. Note that, while the directivity index variation between 1 and 10 kHz for the 604E is more ideal than for the 9846B, the maintenance of a more even horizontal angular coverage is evident in the 9846B.

FIGURE 2. "Q" Characteristics of Altec 604E Loudspeaker in 612C Enclosure

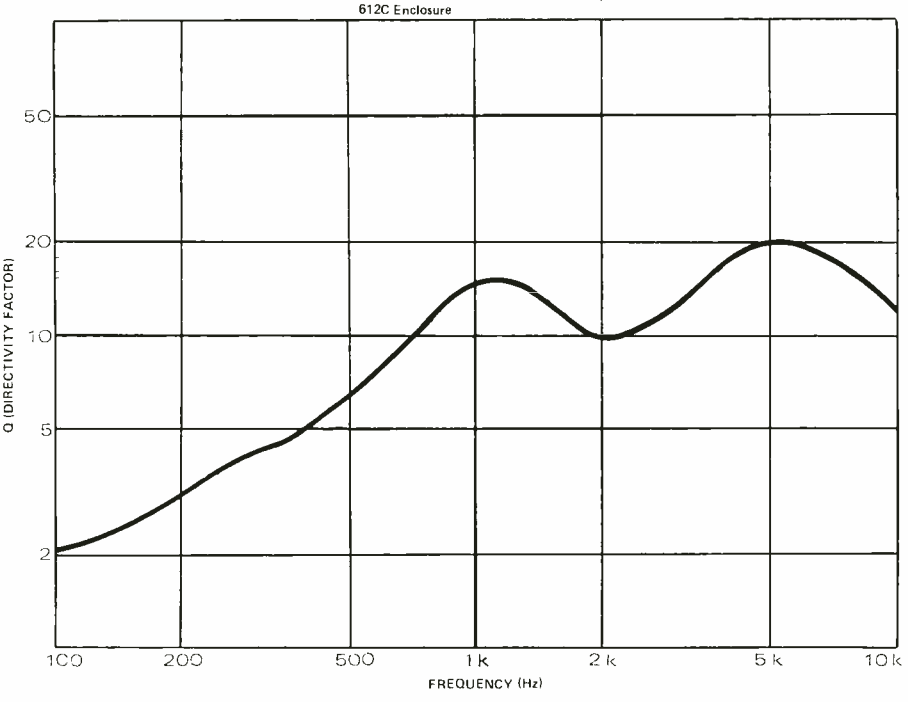
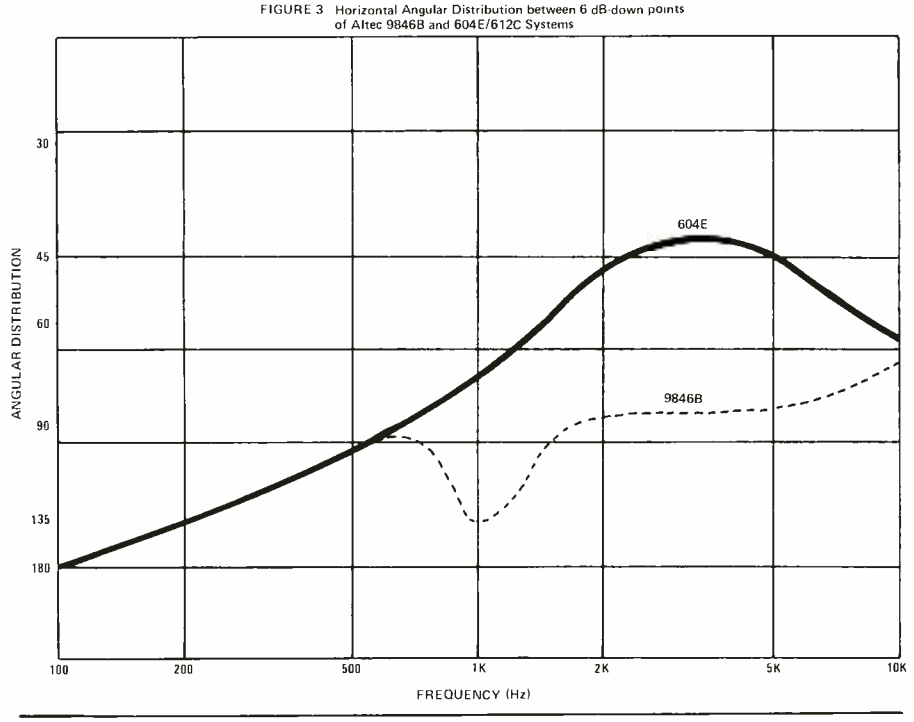


FIGURE 3 Horizontal Angular Distribution between 6 dB-down points of Altec 9846B and 604E/612C Systems



RELIABILITY AND POWER HANDLING CAPABILITY

With today's modern music—and recording practice—a single monitor speaker can be called upon to deliver sound pressure levels (re .0002 dynes/cm^2) of perhaps 105 dB at distances of, say, 8 feet under substantially free field conditions. The demand is a severe one, and it has historically been met through the use of ported enclosures operating up to, say 500 Hz with horn-loaded units above that frequency. Recently there has been a trend toward sealed enclosures for the low-frequency units since this permits better control of the system's response in the 30 to 50 Hz region.

Today's music often requires that a monitor system be able to handle a flat energy spectrum out to 10 kHz at full level. A two-way system of the type just described will have invariably been designed with those demands in mind. Most three-way systems with tweeters crossing over in the 3 to 5 kHz range have been designed under the assumption that the normal musical spectrum rolls off above 3–4 kHz and consequently that the tweeter need not be able to handle such large amounts of power. This need not always be the case, but the user should always make sure before using such systems for high-level flat-spectrum monitoring.

There is no reason why cone type systems, whether of medium of low-efficiency, cannot be used for monitoring purposes provided the components are available in sufficient quantity to produce the required levels and there is enough power available to drive them. Historically, this type of system has played a far more important role in home listening than in studio monitoring. The user, whatever his taste in loudspeakers, should then carefully determine his needs for the applications he may have in mind. In a later section, we shall see how power handling

continued on Page 27

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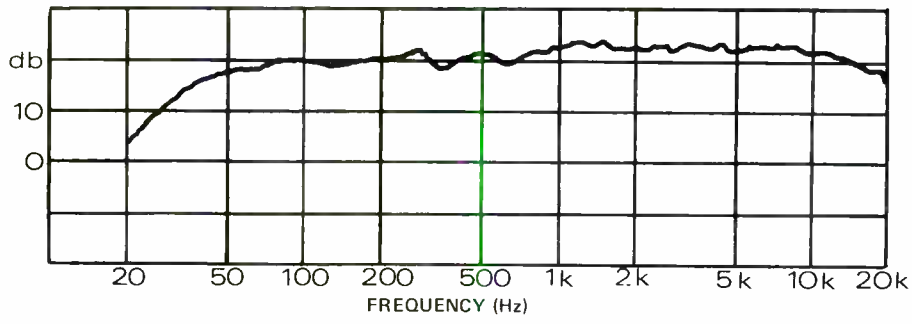
continued from Page 22

FIGURE 4 On-Axis (4-feet) Anechoic Frequency Response of Altec 9846B Monitor System



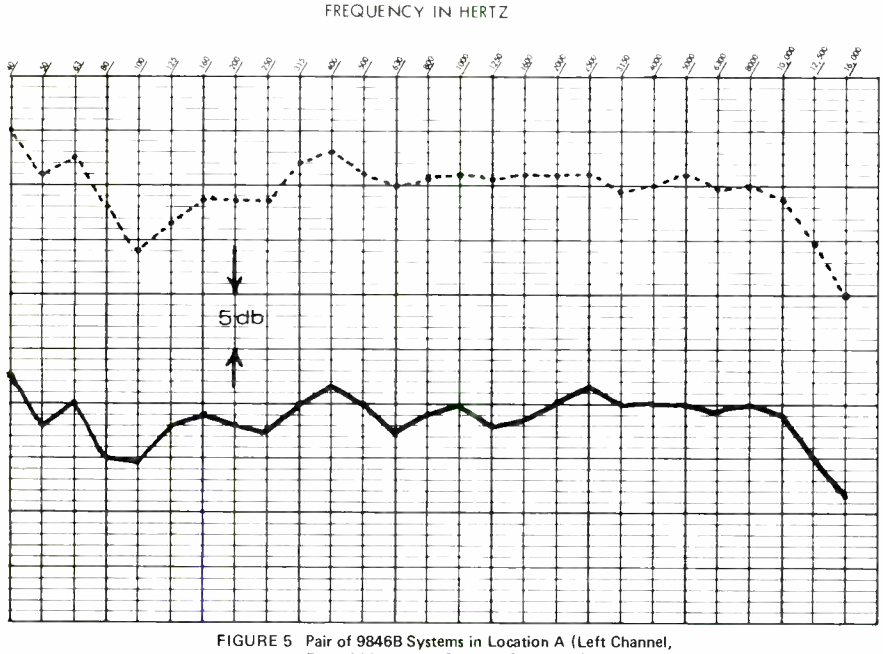


FIGURE 5 Pair of 9846B Systems in Location A (Left Channel, Dotted Line; Right Channel, Solid Line)

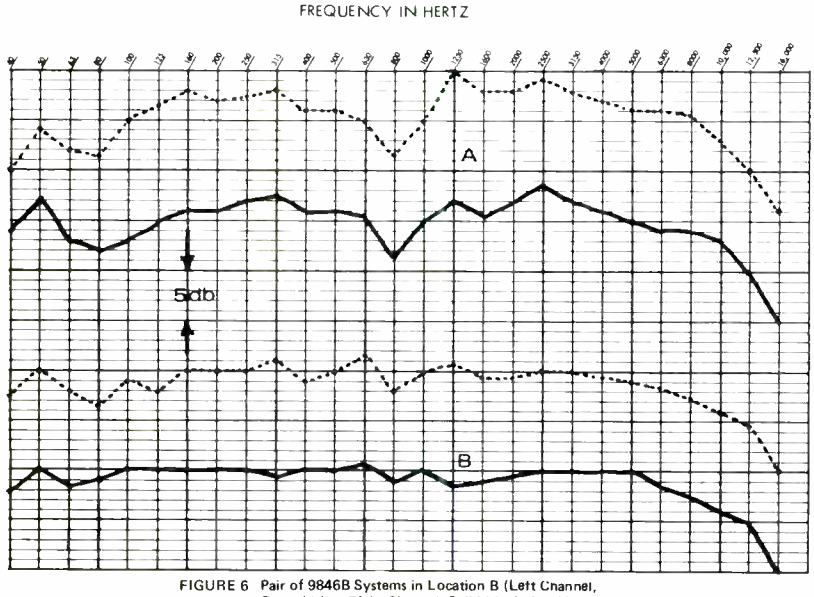


FIGURE 6 Pair of 9846B Systems in Location B (Left Channel, Dotted Line; Right Channel, Solid Line). A — Unequalized; B — Equalized

requirements can be quite accurately determined.

ELECTRICAL EQUALIZATION OF MONITOR SYSTEMS

The requirements, practice, and devices used in monitor system equalization have been discussed in detail (5). Here we will examine a typical monitor system in a variety of acoustical environments, observing the effectiveness of electrical equalization in tailoring the total system response.

Figure 4 gives the on-axis response of an Altec Model 9846B loudspeaker system as measured in a flat baffle in an anechoic environment. We have seen the directional characteristics of this system in Figure 1. Figure 5 shows the response of this system as measured with a 1/3 octave Spectrum Analyzer (Altec Model 8050A), using an omnidirectional instrumentation microphone located at the listener's position in a typically good control room. Both right and left channels exhibit remarkably flat response except for a gentle roll-off at the high end and a few minor variations at the low end. The loudspeakers were properly baffled and located in corners in a well-designed control room. Equalization was not even felt to be necessary, and any further improvement in response could probably be more economically attained through minor acoustical changes and adjustments of the high-frequency shelving controls on the loudspeakers.

Figure 6-a shows the same pair of loudspeakers in another control room. Here, the room was asymmetrical, and the loudspeakers were hung without proper baffling and with consequent cavity resonances between and behind the loudspeakers. In Figure 6-b we see the correction introduced through the use of Altec 9860A Active Equalizer 5.

Figure 7-a shows the response of the same pair of loudspeakers in a remix facility of unusual characteristics; heavy carpeting and draperies accounted for high absorption at high frequencies while wall-board construction and large windows resulted in considerable low-frequency absorption. At Figure 7-b, we see the two systems electrically equalized. We note in passing that particular attention must be paid to both low-frequency capability as well as power availability in playing these systems at the sound pressure levels we would like to attain. The response at 40 Hz in both cases is some 10-12 dB below that of the mid band, and it is evident that the two systems as equalized require some caution, where high levels at low frequencies are called for.

Another important consideration in equalizing monitor systems is the

continued

precise tailoring of the high-frequency response. The question of "flat *vs.* rolled-off" response has been discussed in some detail (5, 6), and there is a general consensus among recording engineers that some sort of high frequency roll-off is desirable. The reasons, of course, are obvious; most home playback equipment exhibits substantial high-frequency roll-off at normal listener's positions, and a recording monitored and equalized over a system exhibiting the same kind of roll-off will convey most of the musical values the recording producer had in mind. On the other hand, a recording monitored and equalized on a flat system would surely sound dull and lifeless played over the rolled-off system. The answer to the problem is not to make all systems flat; that would call for a reassessment of present disk equalization standards, not to mention the problems of playback equipment design and obsolescence. Rather, the answer is to be found in standardizing on a degree of roll-off, with reasonable tolerances, which can be met by the manufacturers of home playback machinery and studio monitors alike. Once this has been done, an orderly change toward flatter monitoring and home playback can get underway with the cooperation of hardware and software manufacturers alike.

Some typical center-line equalization curves are shown in Figure 8. At Figure 8-a we see a curve commonly used in sound reinforcement work and at 8-b a curve recently suggested for equalization of cinema systems. In both these cases we are observing measurements which would be made at some considerable distance from the loudspeakers, upwards of, say, 80 or 100 feet. At a distance of 100 feet at 40% RH, there is a loss at 10 kHz of 9 dB due to air absorption, and it is doubtful if systems used in rooms large as these could be equalized for flat response at such great distances without inviting high-frequency driver burn-out. But the reasons for these roll-off curves are not for driver protection; rather they are largely the result of a certain amount of empirical practice over the years, the general agreement amongst practitioners being that such systems simply "sound better" rolled off. Schulein (6) offers an interesting explanation of why reinforcement systems are traditionally rolled off based upon an analysis of the direct and random incidence response of the microphones used in the operation as well as calibration of sound systems.

FREQUENCY IN HERTZ

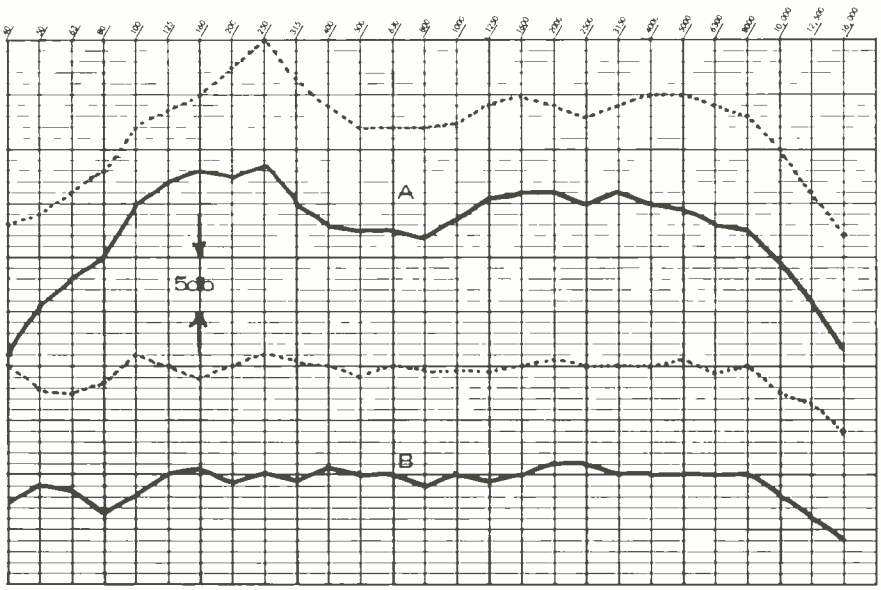


FIGURE 7 Pair of 9846B Systems in Location C (Left Channel, Dotted Line; Right Channel, Solid Line). A — Unequalized; B — Equalized

FREQUENCY IN HERTZ

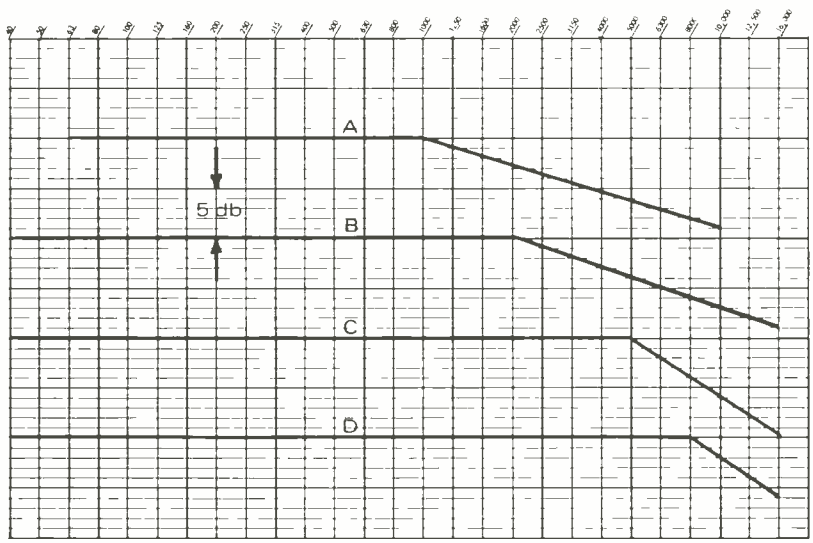


FIGURE 8 Typical Center-Line Equalization Curves for Monitor and Reinforcement Systems

At Figure 8-c and d are typical curves which have been used in a number of control rooms. Usually, in a normal control room, there is no difficulty in equalizing a system as shown in these curves—are even flat, for that matter. In fact, the most flexible monitor systems would be equalized flat and then modified, according to taste or use, with a set of switchable roll-off contours. In this way, a wide variety of playback conditions could be effectively duplicated in the control room.

A note on tolerances is in order. The curves shown in Figure 8-a and b would normally have $\pm$ 3 dB tolerances in practice while those of Figure 8-c and d would normally be held to $\pm$ 2 dB from, say 150-200 Hz up to 15 kHz. Below the 150-200 Hz region, in most control rooms, the distribution of normal room modes makes precise equalization difficult with most of the 1/3 octave equalizers used in room equalization.

A very interesting approach to monitor equalization has been employed by the Mastering Lab in Hollywood. They have integrated the functions of room/loudspeaker equalization with those of the normal passive crossover network for the Altec 604E loudspeaker. The device has two high-frequency shelving controls so that it can be adjusted to the acoustics of a variety of rooms. One control varies frequencies above 2 kHz and the other above 8 kHz. The network also provides a low-frequency boost which is non-adjustable. Figure 9 shows how it works in a typical living room environment. The solid curves represent the third-octave pink noise response through the Mastering Lab network. The upper dotted curve is the response

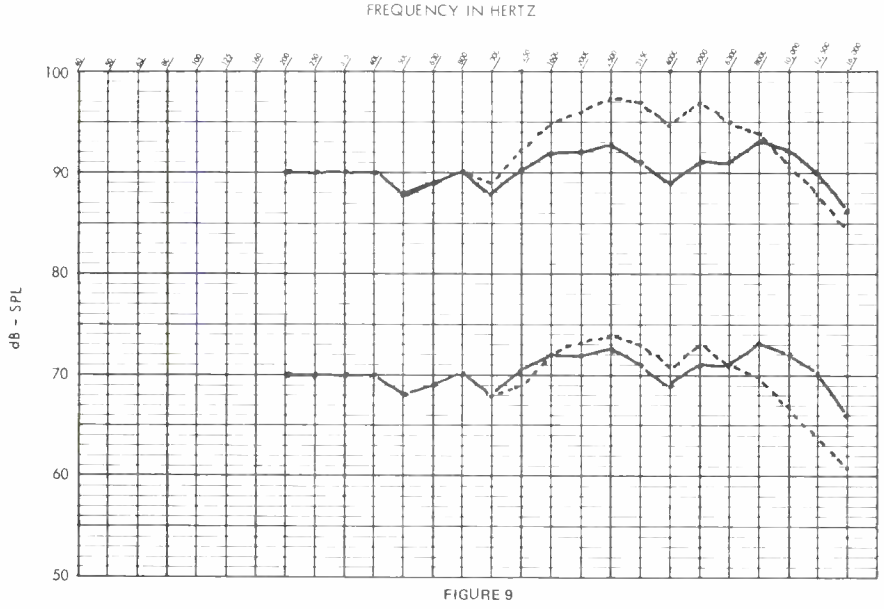


FIGURE 9

through the normal network with the HF attenuator set for flat response at 10 kHz, while the lower curve is with the control set for flat mid-range response. In one case there is too much mid-range, and in the other too little response above 8 kHz. These conditions would vary considerably from room to room, but the Mastering Lab design seems to have struck a center line, so to speak, through the requirements of most control room environments. It does not, however, permit the fine detailed equalization we have seen in earlier examples.

POWER REQUIREMENTS

A number of manufacturers publish sensitivity data on their components by means of a "four-foot-on-axis-one-watt-input" SPL (re .0002 dynes/cm^2) rating. This data is given for many combinations of drivers and horns, woofers and enclosures. The one-watt input signal is customarily a band of pink noise over the operating bandwidth of the device applied at an RMS voltage across the rated impedance which yields one watt. Such data is essential in sound reinforcement engineering; with it, the designer can determine quite accuractely his needs in components and watts to drive them to the acoustical power levels required. If the device is flat over the band the rating is made in, then a sine wave input of one watt will yield a SPL approximately equal to the pink noise rating of the same device.

Another rating given by manufacturers is the maximum steady state sine wave wattage a given driver can be expected to withstand without burn-out.

This allows us to determine the normal maximum levels we can expect from a driver-horn combination for a given peak-to-RMS, or "crest factor", for the signal. A useful figure here is 10 dB; that is, a driver with a sine wave rating of 100 watts can be expected to operate with a complex program level of 10 watts. This is a conservative rating; it provides a degree of "headroom" in loudspeakers which we normally take for granted in recording devices and amplifiers.

Let us examine the components of the Altec 9846B Monitor System. This is a biamplified system with 60 watts (continuous sine wave power) available for the LF portion and 30 watts (continous sine wave power) available for the HF section. From 500 Hz upward, the 802-8A driver is coupled with the 511 horn. The one-watt sensitivity for a pink noise bandwidth of 500 Hz–3 kHz at four feet is 104 dB SPL. The driver is rated at 30 watts, so this means that it can handle sine waves at that power—119 dB SPL at four feet. At a distance of eight feet, typical in a control room, the level would be 113 dB. Assuming a crest factor of 10 dB, we could then expect this combination to produce a level of 103 dB SPL at eight feet with wide band pink noise with an input power of three watts with sufficient headroom to allow for program peaks 10 dB higher.

When mounted in a flat baffle, the 411-8A LF loudspeaker in the 9846B system is rated 94 dB SPL 4 feet on axis with a pink noise input of one watt over a band from 50 to 500 Hz. This speaker is also capable of sustaining a 60-watt sine wave input over the range in question. If we were to allow for 10 dB of acoustical headroom, then the output at 6 watts would be about 102 dB SPL. Going from our reference distance of 4 feet to 8 feet would reduce the level to 96 dB SPL. Experience has shown, however, that LF systems do not need as much acoustical headroom as HF systems do. The reason for this is that they operate over a relatively restricted bandwidth; also, the nature of music is such that high crest factors are far less likely in the 50-500 Hz region than they are in the 500-15,000 Hz region. Accordingly, we can reduce the headroom requirement of the LF section to, say, 6 dB. Under these conditions the LF section would "coast along" at 15 watts producing a level of 100 dB SPL at 8 feet. Finally, when the HF and LF units are matched in level, the combined output would be about 104 dB SPL at 8 feet with ample acoustical headroom.

Where systems such as we have described are to be operated at very high levels, it is wise to insert high-pass filters (12 dB/octave at around 40 Hz) in order to prevent excessive cone motion which could result from subsonic noises, wind noises at the microphone, and the like. The reason here is that at extremely low frequencies the low-frequency loudspeaker's performance is limited mechanically rather than electrically.

CONCLUSIONS

We have examined in detail the general requirements of monitor loudspeaker systems with particular attention to their directional properties, power handling capability, and their relation to the environment. Electrical equalization of monitor systems was examined as a means of minimizing the differences between locations so that equivalent musical judgements might be made at those locations. Finally, we examined in detail the calculations involved in proper specification of power handling capabilities and amplifier power availability.

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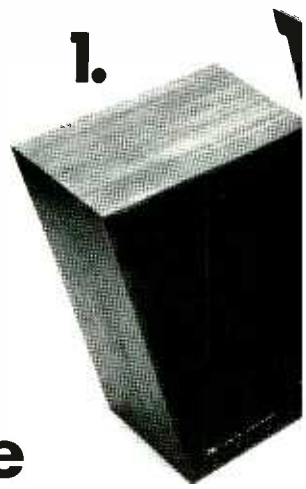

Four reasons why more music is recorded, played back, mixed down and mastered on JBL monitors than on any other brand.

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Especially designed for small studios and portable playback systems.

Wide range response. Full 90° dispersion for vertical or horizontal placement. Power handling capability: 50 Watts program power. 98.5 dB SPL at 10′ at rated power.

12-inch long-excursion low frequency loudspeaker, massive mid-frequency transducer, separate ultra-high frequency transducer.

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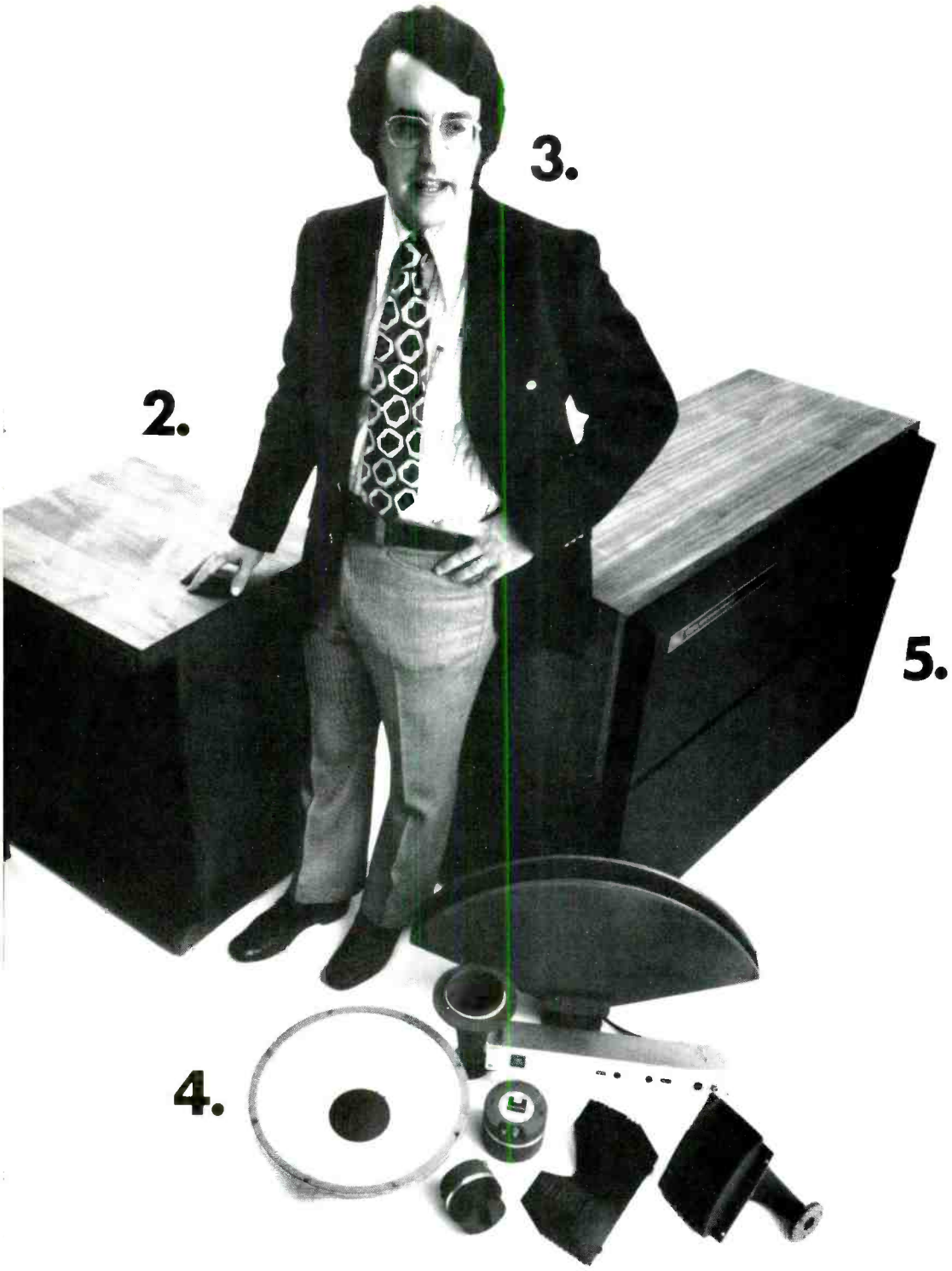

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Bi-amplified steady state power capability, 200 Watts at 4 ohms below 250 Hz. 100 Watts at 8 ohms above; 114 dB SPL at 10' at rated power.

The enclosure features separate acoustic loading of the low frequency and midrange loudspeakers and provides for mirror image mounting of the high frequency and ultra-high frequency drivers.

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Circle No. 116

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When the Burbank Studios decided to create the finest sound scoring facility in the world they came to Quad/Eight Electronics for their recording console.

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AUTOMATING TRANSPORT CONTROL

the author at the controls

by **JIM FURMAN**
ALEMBIC, INC.
SAN FRANCISCO, CA.

Have you ever had your nerves frazzled or your mind boggled by the sheer number of non-creative, repetitive, and routine button-pushing that must be done in the course of a lengthy mixdown session? Here is a plan which can greatly reduce the machine-hopping that the set-up man or second engineer must do to prepare for each take or run-through, enabling him to free his mind for more lofty endeavors.

Outlined here is a system which has been in use at Alembic, Inc.'s main control room in San Francisco, for about a year. It has been declared a useful timesaver by all who have had a chance to try it, and it's kind of fun, too.

Basically the system is an extension of the familiar remote box concept: bringing the transport motion controls (stop, fast forward, rewind, play, and record) away from the transport to a more convenient location, usually within arm's reach of the mixer as he or she sits at the console. The system departs from this simple device in that one set of pushbuttons can control all of the various and sundry transports to be found in a control room, and not just the multi-track transport. The transport to be controlled is selected by punching a button. In Alembic's installation, one of five machines can be chosen by means of a six position, illuminated interlock type switch (meaning that only one button can be punched at a time – punching a second button pops up the first, etc.) The sixth position of the switch selects "mixdown mode."

In mixdown mode, the transports of more than one machine are controlled simultaneously. The various machines in the system are each assigned one of four designations, depending on the role they are to play in the session. These designations are as follows:

1. Multi-track Master: The machine playing the pre-mix-down raw material.
2. Master: The machine or machines recording the mix.
3. Delay: The machine or machines supplying tape delay, for echo or phasing effects used in the mix.
4. Off: All machines not in another category. However, they are not necessarily unused; they might, for

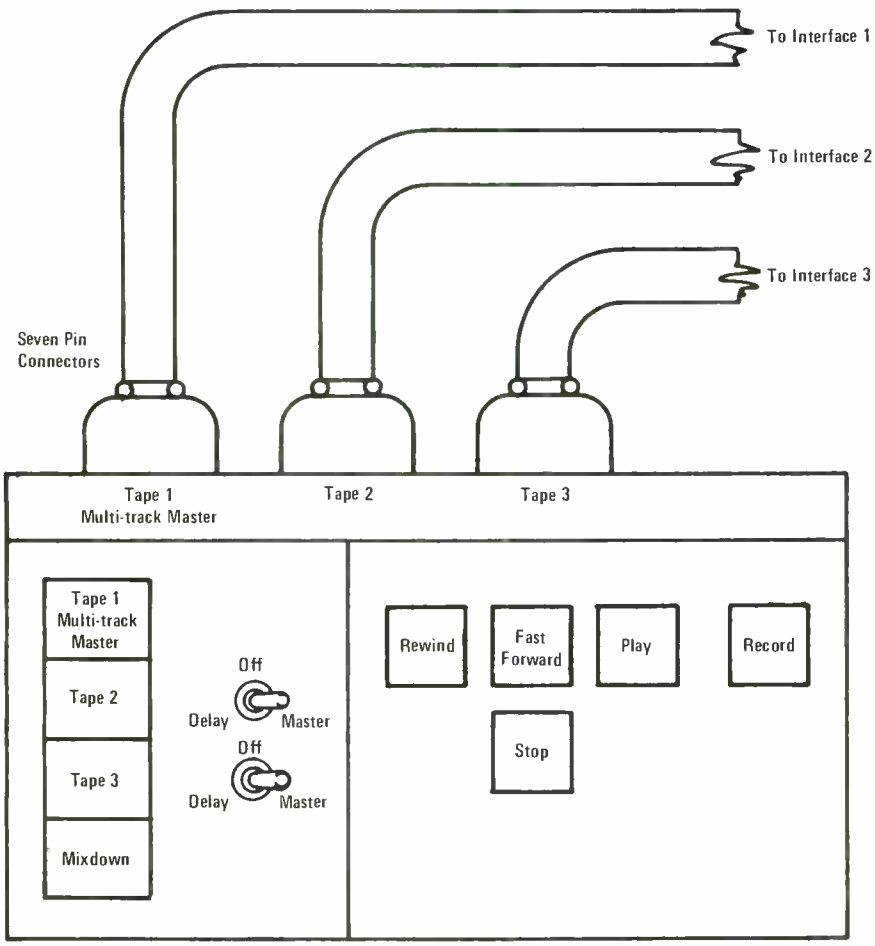


Figure 1. Control Center Box

$1890

You pay for what you need

If you're seriously into music or sound reinforcement you want more than hi-fi products can give you. But full professional studio gear costs an arm and a leg, and you pay for a lot of things you may not really need.

That's why there's a TASCAM Model 10. It's an 8-in, 4-out mixing console, and it's just $1890.

With the Model 10 you get what you have to have. Without sacrificing a single necessary function.

Each input module gives you mic and line attenuation, three bands of peak and dip equalization (two with frequency selection), pre- and post-echo send and receive circuitry, pan function, and a unique straight-line fader.

Each of the four submasters has a meter control switch (line/echo), independent monitor level control, echo receive level control, and a straight-line fader. You also get a master gain module and 4" VU meters with LED peak indicators. Plus pre-wired facilities for up to four additional input modules and other optional accessories including talkback, remote transport control, quad panner, and headphone monitor.

That's what you need and that's what you pay for. Some things, however, you may or may not need, and we leave that choice up to you. For instance, the basic Model 10 is high impedance in and out, but studio line impedances are available optionally. You'll probably want low impedance mic inputs, but you may not need all low impedance line inputs. So we don't make you pay for them. You can order any combination of high and low input/output impedances according to your application.

Details and specs on the Model 10 are available for the asking. At the same time we'll tell you about our new Series 70 Recorder/reproducers.

We've got what you need.

TASCAM CORPORATION

5440 McConnell Avenue
Los Angeles, California 90066

instance, be engaged in making transfers independently of the mixing going on in the same room.

The various machines are given their mixdown mode designations by means of switches immediately adjacent to their corresponding pushbuttons. The switches, pushbuttons, and transport motion controls are all located in the same general area, either built into the console, or in a separate box near it, or as a modification of the existing remote box which usually also remotes machine functions other than transport motion. Such a box might look like Fig. 1. For simplicity it shows a system for only three transports.

Note the umbilical cables connecting each transport to the control center box. These cables terminate in 7-conductor connectors which mate with receptacles on the control center box which are numbered Tape 1, Tape 2, Tape 3, etc. They need not be shielded as they carry only d.c. Additionally, the receptacle for Tape 1 is reserved for the cable connecting to the machine designated to be the multi-track master. Thus the multi-track master machine is selected by plugging the appropriate cable into a socket, rather than by a switch. This was considered reasonable since it saves an awful lot of switch wiring, and this designation is infrequently changed within an installation (almost never during a session).

To proceed with the routine operations of the mixdown session, the transport motion controls operate in the following fashion while in mixdown mode:

"Stop" stops all transports other than those in Off.

"Fast Forward" and "Rewind" apply only to the multi-track master. Master and Delay transports are stopped when either is pushed. Off transports are not affected.

"Play" is the button that is pushed for a trial run-through. The multi-track master plays, the Delay transports record, the Master transports stop, and the Off transports are not affected.

"Record" (to enter this mode, both "Play" and "Record" must be pushed simultaneously) is the mode for a take. The multi-track master plays, the Delay and Master transports record, and the Off transports are not affected.

Note that in mixdown mode, the multi-track master can never record, thus adding another level of protection against accidental erasure.

Having defined the rules, now let us turn to the electronics which enable us to realize them. To begin with, consider the internal system which a professional transport uses to enter a mode (play, fast-forward, etc.) Pushing, say, the "Play" button merely supplies a d.c. voltage to a relay coil, energizing it. This does not happen directly, however. The button is a momentary contact type, yet the transport must continue in "play" mode even after the finger is removed. To accomplish this an IC Flip-Flop may be used, but more commonly a pole of the relay is used to perform a latching function. The "play" button momentarily closes a set of relay contacts which is in parallel with the play button, so that when the coil current path through the play button is broken there will be an alternate route for it and the relay latches. See Fig. 2. The coil is also in series with one or more normally closed switches which are poles of the stop relay, and perhaps the fast forward and rewind relays. When these latter buttons are pushed, their normally closed switches open, cutting off current to the play coil and unlatching the play relay. The "Play" relay has other poles, too, which may control larger currents necessary for such functions as energizing solenoids to pull the idler puck against the capstan and to release the brake, and supplying appropriate voltages to the takeup and supply motors to produce correct tape tension. Different starting and running torques may be required, in which case the first relay may activate a preset time delay relay which times the start up period. (In many tape decks designed primarily for use in the home, the transport motion controls are mechanical linkages and not switches at all.)

Now, most professional transports have a special connector available for hooking up a "remote control box" or more simply, a "remote box." On the remote box are found a set of momentary contact switches, some normally closed and some normally open. A d.c. voltage is also brought out to the box, and pushing

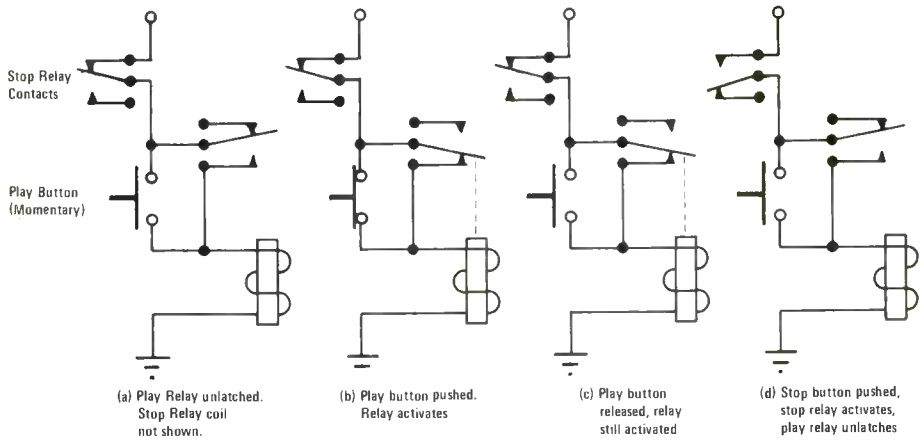


Figure 2. Latching Relay Operation

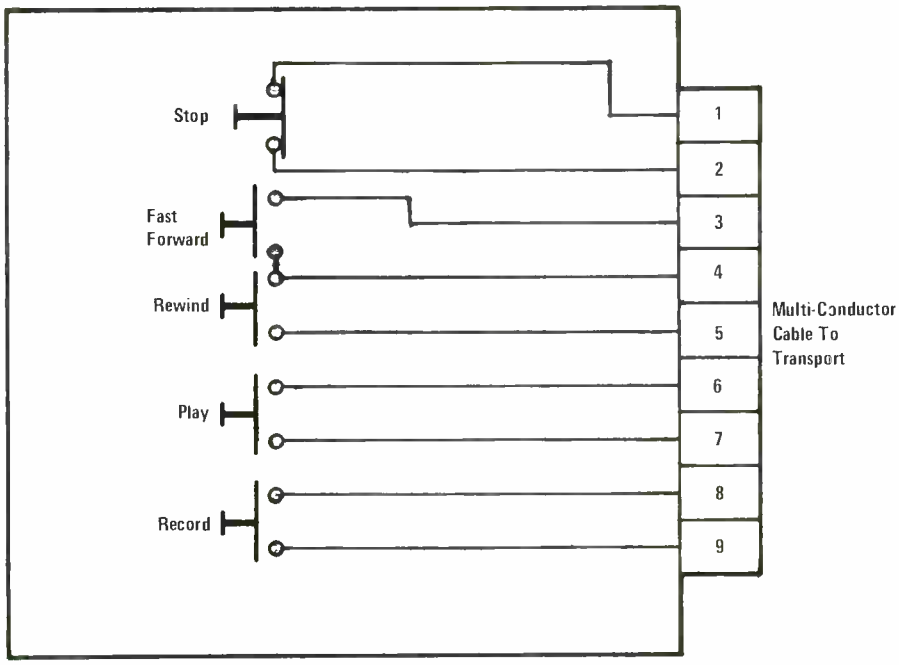


Figure 3. Typical Remote Box Schematic

the various transport motion controls sends control pulses down the cable to the appropriate relays at the transport. The length of these pulses is the length of time that your finger holds the button down, perhaps 100 ms. to one second. See Fig. 3.

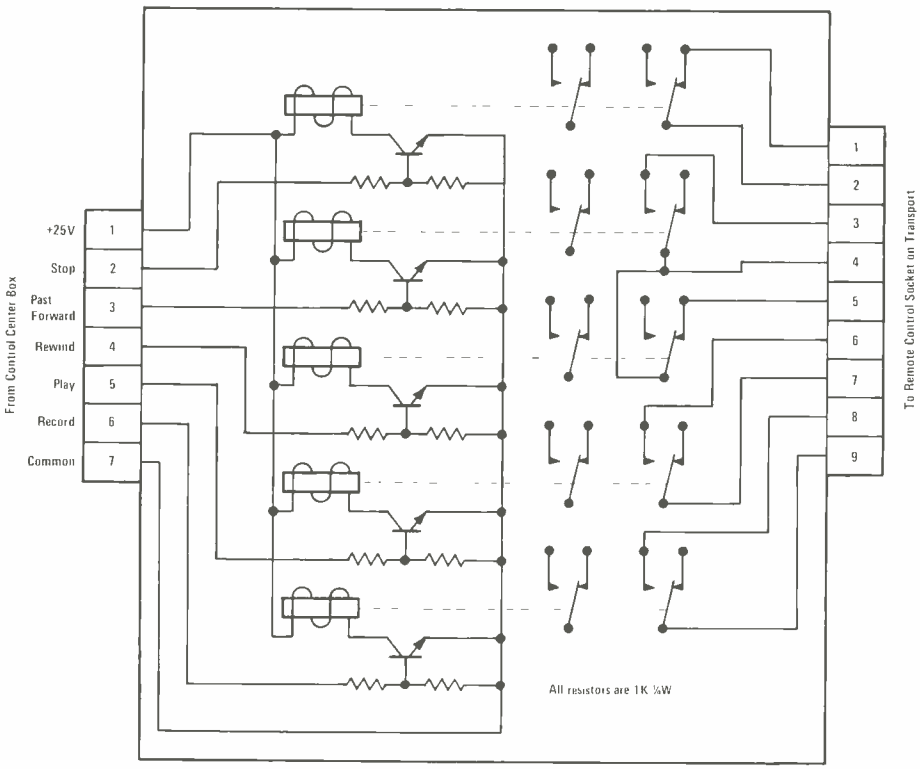


Figure 4. Typical Interface Circuit

Unfortunately, this description has been a bit vague because there are no standards. The exact voltages and switch configurations vary from manufacturer to manufacturer and even from model to model. So, in order to control more than one transport with one set of controls, a standard had to be established. The standard we chose was the 5-volt logic of TTL (transistor-transistor logic) gates. Furthermore, for simplicity the logic was so designed that the presence of a "high" pulse on a line universally meant "enter the transport motion mode" of that line. TTL was chosen because it is cheap (30-40c per IC, surplus), readily available, and practically foolproof at the slow speeds involved. Perhaps someday manufacturers will adopt a similar standard.

Thus, the next problem was translating, or interfacing, between the standard logic system and the specific systems of the various transports. Particular attention was given to keeping all the grounds separated from each other; this avoids creating ground loops, as all the transports were already grounded together via a different route.

Figure 4 shows a typical interface circuit. Basically, the presence of a logical "high" biases a transistor on, which allows current to flow in a relay coil,

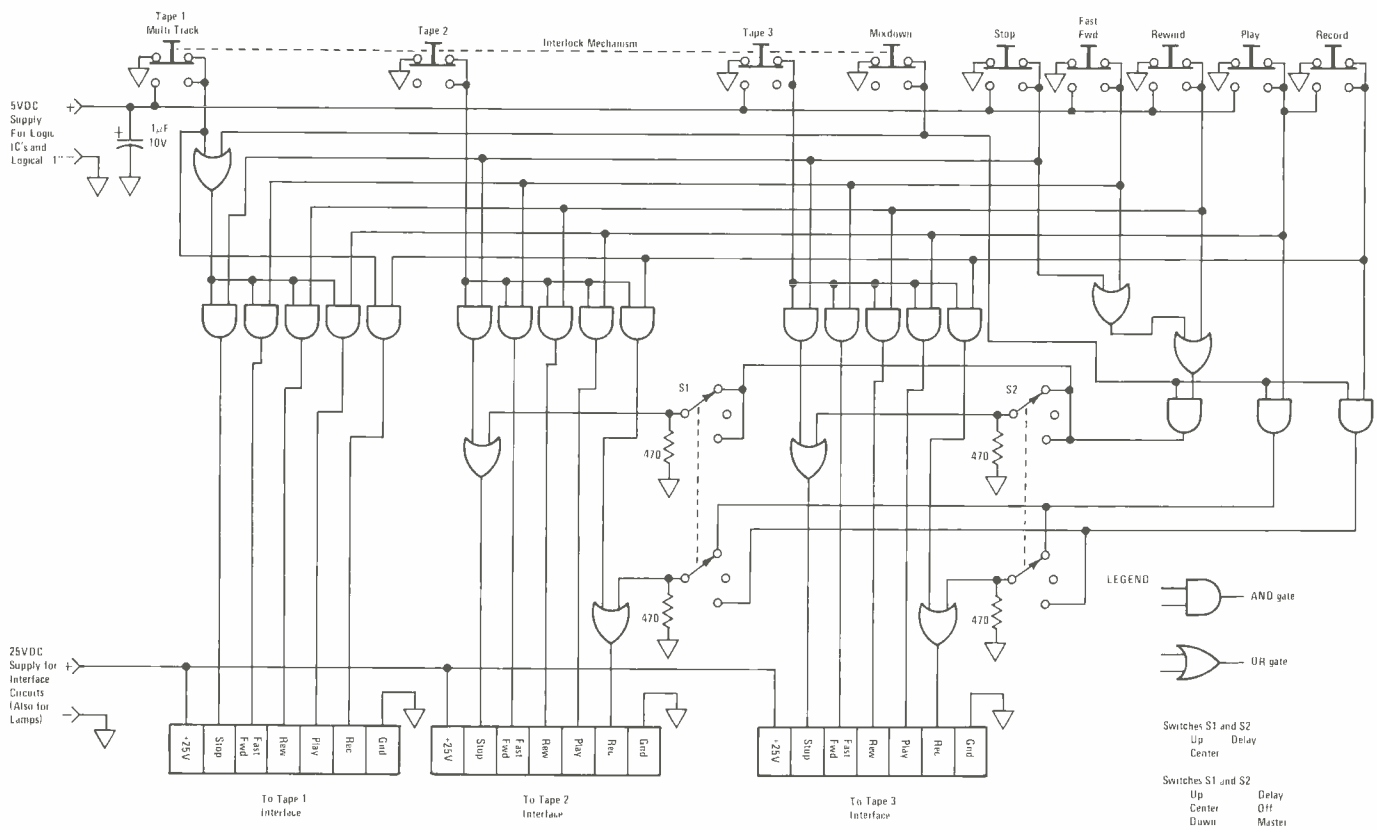


Figure 5. Control Box Logic Schematic

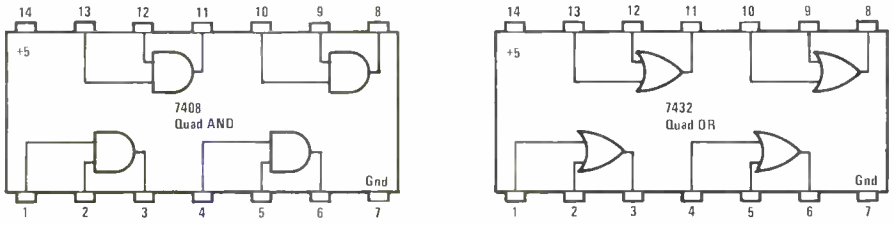


Figure 6. Pin-Outs (Top Views)

energizing it. Each interface assembly was built in a small box which plugged directly into its corresponding remote control connector, and in turn the appropriate umbilical cable from the control center box is plugged into it. None of the parts values are critical. With the resistor values shown, the transistors must be silicon. The relays used were miniature DPDT types with a 25 VDC coil, available at 75c each from the local surplus store. The advantages of the relays are that they maintain complete ground isolation, and can supply either normally-on or normally-off switching, as required. A quick check of the remote box schematic in the tape machine manual will reveal what switching is needed for which function. The transistors used must also have a sufficiently high collector-to-emitter breakdown rating to withstand the relay coil supply voltage.

The only unusual problem we encountered with the interfacing was with an Ampex MR-70 which does not have either a rewind or fast-forward button but rather a slider which allows winding at any intermediate positive or negative speed. Since this is not a momentary action type mechanism, there is no latching relay built in for these two functions. So to get around this two extra relays were put into the interface box, to be latches. In this case, when a pulse is received by, say, the "rewind" input, it activates the first, or isolation relay, which in turn activates the second, latching relay which then keeps the MR-70 in "rewind" until either "stop" or "fast-forward" is pressed (unlatching the relay). This is the same approach that Ampex takes in the accessory remote box, which does not have the slider feature either.

This leaves only the wiring of the control center box itself. Two power supplies were built into Alembic's installation: a 5 VDC one for the logic IC's and a 25 VDC one for the interface relays. The five-volt supply was regulated with a regulator IC, an LM 109, from the same surplus store (which also supplied the transformers and filter capacitors). The 25 volt supply was initially unfiltered but as our relays were DC types, they tended to buzz when energized until we improved the filtering. The latter supply was also used for the lamps in the illuminated pushbuttons.

The actual logic is shown in Fig. 5. All gates are either two-input OR's or two-input AND's. These are available with four gates per IC, as the 7432 and the 7408 respectively. The pin-outs are given in Fig. 6. The four gates within each IC are completely identical and interchangeable. If a system is built to accommodate three transports, as shown in Fig. 5, then 18 AND gates and 7 OR gates are required (hence 5 quad-AND IC's and 2 quad-OR IC's). Of course, the system can easily be extended to any number of transports. All resistors shown are 470Ω ¼ watt; their purpose is to keep gate inputs when not connected to anything else in the "low" state. The capacitor is for power supply decoupling and should be mounted physically close to the IC's.

All the IC's were mounted on a special printed-circuit card designed specifically for breadboarding dual-in-line type IC's. The one we used had room for fifteen IC's and cost about $5. They are generally available from the same surplus dealers who handle the IC's.

The "delay-off-master" switches were miniature DPDT toggle switches with a center off position. The transport selector switch, which also selects mixdown mode, was as mentioned above an interlock-type pushbutton switch bank with lockout mechanism, and with one more switch position than the number of transports to be controlled. These usually come with DPDT circuitry, with one pole being used to turn the lamp on.

Of course, the system that has been described here does not totally free the engineer from button-pushing. Nor is it completely automatic in itself. But when used with a transport with brains enough to rewind to a specified point (such as by scanning for a particular time-code) it can come quite close. Even without that luxury, though, it offers the elimination of a bit of the clutter interfering with the mixdown engineer's concentration.

Ain't nobody else can give you an S/N ratio up to 72 dB. Nobody.

We call it the Scully 280-B Professional Recorder/Reproducer. Not a very fancy name. But it's so new, we haven't had time for anything else but a number.

Briefly, here are the high points, new electronics for up to 72 dB S/N ratio on full track .25" tapes. And a greater dynamic range than you've ever been used to.

Two-track quarter-inch and four track half-inch 280-B lays on a crisp, clean 69 dB on an NAB weighted basis.

We've built in some other choice features, too. Like an OPTAC™ optical motion sensing system that gets rid of deck plate sensor mechanisms. Plus a new mother-daughter board architecture for super easy maintenance.

The spec sheet has all the details.

For more information contact your Scully Distributor or write direct to Scully/Metrotech.

Circle No. 120

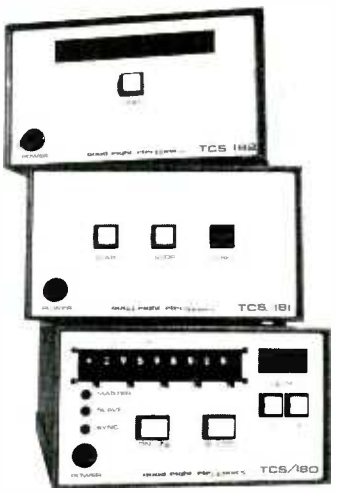
NEW PRODUCT NEWS

QUAD-EIGHT TIME CODE SYNCHRONIZING SYSTEM

QUAD/EIGHT ELECTRONICS introduces –TCS– Time Code Synchronizing system. This series of components is designed for synchronization of multitrack audio tape machines with similar slave units, VTR, or sprocketed film inter-lock systems.

The basic system features SMPTE Generator, Reader, and Synchronizer. A family of optional accessories is also offered, including a Motor Drive Amplifier and "Search and Find" match-up system.

The TCS 180 (Synchronizer) is the heart of the system. Operating with the TCS Reader, it provides the requisite speed up or down error signals to capstans that can be either AC Synchronous or DC Servo controlled. Offset (slewing with frame indicator and pre-select lever-wheel switches), time/phase lock selection, and on/off line



switch are some of the unique extras of this device.

The TCS 181 (Generator) is NTSC or 60Hz data rate selectable. A provision for optional data display and lever-wheel code preset allows SMPTE hours, minutes, seconds and frames to be read and/or pre-selected. Power, start, stop and reset controls, as well as connector provision for parallel data output, are provided.

The TCS 182 (Reader) receives time codes from master or slave machines and provides a large character display of SMPTE encoded tapes at NTSC or PAL frame rates. A hold button is provided to allow annotation of exact tape position. It incorporates a high speed forward or rewind reading capability which allows complete synchronization in the reeling modes of each slaved machine.

Basic system price for –TCS– is $9,100.00 Complete. Including 1 Synchronizer, 2 Readers, 1 Generator.

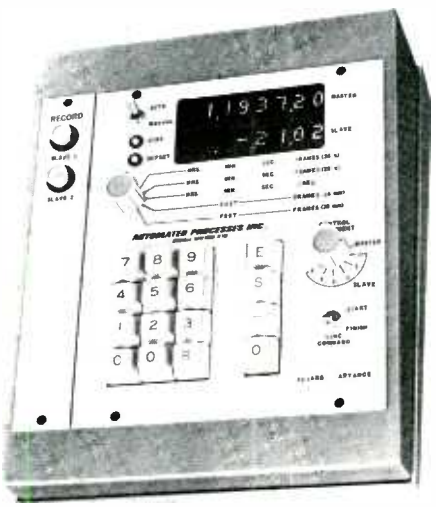
QUAD/EIGHT ELECTRONICS, 11929 VOSE STREET, NORTH HOLLYWOOD, CALIFORNIA 91605.

Circle No. 121

NEW MAGLINK SYNCHRONIZER FROM AUTOMATED PROCESSES CONTROLS ANY NUMBER OF MAG TAPE MACHINES

A new synchronizer called MagLink, introduced by Automated Processes, Inc., 80 Marcus Drive, Melville, N.Y. 11746, is said to offer a faster and more efficient capability for synchronizing, position logging, editing and indexing of video and audio magnetic tapes.

Through the use of a unique time code system developed by the company, videotape, multi-track audio, and magnetic film machines may be controlled simultaneously. They can be locked in sync, offset in their relative positions, or stopped and started according to a pre-set program. With the MagLink Synchronizer, master and slaves will remain synchronized in all operating



modes, including rewind and fast forward. A converter module is available to interface with the SMPTE time code.

When used for multi-track audio production, video mixing, editing and "sweetening," production of film sound tracks, or foreign language over-dubbing, MagLink provides a degree of accuracy and production flexibility not heretofore available. The unit has a sync resolution (accuracy) of 1/300 of a second and a typical search accuracy of 0.2 seconds at 15 ips.

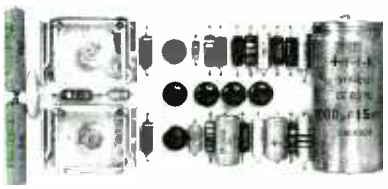
A special feature of MagLink is selectable conversion display. This enables the operator to convert a position code on the tapes to the format (hours, minutes, seconds, frames or feet) selected by the switch.

AUTOMATED PROCESSES, INC., 80 MARCUS DRIVE, MELVILLE, N.Y. 11746.

Circle No. 122

SPECTRA SONICS LINE/DISTRIBUTION AMPLIFIER

SPECTRA SONICS has designed a versatile, solid state, line/distribution amplifier, the Model 109, in the intermediate power range (3 watts) for a wide range of applications. The Model 109 amplifier may be used as: a distribution amplifier to power numerous outputs, for example, 15 or more with 37dB to 43dB gain; high output line or program amplifier for use when unusually high average line levels exist and additional isolated outputs are needed; low output power amplifier, for use with



dynamic program material of a wide range, with output resistance from zero to infinity and power output up to 3 watts.

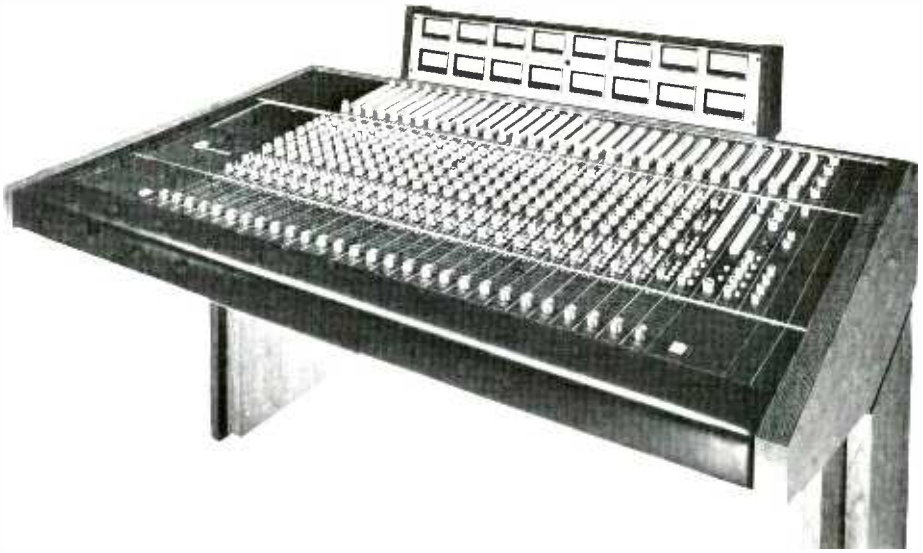
Some performance specifications of the Model 109 are: Gain, 40dB ±0.1dB; output, 3 watts into impedances from 8 to 50 ohms, +24dBM into 600 ohms, frequency response, within ±0.1dB from 50Hz to 50kHz (50 ohms load); output noise, not over an input equivalent of -122dBm, unweighted 20Hz to 20kHz, input terminated 600 ohms. The Model 109 will recover from 1000% overload practically instantaneously (less than 5 microseconds).

The Model 109 is contained on a printed circuit card (2-1/2" x 5" x 1") and is available now.

Price $75.00.

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

Circle No. 123



AUDITRONICS MODEL 501 CONSOLE

SON OF 36 GRAND, Model 501, is an expandable, modular professional recording/remixing console from Auditronics, Inc. of Memphis, designed to accommodate 24 track recording and quad mixdown. Expandable to 26 inputs with complete metering, expandable patching, and a full line of matching accessories.

Up to 26 input channels, each for mic and line with the following: Linear motion fader; microphone gain trim; input on/off switch; solo tape track or input fader; two independent studio cue mixes; echo selectable from monitor channel or input position; echo level control; echo send to four echo chambers in any combination; four knob equalizer; low & high cut filter; equalizer in-out switch; monitor level control; monitor channel assignment L-C-R; monitor sync overdub switch; quad pan pot; quad source selector from monitor matrix or program; independent selection to main 16 output channels.

There are twenty-three program output channels, 16 main, 4 quad, stereo and mono; four echo send & return channels; independent monitor echo return control; two cue channels; four control room monitor channels with automatic change over for multi-track; quad; stereo; mono; and two studio monitor channels.

All console outputs are at +24 dMb capability, balanced, transformer isolated. Also included are talkback and communications facility with independent select & level control to program busses, studio, cue 1, and 2, plus built in test and calibration oscillator, and silent electronic switching for all monitor muting, selection, and input group muting.

Sixteen VU meters are switched to indicate level conditions of 31 output channels, a built-in supply for phantom powering of FET condenser mics is included, and all active circuitry is contained within plug-in modules.

Extensive patching facilities are standard – all line level inputs and outputs are normalled through jacks as well as numerous internal insertion patch points. Total of 288 jacks with space for 624 total.

Master input muting kills all inputs simultaneously. A full complement of accessories including matching equipment cabinet, phase meter, digital stop clock, and Producers desk is available.

Free replacement of faulty parts for one year from date of installation.

AUDITRONICS, INC. 180-B SO. COOPER, MEMPHIS, TN 38104.

Circle No. 126

TAPE-ATHON PROFESSIONAL TAPE RECORDER / REPRODUCER FEATURES ELECTRONIC EDITING

The availability of a new high-performance tape recorder for studio and broadcast application has been announced by Tape-Athon Corp. of Inglewood, California. The new recorder/reproducer has several innovative features, of which the most impressive has been designated "electronic editing" by the manufacturer.

Electronic editing allows the operator to move the tape across the recording heads so precisely that he may actually "split" musical notes and phrases and avoid the tedious practice of physically splicing tape. This precision control is accomplished by putting the recorder in a balanced torque mode which activates the drive motors of both tape reels simultaneously and in opposite directions. In this mode, either reel may be moved manually, in minute increments, without the creeping effect usually experienced in conventional machines.

The new system has been designated Tape-Athon's Model 1001 (ten-oh-one) and incorporates a number

of other user-oriented features. Among these are tach-controlled motion sensing, which detects motion of the tape when switching from fast speeds to recording or play back, and prohibits tape stretching, breaking, or spillage. Other benefits of

the new 1001 are excellent recording quality due to closed loop dual capstan drive, fast tape threading, and a pause control feature that will hold the tape movement as long as the PLAY control is depressed, very advantageous when recording.

Priced at $1,695.00, the new 1001 tape recorder/reproducer is available 30 days ARO.

TAPE-ATION CORP., 502 S. ISIS, INGLEWOOD, CA 90301.

Circle No. 127

THE OMNIPRESSOR FROM EVENTIDE

THE EVENTIDE OMNIPRESSOR is a professional quality dynamic modifier. It combines the characteristics of a compressor, an expander, a noise gate, and a limiter in one convenient package. Its unusually wide range of controls allows it to be used in almost any application where program controlled gain change is useful. Additionally, it can generate new effects, such as infinite compression and dynamic reversal. Dynamic reversal makes high level input signals lower than corresponding low level inputs. Musically, this reverses the attack-decay envelope of plucked string and similar instruments, and gives the effect of "talking backwards" when applied to a voice signal.

The OMNIPRESSOR has a continuously variable Expansion/Compression control which goes from an expansion range of 5 to 1 (gate) to a compression range of -5 to 1 (abrupt reversal), and all possibilities in between. Attenuation and gain limit controls adjust the gain control range from a full 60 db to as little as plus and minus 1 db. Thus, with the gain limit set

at 0, the unit can attenuate up to 30 db, but cannot boost the input signal. Depending upon the setting of the compression control, all signals below 0dbm will not be modified (gain increase limited), while all signals above 0dbm will be attenuated at the appropriate ratio. A step-variable time constant control adjusts attack/decay times over an approximate 100 to 1 ratio. A bass cut switch is provided to limit low frequency response in the level detector.

The unique metering system employs a logarithmic amplifier to generate the following useful information:

INPUT: Reads signal level over a 60db range. Input level control may be used to calibrate the meter in absolute dbm.

GAIN: Reads relative gain of OMNIPRESSOR. Shows how signal level is modified over 60db range. Used in setting up limit controls.

OUTPUT: Reads output level in dbm. Red line warns of possible limiting in output amplifier.

An IN/OUT switch is provided to bypass the OMNIPRESSOR when a return to normalcy is desired. The graph illustrates some of the unusual capabilities of the unit.

EVENTIDE CLOCK WORKS, 265 W. 54TH ST., N.Y.C. 16019.

Circle No. 130

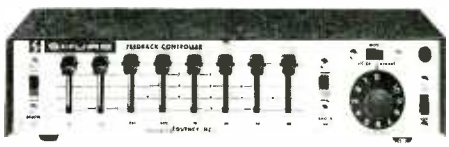
NEW SHURE COMPONENT SOLVES FEEDBACK PROBLEMS

Feedback, one of the most worrisome problems common to sound amplification, now may be drastically reduced through the use of a new dramatically effective component announced by Shure Brothers Inc., Evanston, Illinois.

Called the M610 Feedback Controller, the new unit can be easily added to any sound system for relatively little cost.

In a typical application, the M610 is inserted in the sound system between the preamplifier-mixer and the power amplifier, or between the microphone and the preamplifier-mixer in a single microphone system. Once the M610 is part of the system, its special set of variable depth filters and roll-off switches can be used to smooth out the peaks in the total system's frequency response, so that the system gain may be increased to significantly higher levels before the feedback threshold is reached. The user is able to "tune" the total sound system to correct for the acoustic irregularities of the room, to gain maximum output – without danger of generating feedback. The M610 provides the basic advantages of room-system equalization, but without the very high cost involved in elaborate, complex equalization equipment.

Other capabilities built into the versatile M610 include variable-control preamplification, which allows the user to raise the overall gain of a sound system after "tuning" the room so a direct before and after equalization, comparison can be made. The M610 may also be used to improve sound quality and increase intelligibility by filtering "problem frequencies" that cause oscillating, boominess and other disruptive resonance in acoustically different rooms.



The M610 is self-contained but can be rack mounted in a standard 19" audio rack, with an accessory rack mount kit. A specially fitted lock-on cover is also available as an accessory to guard against tampering with control settings once they have been optimized. Actual size of the M610 is 2-1/2" high, 12" wide, and 7" deep. Weight is only four pounds.

User Net Cost is $117.00.

SHURE BROTHERS INC., 222 HARTREY AVENUE, EVANSTON, ILLINOIS 60204.

Circle No. 132

PENTAGON HIGH SPEED OPEN REEL EIGHT TRACK DUPLICATING SYSTEM

The new PRO-series 2800 Line is directed towards individuals that are starting up new duplicating facilities or expanding their present operations. The new Pentagon Line offers one of the lowest priced professional 8-track

duplicating systems on the market place today.

Features built into all of Pentagon's 8-track duplicators, to name a few, are modular plug-in solid state electronics, full control facilities, fully automated operation for reel to reel duplication, reel master transports available in either 1/4 inch or 1 inch tape configurations, the ability to duplicate 8-track programs directly onto pancakes for later loading into cartridges, or, if you prefer, duplication directly onto cartridge hubs (to eliminate the loading procedure).

PENTAGON INDUSTRIES, INC., 4751 N. OLCOTT, CHICAGO, IL. 60656.

Circle No. 133

ELECTRO SOUND 100 WATT SOLID-STATE POWER AMPLIFIER

A 100 watt solid-state power amplifier, designated the Model 810, is now being made available for professional sound applications. This amplifier joins with other sound components in Electro Sound's complete line for professional sound systems.

Of all solid-state design, the Model 810 is intended for continuous non-attended service in installations where trouble free operation over long periods of time is required. According to Mort Fujii, general manager of Electro Sound, "The Model 810 has several design features that make it especially useful for applications requiring long term reliability. For example, the unit has an internal current sensing circuit which protects the unit from overloads and holds its output within safe operating ranges even if an accidental short should occur. This design feature, along with massive oversized heat sinks for the output transistors, assures maximum protection and reliability."

According to Fujii, the unit occupies only 7 inches of vertical rack space, yet provides a full 100 watt rms output with less than 0.5% total harmonic distortion. Frequency response is ±1 dB from 40 to 20,000 Hz at 100 watts or ±0.5 dB from 20 to 20,000 Hz at one watt. For input versatility, the unit has a pre-wired socket for plug-in bridging or matching input transformers. Standard output impedances of 4, 8, and 16 ohms are provided, plus 50 ohms (70 volt line).

The unit is powered by a standard 117 volt ac input voltage, of either 50 or 60 Hz, and will operate at ambient temperatures up to 55° C. It is also available in a version that contains a +24 and -24 volt supply to power preamplifiers, switching circuits, and similar external devices.

Available for immediate delivery, the Model 810 is priced at $340, end user list price. Literature with description and complete specifications is available on request.

Electro Sound is one of the world's leading manufacturers of high speed tape duplication equipment, theatre, and professional sound system components.

ELECTRO SOUND, INC., 725 KIFER ROAD, SUNNYVALE, CA 94086.

Circle No. 135

NEW INTERCOMMUNICATION SYSTEM FOR SOUND, LIGHTING AND CAMERA CREWS

Lumiere Productions, Inc. announces the formation of its new division Clear-Com. Clear-Com will manufacture its newly developed System CCX100, a closed-circuit intercommunication system designed specifically for the high noise level encountered in the entertainment business.

Clear-Com System CCX100 is designed to provide clear headphone intercommunication for sound, lighting

and camera crews. It is intended for application in production use for concerts, theaters, TV studios, and arenas.

The System consists of two basic units: the Main Station, which houses the power unit, overall system controls, and station controls for the Main Station operator; and the Remote Stations, which are lightweight beltpacks with headphones. Up to 30 Remote Stations can be looped into the system. Shielded two-conductor microphone cables connect stations to the Main Station or to other Remote Stations.

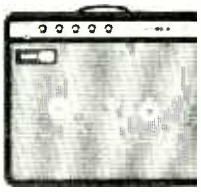
Additional features of the Clear-Com System CCX100 include call light communication and auxiliary input and gain. Call lights back up the audio system to cue operators who have removed headphones. The auxiliary input and gain allow the operator at the Main Station to input additional audio signals to all stations.

CLEAR-COM, 759 HARRISON STREET, SAN FRANCISCO, CA 94107.

Circle No. 136

NEW MODERATE PRICED STUDIO AMPLIFIERS FROM SUNN

Both of these new Sunn amps are rated at 50 watts RMS. The bass amp has an enclosed cabinet with a 15" Sunn Transducer. The lead amp is open-back with two Sunn 10" transducers. The Studio Lead retails for $399.00. The Studio Bass for $379.00.



The Studio Bass has brite and normal inputs plus volume, bass, treble, and presence controls. The Studio Lead has the same control array plus a reverb level control. Both amps weigh about 60 lbs. — light enough for hand carrying.

SUNN MUSICAL EQUIPMENT COMPANY, AMBURN INDUSTRIAL PARK, TUALATIN, OREGON 97062.

Circle No. 137

CLARK/4CH-A FOUR CHANNEL HEADSET

The David Clark Company announces its entry into the 4 Channel Headset market, the Clark/4 CH-A.

In addition to the Clark/4 CH-A Headset, the David Clark Company offers an accompanying DC-2A "Derived Ambience" Decoder designed expressly for 4 Channel Headset use with existing 2 Channel equipment and is physically separate from the headset.

The combination headset and decoder provides a complete system for 4 Channel Headset Listening. The owner uses his present 2 Channel equipment and plays 4 Channel program media, encoded records or FM.

Marketing and Development personnel at the David Clark Company felt the Clark/4 CH-A Headset and DC-2A Decoder System would fill a gap for the headset enthusiast who does not presently own discrete or matrixed 4 Channel equipment but, does desire 4 Channel listening. For those owning discrete or matrixed equipment with appropriate phone jacks the Clark/4 CH-A Headset may be purchased separately without the decoder at $80.00 suggested list price. Headset and DC-2A decoder at $95.00.

The exciting 4 Channel Sound produced by the Clark/4 CH-A Headset is due to the coupling volume which is greater than 100 cubic centimeters and provides a desireable acoustic source impedance. In addition, the decoded 4 Channel signal creates a greater spatial depth totally immersing the listener in the sound field. In spite of the large coupling volume, the moving-coil drivers are capable of low-distortion, high-level output at 30 Hz and uniform frequency response up to 16 kHz.

The decoder mixing ratio provides superb imaging — a strong central image simultaneously with strong left and strong right images. Soloists are unquestionably in the center (if the recording mix-down engineer wanted it that way).

DAVID CLARK CO., 360 FRANKLIN ST., WORCESTER, MASS. 01604.

Circle No. 139

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FOR SALE: 16 brand new MCI I.O. modules (the old model for the JH-416 console)--$500 each. Call or write Alan Kubicka, Sound House, P. O. Box 135, Roselle, Illinois, 60172. Phone: (312) 529-1001.

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Ann Arbor, Michigan 48103

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ENGINEER WANTED: New country atmosphere 8 track studio in the Hollywood Hills. Experienced. Possible partnership; live-in, share English three story house. Incredible potential.
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Recording engineer with excellent 16-track experience to work in Washington, D.C. Send resume to Track Recorders, 8226 Georgia Ave., Silver Spring, MD. 20910

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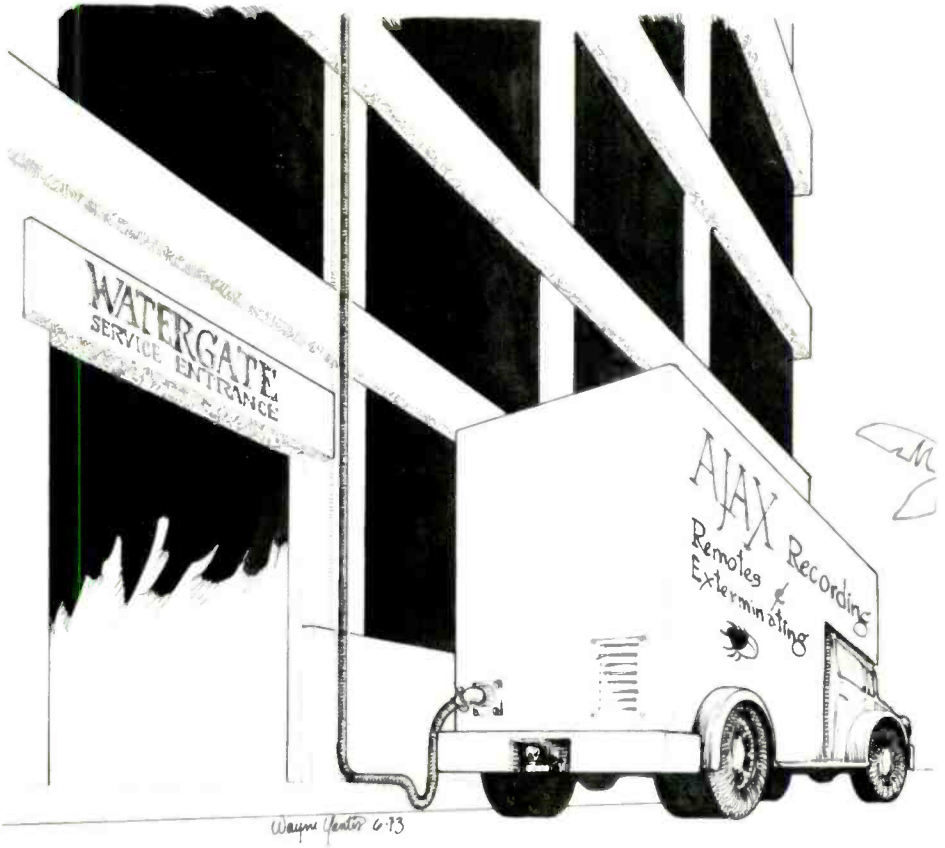
Experienced in professional lighting/sound control package design and construction. Solid technical background, BSEE with credits towards MSEE. Seeking design position in Southern California. For resume, reply to Box PM, 1125A Loma Street, Long Beach, California 90803.

"Engineer with electronics and 8-track experience needs a position as a recordist or set-up man in a 16-track studio anywhere except L.A. Contact Scott Morrison, 2113 So. Garden, Visalia, CA 93277 (209) 732-2747 after 5 pm."

Employment wanted: Engineer, experienced in all phases of recording, mixing, maintenance, construction, and design as well as in music, seeking position with larger studio. Interest and expertise in music recording as well as commercial. For resume and further information write: Box WN R:e/p.



Wally Heider and friend.

When Wally Heider, the internationally known master of the art of location recording, talks about recording techniques, we're very frank to admit that we listen! Imagine how pleased we were to hear him talking about our own SM53 unidirectional dynamic microphone in terms such as these: "The loudest guys in the world, screaming into them, won't break them up"; or "They sound good on any assignment"; or "The front-to-back characteristics are excellent"; or "Whenever I'm not locked into a performer's ov[illegible]icrophone, I prefer to use the SM53." We can tell you about eig[illegible] advantages that can make the SM53 your most effective and [illegible]ng microphone.

Shure Brothers Inc.
222 Hartrey Ave., Evanston, Ill. 60204.

SHURE

Circle No. 140