

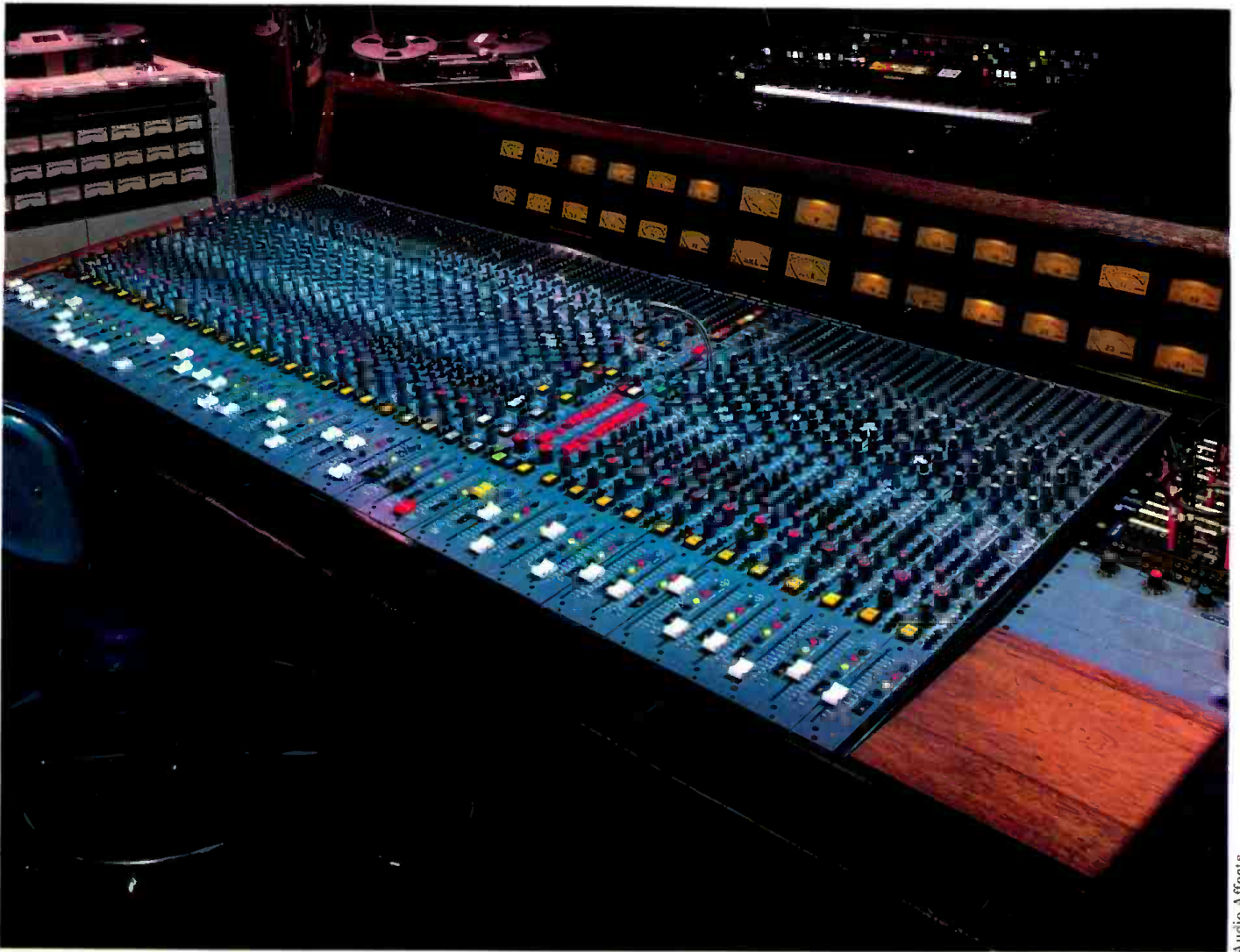
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September 23, 1980

Quite frankly, studios that succeed in the 80's will have to be sensitive, more than in the past, to the desires and requirements of clients. Nothing new about this, of course, but as producers, engineers and artists become more aware of what can or can't be done with certain mixing consoles, the line of selectivity becomes vividly drawn.

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— **The Cover** . . . through the control room window . . . **Spectrum Studios, Venice, California** . . . and this is the view from their front door. Photography by engineer/producer **Michael Boshears**.

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views letters news

JOHN LENNON 1940-1980

The evolution that John Lennon personally underwent was nothing short of remarkable. He pulled himself up by his bootstraps, totally transcending a background that should have been limiting and could very well have been totally stultifying. Much of this history is now well known. In those early days John Lennon did, indeed, experience great pain, and was very much at odds with the world.

By the seventies John Lennon transformed himself into a noted humanitarian as well as a philosopher. His perspective became worldwide - he promoted world unity; concepts like equality under the law for all groups of people, love, peace, and alternatives to war. John had become one of the world's most visible pacifists over the past two decades.

John Lennon was unquestionably one of the world's most inspired artists, and one of its most beloved individuals. He was a leader, a natural-born king, a valuable role model in a world already half-mad with greed, fear, dishonesty and violence.

John Lennon was a very important person.

As record makers. The Beatles were obviously in a class by themselves. In light of the quality, diversity, and originality of their work, it is safe to say they are the finest recording artists seen, so far. The Beatles were unusual in excelling in both content and form. Lennon and McCartney are already the most successful songwriters in the history of popular music, and perhaps the most respected. "Yesterday" and "Michelle" (both comparatively young songs) are already the two most covered songs ever, with more than a thousand recordings by other artists.

The Beatles had exceptional appreciation of form. Not just instrumentation and arrangement, but of recording technique as well. They, along with George Martin and Geoff Emerick, challenged not only the rules, but the very philosophy of recording. They

... continued overleaf ...

from: David Baskind
B & B Audio
Malibu, CA

In the October 1980 issue of R-e/p, I wrote a short piece about Interface Induced Transient Distortion. It has since been brought to my attention that the theoretical reasoning in that discussion was incorrect. Below is a more thorough (and correct) discussion of the phenomena.

The gain of any amplifier will depend on individual stage gain and overall feedback topology, plus the feedback component value. Precisely predictable gain and frequency response, totally independent of individual stage characteristics, is achieved typically by the use of overall negative feedback.

Consider the topology of Figure 1, in which an amplifier with a nominal (open loop) gain of G has its output driving the inverting input through a network with loss factor \mathcal{L} .

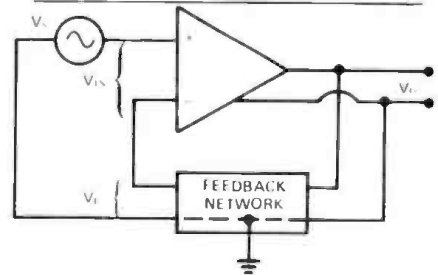


Figure 1: Typical amplifier topology with a four-terminal feedback network.

The network loss, \mathcal{L} , multiplied by the output voltage, V_o , is equal to the feedback voltage, V_f , which opposes the flow of the input source voltage, V_s . The net input voltage to the amplifier, V_i , is thus $(V_s - V_f)$. This is amplified by the open loop gain, G , so that the output voltage, V_o , becomes:

$$V_o = G (V_s - V_f)$$

$$\text{or}$$

$$V_o = G (V_s - \mathcal{L} V_o) \quad \text{Equation 1}$$

Transposing Equation 1, we obtain:

$$(1 + \mathcal{L}G) V_o = GV_s$$

The closed loop gain, A , is therefore:

$$A = V_o/V_s = G/(1 + \mathcal{L}G) \quad \text{Equation 2}$$

For conditions in which the product $(\mathcal{L}G)$ is much greater than 1, Equation 2 reduces to:

$$A = 1/\mathcal{L}$$

In addition to constant gain systems, negative feedback can be used (or may cause) non-flat frequency response.

In general, the frequency response of a negative feedback amplifier is a mirror image of its feedback network's "stand alone" response. Simple examples of typical topologies are shown in Figures 2, 3 and 4.

In the real world, amplifiers have non-flat open loop response (see Figure 5), and non-

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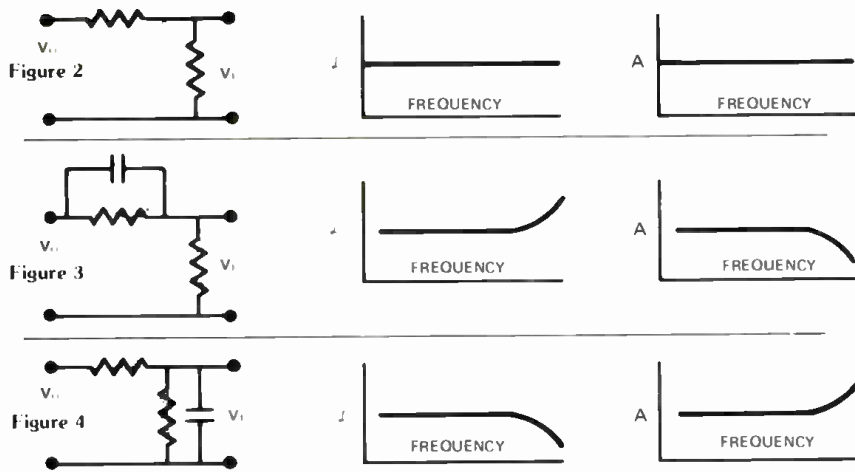


Figure 2: Network and feedback characteristics of a simple two-resistor feedback circuit.
 Figure 3: As Figure 2, but with a different feedback topology.
 Figure 4: As Figure 2, but with another feedback topology

linear output impedances, which may be simulated by resistor-shunted inductors (Figure 6).

Both of the above characteristics must be considered when interfacing an amplifier.

As an example, we shall now consider the case of a power amplifier driving a loudspeaker. A simplified model of the resulting total feedback network is shown in Figure 7. L is the effective amplifier output inductance, R₁ the effective amplifier output resistance, C the load cable capacitance, R₂ the effective loudspeaker impedance, R₃ the amplifier feedback resistance, and R₄ the inverting input shunt resistor.

For simplification, the losses generated by resistors R₁ and R₄(L₁) been broken down as one section, and those generated by R₁, R₂, C and L(L₂) as a second section.

The feedback voltage is then:

$$V_i = L_1 L_2 V_o$$

and the effective gain:

$$A^* = 1/(L_1 L_2)$$

The voltage appearing at the speaker, however, is:

$$V_o(L_1 \text{ or } L_2; V_i \sqrt{(L_1 L_2)})$$

which is simply V_o/L_2 , or $(R_1 + R_4)/R_4$ multiplied by V_o .

Which is misleading, however, unless one takes into account the fact that the source signal is delayed by the L and C components in the feedback loop, causing phase distortion of the output signal.

This phenomena may be predicted mathematically by Laplace Transform

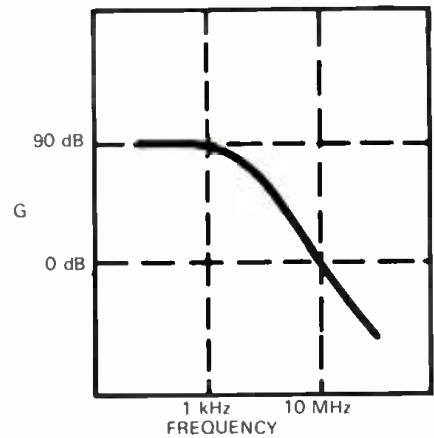


Figure 5: Typical open-loop response of an NE5534 operational amplifier.

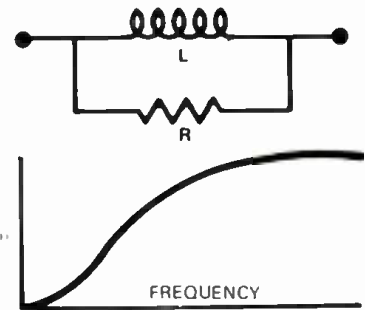


Figure 6: Output impedance as a function of frequency for a simple resistor-shunted inductor.

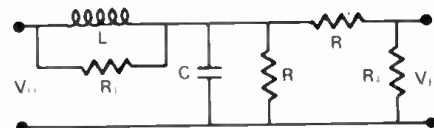


Figure 7: A simplified model of a feedback network representing a power amplifier driving a loudspeaker load.

JOHN LENNON 1940-1980

founded the *painting* school of record production, where there is nothing inherently correct or desirable about an instrument's natural tone — it being merely the starting point — and any and all techniques and tools can be applied without stigma, toward creating new sounds.

John Lennon led the charge as far as experimentation went, and if anyone should be called "*The Father of Painting*", it is he. It was his notion that every track should have its own sound, and thus be treated differently. He would regularly ask George Martin to cook up some new effect to make his voice sound like somebody else's. Early tracks, such as "Rain", "She Said, She Said", and "Tomorrow Never Knows", brought to the fore unnatural textures, backward tracks, strange sound effects, and bent vocals. In so doing he and the Beatles ushered in recording's most fertile era. The Beatles generated technology — most notably ADT (cum: phasing), and arguably, multitrack recording itself. In 1967 John Lennon prophesied 64-track recording.

Because The Beatles recorded almost exclusively in England, and the fact that John Lennon was inactive during the latter half of the Seventies, not many in the American recording industry had the opportunity to spend much time with John. I count myself among the privileged few who did. The occasion in April of 1974 was two days of recording for Harry Nilsson's "Pussycats" LP, at the Burbank Studios. John Lennon was producing, Roy Cicala engineering, and Jimmy Iovine seconding.

A renowned cast of players was assembled: Danny Kootch and Jesse Ed Davis on guitars, the reclusive Klaus Voorman on bass, Jane Getz on keyboards, and horn men Bobby Keys, Chuck Finley, Jim Horn, and Trevor Lawrence. Rounding out the team were three drummers — Ringo, Jim Keltner, and the late Keith Moon.

I was impressed the moment Lennon arrived. He was dressed in flared jeans and a simple t-shirt. He looked the proper post-"Pepper" Beatle with short hair and granny specs. He seemed in good health and excellent spirits, even though this was during his "lost weekend" — the 18 month separation from Yoko — during which he was desperately unhappy, and drinking to excess.

... continued overleaf —

techniques. Since the process is somewhat involved, we will refer the reader to textbooks on the procedure, which runs as follows:

- 1 - Writing the network characteristics in Laplacian form.
- 2 - Algebraically separating the real and imaginary mathematical parts.
- 3 - Calculating the Arctan (imaginary/real part) to determine the phase angle at various frequencies.

The physical effect can easily be seen by monitoring across a loudspeaker with an oscilloscope while sending a square wave into the amplifier input. Typical results seen on the scope screen will be transient distortion in the form of overshoot and sometimes ringing.

from: **Bruce Mallion
Stoneham, MA**

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STRESS

IN THE
RECORDING STUDIO

by Marilyn Davison
and Howard J. Davison

A certain amount of stress is vital during the creative process of recording. However, when it gets so bad that you can't sleep nights, then's the time to possibly examine your work situation . . .

**Case Study — Maintenance
Engineer, Aged 29 Years, Married**

P. works a shift pattern of, on average, 12 hours on, 12 hours off. This is often disrupted, however, and he frequently works 18-hours shifts with little time between them. He travels to and from work by car. The distance is 30 miles on a heavy traffic route that for the past four years has

the authors —

Until recently **Howard J. Davison** was Senior Lecturer in Electronic Music, Music Technology, and Composition at the Queensland Conservatorium of Music, Brisbane, Australia. He has produced and/or recorded a number of albums, and written several articles on the recording scene in Australia. He is now living in the U.K., working as a free-lance composer.

Marilyn J. Davidson, M.A., has been researching the area of occupational stress for the past five years, and is author of over a dozen papers on the subject. She is currently continuing her research at the University of Manchester Institute of Science and Technology, England.

been under repair and reconstruction, causing long delays. The journey time takes approximately an hour. The London studio at which he works is very modern and well equipped. The bulk of studio time is session album work and mainly *New Wave*. Engineers tend to be aggressive and demand high standards of maintenance. *P.* has been responsible for the coordination of both construction and equipping of the studio; on its completion he was hoping for the position of studio manager, for which he is well qualified. Instead he was offered the post of third maintenance engineer. Since that time he has been passed over for promotion many times. He is non-aggressive, diligent, and believes the studio cannot run efficiently without him; he is very good at his job. His wife, who also pursues a career, is on Valium, cannot sleep, and is generally in a state of permanent dissatisfaction. The couple no longer receive invitations to social events and engagements, as they were often broken. They do not have many friends and consequently cannot turn to them for help, understanding and advice. Recently both have visited their doctor, who advised *P.* that his future was in Intensive Care in two years if he kept up the same work pattern. *P.* admits, when questioned, to feeling in a permanent state of jet lag; his work situation is a source of great stress. Bands that frequent the studios have numerous non-musical habits, and the maintenance workshop seems to be a place of sanctuary for engineers, in which to dissipate their built-up aggression and frustration. This is usually directed at anyone who happens to be in the workshop. *P.*, however, on the advice of a career consultant, decided his only choice was to get out. He began to work at home, and then left the organization altogether to move to a more relaxed work environment, in a different, but related, area.

We all live with stress. In fact, without a certain amount of stress we would become understimulated, bored, and — ultimately — “stressed!” Nevertheless, as individuals we have optimal levels whereby we are able to cope with a number of noxious variables and events, known as stressors, and it is when this delicate balance is upset that harmful stress results. Much research has been done in the 50 years regarding the social and cultural factors related to stress. There is much evidence suggesting that the more affluent societies, including the USA and Britain, have higher incidences of chronic stress-related diseases — such a coronary heart disease — than do less affluent societies.

As well as societal influences, extensive research strongly indicates that job stress contributes to poor physical and mental health, plus other stress-induced behaviors such as alcoholism, excessive smoking, high divorce rates, drug abuse and even suicide. In fact, certain specific occupations — for example, police, air traffic controllers, and dentists — have been isolated as high-stress occupations, in which employees are highly susceptible to developing stress-induced maladies. We believe that the job of recording studio personnel, particularly studio engineers, is yet another high risk occupation in terms of work-related stress.

The true case study of *P.* is by no means atypical. However, his ultimate coping strategy — quitting the job — is surely not the only alternative. By presenting evidence of potential high stress factors that may be faced by an engineer in the studio environment, we hope that this article will enable studio personnel at all levels to become more aware of these potential hazards. And hence be more alert in facilitating suitable strategies for coping with them.

While our reference to the stressors inherent in studio professions are subjective in nature (to date we are unaware of any specific study investigating this group, excepting a study carried out by Edward R. Kealy), we have structured our review to the following major stress sources that previous occupational stress research has isolated:

- A) Factors intrinsic to the job
- B) Role in organization
- C) Career development
- D) Relationships at work
- E) Organizational Structure
- F) Health factors
- G) Effects on social and family life
- H) Stress and individual differences

A) Factors Intrinsic To The Job

Sources of intrinsic stress for a variety of occupations include poor working conditions, shift work, dissatisfaction with equipment, job overload and underload, and physical danger.

Physical Working Conditions: Poor and inadequate working conditions have been found to induce frustration, impair work performance and enhance job dissatisfaction. Studies by social scientists have indicated that enclosed and isolated work environments contribute significantly to feelings of isolation, time distortion, heightened emotional responses, and intensified inter-personal relationships. In fact, the soundproofed, windowless, “behind-closed-doors” environment of a studio is perhaps more suited to encounter-group therapy than music recording. However, with the development over the last decade of acoustic/aesthetic design concepts, working conditions have improved enormously. The modern notion of a comfortable and tastefully

**JOHN LENNON
1940-1980**

Roy Cicala introduced us. John showed no signs of his volatility. He was warm, witty, humble — everything that I wanted him to be.

But, he was no pushover as a producer. On one of the nights they got two basic tracks: “Rock Around The Clock” (plus a sub-one-minute goof version that was eventually included on the album as well), and the old Johnny Thunder chestnut, “Loop de Loop”. Being primarily an artist (much less one of cosmic inclinations), I expected John to be inattentive to detail, unduly partial to feeling over technique, and go no more than a few takes. I couldn't have been more wrong! He was hard to please, and egged the band on with lusty cries, “. . . pick it up, pick it up!” They went through 18 and 15 takes respectively, until he was satisfied.

The legendary Lennon humor was very much in evidence. A brief anecdote: A motley assemblage of musicians, roadies, girlfriends, and hangers-on had gathered in the studio for background vocals and clapping on “Loop de Loop”. I was out there with them having been inveigled to join by Ringo (one of many kind gestures he and Madman Moon extended). We were not the best of singers, surely, but that was okay as the song called for a loose, rowdy, a party kind of background vocal sound; where it's the spirit of the thing that counts. So there we were, with Nilsson conducting and jiving up front. The group couldn't seem to keep time clapping (a joint reflection not only of the non-musicians in the bunch, but also the beer), so John suggested we drop the clapping and concentrate on singing. The third take was the one. “Tha's great”, came John's voice over the talkback. “It sounds jus' like a whale singin'”.

John Lennon was very much alive, very much awake, and accomplished much. The grim and senseless manner of his death can't help but underscore his life and his messages: quality, equality, love, truth. Perhaps even more important, he made people aware that there are other possibilities, always alternatives. He taught people to question — question everything! John Lennon didn't say it, but he could have: “Be at least as careful of used ideas as you are of used cars”.

Paul Laurence

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decorated studio (some of which now incorporate windows), together with state-of-the-art equipment ergonomically arranged in a total design, means that both engineer/producer and artist can work in relative comfort for long periods without fatigue. And if other amenities exist, such as game rooms, showers, sleeping and cooking facilities, so much the better.

But not all of us work under such conditions. What of the other, more common, situations found in smaller studios, mobiles, O/B units, location recording, TV and radio? Very long hours spent in smaller mobiles can be extremely tiresome. High concentration levels are necessitated by live recording — usually after the arduous process of setting up, sound checks, equipment checks, fault-finding and repair, and other assorted headaches. Location recording in small, drafty, and often acoustically imperfect rooms, can stretch patience and lead to anxiety. Again concentration levels are high since most recording done under these circumstances is either a chamber, orchestral or operatic performance, and therefore both expensive and demanding. Hours spent closed in minute spaces at the end of a vision O/B truck is no fun. Good sound is more often than not achieved (and ignored by directors) in acoustic conditions that can be equated, for example, with vision mixing in the open air with the sun behind you.

Equipment: In jobs such as studio engineering, where the quality of work is very dependent on efficient and proper maintenance, equipment reliability is very important. Complex studio hardware can be and frequently is a problem, not only because of reliability but also in terms of the level of technology. Much has been written on the effects of automation and the workforce. In most industries the feeling is that automation means less jobs; in music recording, however, automation is rapidly gaining acceptance. Engineers, artists, and producers alike, all see automation as a time-saving and musically beneficial aid that can and, in some cases does, lead to a better end result. But the high degree of automation and sophistication employed in some studios may result in job "underload;" more of that later.

Equipment is becoming more and more complex, as new ideas, concepts, technology, and techniques are developed. Studio hardware is constantly being renewed and updated as new products come onto the market and, as is often the case, equipment will be installed that neither the engineer nor the maintenance staff have had time to properly evaluate or explore. Subsequent frustration, misuse, and wrongful operation can result in equipment gaining a bad reputation through no fault of either the engineer or the manufacturer.

The need to finish a session on time, to bring in an album on time, to finish a show on schedule; all are becoming more and more important. Breakdowns through equipment failure can cause severe delays, resulting in not only embarrassment and a significant risk of future work, but also severe pressures on studio staff to rectify the fault quickly and efficiently. Producers and artists can also suffer: a break in the creative chain of thought, loss of impetus, getting behind schedule, increased financial expense, and so on. Obviously, this kind of scenario is not conducive to good work. The not so evident inferiority complex of the artist, often hidden behind various crutches, can suddenly

emerge in such circumstances — with sometimes disastrous results.

Shiftwork: Numerous occupational studies have found that shiftwork is a common occupational stressor, and can affect neurophysiological rhythm — blood temperature, blood sugar levels, metabolic rate, work motivation and mental efficiency — which may ultimately result in stress-related disease. However, shiftwork becomes physically less stressful as individuals habituate to the condition. Nevertheless, the long hours and shifts that are now part of studio life can cause significant problems. By virtue of its flexibility, multitrack recording is a cost-effective method of working, saving time and money for artists and recording companies. However, whereas the various artists involved do not necessarily have to be brought together for the recording, the producer and engineer are always required to be in attendance. In a recent interview (*R-e/p*, January 1979 issue, Vol. 10, No. 1) leading producer George Martin was asked: "Why do you think there is such a difference between English and American engineers?"

To which Martin responded: "I think there are different pressures on English engineers. They are not well paid... while on the other hand I don't think they have the internal pressure that American engineers face. Here in the States we seem to grind the engineers into the dust, and expect them to be there the following morning at 8:00 a.m. when they have just finished a session at 4:00 a.m. They're expected to work 'round the clock, and weekends are an automatic rule. You question one of them here: 'What do you mean you didn't have a holiday this year?', and he'll answer, 'I haven't had a whole day for the past five years.' I think we treat engineers a bit more humanely in the UK, even if we do pay them worse."

This type of extended shiftwork not only disrupts an engineer's family/social life and health, but can also affect job performance, especially when suffering from gross fatigue due to the inability to sleep during the day. A feeling of exclusion and separation from society and family or social life is a common feeling among studio personnel subjected to erratic shiftwork. Often not enough time can be allowed to adjust to normal daytime working, unlike other industries where adjustment periods are enforced.

Physical Danger: Although the threat of physical danger in the studio environment is not as much of a problem as it is for other occupations (such as mine workers, firemen and police), studios have their own physical dangers. Apart from electrocution, falling microphone stands, plus hernias and back trouble through lifting heavy equipment, the most apparent danger lies in the often expressed and frequently disregarded warnings of high sound-pressure levels (SPL) in the studio. This is a true source of danger, yet engineers repeatedly ignore the evidence at their peril. In most cases an engineer is complying with a request to "turn it up," and there is not much he or she can do about it. It is a cause for concern that a common remedy is to reach for the aspirin, and not the level control.

Job Overload and Underload: Work overload can be seen as being either qualitative (i.e., too difficult) or quantitative (i.e., too much), and has been associated with poor job performance, excessive cigarette smoking, and other stress-related symptoms such as escapist drinking, lowered self-esteem, and low work motivation. Job underload on the other hand has been associated with routine, repetitive and

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— continued on page 112 —

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STUDIO UPDATE

Northeast:

■ **CENTEL** (Boston, Massachusetts) is **ROSS CIBELLA'S** new one- and two-inch video post production facility. The complex is situated in a former RKO movie palace near Fenway Park, and is a three story, 15,000 square foot operation boasting a computerized CMX editing suite, 30' x 60' video shooting stage, video control room, and full support facilities. Architect **JOHN STORYK**, who was also responsible for Tod Rundgren's video complex in Woodstock, New York, designed Centel to meet all professional audio requirements. Cibella is also the owner of Boston's Century III Recording Studios. 851 Beacon Street, Kenmore Square, Boston, MA 02155. (617) 267-6400.

■ **GREEN STREET RECORDING** (New York City) is the reincarnation of **BIG APPLE RECORDING STUDIOS** following extensive renovations. The 20' x 35' studio has a 22' x 16' control room centered around a Trident TSM 28 x 24 console with Allison Fadex Automation, coupled to an MCI JH-114 24-track recorder. Monitors are UREI variable position 811s, JBL 4311s and Auratones powered by Crown and BGW amps. Mounted in the outboard rack are an Eventide 1745 DDL, Lexicon Prime Time™ and DDL, Marshall Time Modulator,™ Eventide Harmonizer,™ Orban Reverb and compressor/limiters by Audio & Design, Neve and UREI. Dolby noise reduction is offered along with mikes by Neumann, Sennheiser, Shure, Sony and a number of tube models. A Steinway concert grand piano heads the instrument list. 112 Greene Street, New York, NY 10012. (212) 226-4278.

■ **MUSICOR RECORDING STUDIO** (Philadelphia, Pennsylvania) has added to its instrument collection with the purchase of a set of Indian Tablas Drums. The studio is equipped with a TEAC Tascam 80-8 recorder with dbx noise reduction, and a Tascam mixing console. Recent sessions include demo tracks for song writer **JOHN BELLMON** with assistant engineer **CURTIS BRACY**. 2539 West Columbia Avenue, Philadelphia, PA 19121. (215) 763-0741.

■ **ROAR PRODUCTIONS** (Columbia, Maryland) has opened an 8-track demo studio on the premises of Eastern Audio Associates, a major cassette duplicating firm. The studio design combined input from Roar, Eastern Audio, **JOHN KENDALL** of Professional Sound, Inc., of Falls Church, Virginia, and **MARK DONOVAN** of Rockville, Maryland. The facility houses a custom mixing console imported from Nova Sound in San Francisco. Oakland Center, 8980 Route 108, Columbia, MD 21045. (301) 596-0600.

■ **SECRET SOUND STUDIO** (New York City) has promoted **LYNN S. HANNA** to the position of studio manager, with **KRYS MURPHY** assuming the post of assistant studio manager. Secret Sound president **JACK MALKEN** also announces the addition of **DENNIS DRAKE** to the engineering staff. Drake's background includes work with Bette Midler, ABBA, Paul Simon, Linda Ronstadt, and The Beach Boys. 147 West 24 Street, New York, NY 10011. (212) 691-7674.

■ **SUSQUEHANNA SOUND** (Northumberland, Pennsylvania) is now in its new facility which boasts the new Auditratics 40 x 24 computerized "Memphis Machine" console. The complex was designed by **JOHN STORYK**, while the equipment was purchased through **BOB TODRANK** of Valley People of Nashville, including UREI 813 Time Aligned™ monitors for the studio's control room. **BOB SPANGLER** is the manager at Susquehanna. 48 A Street, Northumberland, PA 17857. (717) 473-9733.

■ **TURTLE BEACH RECORDINGS** (York, Pennsylvania) reports the addition of a Mutron digital delay, Omni-Craft GT4 gate, Technics RSM85 cassette deck, and Vox Continental organ. Owner **ROY SMITH** adds that the studio will soon be delivery of a Tangent 3216 console. 1912 Alcott Road, R.D. 22, York, PA 17402. (717) 757-6344.

— ACTIVITY —

CELEBRATION RECORDING (New York City) has engineer **MICHAEL FARROW** in working on an album for the **NEW YORK BRASS QUINTET**. Also in the studio: **MX80 SOUND** recording their third album, *Crown Control*, for Ralph Records. The LP is being engineered by **MARK HOOD** and produced by **MARK BINGHAM**. 2 West 45th Street, New York, NY 10036. (212) 575-9095. □ **FRANKFORD/WAYNE MASTERING LABS** (New York City) reports mastering the latest LP by **KOOL AND THE GANG**, *Celebrtion*. Engineer for the project was **TOM COYNE**. Also recently completed was the latest album by **THE BABYS**, with mastering by engineer **JOE GASTWIRT**. Both projects were done in Franford/Wayne's computerized Room "E." 1697 Broadway, New York, NY 10019. (212) 582-5473. □ **RPM SOUND STUDIOS** (New York City) finds **RUPERT HOLMES** is recording a new album for MCA with engineer **MIKE DELUGG**, and **PAMELA STEVENS** and **THE BOBBY BARE BAND** in laying down tracks with engineer **NEAL TEEMAN**. 12 East 12th Street, New York, NY 10003. (212) 242-2100. □ **SIGMA SOUND STUDIOS** (New York City) finds **THE SPINNERS** doing overdubs on their new Atlantic LP with producers **MICHAEL ZAGER** and **JERRY LOVE**; **MICHAEL HUTCHINSON** is engineering. The studio recently finished overdubs on **LEON HUFF**'s self-produced album for PIR with Sigma's **DIRK DEVLIN** at the board, while **BRIAN ENO** and engineer **JOHN POTOKER** are in working on a special project for E. G. Records. 1697 Broadway, New York, NY 10019. □ And at **SIGMA SOUND STUDIOS** (Philadelphia, Pennsylvania), **THE JONES GIRLS** are recording a commercial for a line of Teddy Pendergrass jeans. **DEXTER WANSELL** is producing the PIR project for Tyson & Partners Advertising, while **BLUE MAGIC** is refining its upcoming Captiol album with producer **NORMAN HARRIS** and engineer **ARTHURSTOPPE**. Producer **JAMES PURDIE** is engaged in mixing for **RARE ESSENCE** with engineer **JIM GALLAGHER**. 212 North 12th Street, Philadelphia, PA 19107. □ **SOUND IDEAS** (New York City) booked time for **MASABUMI KIKUCHI** ("POO") to record tracks for a new album on Eastwind Music. **KIYOSHI ITOH** produced "Poo," who programmed and performed on the 21 synthesizer set up. Also in for Eastwind and Itoh was **THE HANK JONES TRI** mixing a live album recorded at the Village Vanguard. 151 West 46th Street, New York, NY 10036. (212) 575-1711. □ **STARR RECORDING** (Philadelphia, Pennsylvania) has **TINY TIM** in doing vocals for an animated film by 1980 Oscar nominee **PAUL FERLINGER**. **LARRY GOLD** is producing with **DAVE STAROBIN** at the console. **VINCE MONTANNA, JR.** is also working on his new album at Starr, while **JERRY COHEN** of the McFadden, Whitehead and Cohen writing team is doing production work with his new band and engineer, **CARL PARUOLO**. 201 Saint James Place, Philadelphia, PA 19106. (215) 925-5265.

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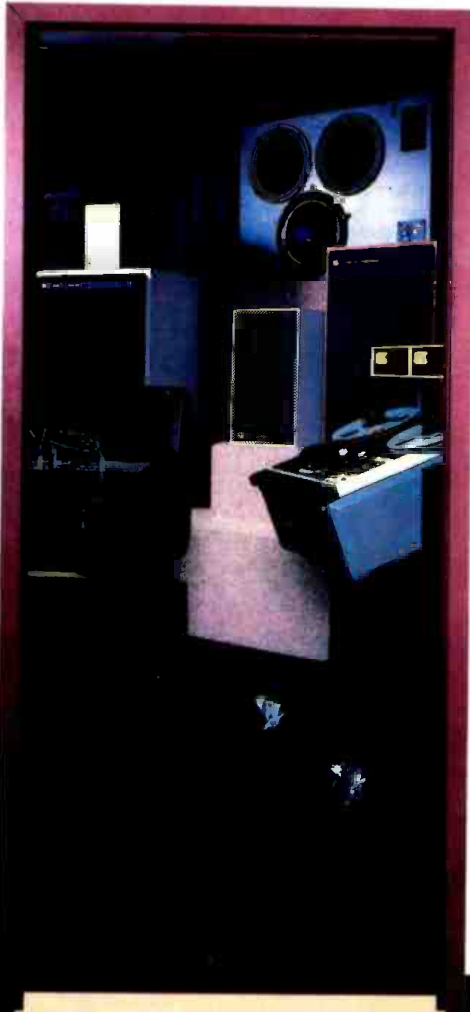
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STUDIO UPDATE

Southeast:

■ **COTTON ROW RECORDING** (Memphis, Tennessee) has opened its doors for business after fine-tuning its newly built studio. Owner **WARD ARCHER, JR.** had the facility acoustically designed by Phase Audio of Memphis under the supervision of Stephen Durr and Associates of Nashville. The operation features an Ampex MM-1200 16-track recorder, Audiotronics 501 console, Electro-Voice monitoring system with White equalization, as well as noise reduction, Lexicon digital delay, Roland phasers, and a selection of instruments and microphones. Ward, a member of the governing board of the Recording Academy and Music Industries of Memphis, runs the studio with his associate **NIKOS LYRAS**, (*Archer, right; Lyras, left*) who has experience as an engineer/producer in Greece. (*Madison Avenue, Memphis, TN.*)

■ **FANTASY SOUND STUDIOS** (Granite Falls, North Carolina) has completed upgrading to 16-track with the addition of a TEAC Tascam 85-16 tape machine. Among the new outboards are the URSA Major Space Station, Omni-Craft noise gates, JBL 4313 monitors, Roland Dimension D effects processor, and Bi-Amp equalizer. The studio has also completed extensive acoustical treatment of the control room, room geometry and surface treatment having been prepared by **JIM BRAWLEY** of Clemson, South Carolina. Other features of Fantasy are a wide variety of keyboards, guitar, and instruments amps, as well as Crown power amps, dbx compressors, and mikes by Neumann, Sennheiser, AKG, E-V, Shure, and Sony. *14 Woods Drive, Granite Falls, NC 28630. (704) 396-1188.*

■ **SCENE 3 VIDEO** (Nashville) has been formed as a subsidiary of **SCENE 3 INC.**, according to the company's president, **KITTY MOON**. Video professionals from the major production areas have been recruited, and state-of-the-art equipment is being installed, including a CMX 340X editor, a Vital switcher with 140 effects patterns, and the Emmy-winning Squeezezoom™ which provides multichannel digital effects. One- and two-inch video tape machines are by RCA. Chairman **MARC BALL** adds that design of the editing facilities emphasizes the creative aspects of editing and the editor's environment. The company will occupy a 6,000 square foot facility and begin its operations around the New Year. One of the first major staff appointments is that of four-time Emmy nominee **TERRY CLIMER** to the post of chief editor. *1813 8th Avenue South, Nashville, TN.*



Cotton Row

South Central:

■ **DODSON PRODUCTION** (Houston, Texas) announces the upgrading of their **A-SIDE RECORDING STUDIOS** to 24-track capability. The new gear is centered around a Tangent 3216 mixing console feeding an Otari MTR-90 recorder. These, as well as an Eventide Harmonizer,™ Neumann mikes, and other peripheral equipment, were supplied by Westbrook Audio of Dallas. *108 Berry Road, Houston, TX.*

■ **REELSOUND RECORDING COMPANY** (Manchaca, Texas) supplied its 24-track remote bus for concert dates by **MAZE** and **A TASTE OF HONEY** in New Orleans. The dates were recorded and video taped for a live album by Maze with **JOHN PALLADINO** producing, and **DAVID COLE**, **MALCOLM HARPER**, and **GREG KLINGINSMITH** sharing engineering chores. *P. O. Box 280, Manchaca, TX 78652. (512) 472-3325.*

■ **STAR TRACK STUDIOS** (Tulsa, Oklahoma) recently updated to 16-track with the addition of an Otari MTR-90 multitrack machine. Other newly installed gear includes an EXR Aural Exciter, and Neumann and AKG microphones. **ROD SLANE** is owner/studio manager of Star Track. *1423 South Xanthus Place, Tulsa, OK 74104. (918) 742-6688.*

— ACTIVITY —

ARTISAN RECORDERS (Fort Lauderdale, Florida) provided its 24-track mobile recording facilities for a live broadcast by **SPYRO GYRA** from Gusman Hall in Miami this past Fall. Artisan president and chief engineer **PETER YIANILOS** handled the mixing chores for this event, as well as for a broadcast series by the **FORT LAUDERDALE SYMPHONY ORCHESTRA** and for a Media Intermix video production featuring **RONNIE MONTROSE'S** new group **GAMMA**. Yianilos and Montrose mixed the 24-track tapes from the latter date at Triad Studios. Artisan also announces the addition of **SCOTT STRAWBRIDGE** to the position of general manager. *5077 North East 13th Street, Fort Lauderdale, FL 33334. (305) 491-3132.* □ At **ADVENT RECORDING** (Memphis, Tennessee), **DENISE LASALLE** has finished recording and producing a new album for MCA entitled *Equal Rights Amendment*, and **JOESIMON** has been producing an album with **PORTER WAGONER** for the Posse label. Ardent engineer **ROBERT JACKSON** was in the control room for both sessions, while **JACK HOLDER** recorded demos of new material for **JIM DANDY MANGRUM**, formerly of Black Oak Arkansas. *2996 Directors Row, P. O. 30012, Memphis, TN 38130. (901) 396-8700.* □ **COLUMBIA RECORDING STUDIOS** (Nashville) reports activity by **WILLIE NELSON'S BAND** recording an album for lead guitarist **JODY PAYNE**, with **FOSTER** and **RICE** producing and engineering handled by **RON REYNOLDS**. **BILLY SWAN** is also in recording tracks with producer **LARRY ROGERS** for his upcoming Epic project, and **THE DALLAS COWBOY CHEERLEADERS** are working on their first single. *We Love the Cowboys. 34 Music Square East, Nashville, TN 37203. (615) 259-4321.* □ At **CRITERIA RECORDING STUDIOS** (Miami, Florida), **GRACE SLICK** is doing overdubs and mixing on her forthcoming solo LP for RCA. She is being produced by **RON FRANGIPANE** with **ED SPRIGG** engineering. Criteria was also the recording site for **HARRY CHAPIN'S** latest LP for Neil Bogart's new label, Boardwalk Records. **RON** and **HOWARD ALBERT** produced the album, which includes the single, "Sequel." **CHUCK KIRKPATRICK** engineered, while mastering of the album and single was handled at Criteria by **MIKE FULLER**, who also performed the same duties for **BARRY MANILOW'S** latest 45, "I Made It Through the Rain." *1755 North East 149th Street, Miami, FL 33181. (305) 947-5611.* □ **THE SOUND EMPORIUM** (Nashville) has been recording **THE MARSHALL TUCKER BAND'S** upcoming Warner LP, *Ride In Peace*, with producer **TOM DOWD** and engineer **KEVIN HERRON**, while **PAUL ANKA** was in the studio working on his new album with **LARRY BUTLER** producing and **BILLY SHERRILL** at the console. Mixing is also proceeding on **MERLE HAGGARD'S** new gospel album engineered by **JIM WILLIAMSON**, *3102 Belmont Boulevard, Nashville, TN 37212. (615) 383-1982.* □ **TRIAD RECORDING STUDIOS** (Fort Lauderdale, Florida) provided its facility to **NEIL YOUNG** for his latest album, *Hawks and Doves*, with **MICHAEL LASKOW** credited for engineering the song "Lost in Space." Mixdown has also been completed on six songs by **YARROW KEARNEY** with Laskow at the board while **THE SOPHISTICATES** have produced themselves on a number of demos requested by interested labels. *5075 North East 13th Avenue, Fort Lauderdale, FL 33334. (305) 771-1431.*

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R-e/p STUDIO UPDATE
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STUDIO UPDATE

Midwest:

■ **AUDIO MIXERS RECORDING COMPANY** (Chicago, Illinois) announces the opening of an additional studio. The new Studio B augments the old 16-track Studio A, and is said to offer greater scheduling flexibility and up to eight tracks for live recording and audio-visual mixing. New offices and film transfer rooms are also included in the recent expansion. 740 North Rush Street, Suite 603, Chicago, IL 60611. (312) 943-4274.

■ **PRISM RECORDING STUDIOS** (Harvey, Illinois) have taken delivery of a new Otari MTR-90 24-track recorder from Pyramid Audio of South Holland, Illinois. The tape deck has been linked to the studio's new Neotek Series III console. New processing gear includes the dbx 900 signal processing rack, a MICMIX XL-500 digital-analog reverb, and the EXR EX-3 Exciter. Control room monitors are Electro-Voice Sentry IIIs powered by Crown amps. Amongst other outboard equipment can be found an Eventide Harmonizer™, a URSA Major Space Station, MXR digital delay, and UREI and dbx compression. Mikes are by E-V, Neumann, Sennheiser, Crown and AKG. Studio manager **STEVE MC CARTHY** reports that recent activity includes sessions by **HUMBLE PIE** and trumpeter **ELMER BROWN** from **EARTH, WIND, AND FIRE**. 16036 Union Avenue, Harvey, IL 60426. (312) 339-8145.

■ **SAINT PAUL PUBLIC SCHOOLS** (Saint Paul, Minnesota) is taking delivery of a new 8-track recording system for their Performing Arts Center. The equipment, supplied by AVC Systems of Minneapolis, is based on an Otari MX-7800 one-inch 8-track recorder coupled to a Tangent 3216 16-input console. Peripherals include a Lexicon Prime Time™ digital delay, a MICMIX XL-500 reverb, and a selection of compressors, limiters, and parametric equalizers. Minneapolis/Saint Paul, Minnesota.

■ **SOLID SOUND** (Ann Arbor, Michigan) has broken ground on a new 600 square foot addition to the studio, which will house an isolation booth featuring convertible hard and soft surfaces, a tape duplication area, and an expanded client lounge. Also new for Solid Sound's control room are UREI 813 Time-Aligned™ monitors, a dbx 900 rack, a new Ecoplate II™, and a transformerless MCI JH-110B 2-track. P. O. Box 7611, 1289 Dixboro Road, Ann Arbor, MI 48107. (313) 662-0667.

■ **SUPERDISC, INC.** (East Detroit, Michigan) which has merged with **SUPER-LYC'S**, a 16-track house, and **STIX & LYC'S**, an 8-track facility, recently delivered to CBS the new **PHILIPPE WYNNE** album, *Wynne Jammin'*. The studio has also been mixing the upcoming album by **FUNKADELIC**. 14611 East Nine Mile, East Detroit, MI 48021. (313) 779-1380.

— ACTIVITY —

LEE MACES OZARK OPRY SOUNDSTUDIO (Osage Beach, Missouri) provided recording facilities for **LINDA COOPER'S** latest single "What You Do to Me." Producing and engineering credits are shared by Ozark Opry staff engineers **JIM PHINNEY** and **R. N. PARKER** and by **HAROLD L. LUICK & ASSOCIATES**. Osage Beach, MO. □ **FIFTH FLOOR RECORDING STUDIOS** (Cincinnati, Ohio) is booking time for the group, **DAYTON**, who are recording their new United Artists album with band member **SHAWN SANDRIDGE** producing and **GARY PLATT** in the control booth. 517 West Third Street, Cincinnati, OH 45202. (513) 651-1871.

Mountain:

■ **CHATON RECORDINGS** (Scottsdale, Arizona) has upgraded to 16/24-track with the addition of an Otari MTR-90 with AutoLocator, and an Otari 8-track. The decks are fed by a new Tangent 3216 console with custom Orbichronics bar-graph display and simultaneous PPM/VU ballistics. Studio monitors are UREI 811s, JBL 4311s, and Auratones, with outboard gear including the new dbx Series 900 modular processing system, MICMIX/Master Room XL-500 reverb system, DeltaLab DL-2 Acoustic Computer, and an Eventide H949 Harmonizer™ with keyboard. Mikes are by AKG, Neumann, Shure, Sennheiser, PML and Sony. The new equipment was purchased from and installed by E.A.R. Pro Audio of Tempe, Arizona. 5625 Nauri Valley Drive, Scottsdale, AZ 85253. (602) 991-2802.

■ **THE LAST RECORDING STUDIO** (Boulder, Colorado) was responsible for the KBCO Boulder Music Weekend livecast, and for the live recording of artists in local clubs for later broadcast during the radio event. Engineer **DICK JENKINS** mixed the awards presentation at the end of the weekend, which included performances by five bands, as well as the interface of the MC, announcer, and station breaks during broadcast. The Last Recording Studio is a 4- and 8-track operation available for studio and remote work. **MARK BARNETT** is company president. Box 6050, Boulder, CO 80306. (303) 442-1158.

Northern California:

■ **CUSTOM RECORDING/STUDIO C** (Stockton, California) announces the addition of a Lexicon 224 digital reverb and an EXR Exciter to its list of sideboards. Plans are also currently being drawn up for Studio C's new 24-track facility. Ground breaking for the **JEFF COOPER**-designed plant will be in March 1981. 2220 Broadridge Way, Stockton, CA 95209. (209) 477-5130.



Fane Productions

■ **FANE PRODUCTIONS RECORDING STUDIO** (Santa Cruz, California) has completed a major upgrade from 16- to 24-tracks, and now features a complete array of transformerless MCI equipment. A new MCI JH-636 console with JH-50 automation can be found in the control room, along with MCI JH-114 24-track and JH-110B 2-track recorders. Tannoy Berkeleys, JBL 4311s, and Auratones make up the control room monitor complement, while Altec A-7s are to be found in the studio. Amplification is by Yamaha and Crown. Outboard gear includes a Lexicon digital reverb, Aural Exciter™, 34 channels of dbx, an Eventide Harmonizer™, and a number of compressor/limiters. A variety of synthesizers are available, headed by a Prophet 5. **PETE CARLSON**, late of L.A.'s Record Plant, designed the remodeling of the studio and, according to studio manager **CORIE ANASTASION**, has joined the staff as the Chief Technical Engineer. 115-B Harvey West Boulevard, Santa Cruz, CA 95060. (408) 425-0152.

■ **HYDE STREET STUDIOS** (San Francisco, California) has taken delivery of a Trident B series console, formerly a fixture at Sarm Studios of London, England. The board is being installed in Studio D along with a new Otari MTR-90 24-track machine. **TOM SHARPLES**, a principle in Hyde Street, is also a design engineer for Otari involved with their line of recorders. Other new gear includes a UREI stereo octave equalizer, a Kepex/Gainbrain™ rack, Audio Arts Parametric EQ, and JBL 4311 monitors. Remodeling has also been completed in Studios A and C under the supervision of **MICHAEL WARD**. In the newly-opened Studio C, **ALLEN SUDDUTH** is engineering and producing **THE IMPOSTERS** upcoming album, while Studio A finds **THE RANDY ODA BAND** recording with **RICHARD VAN DORN** in the control room. 245 Hyde Street, San Francisco, CA 94102. (415) 441-8934.

■ **PRAIRIE SUN RECORDING** (Cotati, California) has upgraded from 16-track with the acquisition of Filmways/Heider's 3M 24-track machine. Owner **MARK RENNICK** also reports that Prairie Sun will have 8-, 16-, 24- and 30-track operations available in their soon to be opened facilities, and that their present studio is fully operational during the expansion. 1034A Scott Street, Petaluma, CA 94952. (707) 778-7175.

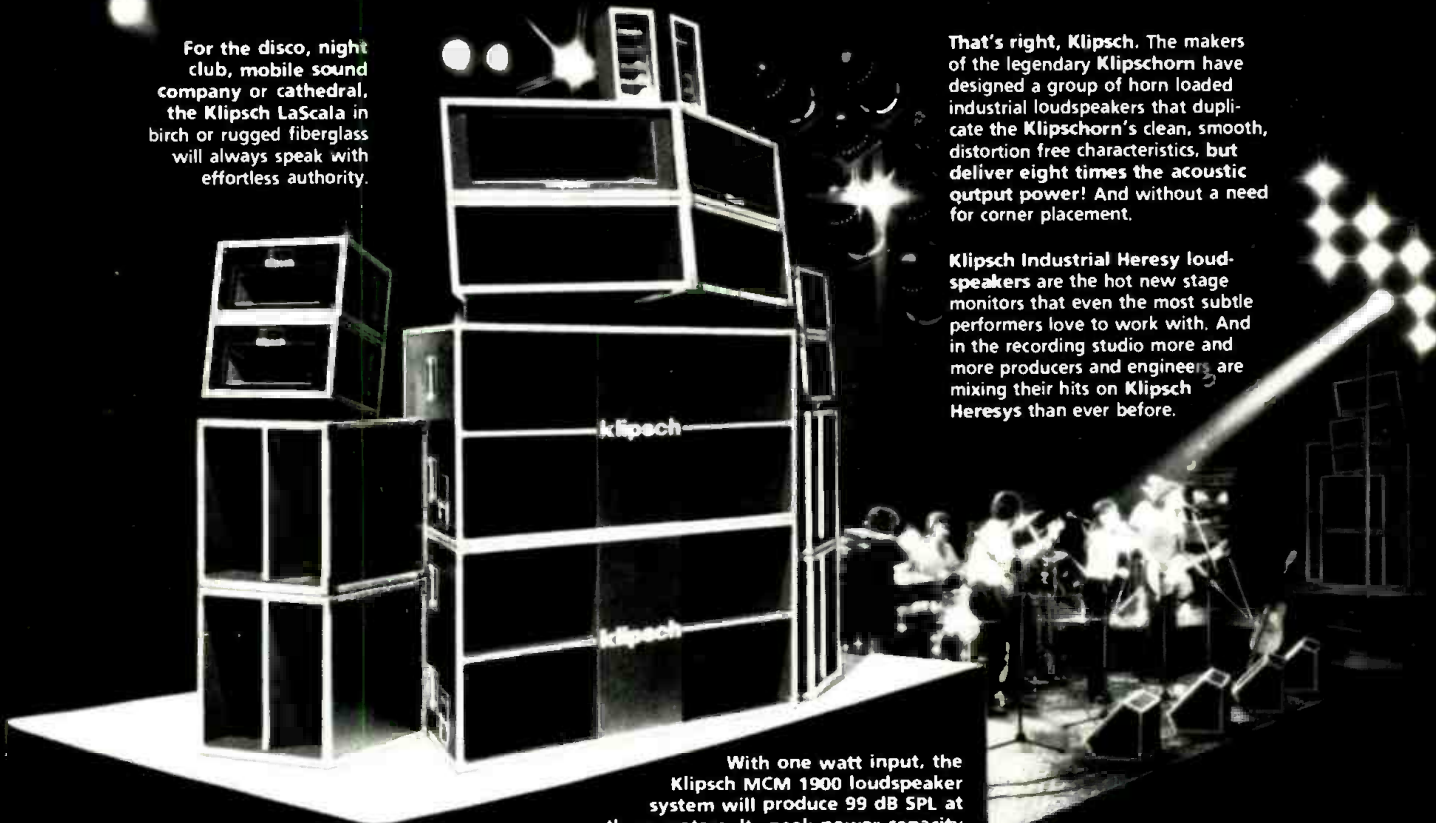
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REP

STUDIO UPDATE

■ **SONIC ARTS CORPORATION** (San Francisco, California) has extensively remodeled its mastering room, according to president and chief engineer **LEO DE GAR KULKA**. The room now contains four complete channels of graphic and ganged parametric equalization, AKG reverb chambers, limiting and compression capability, and continuous graphic spectrum displays. In addition, monitoring is now by two custom-designed Altec 604-C speaker systems and alternate Time-Align™ units. 665 Harrison Street, San Francisco, CA 94107. (415) 781-6307.

■ **VILLA RECORDERS** (Modesto, California) has taken delivery of a Studer A-80-VU Mark Three 24-track recorder and a Ferrograph Studio 8 mastering machine. The equipment will be used on a forthcoming project by the South African band, **MOROCCO**. 3013 Shoemaker Avenue, Modesto, CA 95351. (209) 521-1494.

— ACTIVITY —

DIFFERENT FUR RECORDING (San Francisco, California) is recording overdubs for **BILL SUMMERS HEAT** with Summers producing the band's new project for MCA. **STACY BAIRD** is engineering this LP as well as an album by **MICHAEL COTTON** of **THE TUBES**. **THE TAZMANIAN DEVILS** are also completing their album at Different Fur with **ERIC JACOBSEN** producing and **STEVE MANTOANI** engineering the Warner Brothers release. 3470 Nineteenth Street, San Francisco, CA 94110. (415) 864-1967. □ **HEAVENLY RECORDING STUDIOS** (Sacramento, California) reports **BOB CROCKER'S** new single is in the mixdown stage with **PERRY JONES** producing and **LARRY LAUZON** behind the board. Lauzon is also engineering **GREG SAUNDERS'** new single at Heavenly. 1020 35th Avenue, Sacramento, CA 95822. (916) 428-5888. □ **SONOMA RECORDING STUDIOS** (Santa Rosa, California) recently recorded **ELVIN BISHOP'S** new album with producer **ROGER "JELLYROLL" TROY** and engineers **PAUL STUBBLEBINE**, **NANCY EVANS**, and **DANA CHAPPELLE**. Evans and Chappelle also are engineering a project by saxman **MICHAEL BOLIVAR** produced by **BILL SUMMERS**. 4230 Walker Avenue, Santa Rosa, CA 95401. (707) 584-0699. □ **THE AUTOMAT RECORDING STUDIOS** (San Francisco, California) recently was the site of a live recording session by the **TOKYO UNION ORCHESTRA** featuring guest artists **HERBIE HANCOCK**, **RICHIE COLE**, and **SLIDE HAMPTON**. The sessions were held in the large Studio A with no overdubbing, and mixed as recorded by **FRED CATERO** direct to a two-track, Dolbied tape machine and onto a 24-track recorder for back-up. Other artists recently working in the studio include: **SISTER SLEDGE** with **MICHAEL WALDEN** producing and **KEN KESSIE** engineering for Cotillion; and **CONFUNK SHUN** producing themselves for Mercury with **DON CODY** at the console. 827 Folsom Street, San Francisco, CA 94107. (415) 777-2930.

Southern California:

■ **CLOVER RECORDERS** (Hollywood, California) recently installed Allison Fadex Automation in its 32-channel API console, and plan to complete work on an automation system designed by **BYRON WAGNER** utilizing floppy disk storage and color TV monitoring of information. A new Sony PCM 1610 digital two-track recording system was also purchased for the mixing of **BRUCE SPRINGSTEEN'S** latest album, *The River*. Mixing was handled by **CHUCK PLOTKIN** and **TOBY SCOTT** with digital operator **JIM BAUERLEIN**. Springsteen, **JOHN LANDAU**, and **STEVE VAN ZANDT** produced the two record set for CBS. **DAN MOREHOUSE** is Clover's studio manager. 6232 Santa Monica Boulevard, Hollywood, CA 90038. (213) 463-2371.

■ **DIRK DALTON RECORDERS** (Santa Monica, California) is a 24-track professional studio featuring a Sphere Series A transformerless 34 x 24 console feeding an Ampex MM-1200 transformerless 24-track recorder equipped with Audio Kinetics XT-24 Intelocator™ and Dolby noise reduction. Monitors in the 30' x 30' studio are UREI 813 Time-Aligned™ speakers with 1/3-octave equalization, JBL 4311s, and Auratones. The list of outboard gear includes three Allison Gain Brains™ and Kepexes,™ Lexicon 224 digital delay, an Eventide Harmonizer,™ and a 1,000 cubic foot live echo chamber, which is also used as a live recording room. A full compliment of mikes and instruments is available. 3015 Ocean Park, Santa Monica, CA 90405. (213) 450-2288.

■ **GOLDEN AGE RECORDERS** (Culver City, California) has announced the installation of a Solid State Logic 40 x 32 console. The **JEFF COOPER**-designed studio also features a modular diffuser-slat design to optimize room ambience and to increase the reverberant sound field. With the acquisition of an adjacent building, Golden Age now boasts 1,800 square feet of space. 9733 Culver Boulevard, Culver City, CA 90230. (213) 559-6058.

■ **HOTROCKS** (North Hollywood, California) has taken delivery of a new Otari MTR-90 24/16 track recorder to be interfaced with the studio's Speck 800 console. The operation utilizes JBL 4315 and 4311 monitors as well as Auratones, all powered by BGW amps. Sideboards include DeltaLabs digital delay, Sound Workshop and Master Room reverb, Audio & Design Scamp limiters and noise gates, dbx, phasing, and filters. Mikes are by Electro-Voice, Shure, Sennheiser, and Neumann. **JIMMY RABBITT AND RENEGADE** are currently recording songs for their first album, while co-owner **JIMMY STEWART** is working on his upcoming LP with co-owner/engineer **RANDY WINTERS** at the board. 4822 North Vineland, North Hollywood, CA. (213) 506-9961.

■ **INTERSOUND** (Los Angeles) has begun operations of its new ultra high-speed **ADR STUDIOS**, featuring a unique multitrack computerized system for film looping and soundtrack sweetening. Interface has also been made between 35 mm and 16 mm film and video tape. 8746 Sunset Boulevard, Los Angeles, CA 90069. (213) 652-3741.

■ **MAD DOG STUDIO** (Venice, California) has finished renovations of their 16-track facility with the flush mounting of UREI Time-Aligned™ monitors, and the installation of an Audiotronics 501 console. An Otari MX-5050-B mastering deck has also been added, along with several Neumann mikes. **FLO AND EDDIE** are coming into Mad Dog for work on the soundtrack to *Strawberry Shortcake*, an animated children's film, while other projects include a spot for **THE TONI TENILLE SHOW**. 1715 Lincoln Boulevard, Venice, CA 90291. (213) 306-0950.

■ **SAGE & SOUND RECORDING** (Hollywood, California) has increased its activity since last fall when it took delivery of an MCI Series 600 board with computer mix. The new console feeds an MCI 24-track recorder and is linked to an assortment of new outboard equipment. UREI Time-Aligned™ monitors have also been installed, according to owner/chief engineer **JIM MOONEY**. Staff engineers at Sage & Sound are **RON FAIR** and **JIM SHIFLETT**. 1511 Gordon, Hollywood, CA 90028. (213) 469-1527.

■ **SALTY DOG RECORDING** (Van Nuys, California) has appointed staff member **MOLLY HANSEN** to the position of studio manager, while **BRIAN VESSA** assumes the post of chief engineer for the studio. 14511 Delano, Van Nuys, CA 91411. (213) 994-9973.

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R-e/p 25 □ December 1980

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... his obstetric art of record production — getting the best performance from the artist —

JOHN BOYLAN

R-e/p (Robert Carr): How do you perceive what you do for a living?

John Boylan: Well, the way I perceive record production is that it's analogous to film directing. In older days, before 1955, the record producer may have functioned more like a film producer, by putting up the money, or overseeing the business aspects of it. The arranger did mostly what the producer does today. Now all those functions are combined in the producer. Sometimes even the engineer is combined in the producer. Some of the best producers have an engineering background. I think that, philosophically, the foremost thing a record producer has to do is create an artistic atmosphere in which the product, or album, can happen. If he creates the best atmosphere, he can get the best record, because he will draw the best performance out of the artist. He will guide the artist in a manner which helps him along rather than changing him, or messing with what he does or inhibiting him in any way. A producer must cover every aspect of making the record in order to create the perfect atmosphere in which it can happen. In a sense, it's an obstetric art.

R-e/p (Robert Carr): Staying out of the way, you mean?

John Boylan: In a sense, yes. You're like a utility infielder. If there's a hole at third base, you'll play third base. If there's a hole at second base, you play second base. If you see something wrong with the engineering, you

by Robert Carr

must recognize that; you must say to the engineer: "We need 3 dB at 10 kHz on the bass, because there's a problem there." If there's something wrong with the arrangement, you have to say, "We need a drum fill at measure 16 because there's nothing kicking it emotionally at that point." Or if there's something wrong with what one of the musicians is doing — "Your guitar is out of tune; you're dragging" — you must be able to recognize that and articulate it specifically in order to correct it. You can't be vague about it. That's one of the things you do. Of course, producers take a hand in what is

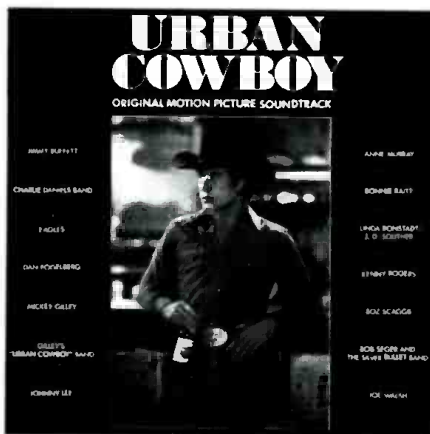
done depending on their general bent. An arranger-producer would be writing charts out or playing parts. An engineer-producer, like Bill Szymczyk, he'd be concentrating on engineering, or a musician-producer, like Jeff Baxter, is more concerned with the musicianship. I prefer the production of people who are more the dilettante, who can handle every level of every aspect. I think they make the best records.

R-e/p (Robert Carr): Do you approach each group that you work with similarly?

John Boylan: Generally, yes. I do a lot of pre-production, and if the way you go about it is general enough, it's going to fit everybody. I do a lot of rehearsal, setting up, and finding everything out. That would work as well for Miles Davis as it would for a string quartet. It should, because no matter who they are, they have to rehearse.

R-e/p: Are you particularly partial to guitar groups? It seems like a great number of the things you produce are guitar-oriented.

JB: I'm not particularly partial to guitar groups. I like them very much, but I would like to think I produce anything. There's a tremendous stylistic variation in the things I do. There's a vast difference between **Boston** and **Charlie Daniels**, between the **Little River Band** and **Commander Cody**, between the soundtrack for **Urban Cowboy**, and **Great Buildings**; some of those acts are like night and day. But I



Jim is one of the good ol' boys of Nashville. His engineering career stretches back some 18 years to the days of mono mixing. He's done everything from pop to R&B to disco—and, of course, country. The aviation industry gave Jim his technical background. But he's also prepared himself by playing four or five different instruments. Some of the names on the other side of the glass from him include Bob Dylan; Simon and Garfunkel; Peter, Paul and Mary; Loretta Lynn; Johnny Cash; Don Williams; Marty Robbins; Conway Twitty; Ray Price; and Roy Clark.

ON SPECIALISTS

"Let me say that I have sympathy for them, because they're missing the rest of the world of music. They're locked into one thing and I got it all. I have done four different styles of music in one day. I did a disco record that got to number six on the Billboard charts, 'Dance With You.' In the same day, I did a number one country record. You don't listen to the same kind of music all the time. And I don't want to listen to the same kind of music all the time, either."

ON OVERPRODUCTION

"'Swarm.' That's my term for overproduction. I've had producers who have turned and said, 'Well, how many tracks have we got left?' You may look at the chart and say, 'Well, we've got nine tracks left.' He'll say, 'Great.' And he looks into the window of the studio. 'Hey, let's put an electric piano on.' Not because the electric piano fits the song and has a place or meaning

in the rhythm or in the feel of the song, but it's because he sees one in the room and we've got nine tracks to go. And that's overproduction, abuse of multitrack recording. And that I don't condone."

ON PLAYBACKS

"I actually mix. I don't load tape. I like to sit down at the console, set my monitor levels equal and put the band together and get a monitor mix in the control room that sounds as close as I can make it to the record, so that the producer and the artist and the musicians can hear and understand what they're doing and correct their mistakes. I'm an old mono mixer. And that's what built mono mixing."

ON TAPE

"A competitor of 3M has stated that 3M has a greater print-through than their product. It's my opinion that there is no greater print-through on the Scotch® 250. It's just not masked with modulation noise. There also was a comment that the competitor's tape was brighter, when in fact, there was just more third harmonic distortion in the 10 to 12 kc range. I am very stringent on monitoring in the control room. And when I hear a signal off the floor, I want it to come back off the tape the same way. I don't want it to be embellished with third harmonic distortion to make it brighter, or modulation noise to confuse the bass line."

SCOTCH 250

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**JIM
WILLIAMSON
ON TAPE.**



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3M



... with Charlie Daniels ... all I tried to do was to get what he does on radio ... I didn't think his records before sounded particularly good on radio ...

guess most of my reputation has been built on my work with guitar groups like Boston, the Little River Band, and Charlie Daniels, which is my biggest act.

R-e/p (Robert Carr): If you get too close to a group, does it become very hard to produce them?

John Boylan: I think so.

R-e/p: And if you don't really have a rapport, then there's no communication and you can't produce them either. Are there any particular guidelines that you set up to choose groups you want to produce?

JB: No, although what you're talking about is that you must have a rapport. That's one of the guidelines. I don't have any particular stylistic guidelines.

R-e/p: Are there any particular limits that you would set on the relationship to keep it workable?

JB: No, I try not to, although I have found that two or three albums is about it. For example, I'm no longer involved with the Little River Band. I did three albums with them, and we just didn't seem to have anything more to contribute to each other after that.

R-e/p: It's more or less spent after two or three albums?

JB: Yeah, I found that as a general rule, although there are some exceptions ... the Gus Dudgeon - Elton John relationship went on much longer, and I think it was continuously interesting. But, of course, that finally terminated as well. There are long term artist-production relationships that have worked, but I have found that two to three albums is about it. Although I must say that my relationship with Charlie Daniels could go on longer than that, just because of the particular nature of the relationship.

R-e/p: Is there a particular magic there, do you think?

JB: Well, I have a tremendous amount of respect for some of the things that Charlie did, and I think he senses that. He was looking, I think, for a producer that would come to him with that sort of attitude. All I tried to do was to get what he does on to radio. I knew if I could do

that, legions of people that liked him would come to him. I didn't think his records before that sounded particularly good on the radio, and I think that was the main problem.

R-e/p: How involved do you think a producer should get in grooming a particular group? Or, let's say, helping them choose a direction, or even to develop a playing style for the musician?

JB: It really does depend on the band. There are some bands where you don't have to do it at all, and there are others where you have to do everything. Now if it comes to the point where you have to do everything, like Phil Spector used to, I'm not sure whether that's production anymore. Phil Spector was the artist, really, on a couple of records.

R-e/p: Who usually chooses the tunes for the groups that you work with?

JB: You have to be specific. In the case of all the self-contained bands, they write everything. In the case of the Little River Band, we used the straightforward democratic procedure of voting. In the case of Charlie Daniels, they come to me with an album already conceived in advance. I modify a couple of things, but don't involve myself. With Linda, I helped her pick a lot of her material, because she didn't write. In the case of Johnny Lee, that song I did for *Urban Cowboy*, "Looking For Love," was a case of doing a lot of things.

R-e/p: He basically just sang, right?

JB: Yeah, he basically sang, which he did very well, and he's a wonderful guy, but the song was found by Becky Shargo for the movie. We decided to put it with Johnny, because he was the right voice for it. We picked the musicians, I wrote the parts out, I did the arrangement; we did what had to be done. So it depends.

R-e/p: With "Devil Went Down to Georgia" — which won a Grammy Award — did you have a particular feeling about that song before you recorded it?

JB: Absolutely. In fact, I was so convinced it was going to be a single that I recorded one alternative line. There's a line that says, "I done told you once, you son of a bitch, I'm the best that's ever been." That's in the song, but I knew that if it were a single Charlie's main power base might resist that line. So at the time we did the record I asked him to also sing, "I done told you once you son of a gun." We just sang that one line on a separate track, mixed that piece of tape with that one line on it, and tacked it onto the end of the master, so that it was available if necessary. That's how convinced I was that it was going to be a single. When it was forced out of the album as a single, I was in Australia. They called me up frantically saying, "What are we going to do?" I said, "Don't worry." My engineer did the edit and we issued altered DJ copies specifically for the stations that wanted them.

R-e/p: You mentioned to Billboard that you were going to make neater and cleaner records; more radio-oriented with Charlie. What other specific things did you do?

JB: See, with Charlie, I felt that was all that was necessary, apart from having a great song. When I first met him, I went out on the road with him to try and get a feel for the band, and I just couldn't keep up with him. He's older than I am

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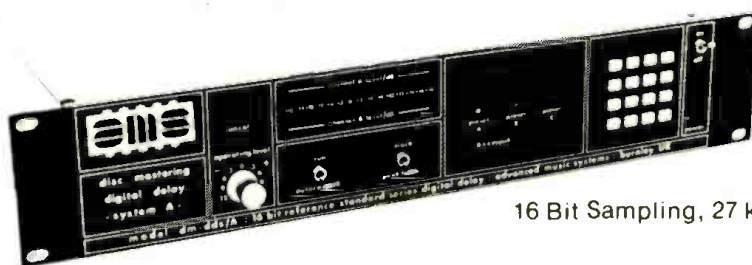
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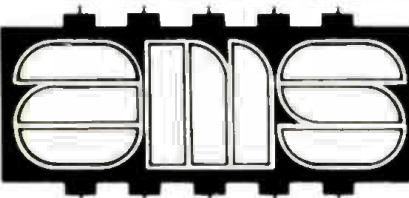
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If it comes to where you have to do everything . . . like Phil Spector used to do . . . that's not production anymore . . . Phil Spector was the artist, really, on a couple of those records . . .

by a few years, but the man is tireless. He gets up at the crack of dawn, goes to the local newspaper and does an interview; comes back and has lunch with the local CBS people. In the afternoon he does a sound check, goes down to the local FM station, sits in and plays guest DJ. Then he'll take the program director and a few other people to dinner. After that he'll do the show, and then I think he went to some local club at the college and sat in with the band. The next morning he was up and at it again. After two days, I said, "Excuse me, I have to go home!" I realized that all I had to do was give these people a record that sounded good on the radio, that still kept Charlie's feel and sound but was just a little bit crisper and more radio-oriented. He had so many friends out there that they would just play it.

R-e/p: Let's say you're in the studio, or in rehearsal determining what the arrangement will be, or whatever . . . who has the final say?

JB: One of the producer's functions is to avoid a confrontation like that; to let the thing happen as naturally as possible. I try to avoid a situation where you would polarize yourself with the artist, and have to force a decision of any kind. Most artists are very intelligent. If you don't polarize them or go after them, it's generally the right thing to do. If you have a chip on your shoulder, they're going to pick it up right away. I try to avoid that type of situation.

R-e/p: How important is the studio? You were talking about how you do a lot of pre-production work, in which you would be working out all the arrangements, and so forth. So I assume there would be no charts.

JB: In a self contained band there's no need for charts.

R-e/p: Is the environment really that important to bringing out a good recording?

JB: Absolutely. For example, what if it's too cold. What if he can't hear or the headphone mix is terrible, or if he's uncomfortable, or unhappy. What if the lights are too bright, or not bright enough. That's the real simplistic view, of course. It gets much more sophisticated when it comes down to all the sorts of things that contribute to the atmosphere of the recording process. Still, the headphones have to sound right; the temperature has to be right; the lighting has to be right; everything has to be right so that the artist is neither indulged, nor antagonized.

R-e/p: How about the style or the design of the studio, in terms of just architecture?

JB: It makes a great deal of difference. Of course, it's so subjective, that you can never know what kind of studio they are going to like, until you get familiar with him. Some artists like the old, coffee stains on the floor, vinyl, green

lighting-type of studio, because they say, "hey, I'm in the Studio, let's get some work done; this feels like a studio." And some people like the sort of bliss consciousness studio — redwood hot tub, smoked glass, solar lighting; that sort of situation. There are as many different preferences as there are artists.

R-e/p: So you try to match up the personality of the band with the personality of the studio?

JB: Of course! I try to steer them towards the studio that I think is right, even if the decor is a little off. It's more important for the sound to be right.

R-e/p: You had a quote: "Give me any studio that's in the ballpark, and I'll make you a record with a hit band."

JB: That was actually paraphrased wrongly. What I meant was, and I'll just put it backwards: "If you give me a hit band and a hit song, it doesn't matter how great the studio is." If the studio is just functional it will work, and the real proof of that is the Boston album, which we cut in a basement in Watertown, Massachusetts.

We cut the drums on to a Scully 12-track with a bunch of rented mikes, through a Stephenson, Interface P.A. board. That album is still selling 10,000 copies a week. So if you give me a hit song and a hit band, I'm not going to make a mistake for you. As long as the studio is in the ballpark, I will make the record. In other words, given everything else, the studio is not really that much of a factor — as long as it's just above the bottom line. The real factor is the song and the artist; that's really what I meant.



R-e/p: You had a list of rules for working in a studio. I don't know if I should dredge all these things up?

JB: I've got some new ones now; I've added to it. Rule 14A is: "Try to resist the obvious," which of course, is an expression of the duality you're under at the studio all the time. The artist will say, "I can't do that, it's too obvious." You should try to resist the obvious, but there are times when you must do the obvious, because it's the artistic way.

R-e/p: You pull the listener into a song. Maybe that's what you need at that time.

JB: Maybe you need to get him there so that then you can change him around a little bit. Maybe you should sugarcoat the pill before you feed it to him.

R-e/p: You mentioned before that you didn't like to get in the way of a production. Don't you feel you have a style, though?

JB: I like to feel I don't have a style. I like to think I'm the guy who could bring home any style because, who knows, Miles Davis may call me up. I could have a style, if that's what the artist

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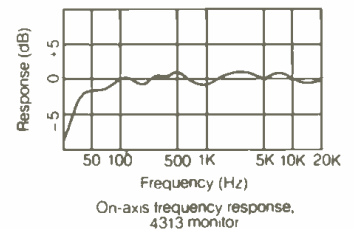
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wants. I have my personal preferences, but I will not impose them on the artist unless he requests it. And then, of course, if you're getting in strict definitions, I feel I've taken on more of a role than just a producer. I do have a style; I have the kind of music I like, but I would like to think I could produce any kind of an artist.

R-e/p: There's certain basic taste factors that apply to all music?

JB: Yes. Quality-wise, I'm hoping it would be above a certain line.

R-e/p: On four or five tunes that I listened to there was a general similarity, in the sense of having background vocals arched from the top center out and down the sides; lead vocalist in the center underneath the vocalist; and a couple of guitars panned soft left and right — either doing rhythm feels or harmony melody lines.

JB: Oh, yeah. You'll find that with the Little River Band, except in certain areas where they all sing together and it comes in the middle. But you won't find that in Charlie Daniels, because some of them had girls singing. I like that spread. That's sort of a Southern California sound. I hate labels, but it's a sound developed in the early 70s by a bunch of people who were around here. I use that where I think it's appropriate.

R-e/p: So you don't particularly think that's your style?

JB: No, although I was there in the development of it. I think I have as much claim to it as any of the other people who use it, like the Eagles, or Linda, or any of those people. And I use that in the case where I think it's appropriate. I have done so on a lot of occasions, and I'd still use it now if I thought it were appropriate.

R-e/p: I noticed on one of those cuts, too, that you had the bass guitar a little off center and the snare right in the center.

JB: That may have been an error. I wouldn't try to do that.

R-e/p: I think it was Little River Band. It was a little off center. The bass drum was in the center. And the snare was in the center too. Usually you have the snare a little off center.

JB: I usually have the snare a little off center. I'm hoping that was some sort of a technical problem, since I wasn't trying for that. I usually try to keep the bass drum and bass in the middle, because you encounter phase problems if you don't. I try to get the snare a little off center, that's where it is if you look at the drums.

R-e/p: In the center of the head, it's sometimes very hard to hear. If you take it a little off-center, it comes out a little better.

JB: Exactly. I'm a big snare freak. If you're listening to, for example, "Cool Change" by Little River Band, there's a big, fat snare sound right there — even though it's a ballad, which is something I like. I would prefer that if you close your eyes and envisage drums six or eight feet in front of you; that's the way you hear it. The toms would go around like that — panned from hard left, through center to hard right — the snare would be just a little off to the right because it's facing you. High hat is over there on the right as well, with various toms and cymbals going around. The kick should be dead center to

correct any phase difficulties. You're going to get too much vertical information if you put bass drum and bass off-center.

R-e/p: You seem to be very aware of not overlapping instruments. Do you tend to visualize five panning positions so as not to overlap?

JB: Yeah. I have five in my mind: hard left and right, soft left and right, plus center.

R-e/p: Do you really visualize that, or do you go for a feel of where to put the instruments?

JB: No. It's all visual — a very visual situation. I have always attempted to keep a special reference in the mix which relates to what the band looks like on stage. The one exception I made is the guitar solo, which I try to put in the center.

R-e/p: I noticed on a lot of things you do, you don't use a lot of panning.

JB: I try not to; it's not really natural. I would do it if I thought the act called for it. For example, I think the panning in that Bob Seger record, "Her Strut," where guitar through a digital delay

THE BOYLAN RULES FOR PRODUCTION

- 1 - **Less is more.**
- 2 - **Form follows function.**
- 3 - **Cheerful musicians make better records.**
- 4 - **No amount of overdubbing can cover a bad track.**
- 5 - **Perserverance pays.**
- 6 - **The producer is always . . . at least usually . . . partially right.**
- 7 - **Sloppy records are generally made in sloppy studios.**
- 8 - **If you want to say something about an overdub, you better be there when it's done. (groups only)**
- 9 - **When all else fails take a day off.**
- 10 - **Be prepared to change any of the rules if it will help the record.**
- 11 - **Try to exhaust the possibilities before you exhaust the musicians.**
- 12 - **Go for sponteniety . . . no matter how long it takes.**
- 13 - **An unlucky number.**

goes back and forth, is quite artistically done. Phony as hell, but artistically done. It's okay; it works for me. Some of the panning in early Traffic or Zeppelin records were overindulgent or unnatural.

R-e/p: How do you feel about the technique of mixing instruments in and out, changing levels on them?

JB: Well, what you hope is that the players will play their own dynamics. If they don't, I try only to help it along. I don't like to create dynamics from scratch using the mixing process. I hope the dynamics will arise naturally out of the playing.

R-e/p: In a live situation, dynamics are created by raising and lowering the volume of instruments. Dynamics can also be controlled by adding and subtracting instruments. On records, however, the rhythm section usually stays fairly constant. Of course, adding and subtracting instruments helps in the dynamics, but there's not really that much variance in the

volume of the rhythm section. Why is that?
JB: Then again, that depends on the act. With Little River Band, the reason you try to make the rhythm section constant is because that sounds better on the radio. The station's limiter is not going to play havoc, and it's going to help for a tighter, more even sound. There are some dynamics in the rhythm section, but not compared to some of the dynamics you can get with other instruments. With Little River Band, I would try, when those instruments come in and out, to make the dynamics natural in their conception, so that they arise out of something that might sound natural; sort of seamlessly going through one thing into another. With the first Boston album, on the song "Long Time," we mixed that to have deliberately violent dynamics. The rock and roll impact of it was so pleasing, was so strong, that you wanted to do it like that. There is a spot where it just cooks along with the bass, drums, and a vocal. All of a sudden a double rhythm guitar comes in so loud, it's louder than anything on the track. That effect is the essence of Heavy Metal — to go from zero to ten just like that. That to me is what that music is all about. So we're not making any attempt to be subtle there at all. It just depends again on the artist and the situation.

R-e/p: The material you turn out seems to be very cleanly recorded. Is that a result of a lot of overdubbing, or is that what you get from the first run through?

JB: It is not the result of overdubbing. I've done some records with a minimum of overdubs. There were a couple of Ronstadt records where she sang with the track and we overdubbed nothing. I think it's just a refinement of recording technique that I've worked out with my engineers. It's much easier to work if you don't get yourself into any distortion or bad recording problems — again, pre-production and good preparation. I never try to record one single note the first day in the studio — sounds. By the time some drummer has been hitting on the snare drum for hours, he doesn't want to play; he wants to go home. I always lock the studio out. The guy shows up at two-o'clock, or whenever, sits down, and the sounds are already there. He picks up the headphones and he knows what they're going to sound like. He starts playing; it's comfortable.

The sound are all clean, because they were all worked on ahead of time.

R-e/p: I have two questions now. Is everything really isolated; does super-isolation get that clean sound?

JB: Yes and no. In rock and roll, it's very isolated. It has to be, because you're dealing with volumes that are very loud.

R-e/p: Do you use small amps for that, or large amps?

JB: No, we use attenuators — large amps with attenuators. We use 100-watt Marshall stacks, but put a variable attenuator between the power head and the speaker cabinet. Attenuators are better than master volumes for me. For some reason the change in volume doesn't seem to affect the tone as much. Of course, if you're overdubbing, you don't have to worry about the attenuator. I use a combination of close and far miking, or two different amps, or whatever. In rock and roll, isolation is important. For other kinds of music, it isn't. On some of the Little

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“ . . . you try to get the presence of sound on the tape with miking . . . so you don't have to do it later . . . If you are doing it off the tape you're equalizing noise as well as signal . . . ”

River Band tracks there are definite room sounds and ambience between the instruments that you don't get with isolation. There you must have ambience.

R-e/p: I just designed a studio where we built in three amp traps, about 4 feet by 4 feet, and about 8 feet high — all double wall construction. The amp is put inside with the mike. You have a female phone plug in the wall for the guitar cord, and that goes through the wall to the amp inside. You can get any sound you want at any volume, with almost complete isolation during live recording.

JB: That's a great idea. Of course, more isolation rooms in studios would help, too. Most of the rooms I work in have traps. Not like what you just described, but mildly trapped and if you baffle well, you can get away with it.

R-e/p: You mentioned sounds before. This is my other question: Do you see a marked change in the way a person performs depending on the sound he gets from his instruments?

JB: If a guitar player is not happy with the way his instrument sounds, he just doesn't play well. That's an absolute fact of recording. The player must be comfortable with what's coming out of his instrument or he's not going to play well.

R-e/p: Doing too many overdubs tends to rob the particular track of a group's energy, don't you think?

JB: Yes. Too many overdubs can do that. But if you're very careful about what you're doing, you can minimize that effect. One of the ways is to record the basic track with all the instruments, and then re-do the ones that have sound or leakage problems. Another way is to be well-rehearsed, because the effect of not being able to hear all the other instruments becomes minimized a little bit.

R-e/p: You don't tend to use much outboard gear, do you?

JB: No. I have used Eventide Harmonizers, and DDLs before they became available in most consoles. I used parametric equalization as far back as 1973, but the need for outboard gear has lessened as consoles have become more sophisticated. A lot of them have built-in limiters that are very good, and parametric equalization in every channel. I think the outboard gear is now used mostly for effects rather than to save something. But then people like Giorgio Moroder started to use it as an artistic tool, which I would do if the situation called for it.

R-e/p: With the Little River Band, you seem to be really into vocal sounds.

JB: They're such good singers, that it's easy to emphasize the vocal sounds, and they can re-create those sounds on stage. If a singer's that good, they should put their best foot forward.

R-e/p: So you really don't do anything to get that real smooth sound?

JB: Well, yeah, we use little tricks of the trade. All Little River Band vocals have been meticulously double-tracked through overdubbing.

R-e/p: And then you pan them left and right?

JB: Yeah, sometimes triple-track, and sometimes all sung together to get an ambient sound on one mike. Normally, you would put the lead vocal down and then add the background, but the L.R.D. is so tight. Glenn Sharroc used to sing a song without the chorus — just the verses — and then all three of them would stand in front of the same mike and sing the chorus together. You could just move them around until the blend was right on the single mike and you'd have it. If you double-track that, and the blend is right, it's an amazingly spacious sound with a good effect. On "Cool Change" we did that. Sometimes I stack parts, or have the singers switch parts when they double-track.

R-e/p: How do you get the depth, space, and presence in a sound?

JB: Well, I use certain microphones to do that which my engineer, Paul Grupp, got me into using. The one mike that I am very glad he recommended is a B&K. It's an amazingly flat microphone; very present. They're \$3,500 — very expensive — and were designed originally to voice speakers. However, my engineer hit

“any drummer I have on a session would be capable — I hope — of playing anywhere in the beat . . . on the front edge . . . the middle . . . in back of the beat . . . or I wouldn't have him there . . . ”

upon the idea of using it on vocals and some acoustic instruments. It has proven to be an amazing asset. I never used it with Little River Band, because we didn't have any down in Australia. Instead I used AKG 414s; those were the first super-present condenser microphones. But the B&K is amazing, because you can get presence far away from the source. You don't have to use a pop filter, or put anything in between; you don't get any lip noises or breath blasts because you're far away. You can record an acoustic guitar and vocals together, with an amazing degree of clarity, by keeping the mike at a distance. You get no finger pick noise, or string noise, no lip smacking. I've used that mike on almost every record I've done in the past 2½ to 3 years, for lead vocals and all acoustic instruments.

R-e/p: And you still get the low frequencies, and the bottom end?

JB: You still get total frequency response, because the microphone is so flat — it has to be since it's used for voicing rooms. So I'm very happy that Paul came up with that notion. In general, you try to get the presence of sound on

to tape with miking, or with whatever you have to do, so that you don't have to do it later. If you're doing it off the tape, you're equalizing noise as well as signal. This goes back a long way, especially on vocals. I used parametric equalization and high-quality condenser mikes a long time ago, in order to get that presence from the vocal sound.

R-e/p: Do you find that when you EQ too much, you get some phase shift occasionally?

JB: Yeah, sure. It depends on the equalizer, of course. Graphics ring like crazy; you get phase correlation problems with all equalizers. The idea is to find a microphone where you don't have to equalize that much. With a 414 or the B&K, you never have to equalize more than 1 or 2 dB. A high-quality parametric shouldn't prove any problem.

R-e/p: Let's say, sometimes a song doesn't rush, but it's really not in a groove. Other tunes can vary a little bit, but the groove is just so big, you can put a train in it. What makes that difference and how can you change it, if there is that problem?

JB: I wish I knew. I think if you've got a case like Charlie Daniel's band, which is a good-time, happy, bar-band type of organization, you've got some room in the groove there. The overall feeling is generally pretty spacy. That rigid, disciplined groove is not required. The style of Charlie's music dictates that you can drive a truck through the groove, and it will still be okay. With another kind of music, you're in trouble if you get out of time. I think straight country music, like that Johnny Lee tune, should be exactly in time. If that speeds up or slows down, you're in trouble. With Little River Band, with very rare exceptions, we tried to keep the groove exact. With Boston, we used a click-track.

R-e/p: Was that a matter of having trouble keeping time, or just a function of what the music wants to be?

JB: Just a function of what the music wants to be. As a matter of fact, Sib Hashian is one of the few drummers I know who can successfully play with a click-track. Michael Botts can do it. I know a few drummers who can do it, but some of the best drummers in the country can't.

R-e/p: Which leads me to another question. There are basically three places in a beat that you can lay a backbeat. You can play it just a little bit ahead; it's not that it's rushing, but it's towards the front of the beat. Ed Shaunessy may play towards the front of the beat with the Tonight Show band to give the music drive and energy. Then you have most groups who usually play right dead in the center. Finally there's some people like Bernard Purdie, Max Weinberg, or Al Jackson, who lay it towards the back of the beat.

JB: That's very astute of you to realize that. There are three positions in the beat, and each one serves a different function. A lot of the Stax-Volt records of the mid- to late-60s had that feeling. A drummer named Roger Hawkins is very good at playing right back the beat. He can also pop right in the middle of the beat. Certain

Mastering? . . . I cut a flat ref right away, no EQ . . . take it home, listen to it and decide what's wrong . . . then try a few things . . . cut another ref with trial EQ and level . . . the main thing is no drastic level discrepancies . . .


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records like "Mustang Sally" by Wilson Pickett, or "Respect" by Aretha Franklin, pop right in the middle of the beat and that gives you sort of a bounce. But to me, ahead of the beat is always a problem. I've never cared for that particular style. There's a lot of it in the New Wave music. In fact, I'm dealing with it now with this new band, Great Buildings. The problem with playing ahead of the beat is that the listener generally becomes disoriented. I don't think it has a good effect on the listener.

R-e/p: Do you think subconsciously it makes them nervous?

JB: It imparts a subconscious franticness; I don't believe it's pleasing. It's good in a live situation because all the other elements are there — the visual elements and all the various things that make up a live performance. But with rare exceptions on records, I don't think it works. It did work on Charlie Daniels.

R-e/p: If you're working with someone in a studio that has a problem like that, how would you deal with it to try and get more of a relaxed feel? Is there something you can do?

JB: Yes. First of all, you just try and talk to them about it. Assuming the guy is a professional, I say: "I want you to play on the back of the beat." If he's really on the front edge, I might exaggerate by telling him to play way back on the beat, hoping he will compensate and end up in the middle. If that doesn't work, I haul out the old metronome and tell him I want him to hear the metronome beat before he plays. You have to talk him into it. Frankly, any drummer I have on a session would be capable — I hope — of doing anything I asked him to do or I wouldn't have him there. In fact, most of the best studio drummers can give you what you want.

A lot of trouble with producers is that they are afraid to ask high-powered studio cats to do something. I think there's a psychological factor there. I know a lot of producers who don't want to upset a "Star Studio Player." But hey, who's paying the bills here? So I just ask for what I want. They're more than happy to give it to you. If there's anything they hate to do it's flailing around in the dark.

R-e/p: What do you think would be the last production trick you learned?

JB: The last production trick that I learned? I hope it was yesterday; I'm trying to think what I learned yesterday. Well, the last major production trick that I learned is concerned with tuning. I now use a quartz crystal 440 Hz tone imprinted on the tape. I print it on channel 24 all the time while cutting basics. It was conceived by my Australian engineer, Ernie Rose, and executed by an Australian engineering firm called Sontron. It's simply a line-out, quartz crystal, 440 Hz generator, accurate to four decimal places. We use it at the beginning of the day to calibrate the strobe tuning. As far as I know, I'm the only guy who does this in America. When we go to overdub on the track,

**... the Sontron 440 Hz,
line out tone generator —**



if there's a slight variation in tape speed, we simply play back the tone into the strobe tuner, and re-calibrate it against the tone. I expect everybody in the world will be doing that within a year-and-a-half!

R-e/p: As soon as they read this interview. Do you have any hobbies at all? What's your favorite?

JB: Writing is the thing I like to do most. I keep notebooks and write all kinds of things, little sketches, songs, screen plays, novels, whatever; I love to write. I also like to ride a bicycle to keep in shape, because you abuse your body enough during the recording process with all-night sessions, etc. I ride my bike five to ten miles every day.

R-e/p: Is there something that you may have learned from bike riding that you could apply to production?

JB: Most of my general production ideas came from when I was an acting major in college. I studied directing and acting for four years. It's all the same really: directing a movie or a play; it's all creating the atmosphere, moving the players around. Once you get the notion that you can cross ideas from one medium to another, you can do anything. Cross bike riding with writing; writing with producing; and so on.

R-e/p: I studied cartooning for a while, and just a subtle change at the end of a line would change the whole complexion of the face, the

Multitrack Digital Recording? ... Right now the lack of high-end bothers me. I love the sound of air above 20 kHz ... the suggestion of harmonics ...

whole meaning of the cartoon. You can take those little subtleties and apply it to recording in terms of musical lines. You can change it just subtly, and it will alter the whole feeling of the line and section of the song.

JB: Exactly. It's hard to articulate specifically, but if you just talk about it like you do, in general terms, then that's what it is. I agree.

R-e/p: When you go in and you're ready to mix your master, what's the first thing you do?

JB: I try to save all the mixing to the end. I also try to lock out the studio so I can leave a mix on the board every night. In fact, the only time I don't lock up the studio is during the overdubbing process. In mixing, I try to set all the non-variables up first, like the echo sound. If it's a band with the same drummer all the way through, I try to get the drum sound and just leave it. When I was mixing the band Angel City, which we mixed digitally a few months ago, the drum sound stayed for the whole album. The set-up is very important. You lock the studio out, get the echo right, get the drums and bass right, the basic instruments right, and after that it's just making moves. I also run back and forth between the studio and the house, because I'm very familiar with my home stereo and Otari 2-track. I just go home, listen to a mix, and then go back to the studio and try something else. I also use home speakers in the studio. I guess a lot of people do that. I use three speakers when I mix: JBL 4311B, Auratones, and Westlake's 4-way, phase-correlated monitors.

R-e/p: How involved do you get in the mastering?

JB: I master all my records at Capitol with a guy

named Wally Traugott. I cut a flat ref right away, no EQ or anything. I take it home, listen to it, and decide what's the matter with it. Then I go back to Wally, try a few things, and cut another one with a trial EQ and level. The main thing is to make sure that there are no drastic level discrepancies between cuts. I take the disc home, listen again, and if it's good, I go with it. If not, I keep refining it until it's right. The Urban Cowboy album was a nightmare, not because it's a terrible album — it's a great album — but because I got the tapes from everywhere. Joe Walsh sent a tape down from Santa Barbara — 30 ips, no Dolby; Dan Fogelberg sent a tape from Colorado — 15 ips, Dolby on 456; I got a tape from Nashville that was dbx; I got 206, 250, 406, and Agfa — every kind of thing. I had to cut them all together for the album; it was just a total nightmare. I spent four straight days at Capitol mastering it. The first thing I did was transfer it all to digital tape. At the same time, I copied it to 15 ips Dolby on high-grade analog tape. When we were ready to master it, we could not get a stable digital machine to work at Capitol. So we scrapped the original digital tape and worked off the compiled analog master. But EQ changes between songs were drastic. We put in four solid eight-hour days to do it. The album wasn't perfect, by any means. There was no way it could be, because everything was mixed in different studios on different tape at different speeds.

R-e/p: You mentioned using digital. Have you done any recording to digital?

JB: Not direct. Right now, I'm not crazy about the sound of multi-track digital. The lack of extreme high-end bothers me. I love the sound of air above 20 kHz — harmonics, or the suggestion of harmonics. For example, if an instrument has a tone that consists of something at 10 kHz and something at 22 kHz, what you get besides these fundamentals are multiple sum and difference harmonics between those frequencies, all the way out past audibility. Digital is not going to print anything that's above 20 kHz or the sub-harmonics, whereas an analog master will print them. They may be down 30 dB, but they're still there. So if you have those harmonics on the analog master, you mix to digital and you combine everything together, the effect of those harmonics is going to be there. The effect will still be there whether you print it on digital, or not. If you've lost the harmonics — if you print the digital — they're gone forever. There's a certain sound about it that's still not right for me. However, I'm in love with digital 2-track because of the transients you lose transferring from analog to analog — for example, snare transients.. I mix to the 32-track digital and stack the album mixes on tracks 1 and 2, then 3 and 4, and so on. When you compile and edit the album, you go to the 4-track machines. I've been using the 3M Digital System, but will be trying the Sony system as well. I also do an analog mix in case I run into problems, because digital machines still suffer from a lot of interface problems.

R-e/p: Where do you see music going in the Eighties?

JB: I wish I knew. I'd be a lot wealthier than I am now. I can say what I like, but that would be about it.

R-e/p: Well, usually when times are soft, financially, music gets hard, and when times

**... continued on page 40 —
December 1980 □ R-e/p 37**

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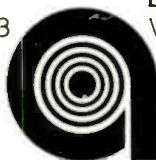


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. . . How many times can you watch a movie . . .
or a Saturday Night Live?**

are hard and money gets tight, music gets soft. According to recent forecasts and studies, there's going to be a massive rise in the population of the under-five year olds by 1985, which means there's going to be more family units. Do you think that will forecast a shift in lyric content from the, let's say, "Let Me In Your Pants After the Dance" type of song, to more of a romantic, family-oriented theme?

JB: First of all, I take issue with the notion that there will be more people under five in the 1980s. I don't know what they're predicting that on, but I don't see any increase in the birth rate. I don't mean to argue with the forecasts, but birth and death rates are down, and the country's getting older. The median age in the United States is rising. When this post-war baby boom hits 60, it's going to be the largest senior citizen group in the history of this country. I disagree with those figures. Your other statement is much more astute. When times get tough, radio tightens its belt and plays sure things like soft rock. They try to get their ratings up, use passive research, and radio ceases to sell records as much as it does in active times. That's happening right now, unfortunately; radio is very soft. If you open *Billboard*, the first rock and roll record you find on the charts is "Hit Me With Your Best Shot" by Pat Benatar. Everything is very soft rock — like Chris Cross, or Streisand — or black-oriented things, such as the Jacksons. They're all very adult, contemporary-oriented. New Wave and rock and roll, unfortunately, are just not selling as far as singles and mass radio goes. Of course, the big hard-rock acts, like AC/DC, is still selling. But the outlet for new music is changing from radio to different areas — like small clubs. If anything is going to happen, I think that artistic things are going to develop out of a solter musical context. Steely Dan is a prime example: they're a huge band right now that doesn't even tour — their only outlet is radio. They are the most progressive act now using radio as their main vehicle, and I think we're going to see more of that. Chris Cross with intelligent lyrics.

R-e/p: But they're not particularly romantic in any way.

JB: No, they're very cynical. If times stay tough, things get cynical. If Reagan turns the economy around, then I think it will change. I really think you're right in terms of that it will be a function of what happens to the economy. Rock and roll was born in the Eisenhower years. And yet the most important advances in rock and roll happened during the Kennedy years. Dylan, Stones, Beatles, all occurred during a liberal time period — the time of Kennedy, of "Camelot," and the opening of consciousness. The original rock and roll — Little Richard, Elvis Presley, Fats Domino — occurred during the bland Eisenhower era, in which people were sort of asleep. Rock and roll was a rebellion thing against that. The Wild Ones . . . James Dean types . . . were rebelling against the soporific situation.

R-e/p: And the cycle's come around again?

JB: Let's wait and see what kind of administration we've got coming; then we can predict. I love to hear cynical lyrics, commenting on things. I love to hear romantic songs; I'm a real soft touch for that as well. If the romanticism is spiced with a little reality — a la Hemmingway, Bogart — that's the best for me; that tough romance. I'm not crazy about gushing romance.

R-e/p: You also stated that you'd like to see more planting and less harvesting; more original music than remakes. But then you mention the 25- to 45-year old generation, which is the biggest generation that's out now, and you just got done talking about the music of the 50s, and 60s, and 70s — a whole wealth of material. That's our nostalgia, just like our parents had Gershwin and Irving Berlin, Cole Porter, and all the standards. Don't you think it's very important to do those remakes to entertain this 25 to 45 audience?

JB: If that's what those people want to hear, and they dominate the market, then we're going to give it to them. Because this is a business, after all. I'm hoping that, at the same time, there's some sort of breakthrough and these new acts will wake people up and get them going. I was real happy to hear the Pretenders record. I love the fact that the Police came along. I was afraid of going to sleep; you need something new every once in a while. I like nostalgia as much as the next guy, but you can't harvest, you must plant. Fortunately, the age group that goes for the Pretenders and the Police doesn't dominate the market right now, because of the baby boom from '46-'52.

R-e/p: Do you feel you will be getting into video production?

JB: Yes, absolutely. I have three machines, camera, tons of video tapes, computers, this and that; I'm ready. I'm trying to develop video skills and video technology, and I'm waiting to see what effect video discs will have on the market. I'm waiting to see if video tapes really sell. What would happen if you compiled certain rock and roll tapes or discs like *The Best Of* . . . — would they sell? Then I want to know if this Blondie video cassette sells. I'm hoping that I'll be ready, that I'll be able to produce an audio-visual package.

R-e/p: Again, according to the statistics, the 25- to 45-year old generation is the biggest audience. And most of the music sold is rock music — soft, medium, and hard — because this generation was raised on rock 'n' roll. The number of families is increasing, and along with rising gas and entertainment costs, it will probably be keeping more people at home. That means there will probably be a growth of in-home entertainment systems sales. What do you see that leading up to in terms of video entertainment?

JB: I see that making a geometric leap in the amount of video entertainment available. Gas costs too much money; you don't want to go down to the theater. I think it's going to be not only through a sales process — the purchase of

video discs or video tapes of movies or music, or whatever — but also a cable communication situation. You're going to be able to tap into more and more channels. There's no way I could even begin to watch what's available to me through cable television. I can get Atlanta, Chicago, Canada; anything I want. And I don't have to leave my house. So video will be very important, and we have to provide software for that.

R-e/p: What will the format be?

JB: I wish I knew. The first format that seems to be working is movies. Movies are something you can watch more than once. How many times can you watch a clip of Jagger doing "She's So Cold?" The ability to experience an artistic performance more than once is the criteria on whether anyone will, or will not, buy it. Therefore, you have two things with which you're going to have to start dealing: (1) Rentals — either through the mail or through some depot. Because people don't want to pay for a concert on video, they will rent it, watch it and then send it back. Maybe they'll even try to copy it. And, (2) you're going to have the proliferation of video tapes and discs that bear repeated showings. Records, of course, have always been repeated experiences; you can listen to records a lot of times. How many times can you watch a movie, or *Saturday Night Live*. So those are the two factors, I think: rentals, and sales of tapes that bear repeated experience.

R-e/p: Do you feel that established rock stars could make a good transition to video?

JB: Yeah. I think Bowie has the artistic sensibility to do it. Mike Nesmith is very much into this and I think he could be a prime mover. Maybe Todd Rundgren. There are certain artists, shall we say, who are gifted along these lines. It's like when silents went out and talkies came in. Some actors just went down the tube because they sounded funny when they talked. They looked great on the screen, but they opened their mouth and it was over.

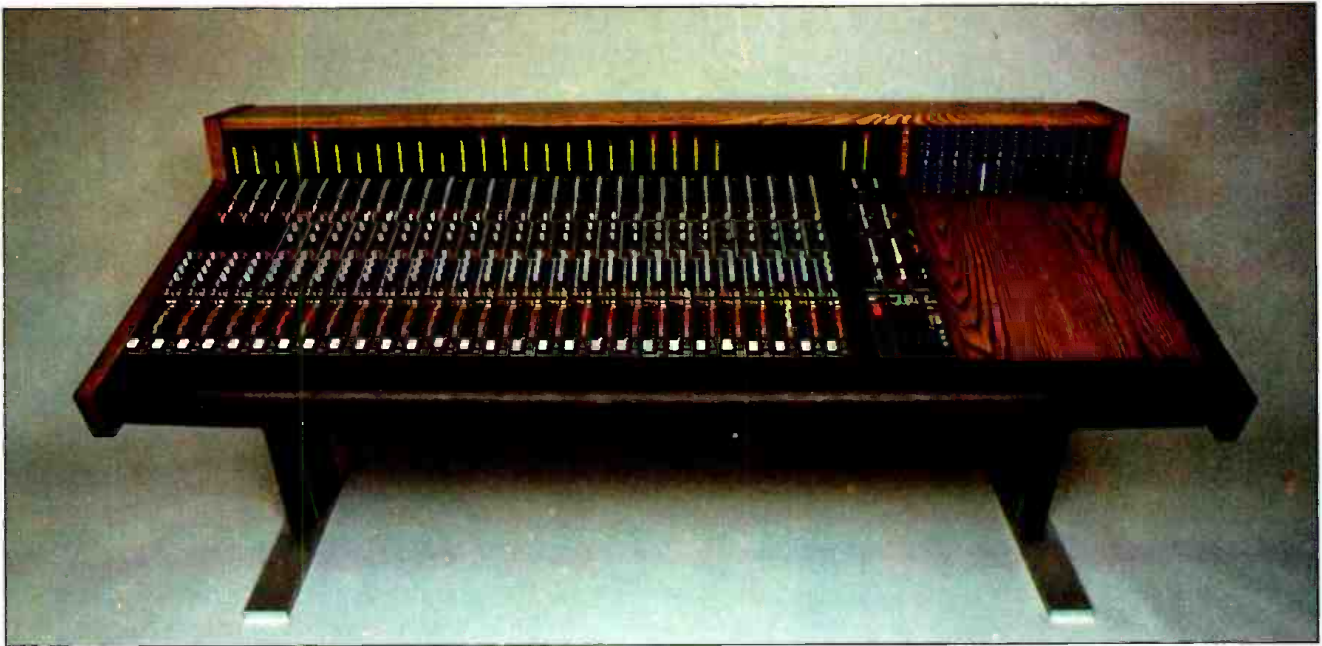
R-e/p: Well, same with musicians, I guess. Do you have any advice for new producers?

JB: Yeah, learn something else. I'm not trying to be facetious, but when I came up into production, it was a lot easier. Now it's tough. You're either going to have to come up through engineering, musician, arranger, or artist — those are the four ways to get into production nowadays. I don't think there are going to be any more line producers that don't have a background in one of those. I was a session player and songwriter in my early career, so I came up through something. If anyone wanted to be a producer, I would recommend going to engineering school, or music school.

R-e/p: Just one final question. How important do you think a positive attitude is?

JB: It's absolutely everything. It's something you must have. Confidence and desire are probably the most important things.

□ □ □



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NOISE LEVEL BUILD-UP RELATIVE to REFLECTIVITY

... control room design to minimize mechanical equipment noise ...

by
Michael Rettinger
Consultant on Acoustics

In the following we are not concerned with control room noise produced by an air conditioning system, or by the transmission of disturbances through the walls, ceiling or floor of an enclosure. Rather, we are concerned with rumble, clicks, and pulsing produced by various pieces of recording and reproducing machinery often located against the rear wall of the control room, behind the mixing console.

Equipment noise may be caused by the operation of recorders, tape reproducers, counters, and various other pieces of machinery located there. Most often the offenders are fans mounted within equipment to

keep it cool, but the disturbances may also be generated by tape reels, movable tape guides, take-up or hold-back motors, and internal pulleys and gears. Most frequently very little can be done to lower the noise level of such sources, since such devices as slower fans simply are not practical. Also, plastic instead of metal gears cannot very well be introduced by the studio without losing warranty on the equipment, or causing some unexpected side effects. The simplest method of reducing unwanted noise would be to provide a housing around the equipment, or locate it in another room, both of which methods of noise reduction entail operating disadvantages.

Figure 1 illustrates the build-up of sound power when a source of sound is placed near a reflective wall. This change in power output is a function of the ratio of distance between source and wall to the wavelength of the signal emitted by the source.

Figure 2 illustrates the build-up in noise level at a given point in the room — such as the mixing console of a control room — when the source position at the rear wall is changed, along with reflectivity of the immediate environment. Thus, if the noise level at a given distance from the source in the open is 40 dB-A, the noise level at the microphone may rise as much as 9 dB, to 49 dB-A, when equipment is placed in a corner of the room at which three reflective orthogonal surfaces meet.

It has been the experience of this investigator that when the highly absorbent rear wall of a "conventional" control room is made highly reflective to achieve a live-end/dead-end (LEDE) control room, the noise level at the console due to the equipment disturbances at the reflective rear wall was readily noticed by the mixer.

Figure 3 shows how noise at a mixing console

may be reduced a few decibels when the equipment is either very noisy, or is placed against a reflective rear wall. Directly in front of the machines are erected 3/8-inch thick Lucite sliding doors about a foot higher than the equipment so that, if desired, it may be observed at all times from the mixing console. The wall behind the equipment is rendered highly sound-absorptive to reduce the noise level there as much as possible. This may be advisable only in a LEDE control room, since the mixer working in a "conventional" control room would probably dislike signal reflections from the Lucite cabinet walls. □ □ □

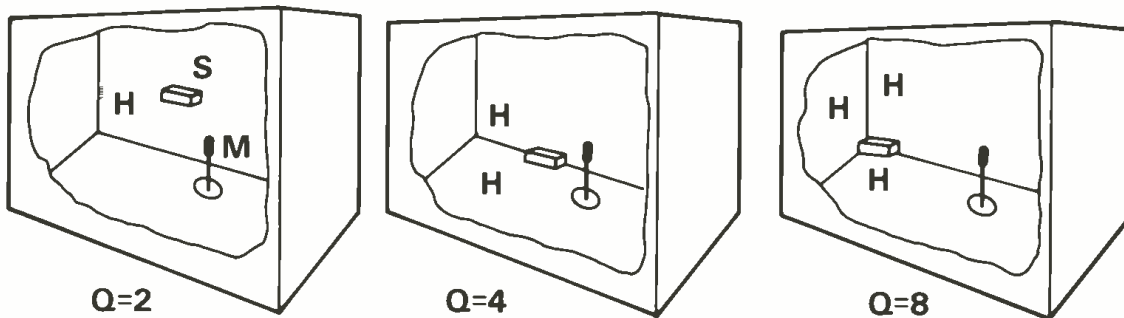
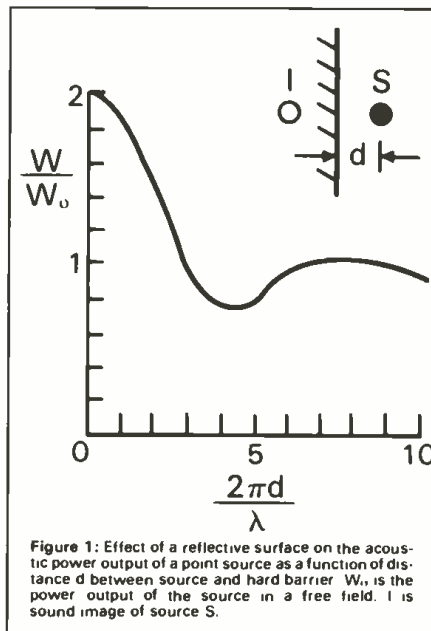


Figure 2: M is microphone; S is noise source; H are hard surfaces, while all other room surfaces are highly sound-absorbent; Q is the directivity factor of the source. When Q is 1, (anechoic room) noise level at microphone is, say, 40 dB-A; when Q is 2, the noise level at microphone is 43 dB-A; when Q is 4 the noise level at the microphone will be 46 dB-A, and when Q = 8, the noise level at the microphone is 49 dB-A.

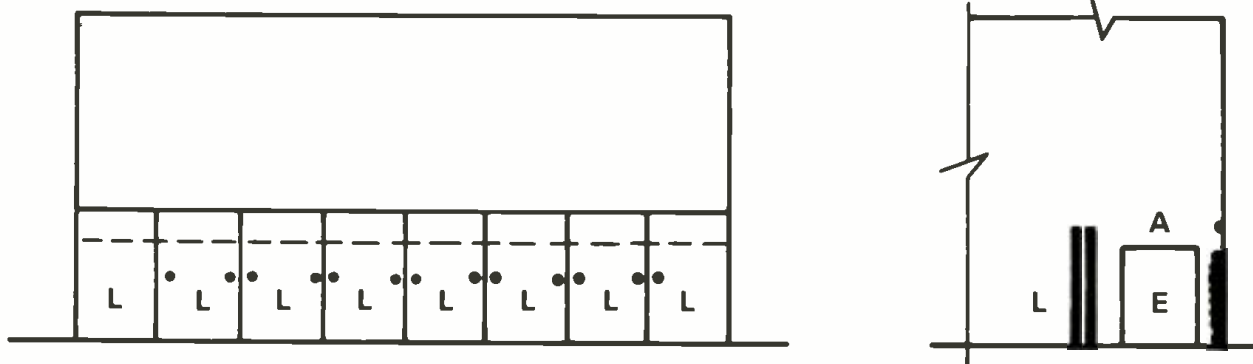


Figure 3: To reduce the noise at the mixing console of a control room, the noisy recording and reproducing equipment, E, may be placed behind sliding 3/8" thick transparent Lucite or Plexiglass panels. The wall directly behind the equipment should be faced with a sound-absorbent treatment marked A.



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THE DIGITAL RECORDING SCIENCE

... a comprehensive introduction to digital recording ... comparative analog/digital parameters ... digital recording requirements

by
Daniel Gravereaux

At last the most brilliant and energetic passages of a performance can have the lowest distortion; the delicate musical transients aren't smeared by wow and flutter or tape guidance; and playback on another machine does not change the sound whatsoever. These are the major advantages of PCM digital recording.

There are many other benefits of digital, such as increased dynamic range, negligible interchannel crosstalk, no annoying tape print-through, no tape equalizing or head alignment and azimuth skew adjustments, or no future copy generation loss, but none are as important

as those first mentioned.

To get a better perspective on digital recording, we should take a second look at recording. To date no recorded music using conventional analog methods, has ever captured the fortissimo of a concert without subjecting the sounds to the more non-linear portion of the medium (be it disc, tape, or film) — that is the region nearing saturation. Further, this is a double-edged sword since the louder the sound, the more distortion we are able to hear. However, digital is completely the opposite: the louder the sound, the lower the distortion becomes. In fact, at a dB or so below clipping, we can expect less than 0.002% distortion from a professional unit!

Even a 1 kHz reference tone will sound exactly like the source oscillator. This is because PCM digital has essentially no wow or flutter. The difficult transients of a piano, drum kit, or even a harpsichord or cymbals are completely preserved and re-creatable with digital. With these sounds you can hear the difference between the best analog (with noise reduction), and a PCM player. Even 13-bit PCM machines, with less dynamic range, will outperform an analog deck on transients, due to the lack of wow and flutter.

Lastly, if the PCM digital machine is in working order, it will not require level or frequency response adjustment to accurately and faithfully reproduce any other tape from a

the author —

Daniel Gravereaux is the manager of the Sound Technology Department of CBS Technology Center in Stamford, Connecticut, where he has been involved in all phases of audio engineering since 1964. Starting with the miniature voice recorders which flew all Gemini space missions, he has developed innovative improvements in disc record fidelity, the SQ quadraphonic disc system, the Ghent microphone, and, most recently, managed the engineering of CBS's DISComputer™ Mastering System. He holds seven patents, has published numerous articles, really enjoys "clean" sound, and relaxes with his amateur radio station.

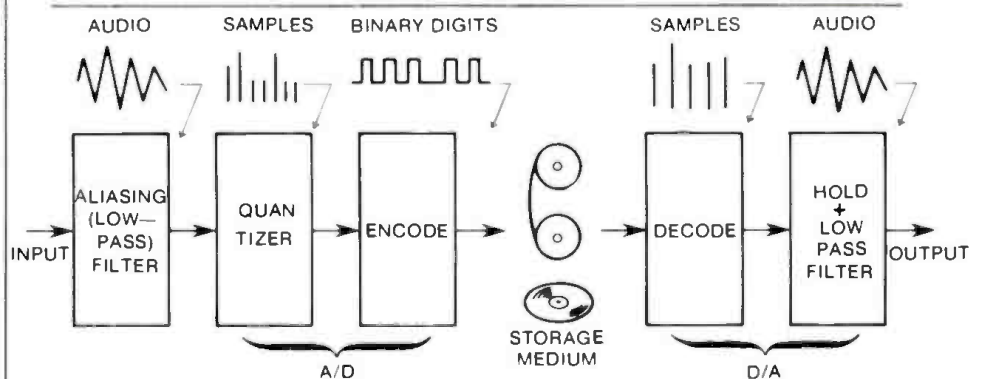
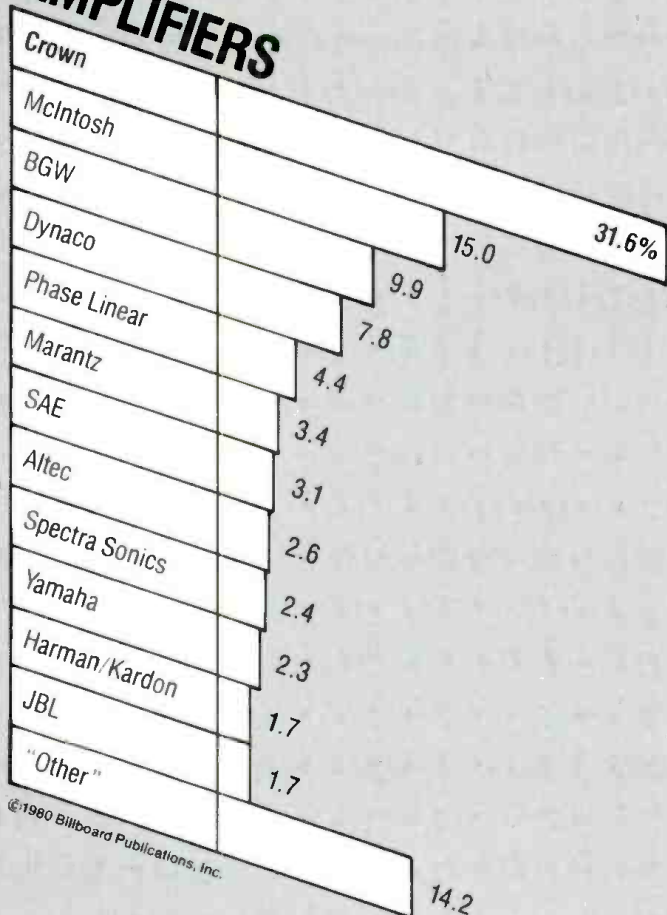


FIGURE 1: PCM DIGITAL RECORDING SYSTEM

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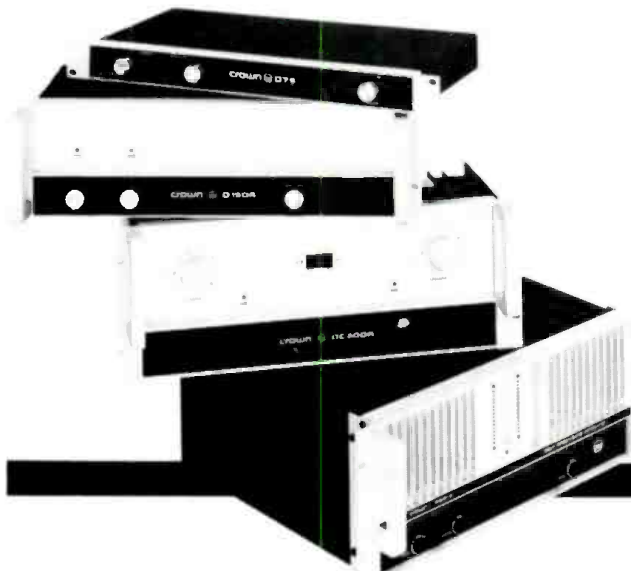
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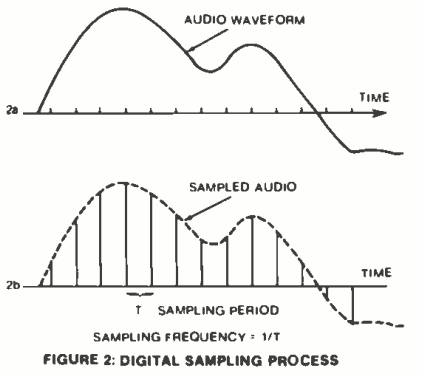


FIGURE 2: DIGITAL SAMPLING PROCESS

similar machine. Head azimuth, equalization, and reference level basically have no adjustments. The operational advantages are obvious, particularly when dealing with out-of-town and international product!

An enthusiast of digital tape recording must recognize, nevertheless, that at its present stage there are some major considerations — cost, complexity, compatibility, and editing capabilities. Presently, a professional 2-track PCM tape system costs above \$30,000, and multi-track units run well above \$100,000. If a technical problem arises a PCM deck will probably require service by the manufacturer. Both the complexity of the deck and the technology employed are foreign to most studio technicians. Also, different manufacturers have adopted different PCM codes, different tape formats and speeds, and tapes are therefore not interchangeable between machines.

The last problem is that of editing; digital tapes are a whole new ballgame. You can't necessarily just cut and splice two tapes together and get optimum results. A special "editor" device may be required and, as of this date, a few first production units are appearing. They work well — when they work — but still this type of editing is costly, time consuming, and will require a lot of "getting used to." Usually at least two digital tape recorders are required: one for the un-edited tape, one for the edited result, and an editor, which itself contains a good deal of digital storage.

Nevertheless, even with the considerations mentioned, digital is presently bringing an evolutionary advance to the fidelity of recorded sound. Many of the "growing pains" of this new technology are being solved in both concept, hardware, standards, and operational requirements. To the recording studios and the artist, a take on a digital tape deck offers such fidelity advances, that some of the operational problems are far outweighed.

The PCM Concept

Before continuing it might be good to review the basic concept of digital recording — in particular, a general pulse code modulation (PCM) tape recording system. Besides providing a background for understanding digital concepts, this will give credence to some of the earlier stated generalizations.

First, an analysis of what is to be accomplished. That is the replacement of conventionally recorded (analog) tape, wherein the degree of magnetism (remanence) at any point corresponds to the audio signal, with a coded representation of the same signal. Then, upon playback, we just have to recognize the code to recreate precisely the original audio signal.

Figure 1 is the basic PCM recorder block diagram. First the audio is passed through a low-pass filter to assure that the signal is confined to the audio band. Then it is converted into digital

by an analog-to-digital converter (ADC). The process is essentially simple in concept. At precise instances in time the audio voltage is measured (sampled) and stored. A binary number, equal to this voltage, is generated, and then recorded on the tape. Upon playback, the binary number is read and decoded back into voltage samples. The voltage samples, which are caused to appear at precise time intervals, are then passed through a low-pass filter, which essentially connects the voltage samples together to recreate the original continuous audio waveform.

The audio fidelity — frequency bandwidth, dynamic range, and distortion — are totally dependent upon the choice of sampling frequency, and the number of bits used in the binary code.

Sampling And Binary Code

Figure 2 illustrates the sampling process. At precise intervals, the audio in 2a is examined, producing essentially the pulsed representation in 2b. The rate at which the audio is sampled is called the sampling frequency. Slightly more than two samples for the highest audio frequency are needed to convey full information. This means that for audio frequencies up to 20 kHz, we need to have a sampling frequency of more than 40 kHz.

Concurrent with the sampling process, the discrete voltages are converted into a binary code. The system's dynamic range and distortion are dependant on the number of binary digits (bits) chosen.

Let's look at the development of a binary code for the numbers 0 through 7. It is a two-state code — either the presence or absence of a signal, or a "0" or "1". In Figure 3, the eight numbers 0 through 7 can be divided between 3 and 4, assigning a "0" to 3 and below, and a "1" to 4 and above. Next, we divide each group again, assigning a "1" to the higher pair, and a "0" to the lower pair. Lastly, each sub-group is re-divided, assigning a "1" to the higher number, etc. Note that now each number is uniquely

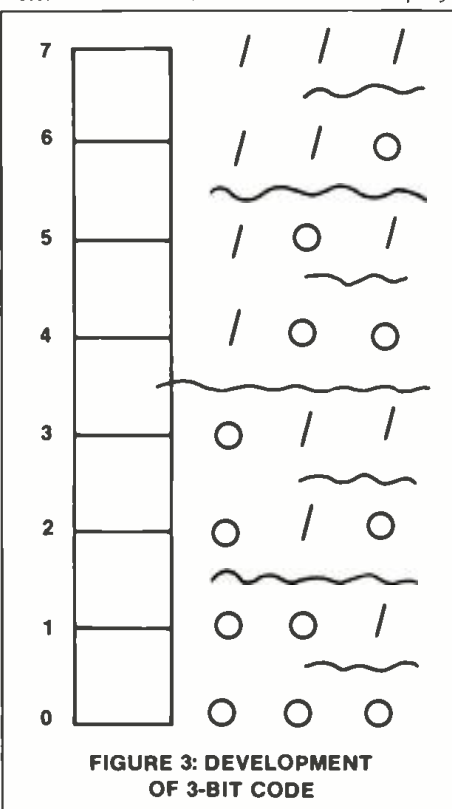


FIGURE 3: DEVELOPMENT OF 3-BIT CODE

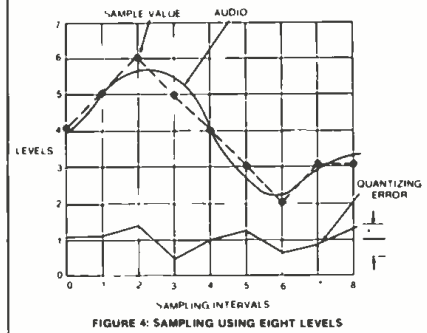


FIGURE 4: SAMPLING USING EIGHT LEVELS

defined by its three-bit code representation. For example, to indicate the number 5 we need only use a "101", etc.

Quantizing Error

If just a 3-bit code is used to represent an audio voltage, a problem becomes apparent. A large range of audio voltages exist, yet only eight different voltages can be represented by a three-bit code. This error is known as quantizing error. It is a source of distortion, as well as a "modulation" noise. Figure 4 depicts the sampling of an audio waveform using only eight levels (corresponding to the 3-bit code). Each sample must be rounded off to the nearest of these eight numbers. The bottom curve depicts the quantizing error — \pm one-half level — 12% peak distortion or a "noise" of only 18 dB down from peak signal.

The question is how many bits are required for a high-quality audio system? Each time another bit is added to a binary system, the number of levels that can be represented doubles. If a four-bit system had been used the ordinate in Figure 4 would have been 16 (levels), and the quantizing error halved, corresponding to half the distortion and modulation noise. In fact, with the addition of each bit there is a shade over a 6 dB improvement of signal-to-noise ratio and 6 dB less distortion.

In equation form:

$$\text{Levels} = 2^{\text{number of bits}} = 2^n$$

And for dynamic range this is expressed as the number of levels in dB;

$$\begin{aligned} \text{Dynamic Range} &= 20 \log(\text{Levels}) \\ &= 20 \log 2^n = n \cdot 20 \log 2 \end{aligned}$$

Since $20 \log 2$ is approximately 6 dB, the dynamic range of a digital system can also be determined by multiplying the number of bits by 6 dB:

$$\text{Dynamic Range} = n \cdot 6 \text{ dB.}$$

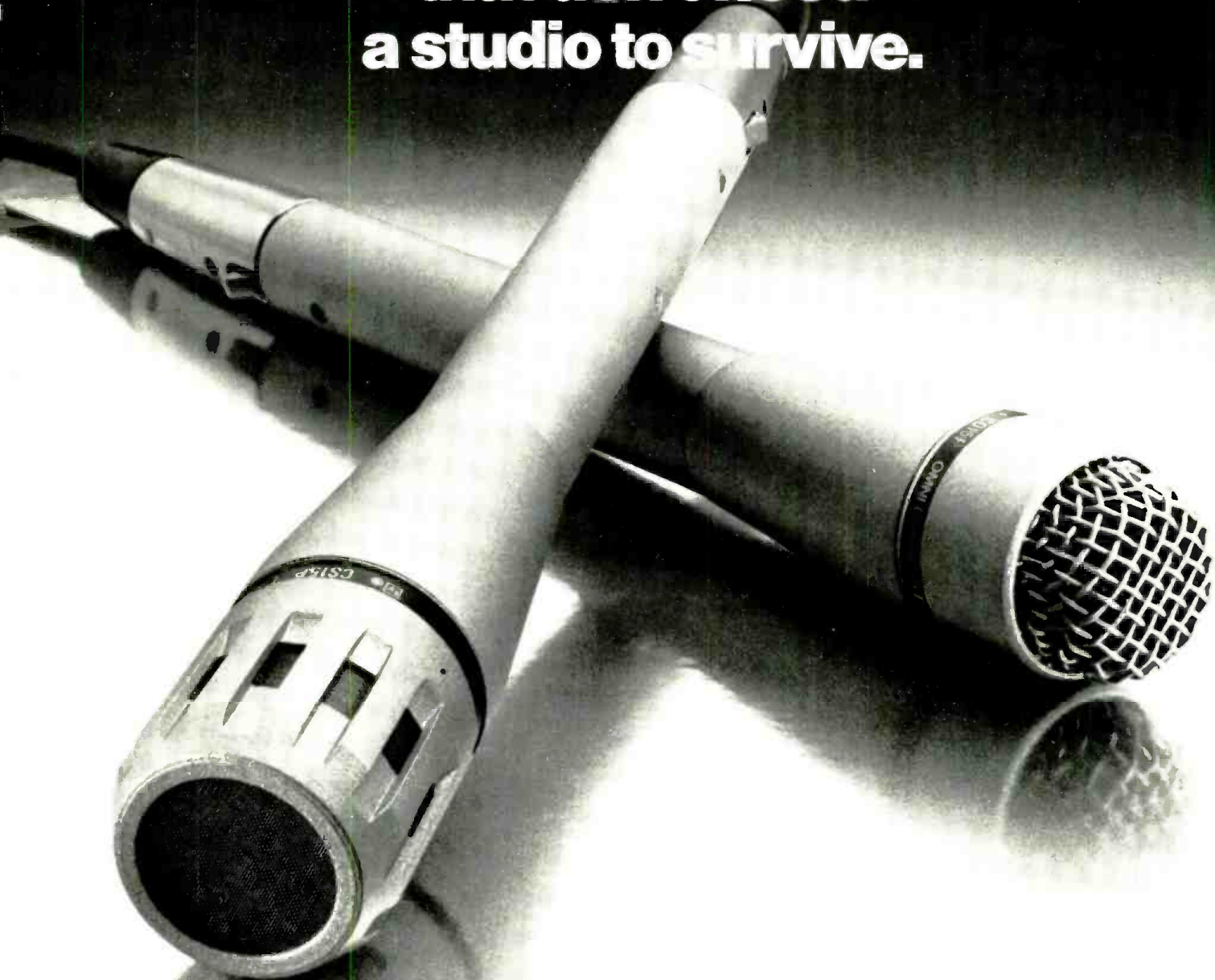
To determine the distortion it can be observed that the system can be no more accurate than one level ($\pm \frac{1}{2}$ level) out of the maximum number of levels. Therefore, just prior to clipping, the distortion is:

$$D = 100\%(\text{Levels})^{-1} = 100/2^n$$

If the allowable headroom of a digital system is 18 dB, then the distortion figure is eight times as great at "0 VU" recording level, and so on. In essence distortion is less just before clipping than at the "average" operating level.

Table 1 shows the correspondance between the number of bits, the levels, the distortion and the dynamic range.

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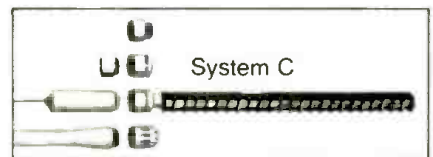
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It is apparent why only systems having the equivalent of 14 or 16 bits are being considered for professional applications.

Tape Signal

Looking now at the digital signal which will eventually be placed on the magnetic tape, this data must contain twice as many samples as the maximum audio frequency, and each sample must contain a sufficient number of bits for good accuracy. Assuming 50 kHz sampling frequency and 16-bit encoding, we obtain a rate of 800K bits/second or a bandwidth of almost 1 MHz. For this reason, video cassette recorders, or "in-line" decks having several tracks per channel are used for PCM audio recorders.

Unfortunately, obtaining such a high "information rate" from magnetic tape is not easy. Aside from requiring special heads, newly-

BITS	LEVELS	DYNAMIC RANGE	% DISTORTION	
			AT CLIPPING	18 dB BELOW
8	256	48 dB	0.39 %	3.2%
10	1,024	60 dB	0.098 %	0.78%
12	4,096	72 dB	0.024 %	0.20%
14	16,384	84 dB	0.006 %	0.048%
16	65,536	96 dB	0.0015%	0.012%

Table 1: Correspondence between number of bits, levels, dynamic range and distortion.

formulated tape, and special digital codes suited to recording, tape dropouts are a major hindrance. Although tolerated in conventional audio recording, a dropout now loses information bits — sometimes the most significant bit — causing a loud click sound.

Various error detection codes and error correction techniques are employed to alleviate

and prevent errors. Parity, which is the inclusion of an added bit to indicate whether the number of "1s" in the sample were either odd or even, is used readily in PCM recording. This provides information as to whether an error exists in a given sample.

If an error is detected, then the sample must be either corrected, or in some manner concealed. A common method of concealment is "interpolation," wherein the incorrect sample is replaced with the average of the two good samples surrounding the error. This is often called masking. Other methods include repeating either the preceding or following sample.

Because dropouts can be relatively long, a large number of samples can be lost, thereby inhibiting error alleviation. As a result, location diversity is often used. Here the individual samples are made non-consecutive — such as sample 3 is located next to sample 52, etc. Then if a large dropout were to occur, most likely the samples surrounding 3 and 52, which occur on a different place on the tape, are good and error alleviation is possible. Of course, the samples are rearranged to be consecutive during playback.

If sufficient further information were to be included within the digital signal, error correction becomes possible. Usually, additional "parity" is included, such as a cyclic redundancy check code, CRCC. Also, redundant (repeated) information is often included so that the individual bits can be corrected. It is, of course, of major concern to the audio industry that the "most powerful" error correction method be adopted for use in a professional PCM tape player.

Clocking

It is important to mention the "timing" constraints which govern analog-to-digital conversion, as well as the playback digital-to-analog conversion. A very stable oscillator is normally employed on the encode portion of the PCM recorder. Its stability governs the accuracy of the sampling time, ensuring that the proper instant of audio voltage is converted. Any jitter in the timing would introduce distortion. For this reason, a quartz crystal is usually employed.

Synchronizing signals are then included in the digital data that is recorded on the tape. The tape deck, of course, suffers from normal (low) wow and flutter, as would any mechanical transport. Upon playback, the bit stream and synchronizing signals are presented to the digital-to-analog converter. The synchronizing signal is then sensed and used to control the average rate of the playback oscillator. The digital-to-analog converter then decodes the binary signal, momentarily stores them (in a shift register), and then outputs the audio samples at precisely spaced time intervals. As a result any short-term wow or flutter in the tape deck does not influence the rate at which the audio appears. Therefore, a PCM recorder has far lower wow and flutter in the music than the best analog machines.

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Anti-Aliasing Filter

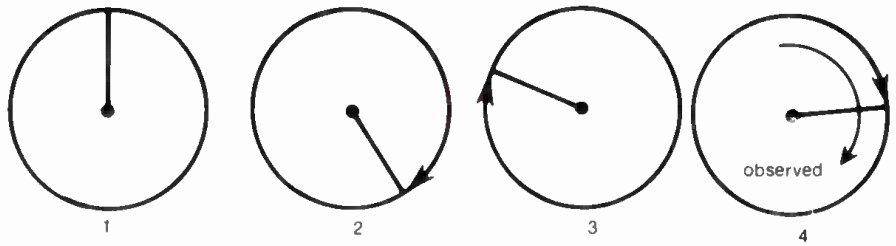
An introduction to PCM techniques is not complete without covering the "anti-aliasing" filter which precedes the entire digitalizing process, as shown in Figure 1. Aliasing is a term given to an unwanted signal that appears to be something that it is not. It occurs in the sampling process when the audio frequency is greater than one half the sampling frequency. In fact, the sidebands about the sampling carrier encroach back into the audio band and appear as progressively lower frequency audio signals. A spectral inversion takes place.

It is identical to the motion picture problem often seen wherein wheels begin to rotate backwards. Here the spoke's rate is higher than one-half the picture frame rate. Figure 5 depicts the motion picture frame of a single spoked wheel rotating clockwise. In 5a the wheel makes less than a half revolution between frames. Therefore, one observes that the spoke progresses in the clockwise direction. In 5b the spoke traverses more than a half revolution between frames, and the observer sees the spokes progress in the counterclockwise direction.

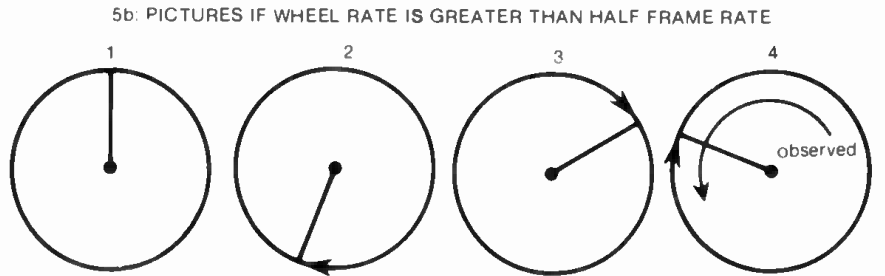
The aliasing filter must greatly attenuate all audio frequencies at and above one half the PCM sampling frequency, without affecting the intended audio range. Since there exists only a small "guard band" between the maximum audio frequency and one-half the sampling frequency, an extremely sharp low pass filter is required.

Non-Linear Coding

Another common practice in PCM recorders, which is also used in many digital audio systems,



5a: PICTURES IF WHEEL RATE IS LESS THAN HALF FRAME RATE



5b: PICTURES IF WHEEL RATE IS GREATER THAN HALF FRAME RATE

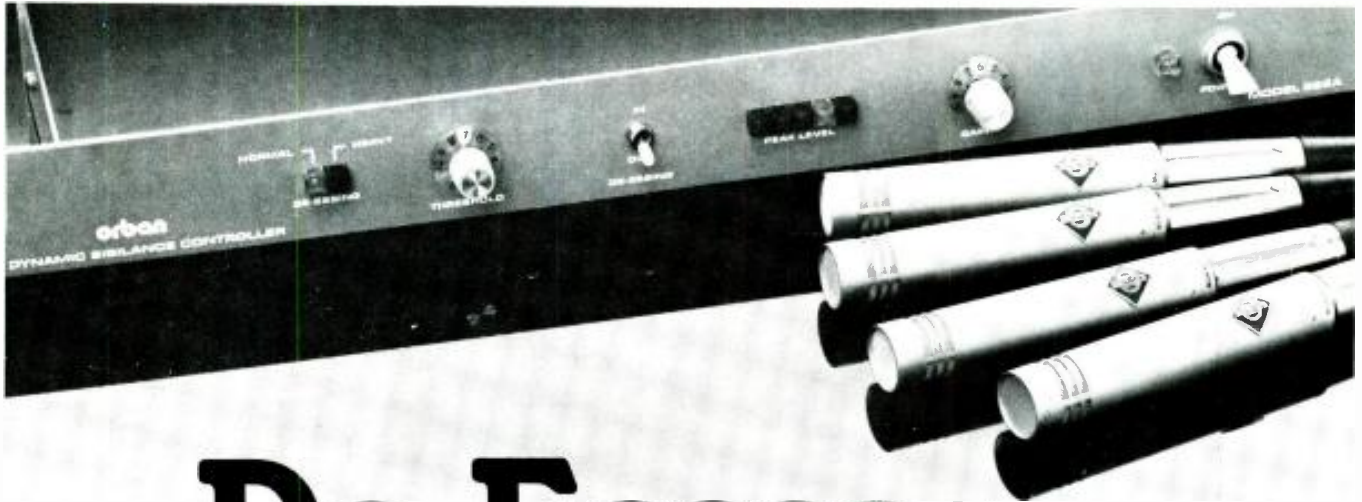
FIGURE 5: ALIASING IN MOTION PICTURES

is non-linear coding. This is a form of bit-saving which results in sample compression and expansion. Effectively both the recorder's input amplifier and output amplifier can be instantly switched in gain in opposite directions. If a factor of 4 times gain is chosen and an added bit is used to record the gain setting, one can achieve an acoustical dynamic range four times as great using only one additional bit. (Linear coding only gave us twice the dynamic range per bit.) Then, as the input audio waveform varies, the effective gains of both input and output circuits are varied

in the digital coding and decoding. This technique has been used in various PCM "home type" recorders, but it is not planned for use in professional PCM tape units.

Dither

The last topic I wish to review is PCM recorder noise. As mentioned earlier, quantizing noise, a form of modulation noise, was given as a limiting factor. Strictly speaking, if the audio signal were below the lowest level of the analog-to-digital converter, no bits would be



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generated and there would be no noise. However, it is common practice to introduce a false noise signal called dither, which is just slightly greater than the "least significant" bit. This is done for two reasons: the audible noise must represent a random signal not uncommon to normal (but much lower) analog tape hiss; and the dither helps ensure average value analog-to-digital conversion without generating quantizing noise coherently related to the audio signal itself.

Figure 6 is a diagram showing the effects produced by adding dither. The top curve, 6a, is an audio waveform being sampled, resulting in the discrete levels shown. Below, the quantizing error, 6b, contains a repetitive signal which is harmonically related to the audio signal. Obviously this quantizing error would not sound like tape hiss to which we are accustomed.

Curve 6c is the same audio signal with a random dither noise added. Note that when it is sampled, the quantizing noise, 6d, appears to have little relationship to the audio signal, and should sound more like noise. Note also that in curve 6e, which depicts the error relative to the audio alone, there appears less low frequency than in 6b. This means that, on the average, the digital signal more closely matches the audio signal. Of course, background noise is slightly

higher with the dither.

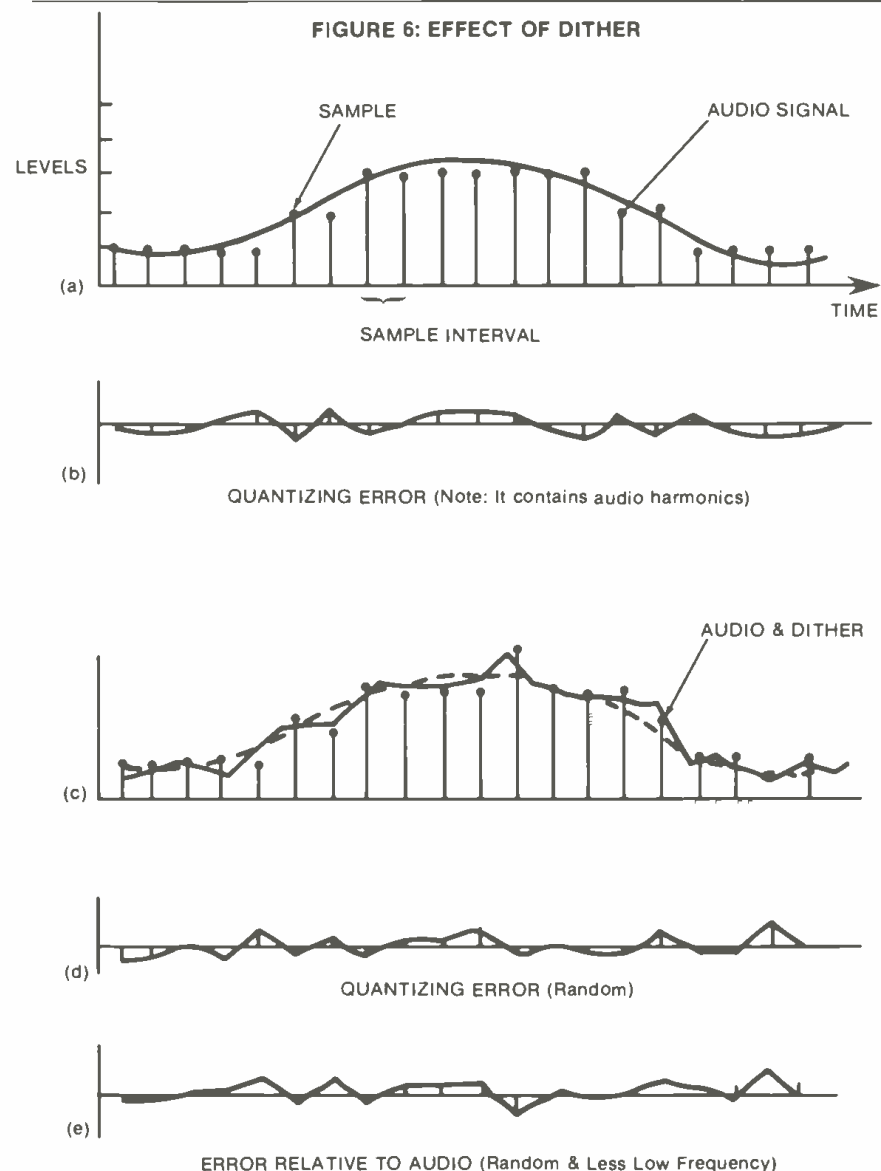
It is important to realize that the background noise of a digital recorder is fully dependent on the activation of the recording electronics. Playback of a blank tape will yield no information. To listen to the background noise of a PCM recorder, one must place the unit in the record mode first (with no audio input), then listen to the playback of the tape.

Conclusions

- Some conclusions can be made about digital PCM recording based on the preceding descriptions. First, the dynamic range and distortion is based solely on the number of bits employed in the digital scheme. Only bits are recorded on the tape, so there are no audio frequencies involved. Both these facts mean that head azimuth, equalization, bias and levels are no longer a factor in the audio quality. The magnetic tape (or disc) does not influence the audio as long as the code can be detected (and any errors corrected).

- Wow and flutter and modulation noise is eliminated because of the record/play timing synchronism.

- Frequency response is controlled by the sampling frequency. If 20 kHz is the maximum audio frequency needed, then a sampling



frequency in excess of 40 kHz must be used. The response is then determined by the efficacy of the anti-aliasing and output low-pass filters, not the tape.

- The background noise is determined by the number of bits, the "0" recording level chosen, and any pre- and post-emphasis employed. If a 16-bit, 96 dB dynamic range system were chosen, and 18 dB headroom is desired, then the noise would be 78 dB down. Pre- and post-emphasis is often used to lower the noise even further and to make the dither replicate analog tape hiss.

- Since distortion is determined by the number of levels used in the individual sample, the higher the audio signal, the lower the distortion. In order to maintain fidelity, particularly with soft sounds, a 14- or 16-bit machine is required for professional results.

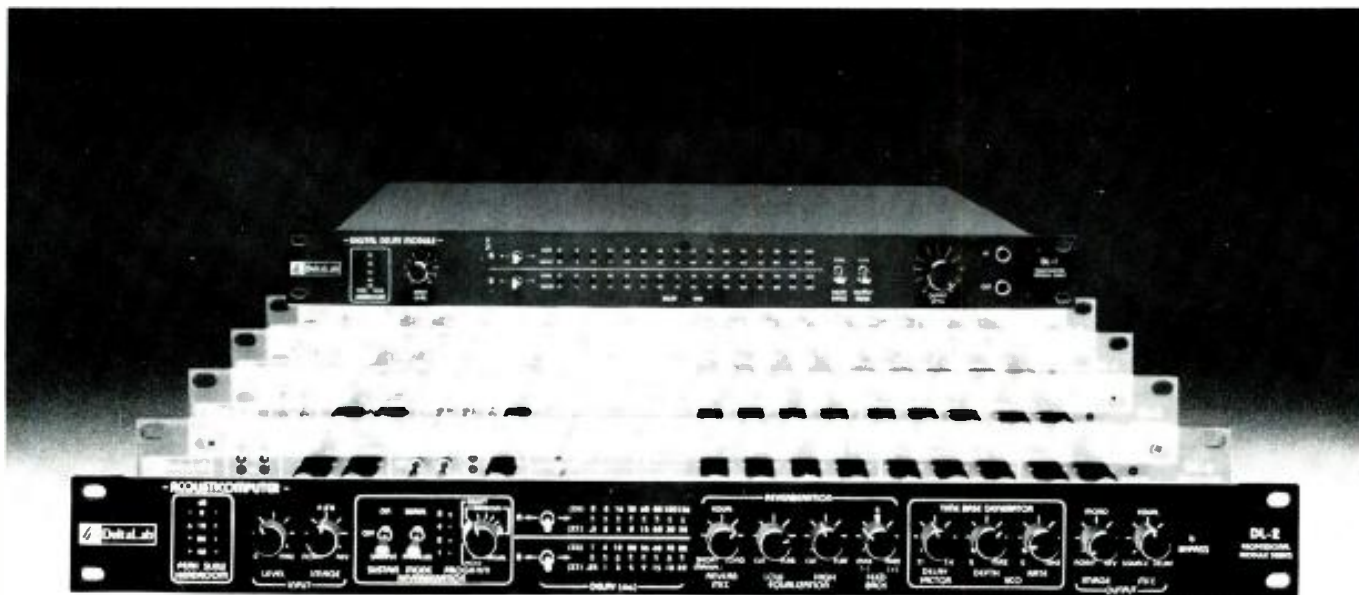
- A few other facts can also be pointed out.

Print-through, the transferring of a small amount of magnetization between tape layers on a reel, is no longer a problem with digital. The "presence or absence" of the desired bits are not effectively changed by this transfer phenomenon. Also, interchannel crosstalk is not a problem for the same reason. (And indeed, audio channels and tape tracks do not necessarily have any relationship.)

- Tape copying, using digital-to-digital, does not degrade the audio. This is because the bits are not influenced by the head to tape properties. Any source bit errors and timing errors will be corrected, and the result is a "perfect" bit stream being transferred to the other recorder. If, on the other hand, the audio output of one PCM machine were connected to the audio input of another, the tape copy would contain the added quantizing noise of the second recorder.

- Lastly, the editing problem remains. Cutting and splicing may end up connecting half the bits of one sample to half of another sample, resulting in a code representing a rather unique and undesired audio sample. Correction circuits may not be able to alleviate the error, unless the error correction code is very powerful. If not, a click is generally heard, and sometimes a momentary pause caused by loss of synchronization.

However, great efforts are being made by the equipment manufacturers to develop PCM recorders whose tape can be cut and spliced. Models are being shown which should be available in 1981. This welcomed feature, along with the ever increasing appearance of "editing machines" is now beginning to solve the editing needs. Then the fidelity advance of digital recording should dictate its ever increasing use. □ □ □



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*See Modern Recording "Hands On Report," Sept. 1978.

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TIME ALIGNMENT of SOUND REINFORCEMENT EQUIPMENT

by
Pat Maloney

(The first paragraph should be
read with Howard Cosell in mind.)

Cast your mind back! The date: October 6, 1927. The place: The Warner Theater in New York City. All eyes are on the premier showing of the Jazz Singer when suddenly — this man — Al Jolson — starts singing and the "Talkies" are born! The crowd is ecstatic! ... Cheering wildly because for the first time in recorded history they are experiencing the magic of the sight — and SOUND! of the silver screen . . .

This momentous occasion also marked the first commercial use of a two-way loudspeaker developed by the ERPI division of Western Electric. With the advent of sound in the cinema came the realization that the generally available full-range, single-cone loudspeakers were incapable of reproducing the necessary level

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and frequency range. Also, amplifiers in use at the time were not generally noted for their high power. Consequently, a more efficient speaker design was required to adequately cover a large movie house with a relatively small amount of amplification.

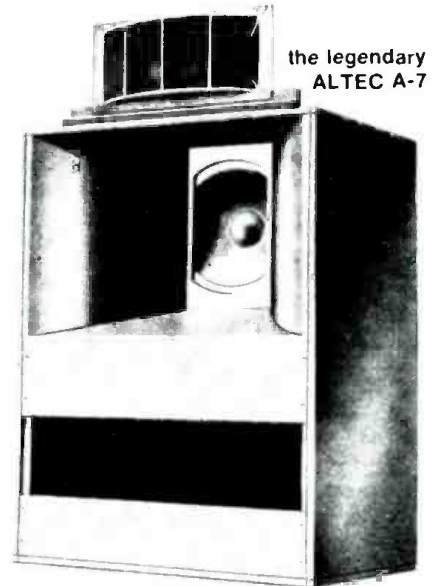
It was soon realized that a good way to increase the power and intelligibility of a sound system was to develop a two-way or even three-way horn-loaded loudspeaker, which would split up the frequency bandwidth amongst separate specialized components and project the sound into a large room. Complementary bandpass networks, or crossovers, were developed to keep the frequencies in their places, and the first multiway systems were introduced.

With multiway systems came multiple problems, however. In his book, *Acoustical Engineering*, (D. Van Nostrand Company, 1957), H. R. Olsen refers to research by Hilliard and Wensen-Torres in 1934 and 1936, in which the authors addressed some of the advantages and problems of multiway systems, crossovers, and the actual physical alignment of all the components in a multiway system. It was noticed that a certain cohesiveness of sound was lacking in multiway systems, depending on the various components' physical relationship to one another. With full-range speakers this problem was not noticeable to any great extent, due to the fact that all the frequencies were being generated from a single point source: the voice coil. With a multiway system, however, there can be several voice coils located in as many different positions. It wasn't until they were all aligned in the same vertical plane that cohesiveness returned to the system.

This "co-planar" technique was put to very effective use by Altec-Lansing in 1945, when the

company introduced the "Voice of the Theater" or A-7 loudspeaker. A direct descendant of the two-way system used for *The Jazz Singer*, the A-7 was developed specifically for the film industry, its frequency response being tailored to match the quality of the optical soundtrack in use at the time. In fact, the A-7 was designed by the same engineering staff that had worked in the ERPI division of Western Electric, prior to the division being dissolved in 1936. These engineers then formed the All Technical Corporation, which eventually became Altec in 1937.

The "Voice of the Theater" was basically a two-way system consisting of a 15-inch woofer mounted in a horn-loaded cabinet. The woofer crossed over to a horn-loaded, high-frequency driver mounted on top so that the two voice coils were positioned in the same vertical plane



the legendary
ALTEC A-7

While such an alignment improved the system's cohesiveness, the crossovers used also created a few problems of their own. Basically, they were second-order 12 dB/octave high-pass and low-pass networks, 180 degrees out-of-phase at the crossover point. Altec simply reversed the polarity of the high-frequency driver so that a signal would be additive at the crossover point; the result was flatter overall amplitude response. Although it was still only a compromise, this co-planar design took care of the greatest amount of phase shift in the system using a very simple solution. Time errors that existed within such simple networks and the speakers themselves were not really addressed at all. Altec felt it had already made a significant improvement and, besides, there was still considerable controversy over whether alignment of drivers was really very important in the first place! As a result, basically not much else was done for the next 20 or so years.

High Power Handling

Enter Rock and Roll, and the need for some serious power! The Altec-Lansing A-7 had been in use in the sound business for many years now but it was only rated at 30 watts. It was soon found to be incapable of providing the output desired by musicians and audiences of high-level rock music. Concerts were fast becoming huge outdoor festivals attended by bigger and bigger crowds, who were sitting farther and farther away from the PA speakers.

At this time, the few PA companies providing

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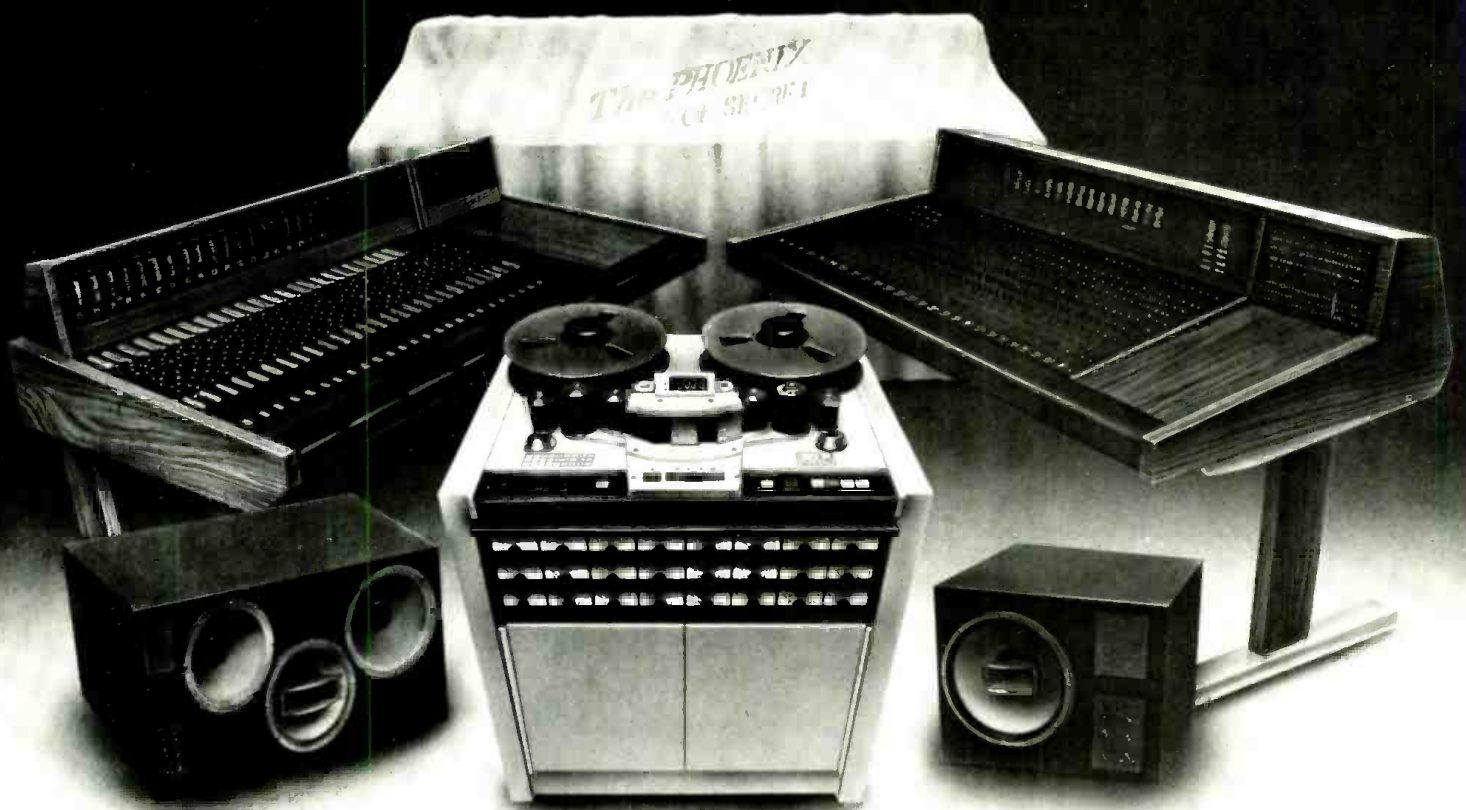
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equipment for these groups and concerts were basically offering beefed-up versions of the A-7. The woofer was often replaced with a 100-watt speaker such as the Altec 421. The single high-frequency horn was discarded in favor of a larger multicellular horn designed for wider dispersion, and which was driven by one or two high-powered transducers, such as the 100-watt Altec 290. These high-frequency horns were often packaged separately in their own road cases to facilitate shipping and set-up; again a potential source of driver misalignment. Often, due to lack of time, physical space restrictions, or just plain ignorance, the components of these two- or three-way systems were not set up with their drivers in the proper co-planar relationship. The result was as expected: a loud but not very intelligible concert sound system that was subsequently overdriven in an often futile attempt at clarity.

Recognizing this problem, several sound companies phased out the stackable array in favor of an integrated self-contained system, which again assured a co-planar relationship between components.

One of the first and foremost companies to go in this direction was McCune Sound in San Francisco. Working in 1972 with loudspeaker designer John Meyer, McCune developed the JM-3: a three-way tri-amplified system mounted

in a single cabinet containing two 15-woofers, a custom designed mid-range horn and two high-powered tweeters. The mid-range driver was positioned in the same vertical plane as the woofers, and the high-frequency tweeters placed as far back in the cabinet as possible, without interfering with their dispersion pattern. In order to eliminate phase reversal problems in the crossovers, McCune went to a unity-sum type of crossover, which basically reduced the phase shift through the crossover point. Used in conjunction with separate subwoofer cabinets, these JM-3 systems could be arrayed in an arc to provide an evenly dispersed high-quality sound that was controllable and consistent throughout the room.

After a brief hiatus in Switzerland, where he designed his own phase coherent and time-corrected studio monitor speaker, Meyer returned to McCune Sound in 1976, and assisted in the development of a time-corrected, powerful loudspeaker of considerably smaller dimensions than the JM-3. Known as the SM-3, this speaker filled the need for a two-way co-planar loudspeaker that could be used as either a high-powered stage monitor, or as a compact general purpose sound-reinforcement speaker. McCune's chief engineer Bob Cavin found that while it was now possible to align the drivers with

a very high degree of accuracy, most people who heard the speaker preferred to have the highs slightly leading the lows, and so it was aligned accordingly. The SM-3 speaker also utilized a summing crossover, and incorporated a driver diaphragm design patented by John Meyer (U.S. Pat. #4152552). The SM-3 is well protected by frequency selective fast-acting peak limiters, which make the unit virtually blow-out proof.

Early 1977 saw development of the SM-4B: a time- and phase-compensated version of the Altec 604. This speaker incorporated active all-pass delay and equalization networks, as well as Meyer's patented diaphragm designs. McCune engineer Steve Kadar engineered the replacement of the standard woofer cone with one capable of handling 150 watts. The SM-4B proved to be very successful in stage monitor use, and also for those difficult PA applications such as center-hung, "theater-in-the-round" systems.

The Altec 604 Family

The original Altec 604, introduced in 1944, soon became a favorite of recording studios that wanted the benefits of a two-way system, but didn't need the projection provided by a horn-loaded cabinet — and they certainly didn't need the size! (Figure 2.) Housed in a ported cabinet, this "co-axial" loudspeaker was aligned along the horizontal rather than vertical axis by positioning the high-frequency driver in the center of the woofer instead of above it. The result was three-fold: reduction in overall cabinet size; maintenance of cohesive imaging of a single-point source; and increased overall power and quality of sound compared to most earlier full-range speakers. Although other speaker manufacturers introduced similar co-axials at about the same time, the Altec 604 was pretty much a recording industry standard here in the States for many years.

As big an improvement as it was, time alignment of these speakers was actually off by between 0.5 and 1 msec., since the high-frequency driver, while in line with the woofer, was actually located behind it. McCune Sound therefore delayed the SM-4B's woofer by 0.57 msec. at 1.75 kHz, using an active all-pass network to bring it into line with the tweeter. Modifications were also done to the tweeter and woofer's support structures, to further reduce inherent phase problems and time aberrations.

Figure 2
Altec 604E



Figure 3
UREI 813



In 1977, UREI introduced a studio monitor speaker that was also built around the Altec 604, but which utilized a crossover with a small amount of built-in passive delay to move the apparent position of the woofer back to that of the tweeter. Known as the UREI 813 Time-Aligned™ Monitor, this speaker was based on an idea proposed and developed by Ed Long, who presented his work on the subject to the AES in 1976. (A *Time-Align Technique for Loudspeaker System Design*, Journal of the Audio Engineering Society, May 1976.) The new speaker, and the recording industry's reaction to it, is largely responsible for the attention being

Problems With Time

At the heart of the problem of time aberrations and phase anomalies is time itself. Within the confines and definition of our physical universe, time is a basic operating principle; eliminate time and you can indeed do wonderful things — although probably nobody will notice! (That, however, is the subject of another article entirely.) Suffice it to say that without time there is no concept of distance; without distance there is no concept of movement; and without movement, a speaker cone has no purpose in life.

Fortunately for us, speaker cones do move, albeit not very willingly and usually not very linearly. Take a single full range speaker, for instance. Now if you feed this speaker with a source of full-frequency noise and measure the resultant waveform, you will find that all the individual sinewaves that made up the noise (and that fall within the upper and lower limits of the speaker) will be present in varying degrees of amplitude, depending on the quality and linearity of the speaker. One of the factors affecting response of this speaker has to do with the phase shifts and time anomalies caused by the physical properties of the unit itself. This problem is most easily understood when one looks at the impulse characteristics of the speaker in question.

Back in 1822, J. B. J. Fourier postulated a theory that has proven to be workable up to this point, and which deals quite well with the problem at hand. Germane to this discussion is his finding that an ideal impulse is actually made up of an infinite number of sinewaves, whose positive-going peaks all occur at exactly the same place and point in time. Therefore, a single signal impulse can occur whenever all the frequencies are triggered at exactly the same time. In the next moment some of the sinewaves start going negative (i.e., those at, say, 20 kHz) before others do (at 1 kHz, for example). A complete cancellation occurs at this point due to the vector addition of all these positive- and negative-going sinewaves.

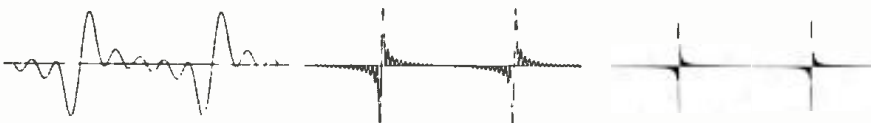
The impulse then stops, only to return again at an interval dependent on the period of the lowest frequency present (so long as all the other frequencies are again going positive at the same point in time).

The figure below is a computer-generated visualization of this phenomena, showing the interaction of up to 100 separate frequencies. It can be seen that the more frequencies involved, the more the resultant waveform approximates a perfect impulse.

Simultaneously triggering an infinite number of sinewave generators is not the only way a pulse can be generated — nor is it the easiest! But it should serve to show that, in theory at least, a perfect pulse contains the entire frequency range, and is the ideal signal to use to test the response of a loudspeaker. Basically, if you know what is going into a speaker you have only to measure what comes out to see where it is deficient.

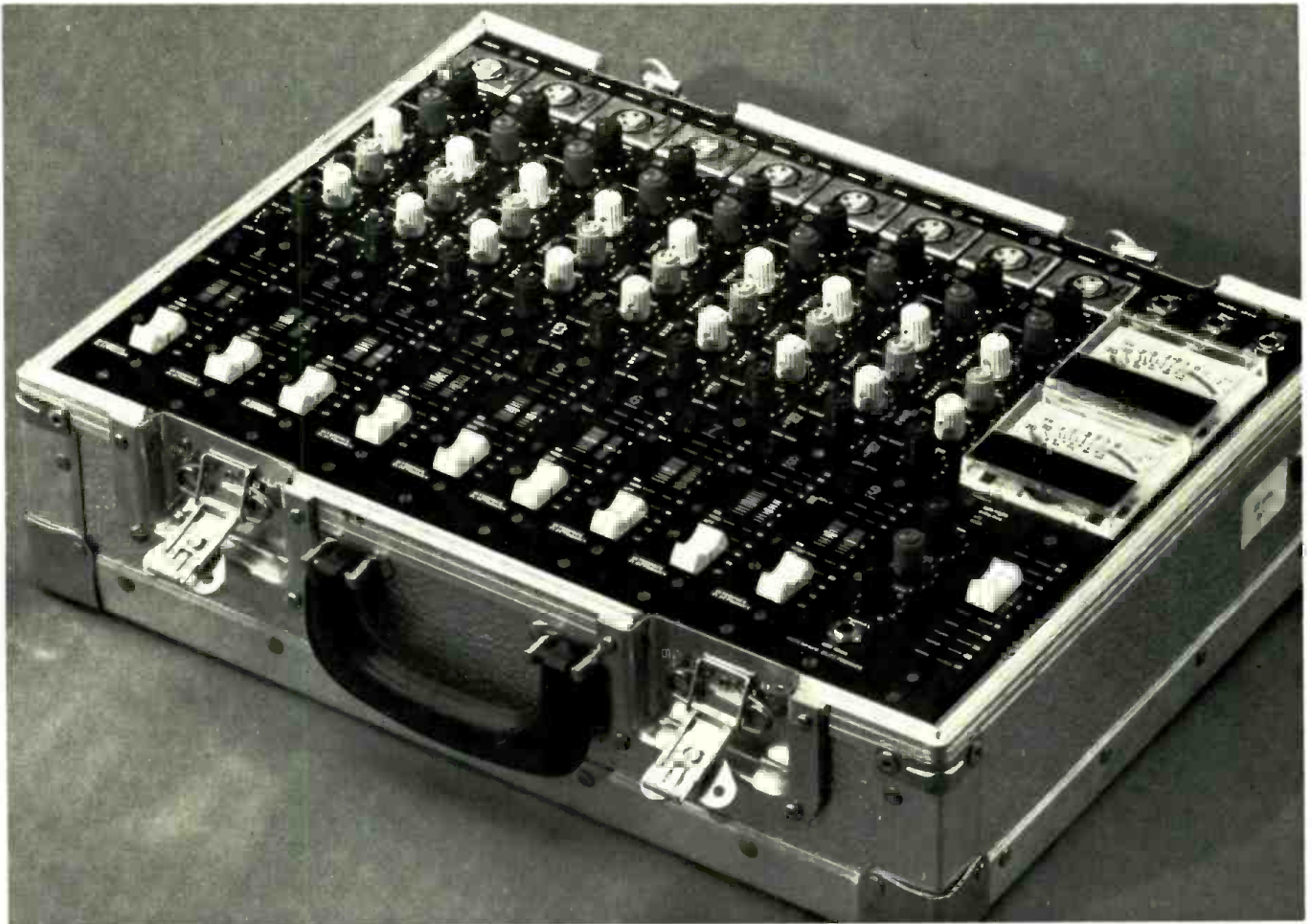
Now due to physical properties of mass, inertia, and a speaker cone's interaction with the air itself, a loudspeaker will react to high frequencies faster than it will to low ones. Therefore, if all audible frequencies are present in a single impulse to a loudspeaker, the highs will lead the lows once the speaker starts to react to the signal. Hence the need to delay the highs in relation to the lows, in order to accurately reproduce the impulse as it was before.

By splitting a full-range speaker up into a multiway system, and then delaying the various components accordingly, a time corrected system is developed. The only other way to keep the synchronization is to speed up the lows so that the speaker reacts *before* a signal is present — a task that should be only attempted by those of you who are already proficient at eliminating time from your universe.



Computer-generated graphs illustrating the way in which an ideal impulse waveform can be considered as comprising an infinite number of sinewaves whose positive-going peaks all occur at the exactly same point in time. The left-hand trace represents two cycles of five integer frequencies, starting at 1 Hz. As more sinewaves are added — the center trace contains 30 integer frequencies, and the right trace 100 integer frequencies — the resultant waveform assumes the shape of a sharp impulse, whose interval is dependent on the lowest frequency present — in this case 1 Hz. (Computer-generated graphs courtesy of Alexander Youilt-Thornton — "Thorny".)

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equalizers with four frequency mid frequency select switch, four position low frequency rolloff (12 db/octave), solo to phones monitor (which works even when module is muted), on/mute/off switch (module draws no current when off), and Duncan professional conductive plastic attenuator with dust seal.

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paid to the concept and benefits of time aligned™ systems in general (Figure 3). For possibly the first time, engineers could listen to a speaker that they were already familiar with — the Altec 604 — and hear for themselves the improvement that was apparent in a more accurately aligned version, such as the UREI 813 or McCune SM-4B.

Concert Sound Application

Following the development of the SM-4B and SM-3, Meyer and McCune Sound turned their collective attention to a larger coliseum-sized PA, and subsequently developed the JM-10 in 1977. Designed basically as a single speaker to replace ten JM-3s, the JM-10 is composed of two separate sections assembled together as the entire speaker is hoisted up inside a construction scaffold (Figure 4). The JM-10 was conceived as a single large speaker, rather than



Figure 4: JM-10 in scaffold at Oakland Coliseum

as several smaller components, in order to maintain as much as possible the integrity of the sound coming from a single point source. The front of the speaker is curved in a seventy degree arc so that two JM-10s cover a 140 degree field in front of the stage. JM-3s are used as side fills whenever necessary.

Designed as a three-way system, bass and mid-range drivers of the JM-10 are physically aligned in a coplanar relationship to one

another, while the tweeters are electronically delayed to a point about 1.6 feet back from the front edge of the mid-range horns. (To have physically moved the tweeters back this distance would have interfered with their dispersion pattern.) An analog bucket-brigade-type delay was chosen for its low distortion characteristics, compared to the digital-delay circuits available at the time. Bucket-brigade delays are fairly noisy, however, so a custom-designed noise gate was included to shut down the output of the tweeters unless there was actually a signal present. JM-10s have been used with a considerable amount of success in recent years, most notably on the Kool Jazz Festival, which plays the large coliseums throughout the country.

Leaving McCune Sound after the development of the JM-10, Meyer formed his own company — MSLI, based in San Leandro, California — to manufacture and market his own line of loudspeakers and electronics. In 1979 he was approached by Owsley Stanley who, working in conjunction with the sound consulting firm, Ultra Sound, was looking for a small, high-powered, cohesive-sounding stage monitor for use by The Jefferson Starship. As a result of this collaboration, the UltraMonitor™ was developed. Capable of delivering 125 dB SPL broadband at one meter, with peaks of 135 dB, the UltraMonitor™ measures a mere 14" W x 14" H x 22.5-inches D.

This two-way speaker uses an active circuit to delay the woofer, not the tweeter. Optimum design criteria necessitated mounting the high-frequency driver about 6 inches behind the woofer — a situation which caused the tweeter's lowest frequencies to lag behind the highest frequencies of the woofer. Since, in any event the extreme low-end of the woofer is going to be effectively behind the cabinet, and highest frequencies are already delayed physically, Meyer simply concentrated on the critical vocal area around the crossover point, and delayed

the woofer so that frequencies in this area are in sync. This approach has the added advantage of not needing to delay high frequencies by electronic means and, as a result, avoids distortion that can be more noticeable at the top end of the frequency spectrum. Delay for the woofer is achieved with low- and all-pass filters, as opposed to charge-coupled (analog bucket-brigade) or digital delays.

I first encountered these speakers at the 1979 Grammy Awards, and recently had the opportunity to use them myself on an Andy Williams concert. The amount of gain before feedback is phenomenal, and the clarity of reproduction is so great that I was able to run them well below the feedback point. The apparent monitor level spilling over into the main system through the vocal mikes was virtually non-existent.

It soon became evident that the quality and size of these speakers suggested applications other than that of strictly stage monitoring. (In fact, Ultra Sound sold two UltraMonitors™ and a pair of MSLI subwoofers to the Berkeley Square night club in Berkeley, California, where they are used as the main house PA system.) Recognizing an emerging need for compact yet high-level PA components, Meyer recently designed the UPA™ or UltraPA™ system, which is essentially the UltraMonitor™ electronics, woofer and driver used in conjunction with a horn re-designed for wider dispersion.

No larger than an UltraMonitor™, the UPA™ cabinet has been designed to stand alone or couple with other UPA™ cabinets to form arrays. Two cabinets mounted side by side will cover an area of approximately 160 degrees. When coupled with a compact subwoofer, this new system becomes a high-quality, time-corrected three-way PA capable of putting out 105 dB SPL broadband at 30 meters. A PA system based on multiples of these two components, capable of covering a 5,000-seat hall, would fit in the back of a small van! (If you hurry you can probably still get a good price for your 40-foot tractor/trailer rig.)

Do It Yourself Time-Correction

So what can a PA company do to realize the benefits of time alignment™ techniques, when it has a warehouse full of multiway bins and horns and can't afford to start all over? What can a music group do to improve the quality of all the bins and horns they just purchased from a PA company that could afford to start over?

One approach to just this type of predicament was successfully carried out by Ultra Sound in the spring of 1979, when the company put together one of the first time-corrected concert-sound systems I know of that utilized a typical multiple stacked component array. The occasion was a Grateful Dead concert outdoors at Spartan Stadium in San Jose, California. Designed by Dan Healy of the Grateful Dead and Don Pearson of Ultra Sound, the system consisted of four individual columns of speakers set up side by side at each end of the stage (Figure 5). The outside column on each side consisted of 18 bass bins housing a total of 54 E-V M15L woofers. Next to this column was the mid-bass stack of nine cabinets containing a total of 36 JBL K120s. Ten mid-range horns powered by Gauss HP 4000 compression drivers were hung in a column next to the mid-bass stack. Farthest onstage was the high-frequency column made up of 12 ESS HT 600 air-motion tweeters. An additional four-way system was also set up behind the main PA stacks and used as side fill.

Up to this point the setup resembled any



Figure 5: Construction of stage-left stacks, view from mix position. Grateful Dead Concert, Spartan Stadium, Spring 1977.

other large outdoor system using multiway components stacked in a column configuration. What set this system apart, however, was Don Pearson's determination to time align™ the entire PA using a UREI Model 927 four-channel digital delay unit.

"What we wanted to do," Pearson explained, "was delay each frequency band of the PA separately, so that a simultaneous pulse into the entire system would combine acoustically in front of the stacks, to form a single wavefront that would arrive at any position in the field at the same time." Previous attempts by Ultra Sound at doing this were unsatisfactory, due to the high-end distortion and aliasing inherent in most delay units available at the time. The new UREI delay, however, seemed to Don to have solved most of these problems. There was no companding used in the circuitry, so the breathing effect common with these circuits was not present. Sampling-rate noise that had been a problem with other delays was eliminated by a 150 dB per octave filter at 12.5 kHz, which effectively looked like a brick wall to any frequencies beyond that. Based on the components he was using, Pearson wasn't too concerned about reproducing frequencies above 12.5 kHz outdoors: "I generally roll-off my systems starting at about 4 kHz, so that the response is down 10 dB at 10 kHz. John Meyer has designed a time aligned™ low distortion horn-type loudspeaker system [The ACD/John Meyer Studio Monitor], which is very flat and not objectionable to listen to at high levels for an extended period of time. He seems to have solved some of the phase problems in the high-end, which we are still required to roll off in a normal PA to keep from hurting people."

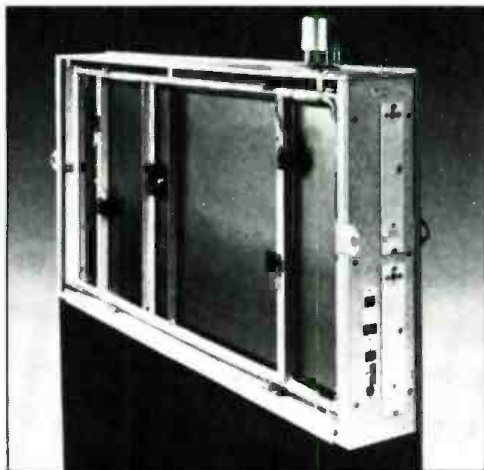
Don Pearson worked closely with Dennis Fink and Brad Plunkett at UREI, both of whom were very cooperative and responsive to what he was attempting to do. The delay unit as it was supplied to Ultra Sound was capable of providing four separate outputs from a single input: each individually adjustable in 1 msec. steps. A total delay of 127 msec. was available on each channel of the delay, which was actually a lot more than was needed or desired in Ultra Sound's application. According to Pearson: "The clock rate was chosen based on this relatively large amount of delay. UREI therefore had to limit its response to 12.5 kHz to prevent clock noise from becoming audible. We, of course, didn't need anywhere near that amount of delay, so they could have doubled the clock speed from 50 to 100 kHz and therefore raised the overall frequency response. As small a step as 1 msec. is, it becomes quite large when one is trying to align a system as accurately as this. A millisecond of delay is roughly equivalent to 1 foot [actually it's 0.887' at 68°F] so each delay channel was set to the closest millisecond, and then the particular stack of speakers it was feeding had to be physically moved the extra 6

— continued on page 60 . . .



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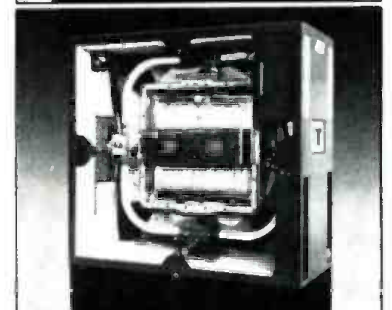
So, for all the people devoted to its singular sound, we have to go on making the EMT 140. Despite its costliness. And even though we can now offer its successor, the EMT 240 Gold Foil. As well as the EMT 250 and 244—the amazing digital units that redefine state of the art in reverberation.

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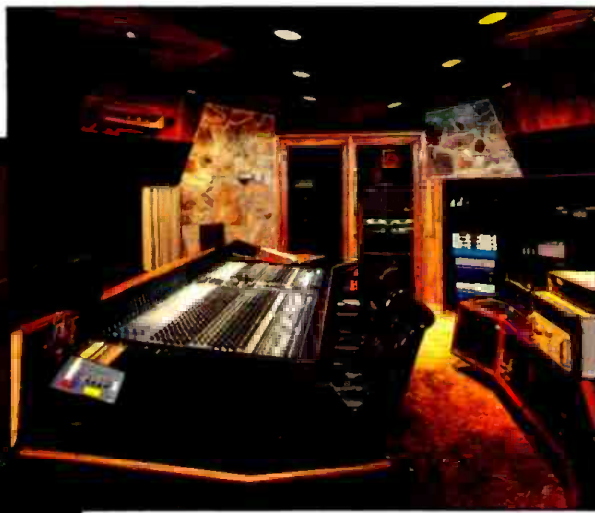


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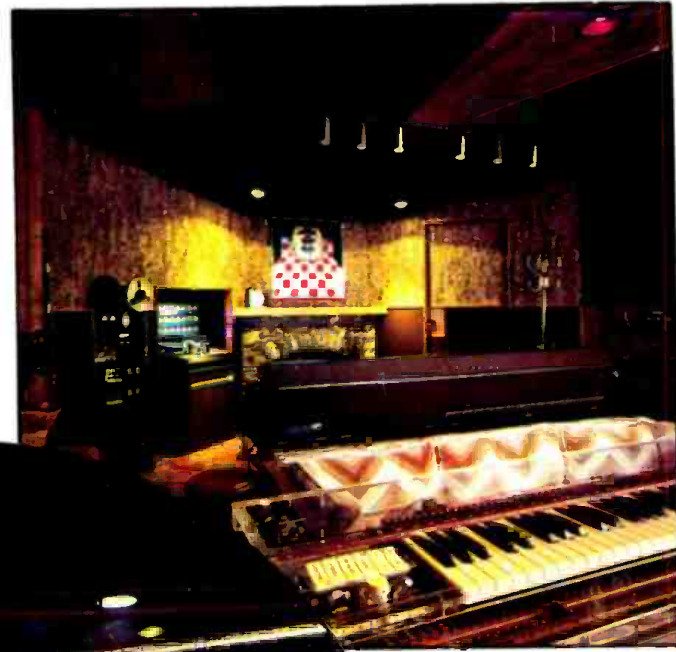


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R-e/p 59 □ December 1980

inches or so required to bring it perfectly in line."

The speaker crossovers were custom-built by Ultra Sound, and have separate inputs to each channel. This made it possible to send each of the four separate delayed outputs from the UREI to its own crossover channel, to facilitate individual adjustment of the PA's frequency bands. (To my knowledge, Ultra Sound is still the only company marketing a crossover with individual inputs that allow a system to be used in this way.)

Alignment Technique

The alignment procedure used is based on generating an impulse into the system, and then adjusting in time each of the components of the system according to the leading edge of the impulse as received by a microphone at the mixing console. The output from this microphone and mike pre-amp feeds the input of an oscilloscope, which is triggered by the emitted impulse, and the returning pulse displayed on the screen. The screen is then marked with a grease pencil to indicate the leading edge of the returning pulse. Input to the bass drivers is not delayed, but used as the reference to which the rest of the system is aligned.

"I start with the bass as a reference because it's usually the slowest to respond to the impulse in most systems," Pearson says. "Depending on the components, the bass driver and crossover network combination can be 3 to 4 msec. behind everything else. The worst case I've found exhibited 15 msec. of delay between the bass and the high-frequency drivers. This was in a 'professional' multiway PA described to me as being unclear and muddled, and that was the reason."

Once the leading edge of the bass stack is marked on the oscilloscope screen, an impulse is sent to just the mid-bass stack. Its arrival time is then adjusted using the UREI 927, until the leading edge lines up with the mark on the screen representing arrival time of the bass frequencies. This process is repeated with all the drivers until the entire system is aligned. At first only one trace from a single frequency band is displayed on the screen at a time. Then, using a filter on the output of the impulse generator to highlight the desired frequency range, Pearson sweeps over the crossover point between two neighboring sections and does a fine adjustment.

"Somewhere along the received impulse display you will see a modulation, which is the neighboring driver section. We then move these drivers around a little more to optimize the impulse display — the result is that the impulse actually gets larger in size on the screen. Polarity is a big factor here as well, because if your speakers are wired backwards the impulse will become smaller or misshapen as you try to optimize it," he related. "An inch really does make a difference — there is a point where it just snaps into place!" (Figure 6.)

The audible result was quite impressive. Large outdoor systems of this type are not generally noted for their cohesiveness of sound, but this system was an exception. Drum solos sounded like percussive charges going off, instead of the usual smeared effect. Vocals, especially, were clear and precise and projected quite well. As the delays were switched in and out there was a noticeable difference in the transient response and the coherency of the system.

Don Pearson had wanted to try delaying the

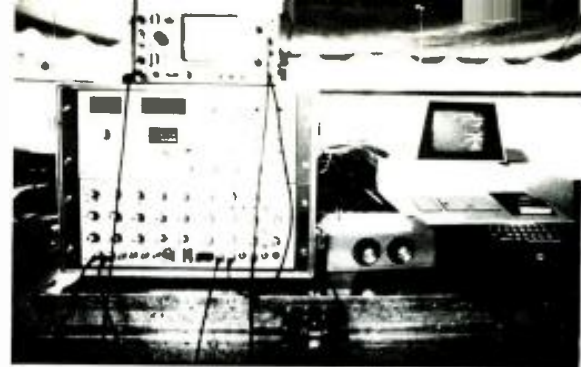


Figure 6: Ultra Sound's pulse alignment and test equipment. Grateful Dead Concert, Spartan Stadium, Spring, 1977.

entire time corrected PA system back to a point on the stage where the band's backline equipment was set up, so that the amplified sound would be more in sync with the acoustic sound coming directly off the stage. He was unable to get the desired effect, however, because sound from the side PA stacks threw everything out of sync again.

The Grateful Dead were very impressed with the sound of the system and have used this type of setup on numerous occasions since then.

"Used indoors," Pearson explained, "a setup of this type seems to mask excess reverberation — the reverb and echo coming off the rear wall has more of a coherent sound to it, and doesn't interfere with the main system as much. The effect is that reverb sounds like tape echo and is masked by the original sound."

Once the proper delay for a particular setup and combination of equipment has been determined, you can eliminate the time-consuming task of alignment on every occasion so long as you set it up exactly the same way each time. Obviously, any variation from this setup would necessitate a re-alignment using the pulse generator and scope.

If, because of the hall's physical restrictions, the cabinets can't be set up in columns — or you don't happen to like a column-type PA in the first place — you can still use this technique of alignment, so long as all the drivers in each frequency band are set up on the same two-dimensional plane. Also, if it turns out that the proper delay required between adjacent stacks is relatively small, you can simply put alignment marks on the sides of the cabinets to assure a proper physical alignment in the future, and therefore dispense with the electronic delay entirely. The less processing a signal goes through, especially in the higher frequencies, the better it is going to sound ultimately.

According to Don Pearson, "Presence in the high frequencies is what determines intelligibility of the system. I've found that before you can identify a sound you have to be able to localize where it is coming from, and that information is contained in the high frequencies. So the more coherent, clean, and quiet the high-frequency response is, the sooner you will be able to identify the sounds, and the more intelligible the whole system becomes." (As Bob Cavin at McCune Sound found out in his work on the SM-3, Pearson has also discovered that the high frequencies should be leading slightly — by a few microseconds.)

Ultra Sound has since taken delivery of two more UREI delays that have been modified for them to provide 125 microsec. steps, instead of the previous limit of 1 msec. "Actually, 100 microsec. increments is more than sufficient, and I can't imagine needing more than 15 msec. total delay per output. I see an immediate need for a combination crossover/delay module that

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would make it possible for you to simply buy however many are needed to align your present multi-component system."

Convinced of the merits of time-corrected sound equipment, the Grateful Dead began looking for a stage monitor system utilizing this technique. Their search eventually brought them right back to Ultra Sound and MSLI. Ultra Sound is a representative for MSLI's UltraMonitor™ and has put together a rental package of speakers, processing electronics and amplifiers pre-mounted in heavy-duty road cases. As soon as the group used the UltraMonitor™ they recognized that someone was on the right track at last. The band had recently replaced the UREI 813s in their studio with ACD/John Meyer Studio Monitors, and were reported to be delighted at having the same level of technology available on stage.

The band's devotion to providing their fans with the best sound possible was epitomized in a series of concerts recently held in San Francisco, New Orleans, and New York, in which the monitors and entire PA consisted exclusively of time-aligned™ components designed in whole or in part by John Meyer. At the eight Radio City Music Hall concerts in New York, for instance, McCune Sound installed two JM-10s flanking the stage, and six JM-3s for front fill. FM Productions brought in a center overhead cluster, called the System 80, and 12 UltraMonitors™ were supplied by Ultra Sound. The bass guitar setup was a prototype of an MSLI subwoofer musical instrument system. The concerts were all recorded for later release using ACD/John Meyer Studio Monitor speakers in the control room. To date, this was the largest amount of time-aligned™ PA equipment ever assembled for a single show; the



Figure 7. Grateful Dead Concert, Warfield Theater, San Francisco, showing McCune JM 10s (hanging), JM 3s (on sides of stage), Subwoofers (on floor, in front of stage), Ultra Monitors (on stage and hanging).

result was nothing short of awesome — ask someone who was there! (Figures 7, 8, 9 and 10 show the setup at the Warfield Theater in San Francisco.)

Equalized Delay

There is also a problem that the simple technique of splitting up a speaker and delaying its components will not correct totally. Namely,

that all the frequencies reproduced by a delayed component will be affected the same amount, even though the delay length was chosen to optimize the response close to the crossover point.

In order to combat this problem, John Meyer has developed an equalized delay system that delays selected groups of frequencies within a single section of a multiway speaker system.

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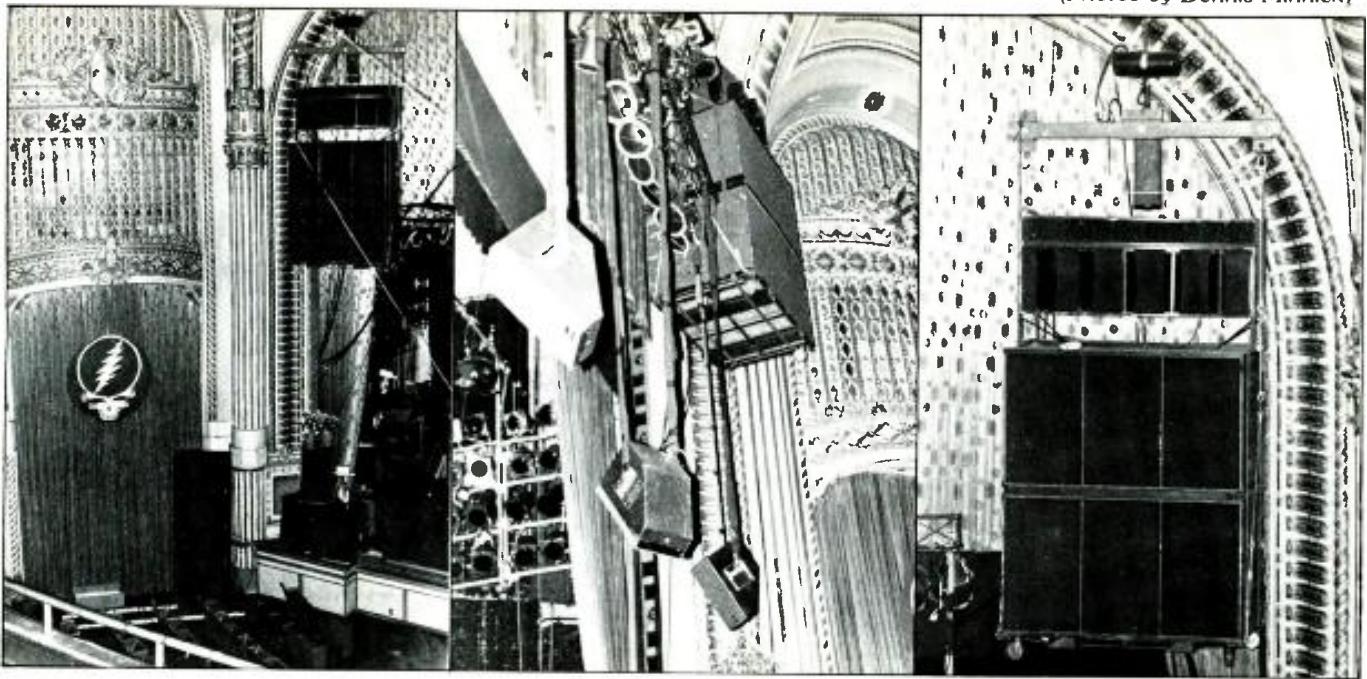
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Figures 8, 9, and 10 (left to right): McCune Sound JM-10s hanging, JM-3s on edge of stage, and subwoofers on the floor of the Warfield Theater, San Francisco for a Greatful Dead Concert.

This delay was first implemented in System 80, the speaker system Meyer designed for FM Productions. System 80 is 15 feet across, looks like a large barrel, and is meant to hang as a center cluster. Based on a design that originated with Owsley Stanley, this cluster is made up of 60 12-inch speakers built to Meyer's specifications. The speakers have been mounted in an

arc, and are designed to cover the frequency range from 80 Hz to 1 kHz. Located above these direct radiators is a horn array for the mid- to high-frequencies from 1 kHz to 8 kHz.

The delay to the 12-inch speakers increases progressively from 100 Hz to 1 kHz. From 1 kHz on up to 8 kHz, the delay is accomplished by physical placement of the horns. This latter

array protrudes to a point behind the 12-inch direct radiators, so that there is almost a 2 msec. difference between them and the compression drivers.

Anything below 80 Hz is handled by MSLI subwoofers, which are positioned physically for proper alignment — ideally slightly forward of the main system, since the low bass typically exhibits the most delay. FM Productions set up another array of Heil high-frequency drivers to cover the bandwidth above 8 kHz.

Even in an array of this size, there are still several milliseconds of delay at and below 80 Hz, so Meyer did not want to delay this range any more. From 80 to 100 Hz the delay is gradually increased from 0 to above 1 msec. and continues on up to approximately 2 msec. at 500 Hz. It remains at this delay setting up to 1 kHz, at which point the delay aligns with the physical location of the compression drivers in the mid-range array. As a result, from roughly 80 Hz to 1 kHz the whole 12-inch array is synchronized in gradually ascending increments. This effectively means that a square wave in is a square wave out — not a statement you can make about too many speaker systems!

The system not only reproduces all the information of an impulse within this frequency band, but also delays it back to the mid-range array. Design of the mid-range horn was originally optimized for its particular function, and then everything else in the system matched to it. A bulk delay was then used on the Heil tweeters to bring them in line with the rest of the system.

Intended to be utilized as a center cluster, System 80 was used in this mode during a recent national tour by Heart. The system does split down the middle, however, and can be run as two separate side stacks — either hung or set up at stage level.

Part of the problem with manipulating a system as complex as this one is that in its present stage of development, it can be very time consuming to set up properly, and tedious to control. It takes skill and a deal of expertise to recognize what is wrong with a particular impulse, and what to do to correct it. You have to be familiar with what happens to an impulse

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as its time domain is changed, or you will never get a square wave to look respectable. It'll look like it's ringing and bending, or will look good at 500 and lousy at 600 Hz.

The time delay functions of System 80 are adjusted only after all the crossovers have been set, and the system equalized. The reason for this particular order of events is due to the fact that all currently available devices that tailor amplitude response, also introduce their own percentage of phase distortion. Cumulative time anomalies caused by the speakers themselves, their physical placement in the system, and the phase distortion of the signal processing devices, are then treated in total by the group delays.

An obvious outgrowth of this specialized frequency-selective delay unit could take the form of an outboard signal-processing device of its own. In fact, John Meyer has adapted such technology for this purpose: MSLI has already produced two such units for the Grateful Dead (who else?), and producer Ron Nevison. The amount of delay as well as the width of the frequencies affected can be adjusted to subtly affect the sound of whatever is being processed; be it a bass guitar or entire PA system.

"The way it's set up now makes it fairly complicated to operate, unless you really understand the theory and know what the device is actually doing electronically," Meyers explained. "We are playing around right now with various schemes to make it more readily apparent what it's really doing. The problem is that we at MSLI need to get a better feel for what the mixer can relate to. What kind of delay and what kind of sound does he want to achieve?"

"What we're doing is isolating the delay function independently of amplitude manipulation, which is something that hasn't been available up until now. The closest analogy to this device would be a parametric equalizer; but a parametric doesn't just change amplitude, it changes phase as well — as does any equalizer. There is a new class of circuitry being designed that will address this problem directly; which will automatically correct for the phase problems that occur as you adjust the amplitude. But it doesn't look like it will be ready for implementation for a while.

"I'm thinking of setting up the delays to operate on an octave-band basis, so that you could adjust the delays as you normally would the relative amplitude of an octave equalizer."

Once the delay of various frequencies relative to the entire bandwidth can be adjusted, it should be possible to create whatever "type" of sound you desire. For instance, if you want to create a "rock and roll" sound, typified by an excess of delay in the low-frequency range, this could be achieved by delaying only the low end of an otherwise flat PA, and not touching the important vocal range of the system. The delay processor could also be applied just to the kick drum, for instance, and its sound tailored to suit the type of song being performed. As might be expected, it is important that you have a PA system capable of reproducing the subtleties in the first place — one that is itself time-corrected and well controlled.

When you increase the coherence and align the time domain, you are actually able to turn a loudspeaker down — especially a stage monitor — because a speaker's intelligibility is improved. As Don Pearson puts it: "When you first hear a low-distortion system, the apparent loudness is lower. Some people relate to distortion as loudness; I don't relate to those people very well. There are some sound men with whom I have worked in the past that need to hear some form

of clipping somewhere in the system, or they don't think that it's working correctly. They are so used to hearing that kind of sound that they feel there is something wrong if they don't hear it anymore. When people who have been brought up on the sound of the old Altec 604 hear the UREI Time Aligned™ version — the 813 — they want to EQ the old sound back in!

"It's really only a matter of educating people a little bit, but you have got to get them to hear the difference in the first place! You teach your ears to hear over a period of time and have to keep educating yourself and your ears constantly. Once you get rid of one form of distortion and have trained your ears and mind to recognize it, then you can move on to the next one and go to work at eliminating it.

"A PA shouldn't create distortion of its own. It should be accurate, although I am not opposed to reproducing whatever distortion the band wants to use, be it from fuzz boxes, overdrive units or whatever."

Conclusion

Ideally, a sound system shouldn't have any particular sound — a "rock and roll sound", "heavy metal sound," or "MOR sound." It should be as transparent and precise and as free from distortion as possible. Once you have a reference that you know is accurate and aligned and flat, it can then be altered to suit the individual client, or whatever the requirement is at the time; only then you can adjust the delay of the bass drivers to produce a boomy, gut-wrenching low end — or not. You can always make a clean system sound distorted, but never vice-versa.

This last aspect brings up one of the early criticisms of extremely flat systems: namely,

that they don't seem to have a certain indefinable "sound" that some groups look for; they don't have "balls" or the "punch" that has always been characteristic of a "rock and roll" system, for instance. A sound company is often chosen on the same basis that a musician chooses one guitar amp over another — it has a certain "sound" that he likes. But the whole point of having a flat system in the first place is that you can always modify it, using various delay and amplitude techniques, to sound like any other system presently available, without being permanently locked into only one "sound." A system can be adjusted from the ultra-transparent, low-noise requirements of symphonic reinforcement to also provide the larger-than-life and ballsy sound favored by PA companies that cater to the strictly rock and roll business.

One of the biggest differences between the many types of systems currently available is the amount of delay inherent in the types of speakers, cabinets, and processing equipment favored by the various sound reinforcement companies. If more companies modified their equipment to be phase coherent and time-corrected, they would then be able to start with a flat reference point and adjust to the individual needs and desires of many different types of artists. This could open up the market potential considerably, since it would enable a company to compete for the business of a broader range of talent. It would also give performers a greater choice of companies from which to choose.

Most importantly, it would go a long way toward establishing a measurable quality standard in the sound reinforcement industry that everyone could agree on, refer to, and work towards. □ □ □

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SOUND MAN'S GUIDE TO VENUES

— number 13 in the series —

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Driving Directions From Airport

From San Francisco International Airport take 101 North toward downtown San Francisco. Exit at 7th Street and continue east one block to 6th Street; left to Market Street. Theater is between 5th and 6th on Market.

Facility

Old movie house, seating 1,021 in orchestra and 1,258 in single balcony, for a total capacity of 2,279. Open normal business hours but suggest calling ahead for appointment. No specific ending time for shows. Permanent proscenium arch with level stage. No orchestra pit, although front section of seats can be removed for dancing. Eighteen moveable pipes above stage. Two-inch thick hardwood stage floor; no trap doors. Proscenium arch: 44' 11" W x 37' 10 1/4" H. Stage width: Upstage, wall-to-wall: 46' 6"; Downstage, wall-to-wall, 74' 6"; Upstage left to counterweight: 46'; Downstage left to counterweight: 55'. Stage depth: Stage edge to back wall: 34' 10"; Stage edge to house curtain: 5' 2"; Stage edge to last line set: 32' 5". Height: Deck to grid: 63'; Stage floor to auditorium floor: 3' 8". Distance from stage to balcony: Approximately 35'. Distance from apron to first row of seats: 3'.

Acoustics

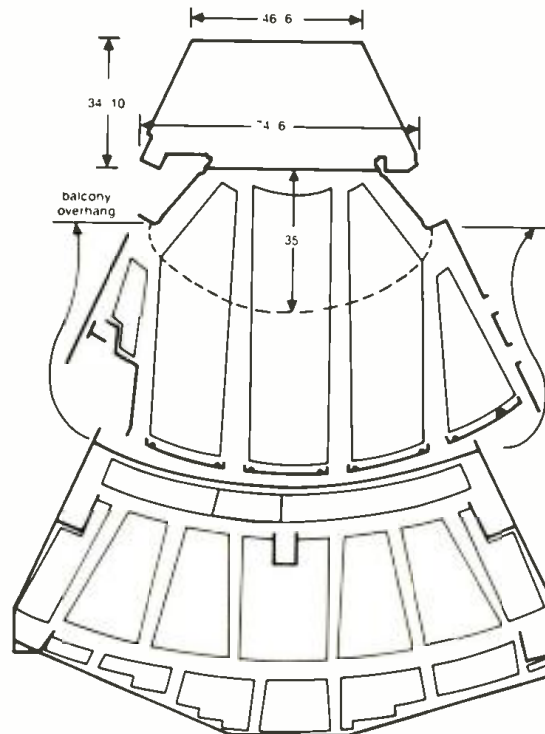
All seats are padded. Slight reverberant persistence in room in low-mid-range. Slight hollowness on stage but not really a problem. RT60 measurements available.

Loading

Stage loading door is at 24 Taylor Street (5th Street becomes Taylor Street after crossing Market Street). Park on street and load two steps down onto stage. Ramp available. Loading door measures 11' 3/4" H x 7' 10 1/2" W. Street parking can usually be reserved ahead. Small stage makes it difficult to store equipment backstage. Suggest storing cases in truck.

Setup

Small 5' W x 32" D areas in front of fire curtain on either side of stage available to set up speakers. Use of these areas can block up to 40 seats, depending on stage setup. Recommend putting something here to cover under the balcony and then hanging main PA. Five separate hanging points in front of proscenium arch can each support at least one ton. Large area in front-section of balcony (Rows AA, BB, CC; Seats 101-119) reserved for sound console. Console must be located in this position. Snake (150' minimum) must be run off front of stage right; behind curtain next to stage; up to hole in wall at balcony level; over to balcony and then along balcony rail to house mix position. Balcony overhang begins about 12 rows back from the stage over orchestra Row J, so that most of the main floor seating is under the balcony (see diagram).



Sound System

Two balcony-fill speaker clusters are presently hung in front of arch, stage left and right, and run in mono mode. Each cluster contains a 3 x 15" folded-bass cabinet; a 4 x 12" front-loaded low-mid horn; a horizontal array of four Gauss HF 4000 compression drivers; and two Ess/Heil HS 600 air-motion transducers.

This system is quad-amped using four Crown DC300As, and two Crown D60s. An Orban 672 para/graphic equalizer in line with an APR 550A EQ/line driver is available at house mix position for equalizing the system.

Balance of PA should be brought in or rented locally.

Electrical

Two 100-amp single phase circuits available: one stage right; one stage left. Main breaker boxes on stage require pigtail connections. Actual voltage is 119 VAC. No in-house lighting system.

Personnel

Union house with non-union assistance.

Building Manager: Dave Murphy, (415) 878-4491.

Stage Manager: Contact Bill Graham Presents, (415) 864-0815.

Light man and Chief Electrician: Dave Murphy, (415) 878-4491.

Piano tuner available through B.G.P., (415) 864-0815.

Traveling Soundman Reaction:

"Quite good acoustically, except under the balcony, so set up some speakers to cover this area specifically. Room is remarkably free of echoes. Stage itself has odd shape due to its location in corner of building. Recommend flying PA in here since it is hard to hit top of balcony from stage level. Area under balcony also gets a

lot of sound directly off stage." **Steve Kader, McCune Sound.**

"This room has a good feeling to it, although a buzz usually crops up somewhere in the system. During the setup for the recent Grateful Dead concerts it was discovered that there was a 60 V potential between the grid and the Fire Department water pipe! This has been eliminated, and the buzz problem is less pronounced now. Very professional crew. Old "speakeasy" downstairs, which we converted into a control room to record the Dead concerts." **Don Pearson, Ultra Sound.**

"I don't particularly like the sound in this room too much. Under most conditions it has a "canny" sound — somewhere in the lower midrange. It's best to have two separate systems: one for the balcony and one for the orchestra, although the amount of PA you can put in at stage level is limited." **Howard Danchik, Ultra Sound.**

FEEDBACK ISN'T ALWAYS A DIRTY WORD!

The information contained in these surveys is as accurate as possible at the time of printing. However, there will always be changes and improvements made to in-house sound equipment and acoustics as more and more venues become conscious of high quality sound. Many of these halls rely on the comments and reactions of visiting engineers such as yourselves and make changes accordingly. So, if you should come across a situation that you feel is contrary to what is printed, please drop me a note and I'll print an update. Also, if you have any reactions to a venue (pro or con) that you'd like to see surveyed in an upcoming issue, please address them to:

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SOUND MAN'S GUIDE TO VENUES

— number 14 in the series —

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Acoustics

Suspended acoustical ceiling made up of 5' x 5' "nubby" fiberglass squares. All wall surfaces faced with polycylindrical sections alternating with absorptive material areas. Fairly even reverb characteristics with no serious echo problems. 2,800 seats are padded; 10,000 are hardbacked. Noisy air conditioner is not a factor with loud music acts. RT60 reverb time is estimated at about 1.8 sec., mid-band, in an empty hall. Slightly less in the higher frequencies.

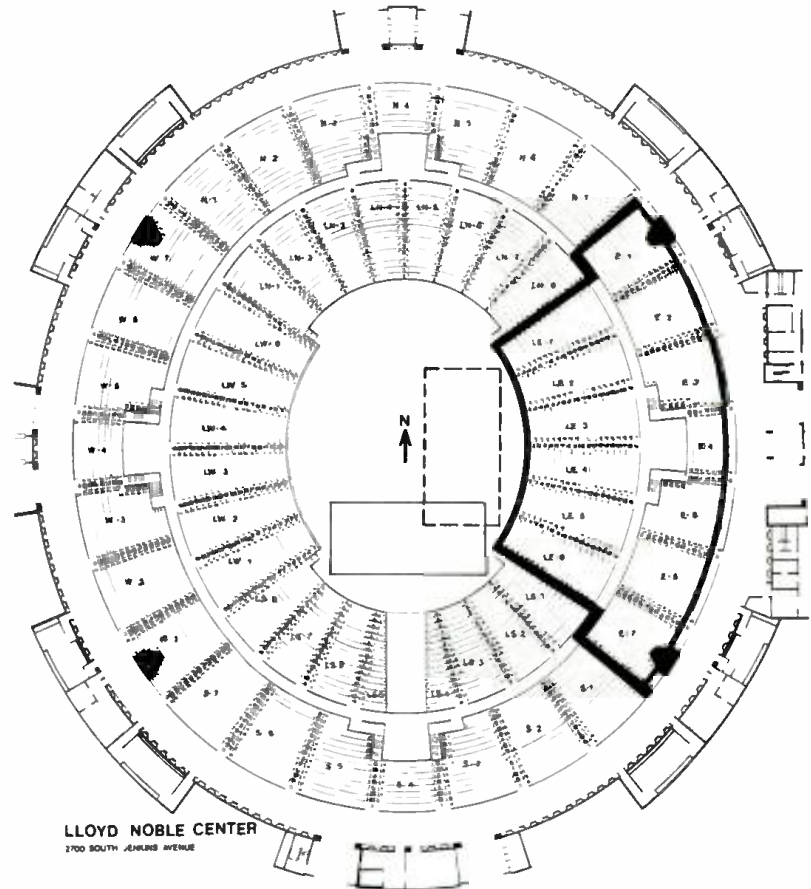
Loading

Loading door located at south end of building at ground level measures 19' H x 13' W. Long ramp leads from parking lot down to stage level and also measures 19' x 13'. Semi's can back down ramp and unload directly onto stage. Unlimited truck parking.

Setup

Four loudspeaker risers measure 16' x 10' x 40" and can be stacked offstage. These risers block sightlines from 400 to 800 seats. Speakers can be hung from ceiling points capable of supporting 1,500 - 4,000 pounds each, depending on the location. Union stagehands must be called when hanging speakers. A 24' x 12' section is reserved for visiting sound

SOUNDMAN'S GUIDE to VENUES is a series being compiled by *R-e/p's* sound reinforcement consulting editor, **Pat Maloney**, whose full-time profession is as an internationally recognized sound reinforcement engineer/mixer. The series is the result of a questionnaire Pat developed to be sent to performance venues in anticipation of the start of a concert tour. The information returned by the venue is considered vital to pre-planning the tour. Periodically *R-e/p* will offer an updated collection of the reports published. — ed.



company console and can be located anywhere on main floor. Generally it is set about 100' from stage and requires 150' cable to reach center stage. Grounded AC outlet is 15' away.

Sound System

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Electrical

Virtually unlimited 3-phase AC service into building. Main breaker box is located at south end of arena, 10' from normal stage position. Pigtailed required to connect to house power. Two transformers provide 75 and 150 amps respectively to stage AC boxes. Actual voltage is 110 VAC.

No in-house lighting equipment other than four Super Troupers and overall house lights normally used for sporting events.

Personnel

Non-union house: University students used

as stagehands unless rigging or extra spotlights are required. Separate loading crew not required.

Building Manager: Don Hotz, (405) 325-4666.
Stage Manager: Buddy Combs, (405) 325-4666.

Chief Electrician: Henry Loyd, (405) 325-4666.

Piano Tuner: Eddie Knight, (405) 632-3872.

Traveling Soundman Reaction:

"No reverberation problems here since there are virtually no parallel surfaces at all. Pretty easy to get a good-quality sound in this arena compared to most others. There is a wide ramp down to the arena floor but the stage is usually built right at the edge of the ramp. This prevents trucks from leveling out to unload so we first brought the trucks in, unloaded them, drove them out, and then built the stage. Fortunately the design of the stage enables it to be put together fairly quickly." **Mike Brady, McCune Sound.**

"Steep incline of ramp makes it impossible to drive trucks down to stage unless stage is in center of arena and plywood layed down. Forklifts can't go on basketball floor either. Dangerous to roll anything top-heavy down ramp and, in fact, a few of our cabinets were dropped and damaged. No problems sound-wise. Power is plentiful and clean. House crew very cooperative, but suggest collecting ID cards of college help before show to insure that they will return at the strike!" **Dave Morgan, Soundman for Barry Manilow.**

STUDIO MAINTENANCE ROUNDTABLE



— PART 2 —

In the April 1980 issue R-e/p looked at the philosophy of preventative maintenance and the importance of keeping routine test and repair reports. In this issue our roundtable of maintenance engineers considers specific problems that may occur during the day-to-day running of a busy studio. In addition each engineer has contributed a favorite modification of studio equipment.

A maintenance engineer's importance is before the fact. If he hasn't done his job correctly before the session, he hasn't done his job. Routine maintenance is the best protection against sudden calamities occurring during an inspired recording session.

First things first. Power supplies should always be checked. Pull the back panel off



JEFF HANSON



MIKE FUSARO

everything, remove all cards, clean the connections and contacts (John Sands, of Soundlabs, Hollywood, recommends cleaning gold contacts with a pink pencil eraser), and vacuum the dust out. "Dust and fur that grows on contacts in the depths of the machines is a time bomb. Comes the day when a little bit of moisture gets in there, you have a lot of problems."

Compressed air can save time, but it can also blow the dust and dirt to other less accessible parts of the machine, like bearings and relays. It's best to use compressed air only at the work bench and sometimes on the patch bay, depending on its location.

Mike Fusaro (Automatt, San Francisco) checks the studio's patch cords periodically. If an intermittent caused by a faulty wire crops up



JOHN SANDS

Jeff Hanson: AUTOMATIC DOLBY MODE SELECTION FOR AMPEX MM-1200 MULTIRACKS

This interface circuit was designed by our technical staff to provide logic-switching commands from an Ampex MM-1200 multitrack to external Dolby channels, so that the latter would not require independent manual switching but would automat-

ically follow the machine's functions. Any of the multitrack channels in "input" and/or "record" will switch its respective Dolby channel to a record mode.

The schematic shows the circuit for four channels. All signals and voltages can be

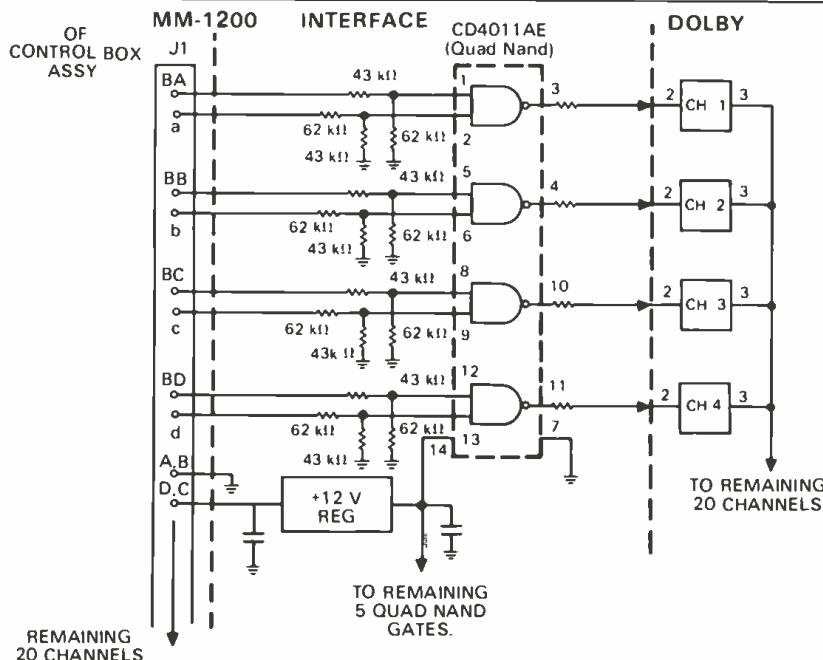
derived from one of the two large duplicate control box connectors (J1) located at the rear or top of the MM-1200.

If all the channel functions are handled remotely, leaving only transport functions on the machine, the interface circuit can be installed directly inside the mostly empty control box. Pins can then be inserted into the control box connector to pick-up all of the control signals available in J1. Supply voltages can be derived by splicing into the existing lines in the connector. Pin codes for the remaining 20 channels can be found on the control box assembly schematic #4840430.

Pins BA, BB, BC, BD ... of J1 ... go to +18 V when the status of the channel is "input;" otherwise the signal is 0 V. Pins a, b, c, d ... of J1 ... go to +25 V when the status of the channel is "record;" otherwise the signal is 0 V.

For this reason, a voltage divider is used at each input to keep the signal less than the supply voltage. A single +12 V regulator can be used to supply all ICs. The Dolby switching inputs are bussed on one side and then grounded to the Ampex. After a year of use at S.B.S., the interface has been dependable and trouble free.

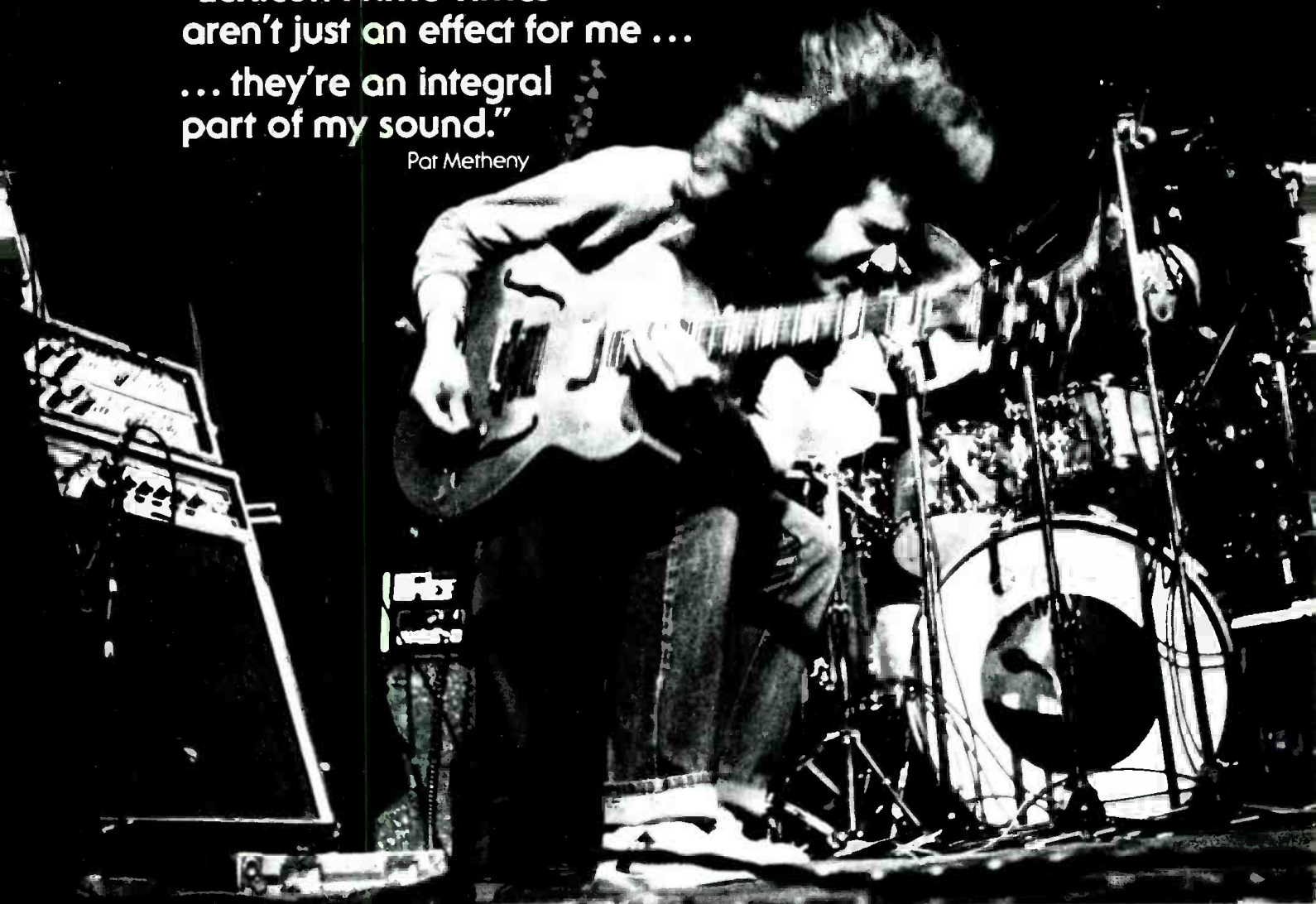
Any comments or suggestions are always appreciated. If you have any questions or would like information on a PC board for the interface circuit, feel free to contact us at (805) 963-4425.



by Robert Carr
Photos by Stephen Burchesky

**"Lexicon Prime Times
aren't just an effect for me ...
... they're an integral
part of my sound."**

Pat Metheny



Pat Metheny records for ECM Records.

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"Today, I use five Lexicon systems on a typical concert, of which I do about 300 a year. On stage at my right hand is a Prime Time; another Prime Time is at the board that mixes the drums and piano. A third Prime Time is used on the PA line. We also use a Model 92 and the new 224 digital reverb."

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BART JOHNSON

during a session, it can be most time consuming to find. By keeping the patch cord plugs clean, and the patch bays covered as much as possible, Mike finds the patch bays themselves are less susceptible to failure through poor connections.

About once a week John Sands does a distortion measurement on the board. He has noticed that he gets a more accurate reading if the console has been on for at least an hour. "Solid-state equipment isn't supposed to need warm-up time, but I think it makes a difference," he says. "When my seconds fill out trouble reports, I stress that they log the time of the malfunction in relation to the start of the session — i.e., was it all right after turn-on or one-hour-and-forty-minutes into the session . . . ?"

A major point of debate is whether or not a board should be shut down at night. There are two schools of thought: 1) a console will last longer if it's left on; it will stay warm and more stable; and there is less chance of blowing out op-amps and burning out lamps; or 2) turning the board off at night conserves power. If something does blow when it's turned on again, there's a problem that should have been fixed anyway. Leaving the board on could allow a

sharp AC transient to blow out a good component. Such a problem might be compounded if the blow-out caused a short in an unattended board. Essentially, it boils down to doing whatever works best for the individual studio.

Well! How'd It Happen?

One universal law is that if anything is spilled into a console — or any piece of gear for that matter — the maintenance people have to know about it *immediately*. Blame the accident on anything, but just let somebody know so it can be cleaned out as soon as possible, with as little damage as possible.

A recording studio is only as trouble-free as the power supplied to it. Usually power presents no problem in the city, but Indigo Ranch (Malibu, California) is the last customer on a five mile line in Malibu Canyon, and at times the voltage drops to 90 volts. When Bart Johnson of Indigo complained about these intermittent deficiencies, Southern California Edison sent out customer service people whose main job is to keep customers calm. As Bart explained: "The power company hooked up a chart recorder into the line that would take a reading every one or two seconds. It shows you nothing except a change over a long period of time. I had to rent a storage oscilloscope to take pictures of the transients. When I showed them [S.C.E.] the voltage spikes, they seemed totally lost. I had to go to the Public Utilities Commission to reach people who would respond to our problems and correct them. They then put a new 16 KV line in for us, and periodically come out to clean the terminals to keep the noise down. It took a fair amount of pressure to get the power company's bureaucracy moving, but once we were able to communicate the problem, we were able to get



JERRY JENSEN

it solved completely."

While working for a broadcaster a few years ago, John Sands had an unexplainable annoyance concerning noise in the equipment. Southern California Edison, he says, sent out "some very qualified people and an RF mobile truck with sophisticated gear." They traced the disturbance — airborne interference — to unsuppressed arc welding at a commercial firm down the block. S.C.E. threatened to cut the power to the welding operations if the problem wasn't corrected within 24-hours. (The company was using the power in violation of an FCC ordinance). The unexplained noise disappeared when the company complied.

Canon and Minolta copiers with high intensity Argon gas-discharge lamps draw current when the sine wave is over about 90 volts, and extinguish somewhere below 60. This quick 120 cycle transition between high current and nothing at all often creates a radiation problem that can extend as far as a block away. Peter Butt, of Wally Heider Recording, Hollywood, has found the utility company to be helpful in such situations — if he is persistent.

Grounding

Probably the biggest headache in any studio is grounding; one little flaw or break can cause all sorts of hum, buzzes, or other assorted, impossible-to-live-with, sounds.

Mike Fusaro worked for a while at CBS where everything is brute grounded; all the equipment being grounded to a common buss bar. Very often ground problems get masked with this type of format. When new equipment is added, problems show up that can be very hard to find, simply because there are so many grounds.

The Automatt recently got a new Trident board. Everything is electronically balanced, and requires a good ground. "The better the grounding system, the more care is needed," Mike says, "because mistakes show up very quickly. We're designed so that no ground reaches AC ground. If it does, there's hum, and we know where it's caused."

Grounding at Capitol is complicated; there are twelve rooms, and they all go through a common echo patch bay. Different philosophies were followed as each room was built, so grounding was done on a room-by-room basis. Capitol's Jerry Jensen: "We used a lot of U-Ground third prong lifters. If I notice one on a piece of equipment, I pull it off to see if it's really needed. There are rooms that are all-transformers, and rooms with none at all. I have a couple of boxes around the shop containing transformers with faders and buffers. There's no problem that they won't solve."

Patch bays at Capitol are wired in reverse; the ring is the audio's high side and makes contact last. This method has saved a lot of op-amps. All the patch cords have their shields lifted at one end, except for specially coded ones kept in the shop.

John Sands: 15/30 IPS EQUALIZATION SELECT SWITCH FOR SYNCHRONIZED 3M 79 SERIES TRANSPORTS

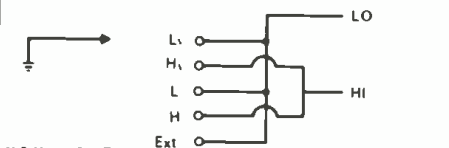


Figure 1: Existing Factory Circuit.

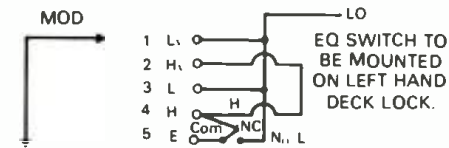


Figure 2: 53A Modified.

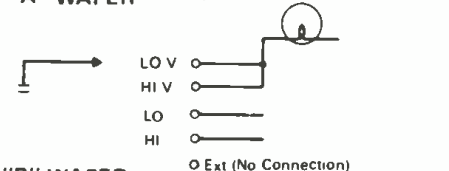


Figure 3 Don't Touch 53B

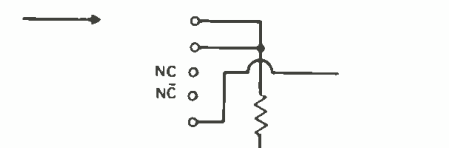


Figure 4 Don't Touch 53C

Problem:

3M Model 79 when used in external capstan mode switches logic to 15 ips. During synchronization (i.e., lock-up as a slave with another machine), if the master machine is at 30 ips, the synchronizer will drive the M79 to 30 ips. Equalization, however, will not be switched to the AES curve, but is held to the NAB curve used at 15 ips. This will result in an uneasy surprise when the tapes are taken to another studio, or the slave tape is played and/or recorded on the master machine.

Solution:

An external capstan EQ logic switch allowing EQ to be selected to match the chosen synchronizing speed.

Procedure:

- 1 - Locate and remove switch S-3 on left hand side of deck.
- 2 - Remove wire from S-3 wafer A #5.
- 3 - Solder wiper wire of EQ switch to S-3 A-5 (see Figure 2).
- 4 - Solder normally closed wire of EQ switch to S-3 wafer A #4.
- 5 - Solder normally open wire of EQ switch to 3M wire removed in step 2 (use shrink).
- 6 - Drill hole for EQ switch in transport shipping lock brace. Switch should be 15 ips EQ in right position; 30 ips EQ in left position.
- 7 - Re-install S-3.

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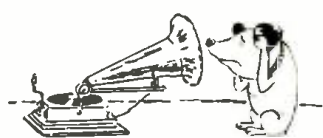
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MAINTENANCE ROUNDTABLE

Peter Butt's experience with manufacturers' use of the cheapest possible power transformers — those without Faraday shielding between the primary and the secondary — has convinced him that they are very dangerous. The absence of Faraday shielding allows a large capacitance value to exist between the primary and the secondary. Such a high capacitance allows common mode signals to pass through to the secondary winding, causing the audio common to be capacitively-coupled to the power line. "The audio DC common should be isolated from case safety ground. This permits discretionary connection to case. Case safety ground should never be defeated as someone could be injured or killed due to a failure of insulation somewhere."



PETER BUTT

Santa Barbara Sound Recorders is located four blocks from a 1 kilowatt AM transmitter. Since good grounding is essential, they use four, ultra-isolation transformers on the power feed, and hospital-grade receptacles — each with their own path to ground. These extra-heavy receptacles have a third pin ground connection that is isolated from the metalwork. Separate ground leads from every outlet terminate at a cluster of eight ground rods, located outside the building in an area of a couple of square feet.

Each wire is attached to a one-inch copper strip that connects all the rods. All wires are double shielded and the couplings on every conduit are tightened securely. Santa Barbara's **Jeff Hanson** can relax knowing that he "can unbalance stuff left and right, and have no ground or RF hassles at all."

With more and more studios also shooting video, Peter Butt recommends keeping the grounds for audio and video separate. This habit eliminates the probability of horizontal and vertical video sync pulses (about 15 kHz) creeping into audio lines. "Don't even bundle both lines in the same harness. You're just asking for trouble."

Sound That's Liked

Clients tend to be very opinionated about which amplifiers and speakers sound best. When Capitol contemplates making a modification in one of its rooms, regular producers and engineers are always informed before anything is done. If they don't agree, the change is usually tabled. "We were going to replace a ten-year old board in one of the rooms," Jerry Jensen explains. "A good client who used the room a good deal of the time liked the sound of that board, even though there were some minor things wrong with it electronically. He was so attached to the sound that he offered to block book the studio for a year at a time, and then sub-lease it when he wasn't in there. We didn't change it."

Sound in a room is a very subjective commodity. It depends a great deal on the size, shape, and acoustic treatment of the listening room. To a certain degree equalization can be used to even out the peaks and drops in specific frequency ranges. Jerry Jensen has his rooms shot by George Augspurger. "That's a simple statement the client can count on. It doesn't mean that other value judgments aren't valid; just that George was the last man to touch those EQ controls, and the setting is sane. The only drawback occurs when we change speaker drivers. Then have to call George."

How does one know when it's time to change a driver? If the driver is blown, of course, there is no question, but detection of speaker fatigue is a very subtle determination. Half the people will say a monitor should have more punch; while the other half will say it sounds great. Some engineers have familiar tapes they pull out for comparison, although that's often dubious, too. Jeff Hanson always has a couple of spare drivers on hand at all times in case one of their 604s runs into trouble. "If there's a complaint, they're replaced with no questions asked."

When connecting power amps to speakers, use the minimum length of wire and smallest gauge number practical — and shield the speaker leads. Jeff Hanson had been placing the monitor amps in the attic about thirty feet from the console. When he moved them down next to the speakers, they responded with a more punchy bottom end, more mid, and a significant reduction in distortion.

It's Not Loud Enough

A universal pet peeve that seems appropriate at this point is control room monitor levels. Clients usually want more volume, whereas anyone who is in that environment for a number of hours could eventually impair his or her hearing by being subjected to excessive sound pressure levels. Mike Fusaro has had some artists who wanted it so loud, they asked him to stack two JBL 4311s on top of each other on both sides, in addition to the main monitor speakers.

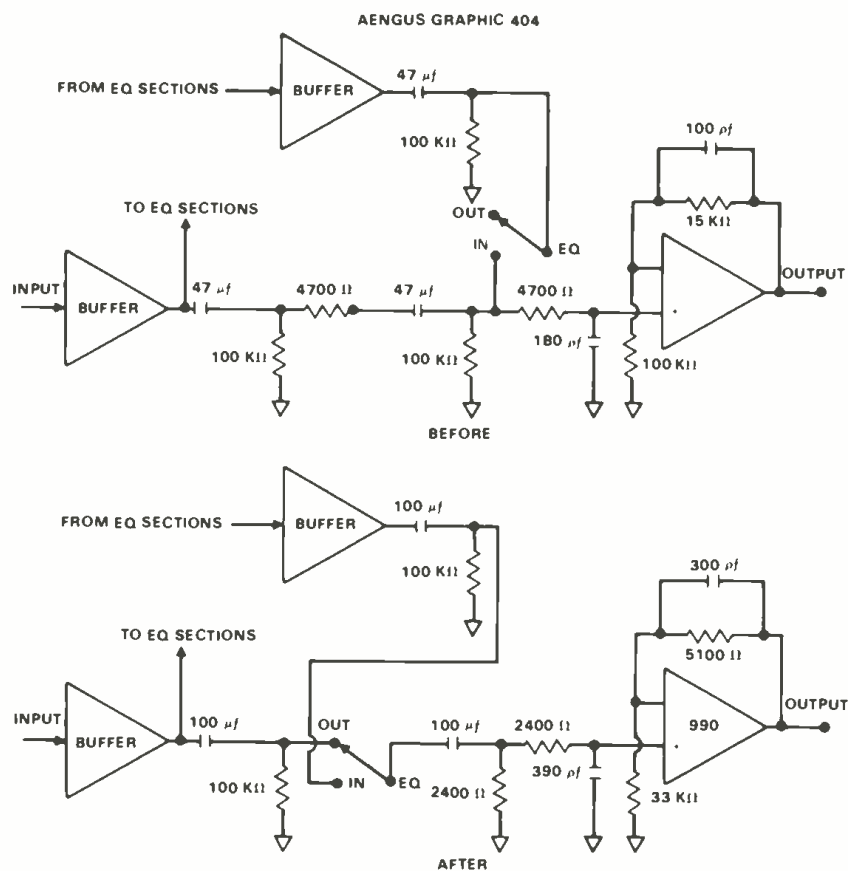
Bart Johnson: UPGRADING CONSOLE PERFORMANCE WITH JENSEN 990 DISCRETE OPERATIONAL AMPLIFIER

In the interest of better all-around performance, Indigo Ranch has replaced its console amplifiers with a Deane Jensen designed 990 discrete operational amplifier. In some configurations (mike-pre and combine amplifiers) the 990 directly replaced the existing amplifier. However, in some instances topology changes were required to take advantage of the low-side specification of the amplifier by lowering the source impedance as seen by the non-inverting input; this also serves to reduce

output offset.

Indigo has also scaled down the feedback resistor to lower noise even further, which is not always practical with an IC-type op amp. This is because of the latter's limited output drive capabilities, since the device output current also flows through the feedback resistors.

The schematic shows the before and after modification for an Aengus 404 graphic equalizer buffer and switching section, incorporating the above mentioned ideas.



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And, when the Pope celebrated Mass on Washington's mile-long Mall, BGW 750's were there again (along with BGW 250's and 600's)... selected by Audio Technical Services, Ltd. of Vienna, VA for their reliability and because they can be operated right up to the clip point for hours with no problems.

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MAINTENANCE ROUNDTABLE

None of the maintenance men present have any reservations about obviously putting plugs in their ears during such a situation. Everyone wants to be able to keep on working. In order to analyze a problem, you have to go into the room and hear it. A maintenance man's ears are his most valuable analyzing tool in the studio.

On occasion Sound Labs refuses to allow control room levels to go beyond a certain maximum. "We have a set of small auxiliary speakers that are great for mixing," John Sands says. "The company got big and sub-contracted the manufacture of components. Subsequent speakers were not as good as the originals. We've had them for over eight years, and no one turns them up loud. There's no way they can be replaced. If the client wants to bring in his own speakers, that's another story. Ours have to be used the next day."

England and the United States have strict standards concerning weighted SPL versus human exposure time, but as of yet they have not been enforced in American recording studios. Enforcement will probably come only as a result of a lawsuit. But who would be liable? . . . the second engineer who's supposedly responsible for everything that happens in the studio? . . . the engineer who actually had his hand on the controls? . . . the producer who

Mike Fusaro: PROGRAMMABLE TOGGLE MUTE SWITCHES FOR HARRISON 4032 AND 3624 CONSOLES

The mute keys on the Harrison 4032 and 3624 are of a push-to-engage/push-to-release variety, and are not automated. All engineers at The Automatt had used boards that had toggle switch mutes, and also they wanted to be able to program this function. A toggle switch was mounted directly

above each fader. When this switch is on it overrides the fader and indicates to the computer that the fader is off. For the 3624, when the switch is on it connects the top of the fader to ground. On the 4032 this switch completes a circuit that shorts the wiper to the bottom of the fader for muting to occur.

ordered the increase? . . . the studio itself?

In order for a Workmen's Compensation claim to be honored, the present criteria for hearing damage is destruction of intelligibility below 5 kHz. Critical listening levels are nebulous standards to measure, let alone verify in court. (See *Law and the dB*, Martin Polon, *R-e/p*, April 1980, Volume 11, No. 2.)

Bart Johnson of Indigo Ranch relates a mythical story about a tape dubber in a big complex, who called maintenance and reported getting a reading from his meters, but failed to get any sound from the monitors. When the maintenance engineer opened the door, he was knocked over by 10 kHz at an incredible sound pressure level. After he dove for the control to lower the volume, the tape dubber just sat there trying to explain that something was wrong; he couldn't hear any sound.

Headphone cue systems are another sore spot between studio people and those artists "who must feel the mix." There are artists and singers who will sit through pops, buzzes, and even the absence of sound in one side of the phones, while others will complain about anything and everything.

The capability to drive six pairs of cans at ear-splitting volume and then 60 pairs at a comfortable orchestra-section level has always been a puzzler. The power requirements are so different. The Automatt has a relatively high voltage system (70 volts). Each artist is provided with a four-channel mixing box, and can select and regulate the volume of whatever instrument mix is most important to them at the time. A guitar player may choose a stereo mix of the whole rhythm section. The bass player may want the same mix, but will also boost the kick drum on channel three and his bass on channel four. There are four separate amplifiers — one for each channel — and each mixing box receives the same four channels. The artist has control over how the channels are mixed for his own headset. The only danger is blowing out headphones.

Headphones can be destroyed if they are connected directly to the amplifier output. Most maintenance people install a high-wattage series resistor in the line to reduce the voltage to the phones, and to protect the amp from momentary dead shorts when cans are plugged in.

Jeff Hanson from Santa Barbara Sound has come to the conclusion that amp clipping is what damages headphones. "Headphones can take a 150-watt peak, but not a 50-watt peak that's clipped. Clipping produces continuous high order harmonics, and the resultant heating effect burns out the phones." S.B.S. has four 150-watt stereo amps to drive the cue system.

Locating headphone jacks on the walls is not the most efficient means of signal distribution, since no musician stands next to the wall. Any other positioning of artists necessitates employing long cords or extensions. Jeff put a multi-pin connector on the wall, and built several boxes that can handle eight sets of phones — a set of two stereo outputs for each of the four cue sends per box. Protection resistance, of about 10 ohms, is placed in series with each output, as well as another 10-ohm switchable resistor to ground. At a flick of a switch the output level can be dropped by about 6 dB. "That keeps most people happy. To insure that the 5-watt resistors don't burn out, I've epoxied them to the side of the box. It acts as a heat sink; they do get pretty warm sometimes." Their cans are 150 ohms, but the principle applies for any impedance.

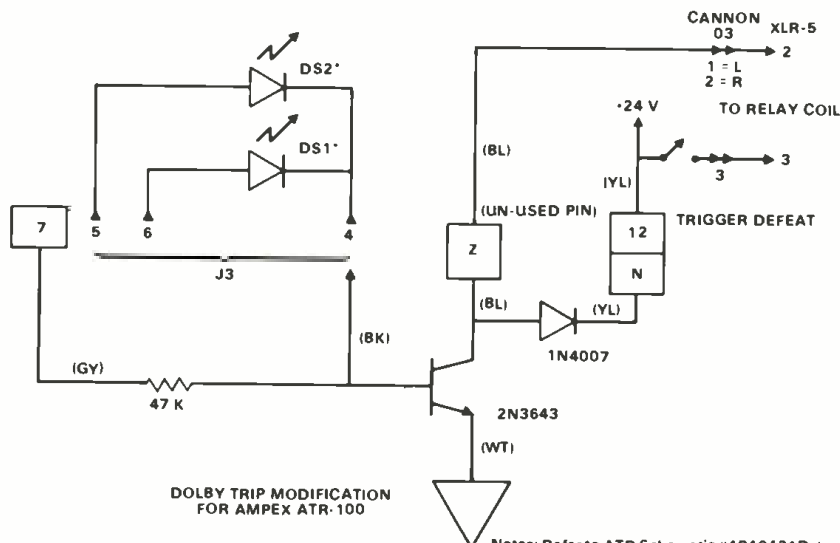
The multi-pin on the wall gets the full power of the amps. There is no series resistance between the amps and the wall. "If a guy brings in a favorite set of speakers, we have a connector that will interface them with the multi-connector on the wall," Jeff says. "This eliminates any series resistance between the amp and speakers, which would cause muddiness in the bass range."

Clients' tastes in headphones are as varied as the number of available choices. Some like open air design, because they want to hear what's going on around them as well as the cue send. That design is also a favorite of vocalists who

Jerry Jensen: AUTOMATIC DOLBY MODE SELECTION FOR AMPEX ATR-100 MASTERING MACHINES

A common inconvenience that can turn into a minor disaster for owners of an Ampex ATR-100 is the necessity to operate the machine and Dolbys separately. This modification by Capitol Records' engineer

Mitch Tanenbaum is for an automatic Dolby trip modification. The diagram refers to ATR schematic #4840421D, input/output PWA. Starred components are existing. Lift "pin 4" on "J3" from ground and attach to new circuit.



DOLBY TRIP MODIFICATION FOR AMPEX ATR-100

Design by Mitchell Tanenbaum, at Capitol Records.

Notes: Refer to ATR Schematic #4840421D, input/output PWA. Starred components as existing. Lift Pin 4 on J3 from ground and attach to new circuit.



MAINTENANCE ROUNDTABLE

don't like the heavy feeling that closed phones cause after a couple of hours of doing overdubs. On the other hand, the isolation provided by such a full cup is often necessary.

Indigo Ranch prefers Koss Pro 4AA. "Even if they fall apart physically, you can cannibalize some to fix others," Bart Johnson says. Capitol uses Pioneer SE 305s amongst others,

according to Jerry Jensen, because they're "easy to fix, they get a lot of volume, and they have a lot of phoney bottom end." The Automatt has Beyer and AKG. Sound Labs likes Koss Pro EE for "their ability to produce a lot of level with no leakage." Santa Barbara Sound chose Yamaha. "Mechanically they're kind of fragile," Jeff Hanson feels. "The headband goes flaky on you, but they sound great. The drivers are very, very rugged. If one blows out, you just pop the old one out and snap in a new one."

Cords don't seem to present a problem. Bart Johnson will sometimes open the phones, and attach a proper strain relief device inside the headset. Jeff Hanson recommends winding tangled coil cords around a broom handle about once a week to restore their shape.

One Step Back

The audio industry is the only industry that still uses tubes to a large extent. How long that will last, no one is quite sure. The general consensus is that well-built tube, solid-state, and transistor gear will probably always exist side by side.

A lot of the attraction of tube equipment comes from the soft overload characteristics that tube circuits have, and the prominence of even-order harmonic distortion. Transistor circuitry tends to have a harder clipping point and more odd order harmonic distortion. Jerry Jensen feels that "a lot of the time, when people are talking about tube sound, they're actually talking about the coloring of the old transformers. Tube gear is forgiving. Nine out of ten times it will not destroy itself."

Peter Butt: TIGHTER PUNCH-IN PERFORMANCE FOR AMPEX MM-1200 MULTITRACKS

Applicability: Ampex MM-1200 switcher card part number: 4050774.

Purpose: Reduce time required for entry and exit record function.

Warning: This modification may produce objectionable punch-in "thumps" if installation is not concurrent with proper termination of the reproducer preamp input transformer secondary. (See termination details in "Flatter Is Fatter — Magnetic Reproducer Equalization Accuracy," Peter Butt, R-e/p, October 1978, Volume 9, Number 5, p. 84.)

Deletions:

C7, C4, C6, and C3.

Changes:

C2 was 20 mfd to be 1.5 mfd $\pm 5\%$, 50 VDC (Kemet T110B125M050AS or equivalent, and install with strain relief for leads).

C13 was 6.8 mfd to be 2.2 mfd $\pm 20\%$ 35 VDC.

C10 was 6.8 mfd to be 3.3 mfd $\pm 20\%$ 35 VDC.

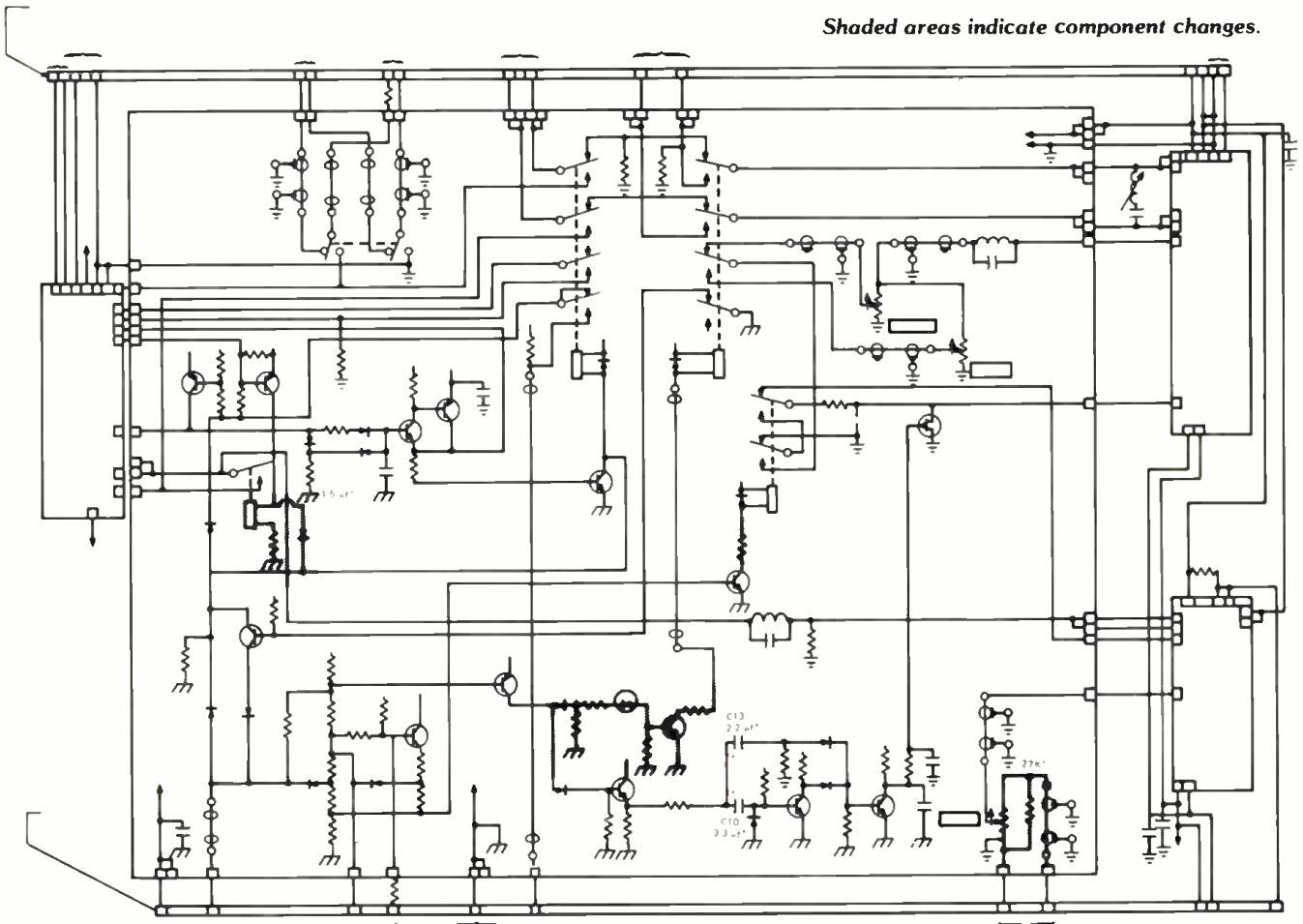
Additions:

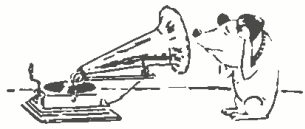
Add diode, with anode to collector of Q3, cathode to collector of Q6. (Use 1N4148,

etc.) Add 27 kilohm $\frac{1}{4}$ -watt resistor in parallel with R11 for termination of line input transformer, if used.

This modification reduces the time required for 90% bias level to about 50 msec., from the stock time of about 180 msec. If the reproducer preamp is properly terminated, the punch-in/out thumps will be less in amplitude than for the stock configuration. This mod may be already partially installed in newer models of the MM-1200. Check your switcher card assembly as delivered.

Shaded areas indicate component changes.





MAINTENANCE ROUNDTABLE

The Automatt's Mike Fusaro has found that if tube equipment heats up, it'll blow the fuse and not the amp. Solid-state gear tends to burn out transistors, and requires more time to repair than just popping in a new tube or two.

Jeff Hanson likes the sound of tube equipment, too, and was quick to point out that tubes don't necessarily have to run at high voltages; microphone pre-amp tubes can operate on fifty volts. "Most of the good tubes are produced in Europe, except for military/industrial types. There are still applications in industrial use where transistors haven't taken over. In many cases it's in high reliability situations."

Even though tubes are hot, bulky, heavy, and use relatively high voltage, the unanimous opinion is that the next five years will bring a proliferation of new tube processing gear, tube pre-amps, and tube microphones.

Peter Butt from Heider's feels that phantom microphone powering would be better abandoned. He suggests using a 5-pin microphone connector, thereby eliminating the need for phantom power. Connect one pin to the shield, use two for signal conductors, and the remaining two for plus and minus going to the power supply for the mike. In that way the DC never gets united with the audio. "Unfortunately, I've never seen anyone do it. Phantom microphone powering is, at best, a

compromise."

Sound Labs has a phantom power switch on their microphone wall boxes. It helps prevent putting 48 volts into a dynamic mike by mistake. John Sands also recommends separate power lines. If a mike transformer accidentally receives phantom power, it becomes magnetized, distorts, and then can't be demagnetized. All it takes is one DC transient between pin one and pins two and three. "We've done subjective tests on dynamic microphones that have been phantom powered and those that have not; they just don't sound the same. Phantom powering is not supposed to hurt the mike, but I have a feeling it overworks the capsule. As far as I know, all our dynamic mikes are still virgins."

Jerry Jensen adds that "any little surge of DC through a dynamic mike will hurt the transformer. The mike will never be the same and neither will the mike input channel." Peter Butt also had a problem "with the multi-pin DIN connector used on the AKG C-5 between the mike and the power supply, when the original connectors were replaced due to damage. They were replaced with Amphenols, which are mechanically identical. However, it turned out that there was an insulating contact potential on the pin used for the shield, such that the latter was floating. Since there was no voltage on the shield to override the contact potential, the shield remained floated. The problem can be solved by changing the shield pin or the entire connector.

"It showed up when I measured it on the low-voltage ohms function of a digital multi-meter, as opposed to the high-voltage ohms position. A lot of DVMs have a low-potential ohm reading capability so that the semiconductor junctions will not be forward biased by the meter. It

turned out I was reading an open circuit using the low position, and a short for the high position. There has to be something like a half-volt potential for a low resistance between the shield pin of the Amphenol connector. It's a very subtle difference."

Richard Kaplan, of Indigo Ranch, is an avid collector of vintage microphones, which presents a unique problem for Bart Johnson. He gets handed an incredible stash of unusual power supplies every week. "Richard buys mikes from all over the world, and they use the wierdest sort of connectors you've ever seen." Replacing cable for the mikes is not any trouble, but connectors are hard to find. Bart re-adapts the connections at the power supply using Amphenol MS series connectors.

Neumann mike cable is generally considered very high in quality, but in many cases it's too thin and fragile if heavy equipment (i.e., grand piano) or hard floors are present. "Run over it a few times and it will short out," says Jerry Jensen. Capitol Records chose a heavier gauge cable made by Pro Sound. "We'd use Belden, except that Pro Sound is color-coded; red cables are long, blue are medium, and white means short cables."

S.B.S. likes Audio Industries cable. "It's similar to Neumann, but has got a little stiffer jacket; it's more abrasion resistant." All cables are triple woven shield and contain three inner conductors. "It's tougher, yet quite flexible," offers Jeff Hanson.

Connections And Multi-Pin Connectors

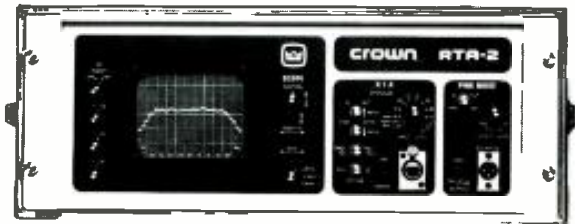
Elco multi-connectors are good, but very delicate. If they're dropped from about waist height on to any hard surfaced floor, the plastic contact blocks tend to crack and break. In low mate/un-mate situations, such as inside a piece of equipment, Elco are excellent. They have a pin density of up to 120 per connector. Wally Heider Studios has 60-mil steel bands made at a machine shop that wrap around the connector in such a way that the steel covers the plastic, and takes the impact.

Sound Labs chose North connectors. "I won't say they're indestructable," John Sands claims, "but they're close. They are mostly metal shells, don't have as many pins, and have to be soldered instead of crimped."

Peter Butt adds that he's discovered a generation of semi-dry crimps in the Elco's. After a long period of time they tend to open up. "The remedy I've found is to retract the pin, solder it with a micro-soldering iron, and then reinsert it. Crimping onto insulation takes a long time to trace down."

Jeff Hanson, on the other hand, is totally in favor of crimping over solder. He prefers using Amp (not Amphenol) multi-connectors, which offer a pin density of up to 160 pins. Amp has a metal pin hood and back shell with a non-conductive material holding the pins. A T-screw in the center enables it to be completely undone by hand in a matter of seconds. Unfortunately, Amp sells only through their own factory distributors. There is very often a wait when it comes to ordering.

All connections for Amp are crimp. You must have the factory crimping tools (about \$150) to obtain tight crimps which, as Jeff feels, are actually "more reliable than solder." The process can be done by a totally unskilled person. Tinned wire becomes a weak link where it comes out of the pin, and the time it takes to crimp is much less than solder or wire wrap. Factory tools are foolproof; they will not release until a certified crimp is made. Ring, tip and



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shield can be crimped in a matter of twenty seconds.

When re-programming a patch bay to add another piece of outboard gear, multi-connectors can save a lot of time. "You can knock all the pins out of a connector in less than five minutes," Jeff Hanson offered. "As long as the pins are properly coded, re-positioning them back into the multi-connector to incorporate the new equipment takes a minimum of time. One client brought in a rack of Kepex gates that required eight in, eight out, and eight key patch points. It took less than a half-an-hour to install by crimping, and would have taken hours to solder ring, tip, and sleeve."

Jeff figured that it took about 10,000 crimps to wire Santa Barbara Sound, and out of those two were bad. He attributes these to a plastic stop in the crimping tool that started to wear out after about 8,000 or 9,000 crimps. Debugging the wiring took about a half-a-day.

Automation

Automation is becoming more and more common in the industry. Sound Labs boasts a Neve board and Necam computer, as does Capitol and Wally Heider. Amazingly enough, very few problems have been encountered with such a complex system.

Trouble-shooting a microprocessor is time consuming. The only logical solution to malfunction during a session is to replace whole sub-assemblies. Spare faders are usually kept on hand by studios, and if one goes out, the whole sub-assembly can be replaced within a matter of minutes. However, at about \$860 a fader, that can be an expensive proposition.

It's almost cost prohibitive to stock all the parts needed for quick repair. Neve/Necam has an office in Los Angeles that carries a large inventory of parts, and so far everyone is very pleased with the service.

Capitol feels the software could be better, but Neve is not willing to make the changes. Jerry Jensen has "the background to do software changes, but it's not practical without access to the software they [Neve] have already done. To start from scratch would be possible, but how much better it would be in the end wouldn't be worth the investment in time and money. If they'd give us a listing of what the software is right now, we would be happy to make the changes for them. But they won't even do that."

Peter Butt noted that "with ROM [Read Only Memory], you don't really know if you have a malfunctioning chip, or if there is something wrong with the microprocessor. Sometimes a transition is just a bit late or a bit early. That could blow the whole thing."

Mike Fusaro thinks the industry is reaching the limit of analog recording; the next step has got to be digital. "The market is such that the only option left for the audiophile or anyone else who wants record quality is direct-to-disc recordings. They offer the transient response and clarity that people want. In order to preserve the versatility of multi-track recording and the flexibility of overdubbing, digital is the only alternative."

But all agree that digital is still a product of the future as far as being commonplace. The Automatt has done several digital sessions, and is checking out the feasibility of purchasing a digital machine. However, Mike Fusaro stresses that the studio is still cautious about buying into the vanguard of a non-standard medium. Stanford University, Palo Alto, California, already has a digital recording studio that can store thirty to forty minutes of program material on disk drive rather than computer tape. EQ

and all other parameters are typed into the computer. "In the near future there'll be no reason for large numbers of volume controls and EQ setups. They'll all be stored and processed. When the program is played back, all the processing is recalled by the computer for the full mix. The point I'm making is that there will be a lot of changes coming very fast in the next few years." Why buy new equipment that may soon be obsolete? "I think it's wise to wait and see what kind of technology will become standard."

Can't We Get Some Air

Another point raised was how important rumble-free, quiet air conditioning was when recording digitally. Compressor/blower performance becomes more critical when the recording machine is flat to such a low frequency.

One client wants an environment where there is 96 degree heat, steam, and no light. The next client who comes in can't play the piano unless it's 65 degrees, and he wants lots of light. According to John Sands, Sound Labs has "an adequate system. We can make it as hot or as cold as we like. The staff has the keys to the thermostat, and within reason we will change the temperature in a short amount of time."

Because of the Necam computer's sensitivity to heat, Sound Labs installed a failsafe device to cut power to it in case its temperature gets too high. If the computer overheats, it suffers serious, expensive damage.

S.B.S. went overkill on their air conditioning system. They purchased three big units — one each for the control room, the studio, and the offices. "We don't have sensitive equipment, nor do we have to maintain a range. We don't

lock the thermostat. If somebody throws a lever, in five minutes they're going to get what they dialed." The control room is cooled by a one-and-one-half ton air conditioner in order to cool the room sufficiently, even when it's occupied by a number of people. The use of an electrostatic air filter extends the comfort range and they use very little recirculated air.

John Sands made a remarkable discovery while working for KPLM-TV. Once their electrostatic air cleaner was operational, the head life on their video tape recorder improved about 100%. They were getting about seventy-five hours of head life on an RCA TR22 HB video machine. After that the heads would have to be pulled off, shipped to England, and then re-installed about two or three weeks later at a cost of about \$3,600. Soon after the air cleaner was in service, the head life increased to four hundred hours. The next head ran over one thousand hours, and received an award from RCA.

Toward The Future

With the advent of computers, microprocessors, digital recording, and such, the future will impose many new demands on the maintenance engineers. The person who sweeps floors during the day and learns how to run and maintain the equipment at night will become a phenomenon of the past. New engineers will be forced to obtain degrees in computers, electronics, or both, as well as having an extensive background in acoustics and other recording-related fields. But with all the required technical expertise there is one requirement that can't be learned or measured, and without which all the rest is a useless exercise in high-level, busy work: you can't teach someone to be dedicated! □ □ □

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Modifying and Upgrading 3M 79 SERIES Tape Machines



by Gordon K. Kapes

The 3M Brand M79 Series tape machines were unveiled in 1972. Since that time they have become one of the most popular multitrack recorder/reproducers in use. Many artists, mixers, and studios have chosen the M79 as "their" machine. With so many M79s out in the field, it is inevitable that many updates, modifications, and changes have been performed, both by 3M, and by studio users. Some changes were made to correct design problems, some to take advantage of current technology, and other to satisfy the needs of individual studios.

After spending a summer repairing, installing, and maintaining 79s, I became curious to find out what changes have been, and could be made to improve their performance. Since my knowledge about the M79 was somewhat limited, I decided to become the "editor" and gather information and comments from some of the most creative studio people within the industry. The following is just some of the information I gathered through telephone and personal interviews.

I would warn the reader to use this information as a basis for their own study, rather than as a precise "how to" guide. While I have obviously tried to be as accurate as possible, each installation has its own peculiar "quirks" that can cause problems. Incorporate only those changes that help your ease of operation and sound; avoid changes that just look good on oscilloscopes.

Don't modify your machine if your best client likes to use a stock M79. Good mixers understand how to use the limitations of a piece of equipment, and adjust accordingly. Don't ruin their reference point because you might think it sounds better; "better" also means different and can upset some people. A client might want to bring in for mixing tapes recorded on a 79 at

another studio. Will your M79 still "sound" the same? So please be careful about major changes without getting feedback from studio users. Stock machines sound very good; updated and carefully aligned 79s can sound excellent — as good as any machine on the market today I am told, a claim I tend to believe.

Service Bulletins

Do you as a 79 owner have a complete set of Service Bulletins published by 3M? As of May 1980 34 had been published. They are very useful, interesting, and *important* for you to have. To obtain a complete set of Service Bulletins, or to update your set, write to: Mincom Tech Service, Building 236-GN, 3M Center, St. Paul, Minnesota 55144. 3M does not have a mailing list of all 79 owners; if you do not ask for this information you will not receive it. Many of the changes described in these Service

Bulletins were incorporated in later batches of production machines. As a result, if you have a later machine (after about 1974) most of the changes have been included in your machine. If you have early 79, however, careful study of the Service Bulletins may prove valuable.

There are also topics discussed in the Service Bulletins that cover user-installed special functions. Highlights of the Service Bulletins include: No. 5A reading SMPTE code; No. 11 and 17 Dolby interfacing; No. 32 minimizing chance of servo-driver transistor failure; No. 25 keeping a channel in the input monitor mode after that channel has gone out of record (an excellent modification); and No. 34 punch into record by pressing only the record button and punch out of record by pressing the play button. (Be careful of Bulletin No. 15; many people think the addition of C61 to the signal electronics card is, quoting an engineer, "evil." I discuss this further in the section on op-amps.)

There is some additional "unauthorized" technical information available indirectly from 3M. It seems that an in-house service booklet was put together for the 3M service people. Called "Problems, Symptoms, and Cures," this booklet is quite helpful in servicing M79 machines. Although these loose-leaf pages are not available from 3M, I know that some studios have somehow obtained copies. If you ask around you might be able to find a copy from which to make your own. It is definitely worthwhile doing so.

Changing Components

Although 3M makes use of high-quality components, those of you who are picky about adjustments staying constant might consider changing some of the M79's capacitors. Such modifications involve replacing existing capacitors with silver-mica or polycarbonate film types of the same value. Silver-mica capacitors are notable for their excellent temperature stability; the components listed below are to be found in frequency-dependent circuit areas of the M79's electronics. (Temperature stability of silver-mica type would translate to frequency stability of tuned circuits.) In the master bias oscillator section of




the author —

Gordon Kapes graduated in 1978 from the University of Rochester, Rochester, New York, with a degree in electrical engineering. He is currently employed as a consulting engineer in Highland Park, Illinois.

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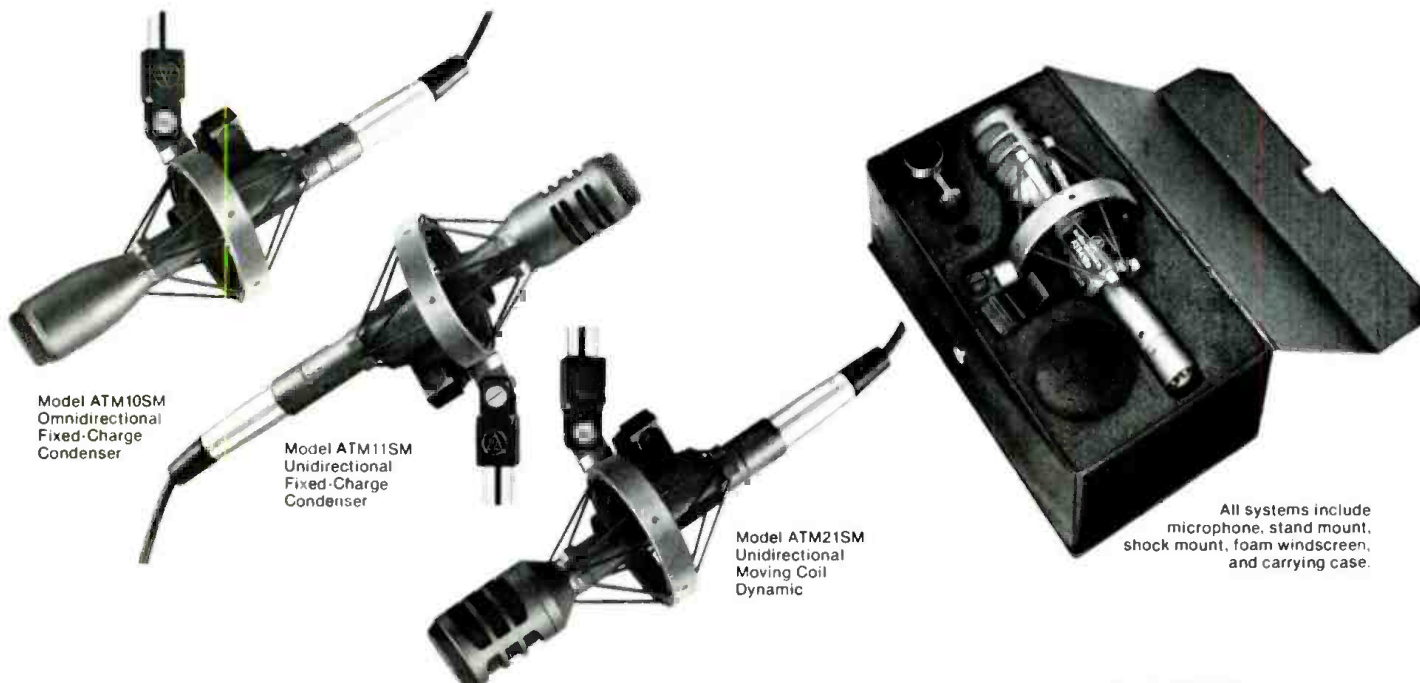
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R-e/p 77 □ December 1980

the logic and master bias supply card, C22, C23, and C26 could be changed to maintain a constant bias frequency. On the bias section of the signal electronics cards, C16, C25, C28, and C51 might also be updated. Silver-mica capacitors would help to keep bias levels temperature independent. As an option, consider changing the following capacitors on the signal electronics cards: C5, C23, C39, C40, C41, C42, C45, C46, C47, C48, and C56. The majority of these parts are in the record and playback equalization circuits; changing them to silver-mica or polycarbonate type would help to keep the EQ adjustments more stable.

It may turn out to be more prudent to think about changing all these capacitors, rather than actually doing it. A 24-track 79 would need 363 capacitors if all the recommended changes were performed! [Peter Butt, *R-e/p*'s consultant editor, suggests that the interested reader obtains a copy of the following article, which covers in great detail the selection of capacitors for specific applications: *Picking Capacitors*, by Walter G. Jung and Richard Marsh, *Audio*, February 1980 issue, Vol. 64, No. 2, page 52.]

FETs

Some studio people are opposed to using an M79 because of the large number of FETs to be found within the signal electronics. They feel

that FETs add unacceptable amounts of harmonic distortion. Each to their own opinions but, like it or not, FETs are an integral part of the 79's electronic design. FETs that are in a position to cause the most harmonic distortion are Q10, Q11, Q34, and Q35, all of which are 2N4343s. The amount of distortion produced by a 2N4343 appears to be related to its drain-source on-resistance, specified at 700 ohms. In practice, however, the majority of 2N4343s used in the M79 have a much lower drain-source resistance than this — which is a good thing. Those 2N4343s with higher than average drain-source resistance might well be replaced.

An alternative test is to check each output mode — input, sync, and repro — on all channels for harmonic distortion. Try changing the FETs in the mode with worse than average harmonic distortion. (Record and reproduce head can be excited with a flux loop; please refer to Peter Butt's article, *A Fuss About Plus*, *R-e/p*, December 1979, page 66.) One major studio found it helpful to change Q10, Q11, Q34, and Q35 from 2N4343s to Siliconix P1086s. The P1086 has a lower drain-source resistance of 70 ohms.

Operational Amplifiers

Of all components in an M79's signal path, the one that causes most grumbling is the 741 type op-amps used in the record and playback sections of the signal-electronics card. At the time the M79 was designed, a 741 was a good choice. Progress moves on, however, and is especially evident in the variety of excellent op-amps now available that directly replace, pin for pin, the ubiquitous 741. IC4 in the line-driver stage may be the first op-amp to be replaced. An improved slew rate may help this stage to better handle the large voltage swings required of it. IC3 in the record amplifier stage may also benefit from improved op-amp performance.

Everyone seems to have their favorite replacement op-amp, so I'll list all the main choices. A very good, garden variety op-amp is the LF351, commonly made by National

Semiconductor and priced around 75¢ in small quantities. Even better, and in the same family, is the LF356. This has similar characteristics and improved noise specs, but the price doubles to around \$1.50. Texas Instruments' TLO family offers two chips that are quite good as replacements in this application: the TL081 and the low-noise TL071 (the latter costs around \$1.00).

If such a thing is possible, the Signetics NE5534A is really too good an op-amp for this application; too good in the sense that some of its outstanding features are not needed. However, it is still a good choice if the cost (around \$2.50 each) does not bother you. The 5534A is the guaranteed low-noise version of the 5534, and is preferable.

Using LF351, LF356, TL071/81 op-amps is really quite easy. Remove the offending 741, and add a power supply by-pass capacitor between pins 6 and 11 of the IC socket. (A ceramic disc capacitor in the neighborhood of 0.1 mfd should insure that power to the op-amp is clean.) Now insert a new op-amp into the socket, being careful of the pin numbering. The 741 is a 14-pin chip, while the replacements are all 8-pin devices: match pin 1 of the replacement with pin 3 of the socket and you should be correct. (Also see the section of this article that describes IAM Studios, Irvine, California. IAM needed some parts changes in the record amplifier for successful use of the LF351.)

The 5534A, on the other hand, takes a bit more work to use, a situation that might stop some of you from using it (Figure 1). Remove the 741 and add a power supply by-pass capacitor as before. Compensate the op-amp by adding a 22 pF capacitor between pins 9 and 12 of the socket (which will result in the capacitor being connected across op-amp pins 5 and 8). This reduces the slew-rate, but adds greatly to the stability of the op-amp. Also, to improve stability, you might want to add a 50-ohm resistor in series with the output of the 5534A, socket pin 10 (op-amp pin 6). You will have to cut the printed-circuit board trace and solder

M79 LOGIC ANOMALIES

by Peter Butt

The M79 transport control logic uses a number of discrete bistable circuits to remember momentary logic commands from the deck's pushbuttons. These flip-flops have the dual function of acting as drivers for the 387 lamps housed within those pushbuttons, which indicate the deck logic status at any given time. Incandescent lamps, unfortunately, do fail from time-to-time, which is not surprising in itself. In general, incandescent lamps have two different catastrophic failure modes: electrical open and electrical short. In the case of a normally occurring burn-out, where the lamp filament merely opens, the result is fairly inconsequential in that only the lamp illumination is lost; there will be no effect on the operation of the logic flip-flop.

On the rarer occasion of a lamp failing as a short circuit, the matter becomes a bit more troublesome. Because the lamps are driven directly by the flip-flops, and not through a buffering circuit, a shorted lamp effectively ties one collector of a flip-flop pair directly to the +28 V line — a fault that prevents the flip-flop from resetting, and holds the deck in that particular logic state. This can be a disaster if a valuable master tape is being played on the machine, and deck functions, including record, become uncontrollable.

A solution to the problem is to install a 150-ohm, or similar value resistor having a 1/4-watt dissipation rating in series with each of the pushbutton indicator lamp lines. In the event of a shorted indicator lamp, the flip-flop will still be able to reset, although the added resistor may get a little hot if it is not reset within a short period of time. The alternative is, however, better than complete loss of control. The added resistance in the lamp circuit will result in reduced brilliance, but should also prolong lamp life by reducing the applied voltage by about 10%.

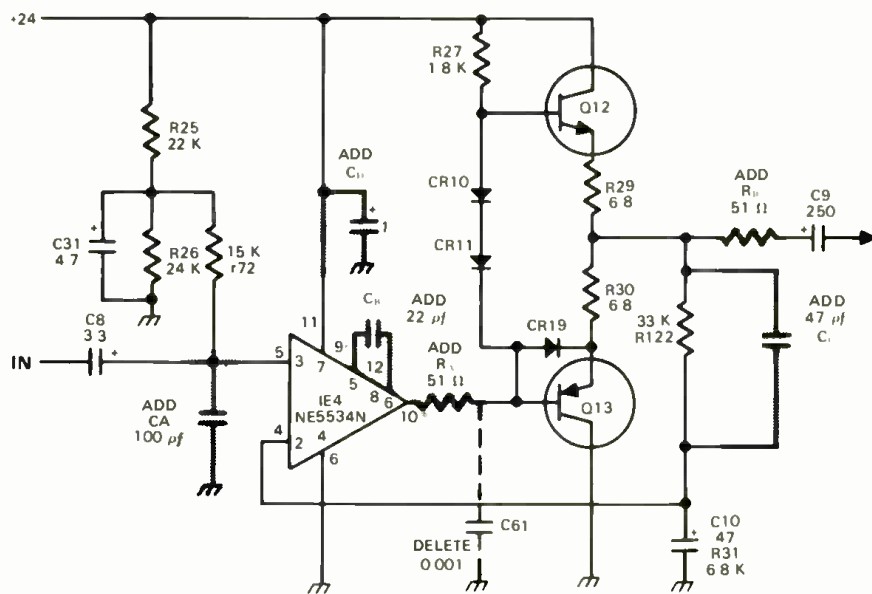
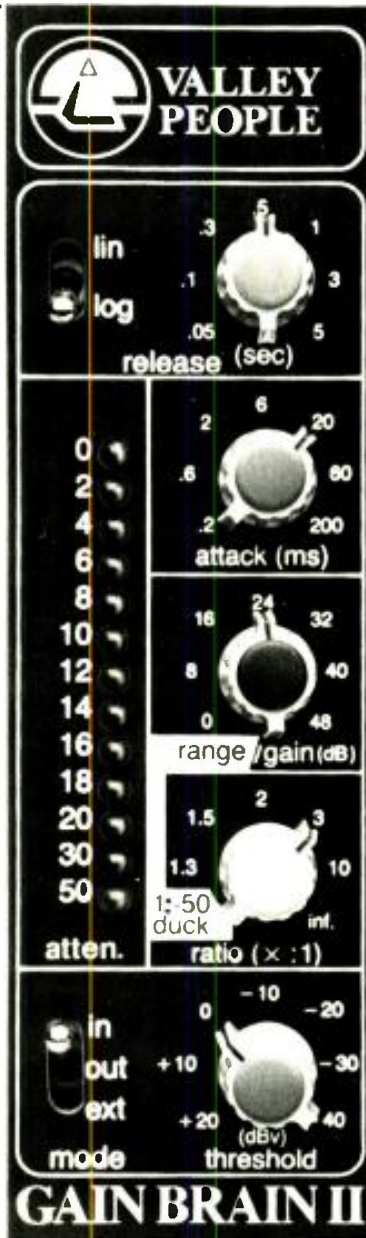


Figure 1: Line Driver schematic for Signetics NE5534N modification. Capacitors C₁, C₂, and C₁₁ should be silver-mica types, and C₁₂ a high-quality tantalum. Resistors R₁, R₂, and R₁₁ have been added for load isolation; R₁₁ is more necessary if this circuit is to be used in machines where output transformers have been removed, to protect the line driver from damage due to inadvertent shorting of the output line. Capacitor C₂ may be deleted for TLO71P or LF351 op-amps. Bandwidth of the resultant circuit should extend to approximately 100 kHz.

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R-e/p 79 □ December 1980

the resistor onto the cut. Be certain this resistor gets installed between the output pin of the 5534A and ALL the rest of the circuit.

Like the other op-amps mentioned, a 5534A is excellent but requires correct usage. Do not try to fudge and skip the by-pass capacitor, compensation capacitor, and possibly the series resistor. Many components get a bad reputation because they are not used correctly.

One benefit of replacing the line-driver 741 is the possibility of eliminating capacitor C61. 3M Service Bulletin No. 15, October 1974, shows the addition of C61, a 0.001 mfd capacitor connected between the output pin of the 741 (IC4) and ground, to prevent high frequency oscillation. (This change was incorporated into all M79 production models after the Service Bulletin was released.) Such a "fix" was easy for 3M but is of questionable engineering practice. Capacitive loading on the output of an op-amp is

not a standard method of achieving stability; when the replacement op-amps are correctly installed stability should not be a problem. Consequently, C61 could very well not be required.

Transformers

The M79's input and output transformers have been the subject of considerable disagreement; some people like them and some don't. One view held is that the transformers are of very good quality and do not degrade the signal by any appreciable amount. If you subscribe to this view then leave the transformers intact and tackle some other area of the 79. Nevertheless, there are some good reasons for removing these components. Transformers solve at least as many problems as they create: impedance matching, rejecting common-mode signals, and curing grounding

problems are a few of their virtues, while increased distortion, phase shift, ringing, and limiting frequency response can be considered as drawbacks. Retaining or removing the transformers on an M79 comes down to a decision based on your use of the machine, your location (studio or remote), the equipment connected to the recorder, and tendency of your location to suffer from induced hums, buzzes, etc.

M79 input transformers are an option from 3M, even though most machines in the field have them fitted already. The transformer's input impedance is 20 kohm with a 3:1 step-down ratio, resulting in a voltage attenuation of 10 dB to the input of the signal electronics. With the transformer removed, the input impedance is 2.5 kohm, single-ended (unbalanced), which can cause some problems. Certain equipment does not like to feed an input impedance as low as 2.5 kohm; so make certain that your console, noise reduction equipment, etc., can handle it. Also, if you parallel the inputs on two 79s, the input impedance will obviously drop to 1.25 kohm. A transformerless single-ended input can make hum and noise a problem if your cable runs are very long; your cable is not of low capacitance; the source impedance isn't very low; your location is subject to longitudinal (common-mode) noise being induced into the signal lines due to the AC mains, RF, etc.; or if you suffer any grounding problems when connecting equipment together in your system. In fact, if you have any doubts, leave the input transformers in place; the slight benefits gained may not offset the major problems that can occur.

Another slight annoyance can be created with input transformers removed. The 10 dB voltage loss is now not in the circuit. This makes adjusting input pots a bit trickier, because their sensitivity goes way up. One possible solution is to add a 5 kohm resistor in series with the high side of the input. This will reduce input sensitivity and raise the impedance to 7.5 kohm.

If you wish to remove input transformers, the best solution is achieved by adding a differential input buffer stage. This can be a big pain to build for a 24-track 79, but has been done successfully. A differential buffer stage gives you the benefits of removing the transformer, while maintaining an electrically-balanced input. Hum problems may still occur, however, even with the differential input buffer.

Some consideration must be given before removing output transformers. If you need balanced line-outputs and electrical isolation, do not remove the transformers. If you do choose to remove the output transformers, several points should be noted. The output impedance becomes around 50 ohms, and is unbalanced. Such a low impedance now limits the amount of harmonic distortion that the bridged VU meters induce into the line outputs, eliminating the need for meter buffers. Maximum output level is also reduced, because the 1:2 voltage gain achieved by the output transformer is no longer in circuit.

I will be honest and tell you that I have talked to people who removed the input transformers and found that, while electrically the machine works well, sonic improvements were not very significant. However, removing output transformers can significantly reduce VU-meter induced distortion.

VU Meters

Until recently, most people have not given much thought to the problems created by using VU meters. For all the good points a meter

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much thought to the problems created by using VU meters. For all the good points a meter possesses, it does not monitor a signal line without adding signal components — harmonic distortion — of its own back into the signal line.

The source of a very significant amount of harmonic distortion is the bridge rectifier used to convert an AC input signal into DC to drive the meter movement. The VU meter standards, as of 1961, require that a VU movement, when

connected correctly, shall produce not more than 0.3% harmonic distortion. I assumed, incorrectly, that currently-manufactured VU meters would produce much less than specified
... continued overleaf —

The main part of this article was written to provide a broad base of information about modifications that can be done to the 3M M79 tape machine. To provide "real life" information I spoke with Jerry Shirar, of IAM Studios, Irvine, California, a facility that has been very successful in modifying its M79 machines to improve sonic performance and operating ease. As Jerry told me, final modifications are not very complicated, but much time was spent experimenting and listening before they were satisfied. Valuable help was also received from the people at Westlake Audio.

It is my contention that IAM did a "rational" amount of modification. It didn't radically alter the basic "sound" of the 79; didn't spend a fortune on parts; and didn't have to change the machine into some alien form. The studio worked toward reducing distortion, and achieved 50 or 75% of the possible improvement with a reasonable amount of effort. A few studios have completely redesigned the M79's signal electronics and I respect them for it. However, I do not consider that approach to be worthwhile for the majority of studios.

At IAM all potential improvements were tested on an M79 2-track. After the modifications were proven they were installed in a 24-track machine. Here is the present state of their 24-track M79:

- Input and output transformers removed — no hum, noise, grounding, or other problems were encountered.

- On the signal electronics cards, both type 741 operational amplifiers replaced. IC4 in the line driver stage was swapped for a NE5534A, and

MODIFYING and UPGRADING the M79 at IAM STUDIOS Irvine, California

- a 0.1 mfd disc capacitor soldered across socket pins 6 and 11. This latter mod is to bypass the power supply input to the op-amp. A 100 pf capacitor was also soldered between socket pins 4 and 10, to improve stability by reducing the gain of the op-amp at very high frequencies. A compensation capacitor was not added, however, thereby retaining the full 13 V/microsecond slew rate of the NE5534A. C61, a 0.001 mfd capacitor from the output of the op-amp to ground, was also removed (see 3M Service Bulletin No. 15). This capacitor was added to keep the 741 stable, and is hence not required by the NE5534A. IC3 in the record amplifier was replaced with an LF351.
- Low-pass filter, R132 and C56, at the input to

the record amplifier section removed. A 47 pf capacitor and 330 kohm resistor were both added in parallel with resistor R55. This reduces the op-amp's gain in the higher audio frequencies to allow for correct record equalization adjustment. High-frequency EQ at 15 ips is a bit tricky, but can be correctly adjusted if care is taken.

- In the course of normal operation several capacitor problems have appeared. Bias trap capacitor C5 on the signal electronics cards has often failed. IAM solved this problem by replacing all C5 capacitors with better quality devices. Also, capacitor C50 on the signal electronics cards have gone bad; when it does a "pop" appears on the tape. Changing C50 on all signal electronics cards was the required solution.

IAM keeps a full set of 3M Service Bulletins and has updated its machines as needed. Especially helpful, it says, have been the modifications covered in Nos. 25 and 27. Correct alignment is carefully maintained.

After these modifications were complete, IAM compared their 79s to recorders from all of the major manufacturers. Listening tests were performed and it was decided that the 79 was sonically best for the studio. In general, IAM records at 30 ips, without noise reduction, since the modifications helped to eliminate the need for noise reduction. Eighteen months after the studio's 79s were modified, IAM is still satisfied with the results. Although IAM Studios is used primarily for in-house production, recent outside clients include Stevie Wonder and Miles Davis.

My thanks to Jerry Shirar for sharing this information.

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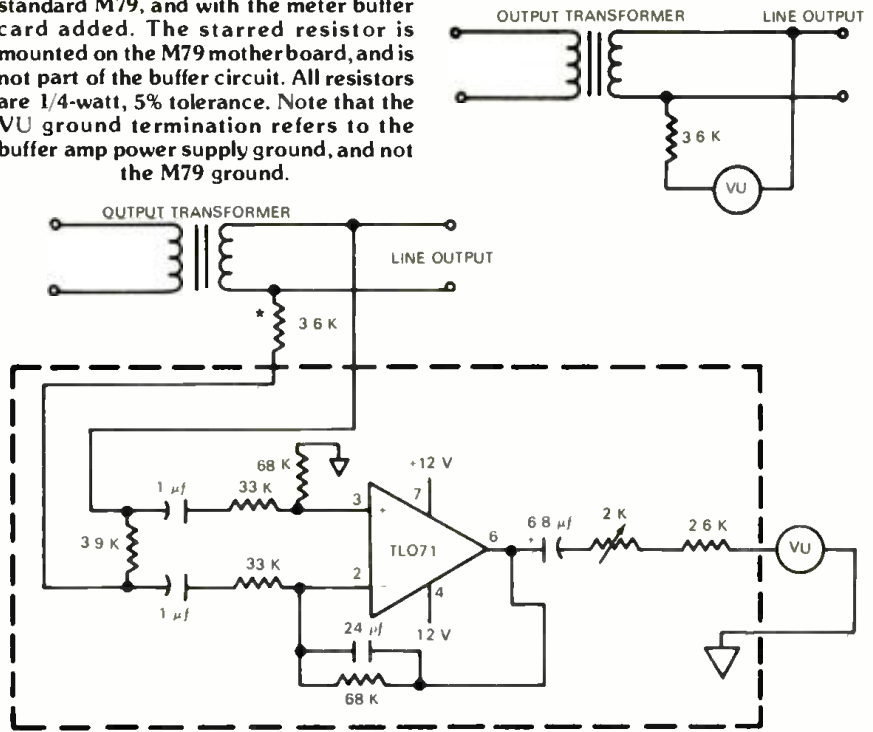
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by the standard. Upon telephoning one of the major meter manufacturers, I was told by their Chief Engineer that the company's VUs are specified at 0.3% harmonic distortion. Eliminating VU meter induced distortion is not an esoteric goal; harmonic distortion of the order of 0.3% is significant.

As with most equipment in the field today, the M79 has its VU meters in series with a 3.6 kohm resistor, bridged across the line output — a method of connection that allows the meter-induced distortion to appear across the line output signal. It is hence highly desirable to somehow isolate or buffer the VU meters from their respective line outputs. The simplest solution is to unplug the edge connectors that connect the meter bridges to the mother boards. In some studios this will be satisfactory, since all level metering is done on the mixing console's VU meters. Another solution is to install switches in the VU meter lines, and only turn them on when the meters are really needed.

The best solution, however, is to use an isolation or buffer network, such as an operational-amplifier buffer circuit between the line output and VU meter. A simple circuit to accomplish this is shown in Figure 2. Gaining access to meter lines on an M79 is a simple matter due to the use of a multi-pair cable from the mother boards to the meter bays. An additional advantage of using an active isolation circuit is the ability to calibrate the VU meters. By definition, a VU meter, in series with a 3.6 kohm resistor, should read -4 VU when bridged across a 600-ohm line sinking 1 mW (or 2.51 mW for 0 VU). In practice the calibration of VU meters can vary from instrument to instrument. In mock seriousness I ask: when the VU meters in your studio read -4 VU, is the line output

Figure 2: VU meter connection for a standard M79, and with the meter buffer card added. The starred resistor is mounted on the M79 motherboard, and is not part of the buffer circuit. All resistors are 1/4-watt, 5% tolerance. Note that the VU ground termination refers to the buffer amp power supply ground, and not the M79 ground.



really sinking 1 mW into 600 ohms? Anyway, the circuit in Figure 1 contains a calibration trim pot used to correctly set up the VU meters movement.

Sidetracking the discussion leads to another means of reducing VU meter-induced

distortion. If you choose to remove line-output transformers, the output impedance drops to a figure which, for all practical purposes, prevents a VU meter from adding significant harmonic distortion. As a result, if the output transformers are removed, meter buffering is not needed.

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Whether eliminating VU meter-induced distortion will lead to significant sonic improvement is certainly debatable. (Some weight must be given to the use of meter isolation, since all major console and tape machine manufacturers use buffers on their new products; in general, manufacturers do not include circuitry that does not have significant merit.)

Tape Run-Out Sensor

The M79 tape run-out sensor can be somewhat of a pain at times. Due to aging of the photocell, periodic adjustment of the sensitivity pot (R142) on the logic and master bias supply card is needed. To extend the time needed between adjustments, change R143 from 12 kohm to 10 kohm (Figure 3). Reducing the response speed of the sensor can also prove helpful. Sometimes movement of the tape lifter will allow enough light to get into the sensor to activate the run-out mode. Solder a 0.1 mfd capacitor from the base to collector of Q33. This modification shouldn't degrade the operation during normal tape run-out, but will prevent momentary "spikes" of light from activating the run-out mode.

14-Inch Operation

3M Service Bulletin No. 12B, July 1980, discusses converting the 79 to 14-inch reel operation, a kit of parts for which is available from the company. The funny thing about this Service Bulletin is that 3M does not recommend 14-inch reels for recording studio use, and does not recommend 30 ips operation with such reels. So why have the conversion kit available at all? I guess it is called "limiting your liability."

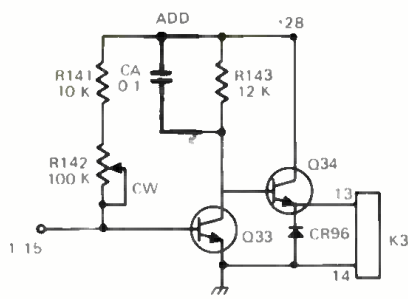


Figure 3: Modification to reduce response time of the M79's light-sensor circuit.

Anyway, successful operation at 30 ips with 14-inch reels is possible, and has been used at some studios.

Two parts changes can improve tape handling: on the logic and master bias supply card, change R88 from 4.7 kohm to 2.2 kohm, and C8 from 100 mfd to 200 mfd. Such changes result in a lengthening of the time that high-tape tension is maintained when play mode is initiated. Careful adjustment of reel tensions is also required. You might also want to increase tape tension in the play and standby modes. Please note that, besides the two parts changes mentioned, you must still follow all the alterations outlined in Service Bulletin 12B. The only effects caused by modifying an M79 to handle 14-inch reels is a slower stop-to-operating speed time when going into play mode. This could be annoying when using 10½-inch reels, but is needed to handle 14-inch reels correctly.

Outside Suppliers

Several companies offer modifications designed for M79 Series machines. **Electro-Media Systems, Inc.** (8257 Beverly Boulevard, Los Angeles, California 90048) has provided its clients with circuit cards that replace input transformers with differential input amplifiers; a logic card that makes the output mode switching more convenient; and a meter buffer card. **Westlake Audio** (6311 Wilshire Boulevard, Los Angeles, California 90048) has printed circuit cards designed for meter buffering; Dolby interfacing with user-selectable switching; and will soon offer a user-installed kit that provides a new record amplifier circuit. The author (1127 Ridgewood Drive, Highland Park, Illinois 60035) also has a meter buffer card available.

Please contact the above companies and individuals for more information.

Good luck on updating your M79!

□ □ □

Acknowledgment

I would like to thank the following people for contributing information and ideas to this article: Dave Baskind, Malibu, California; Peter Butt, Wally Heider Recording, Hollywood; James Cunningham, Studio Technologies-ECOPLATE™; Dan Gwynne, Electro-Media Systems, Inc., Los Angeles; John Peluso, Streeterville Studios, Chicago; Glenn Phoenix, Westlake Audio, Los Angeles; Jerry Shirar, IAM, Irvine, California; Penn Stevens, Record Plant, Los Angeles; Bob Titus, Sigma Sound, Philadelphia; Walt Travers, Mincom Division, 3M; and Steve Waldman, Record One, Sherman Oaks, California.



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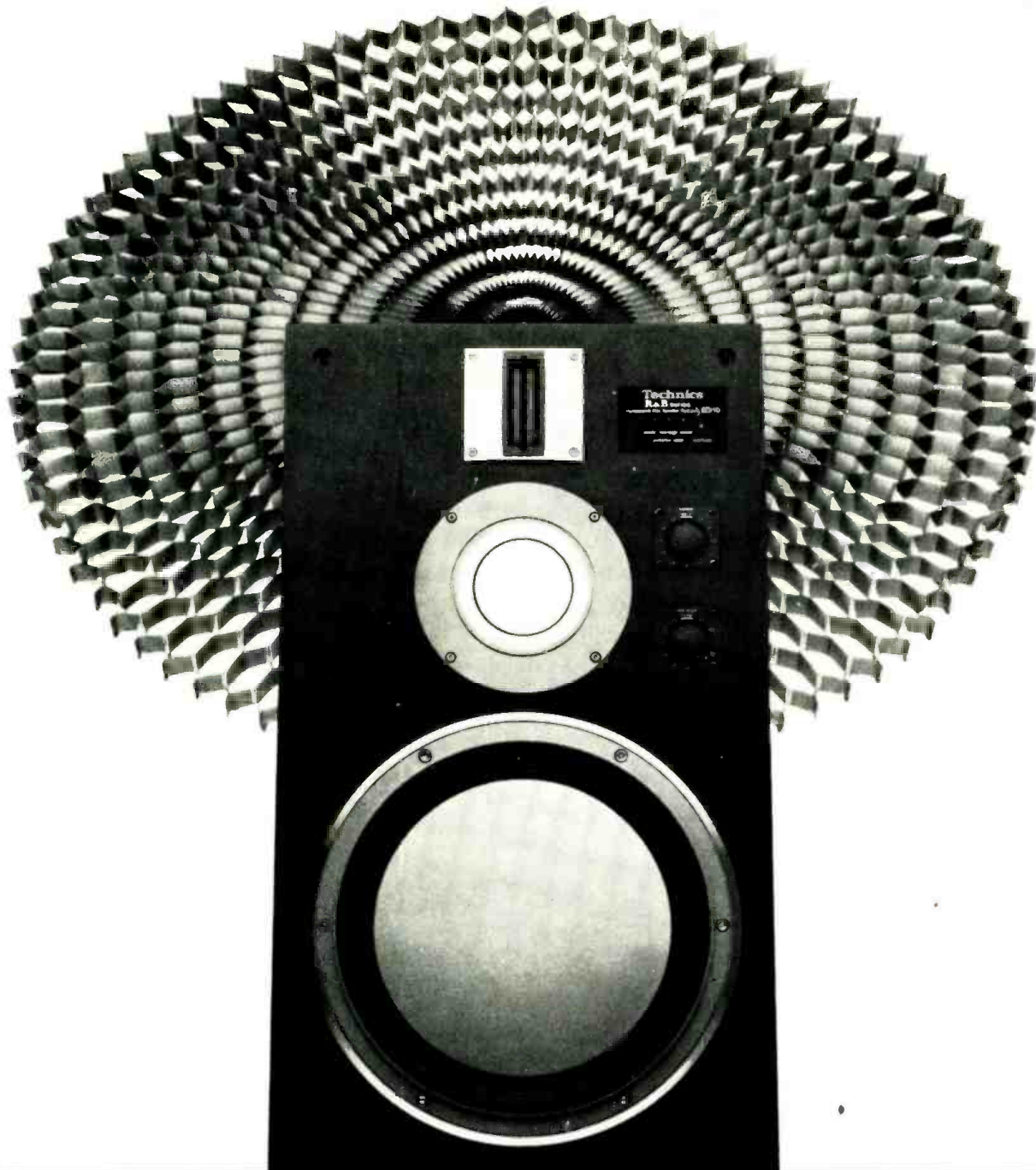
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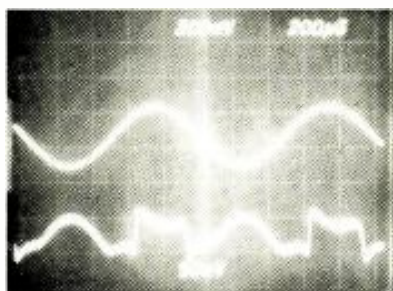
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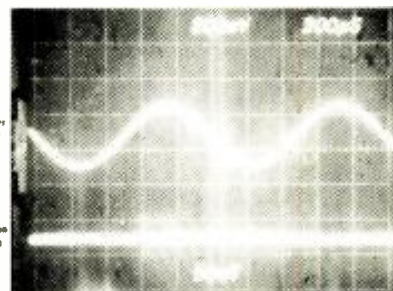
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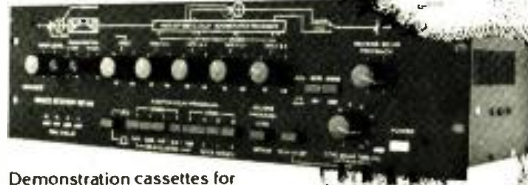
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cutting signal for variable pitch/depth control in lieu of preview arrangement.

Tentative prices of the Series 90 System are: BP-90 Processor, \$39,900; AE-90 Editing System, \$36,900; and CD-90 Disc Mastering Delay Line, \$19,900.

BP-90 Digital Audio Processor

A professional two-channel PCM processor for use with any U-type VTR, the BP-90 utilizes 16-bit linear quantization, 44.056 kHz sampling rate, and a highly effective error correction system. Adequate consideration is paid to editing operations, with the simultaneous recording of an address per V-unit (a field of video signal), V-unit encoding, and with the digital input and output terminals.

The BP-90 may be used in one of four operating modes:

1 - Normal Recording Mode: An analog input signal is subjected to 16-bit linear quantization.

2 - Dubbing Mode: In this mode, the reproduced output signal enters the digital input of the recording section with address codes added, so that dubbing can be performed.

3 - Synchronous Mode: This mode is used for reproduction with timing controlled by a quartz crystal, and for editing in combination with the AE-90 Digital Audio Editor, to feed the VTR with the sync signal.

4 - External Signal Monitor Mode: This mode is used to monitor external digital signals; for example, during editing using the AE-90 or for reproduction of the main signal during disc cutting.

AE-90 Digital Audio Editor

Combining one BP-90 Digital Audio Recording Processor and two U-type VTRs, the AE-90 Digital Audio Editor enables recorded material to be monitored during play back of a tape in either direction. Automatic and manual scanning can be applied to locate the exact editing point. Cut-in and cut-out points are confirmed independently by recalling the signal stored in memory.

A cross-fade function secures smooth continuity of program at the editing point. Cross-fading time can be varied in four increments. A digital rehearsal function enables an operator to rehearse editing performance by recalling the music signal from a built-in memory store without running the tapes. A level-adjusting facility allows the music signal level to

be altered, or enables fade-in and fade-out operations.

A special function adjusts the editing point backward or forward in steps of 2 msec. Once a rehearsal sequence is satisfactory, the editing operation is fully automatic with a single control button.

CD-90 Digital Delay Unit

To cut analog record masters with digital music material decoded from a BP-90 Digital Audio Recording Processor, the CD-90 unit delays the music signal to produce the preview signal for variable pitch/depth control system.

At any sampling frequency, the delay timer can be set up to 1.5 seconds in 6-msec. increments. Delay time can also be adjusted to suit 45 or 33-1/3 rpm, providing that the sampling frequency is 44.056 kHz.

Dynamic range of the delayed signal is more than 90 dB, and digital input 16-bit serial/parallel data. Controlled by an external clock signal, the unit may be operated at sampling frequencies ranging from 30 kHz to 60 kHz.

JVC CUTTING CENTER, INC.
RCA BUILDING, SUITE 500
6363 SUNSET BOULEVARD
HOLLYWOOD, CA 90028
(213) 467-1166

for additional information circle no. 59

BULGIN-SOUNDEX AMM100 AUDIO MULTIMETER

The AMM100 audio multimeter, manufactured in Britain by Bulgin-Soundex, and now available through H. R. Kirkland Company, Morristown, New Jersey, is a multi-purpose instrument suitable for line testing and listening, peak program metering, amplification of microphone signals, calibration of peak program monitors, bench testing and other audio functions.

The instrument combines a switched gain



MEET THE NEW TRACK STARS OF THE '80s



NEOTEK
SERIES III
28x24 CONSOLE

ANNOUNCING THE OTARI/NEOTEK 24-TRACK SUPER SYSTEM

With the introduction of the MTR-90 Masterecorder, Otari has made its entry into the world of professional 24-track recording. The MTR-90 reflects the leading edge of current technology with its fully symmetrical tape path and pinch roller-free direct drive capstan. The transformerless design of the Neotek Series III recording console offers in-line monitoring and logic controlled FET switching of console status functions. The Neotek Otari Super System delivers simple and efficient operation yet affording the experienced engineer an unprecedented degree of flexibility at a surprisingly affordable price. With "hands-on" experience in the recording industry, the consultants at Flanner's Pro Audio know how to put the Neotek Otari Super System to work for you. No matter what the size of your purchase, you'll appreciate the personalized service received before, during and after the sale. Flanner's Pro Audio has been selected to represent most of the leading names in professional audio products which means they probably have the items you want in stock for immediate delivery! Call today for your next purchase!



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MASTEREORDER

MTR-90
REMOTE CONTROL
WITH OPTIONAL
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amplifier and full-spec peak program meter capable of audio program level measurements down to -72 dB with 0.1 dB accuracy. Amplifier input is fully protected to 400 V, isolated and balanced to prevent grounding when connected to a jack field. The 50-ohm impedance output has sufficient power to drive headphones.

Gain settings are achieved by eight pushbuttons on the front panel. A further four buttons provide on/off, battery test, 600-ohm termination and, access to a front-panel, variable-gain potentiometer.

Power is supplied by internal rechargeable batteries, with a built-in AC converter/charger for bench use. Measuring approximately 7 x 8½ x 2½ inches, the AMM100 audio multimeter is enclosed in a tough plastic case, with an optional carrying case available for field use.

H. R. KIRKLAND COMPANY
8 KING STREET
MORRISTOWN, NJ 07960
(201) 538-2777

for additional information circle no. 61

PROGRAMMABLE GRAPHIC EQUALIZER

FROM AUDIO DEVELOPMENTS

The ADO 070 Programmatic™ equalizer uses a computer memory circuit to provide instant comparison of curves stored. The new unit, said by its developers, Audio Developments, to be the only equipment of its type, utilizes digital control to amplify or attenuate a range of frequencies, thereby eliminating the need for a

bank of faders.

The ADO 070 is unlike any other graphic equalizer in appearance: it has only one fader, instead of a row of sliders, and a display of colored lights with a group of keys and pushbuttons beneath. The spots of light give approximate representation of the frequency response curve. They can be set to the same types of curves as those of a conventional equalizer, by using the single fader and the control keys.

A built-in memory stores up to 32 different equalization curves, which can be altered at any time. The computerized control panel provides instant comparisons between any of the stored curves. A back-up battery hold the contents of the memory even with main power disconnected.



Any number of channels may be set simultaneously to the same curve — the basic unit controls two channels for stereo operation. Precise and accurate resetting is possible, and reportedly the memory contents are recalled far more rapidly than resetting an equalizer by standard means.

AUDIO DEVELOPMENTS
HALL LANE, WALSALL WOOD,
WALSALL, WEST MIDLANDS
WS9 9AU, ENGLAND

or, in the U.S. —
AUDIO SERVICES CORPORATION
4210 LANKERSHIM BOULEVARD
NORTH HOLLYWOOD, CA 91602
(213) 980-9891

for additional information circle no. 63

A GREAT NEW GATE... (Two of them, in fact!)



The SG-200

Dual Signal Gate™

It's the gate you set and forget!

The SG-200 is as easy

to use on stage as it is in the studio.

The settings are non-critical, no "touchy" threshold or release settings. The solution is the

SG-200's unique **Program Controlled Attack Logic** which positively prevents gate stuttering, chatter, distortion, or modulation problems.

• Use the SG-200 to gate individual input channels in PA. or recording, for controlling echo chamber decay time, eliminating effects pedal hum or any other kind of low level interference. • Use the SG-200 live or in the mix—it's the gate you set... and forget!

Check these features of the SG-200 • Fast VCA control—no distortion producing FET's or slow optical attenuators. • Two channels in one sturdy 1¾" rack cabinet. • Independent attack, release, range, and threshold controls. • External control input.

For complete information call or write: **Symetrix** 109 Bell St., Seattle, WA 98121. (206) 624-5012.

EMT 251 DIGITAL REVERBERATION SYSTEM

While the new EMT 251 retains the distinctive "space machine" look of its predecessor, the 250, the two units are said to be quite different. Using the latest technologies, the 251 surpasses the 250 in frequency bandwidth and operational versatility. The EMT 251 has double the memory capacity, and incorporates internal error correction and self-diagnostic features. Increased versatility mainly results from increased processor speed (40 nanosec. per instruction, down from 50 nanosec.), and more refined programming techniques.

Digital-to-analog conversion is 16-bit linear with 15 kHz bandwidth for all programs. As a result, EMT claims the 251 provides unmatched excellence in dynamic and phase characteristics and generates denser, more refined reverberant images. The totally new control panel employs an advanced dot matrix, liquid crystal display which shows reverberation curves, delay settings and amplitude settings at a glance.

The EMT 251 is said to provide high-quality reverberation with extraordinary versatility in the control of its characteristics. Recent findings emphasize the importance of discrete reflections as well as diffuse reverberation in determining the perceived qualities of reverberant "space." The EMT 251 simultaneously provides a reverberation program and three delay lines, all individually controlled to



permit detailed "placement" of first, second and third reflections, and assignable across the stereo output. In addition, a fourth delay line produces a reverberation cluster just prior to the onset of actual reverberation, thereby making a smooth transition into the reverberant field.

In addition to the basic reverberation mode, the EMT 251 has three special modes: a delay mode, echo mode and chorus mode. The chorus mode processes a single input to create four independent outputs, each one slightly different and varying both in pitch and amplitude. Delay and echo modes allow time delays ranging from a maximum interval of 440 msec. down to extremely short (less than 4 msec.) intervals, which are useful in "broadening" or "fattening" dry tracks.

The EMT 251 is also compatible with console automation systems, enabling direct control of all parameters. Variations in reverb characteristics are recorded on a data track or disk drive along with the console fader information, and later decoded to precisely reproduce those settings during mixdown. The unit's interface is

compatible with DC-type systems such as Harrison Autotset and others.

The first delivery of an EMT 251 was made recently to Sunset Sound Studios in Hollywood. Further deliveries are slated to: Moonbeam Productions, Soundcastle Studio, engineer Bill Schnee — all in Los Angeles; producer Norman Putnam in Nashville, and Hit Factory and Lenono Studio in New York. Future units go to Record Plant, Location, Broadcast Services, Westlake, Nova, Spectrum — all Los Angeles; Sound Stage and Jimmy Bowen in Nashville, and Chicago Recording in Chicago.

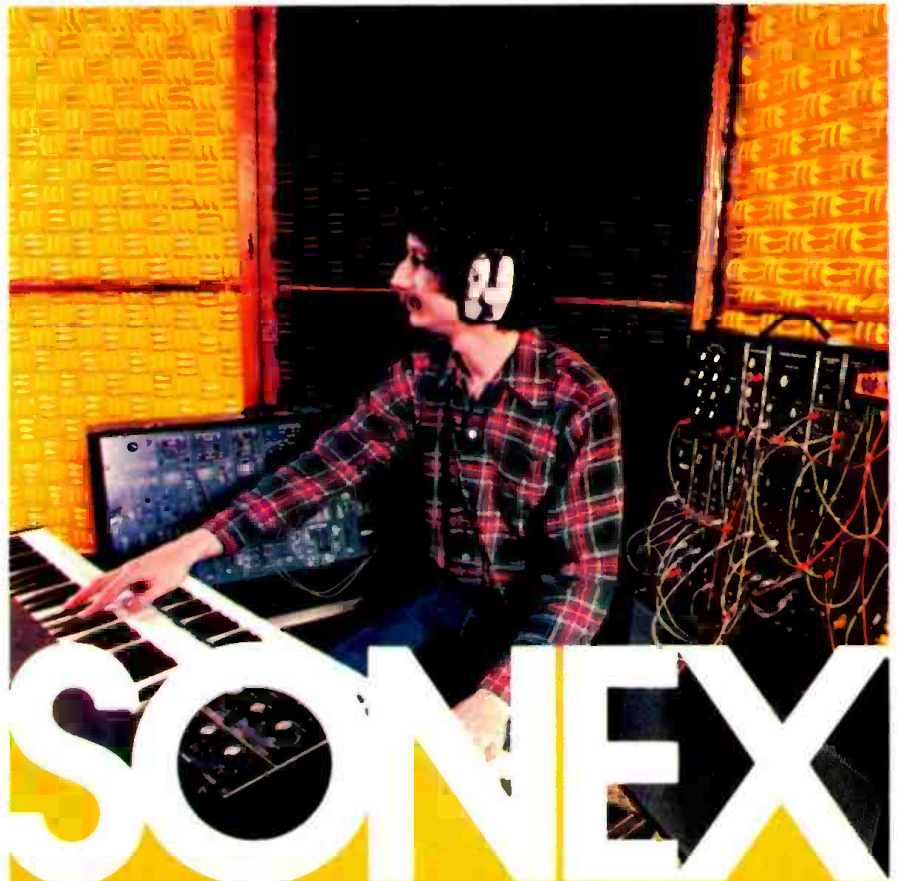
**GOTHAM AUDIO CORP.
741 WASHINGTON STREET
NEW YORK, NY 10014
(212) 741-7411**

manufacturer requests direct contact

SOUNDCRAFT SERIES 800 CONCERT SOUND AND RECORDING CONSOLES

The Series 800 is a versatile range of eight-bus consoles available in two frame sizes: 18- and 32-input. Two types of input and output modules enable one of three formats to be selected: an eight-group recording console with 16-track monitoring; a concert sound board with eight sub-masters; and a stage monitor/theater sound mixing console with 10 discrete sends on each channel.

Series 800 boards are housed in a custom-designed extruded aluminum frame, which is light but very strong. End profiles are made from solid hardwood, and the armrest is real leather. Instead of having a fragile printed circuit motherboard, a continuous ribbon cable attaches to each module. As a result,



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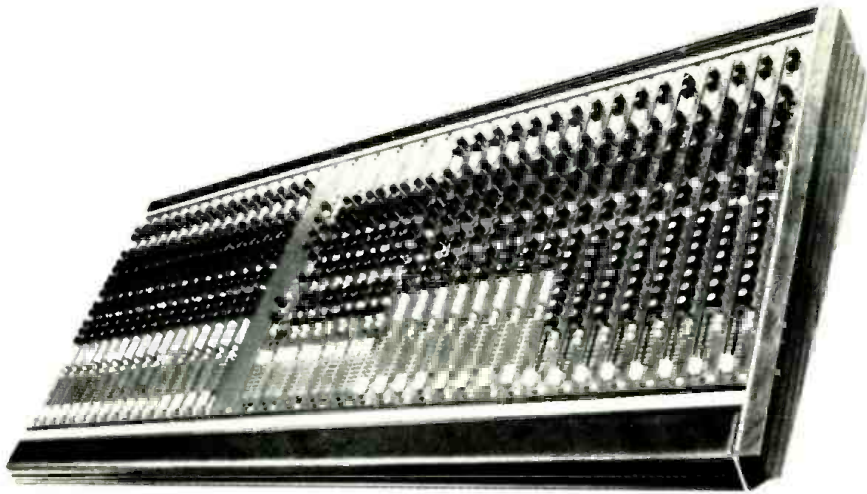
and put SONEX in place. SONEX is available in 15 inch square silver Audiotiles or 48 inch squares in silver, green, blue, yellow, or brown colors to match your decor. When you need to eliminate noise and hear pure sound, go with the best. SONEX, made only by Illbruck/usa. Distributed through Alpha Audio. Get the clean sound today. Call:



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Soundcraft claims, there's nothing to crack or break at a crucial moment.

The console's gentle slope gives a clear view of all the controls, and ensures an uninterrupted view of the stage or studio, with the minimum of acoustical interference.

Totally transformerless, electronically-balanced microphone inputs keep sound quality up, and weight down. Other design features include: click-stop rotary controls for precise, repeatable settings; high-resolution LED bar graph meters (individually selectable for Peak or VU characteristics); and patch points at

nominally zero level for easy interface with peripherals.

SOUNDCRAFT, INC.
P. O. BOX 2023
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(616) 382-6300

or
5-8 GREAT SUTTON STREET
LONDON EC1V 0BX ENGLAND
01-251 3631

for additional information circle no. 66

**NEW LINE OF KELSEY MIXERS
FROM DALLAS MUSIC INDUSTRIES**

Thirty-seven models are offered in the five new lines. All Kelsey boards are furnished with

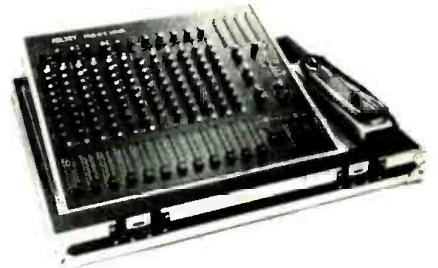
an aluminum reinforced fiberglass SMF ATA-style roadcase.

The Pro-Club +3 Series is offered with six through 24 inputs, and features separate stereo and mono operation, balanced and unbalanced inputs and outputs, shielded studio-grade mike input transformers, built-in reverb system, and two LED level arrays.

The Pro-4/3 Series is offered with 12 through 24 inputs, and features two stereo or four mono submaster operation at the touch of a button, separate stereo and mono outputs, balanced and unbalanced inputs and outputs with shielded, oversized mike input transformers, gain status indication, stereo solo and mute, four LED level arrays, four sends, four-band EQ, long throw faders, channel patching, and external power supply.

The Stagemix +4 Series is a four-output stage monitor board, available with eight through 24 inputs, featuring a unique snake eliminator input configuration, and channel submastering with solo and mute.

The Pro-Tour 8/3 Series is based on a modular format with up to 32 inputs. Features include: stereo and mono outputs; four true



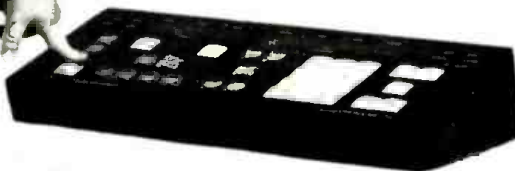
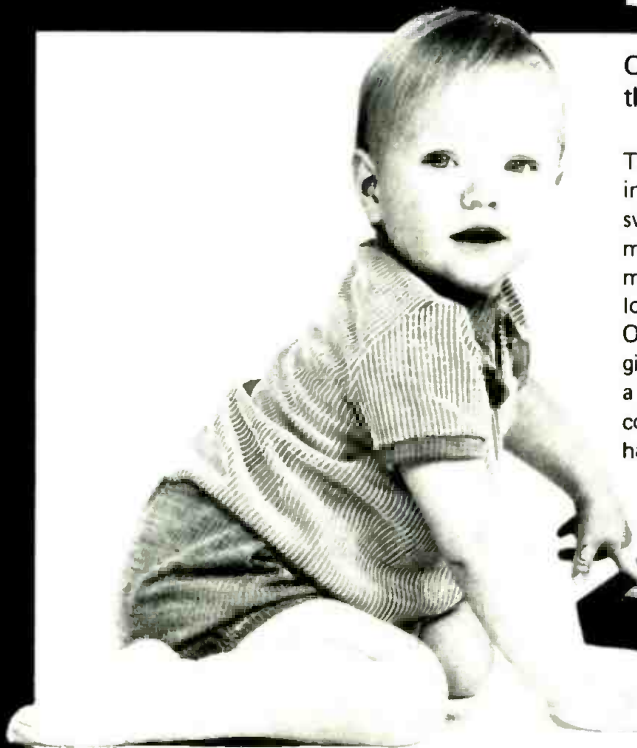
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The operator orientated Q-LOCK system offers the recording studio access to the world of Video post production audio sweetening, increasing the earning potential of existing multitrack facilities. The control panel commands 2 or 3 machines as if they were one, with a 10 memory cycling locator that can be operated with or without time code. Optimised software interfaces to audio and video machines give uncompromised performance. Q-LOCK, incorporating a multi-standard SMPTE/EBU time code generator, is a complete self contained system requiring no additional hardware.

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America: QUINTEK, 4721 Laurel Canyon Blvd., Suite 209, North Hollywood, CA 91607 Tel: (213) 980-5717 Telex: 194781

stereo submasters; separate four-track mixdown; eight LED level arrays; gain status indicator system; phantom, pad, and mute; four-band EQ; four sends; external power supply, and talkback system.

The Soundprism Series is the top-of-the-line based on a modular format with eight through 48 inputs. Features include: 15 main mix busses; four assignable sends; mike/line, mike phase switch, phantom, pad and mute; gain status indication, four-band EQ; stereo "zoom" system; four returns; four true stereo subs and four mono subs; and separate stereo and mono outputs.

List prices range from \$925 to \$20,280.

DALLAS MUSIC INDUSTRIES
150 FLORENCE AVENUE
HAWTHORNE, NJ 07506
(201) 423-1300

for additional information circle no. 67

PANASONIC RAMSA SOUND LOCALIZATION PROCESSOR

The unit enables an engineer to place up to eight channels or inputs of a master recording anywhere within the frontal half of the listening space in a two-speaker playback system, as well as continuously control an input's movement via joy-stick controls. Unlike conventional systems where sound localization is determined by the signal amplitude difference between two channels, and restricted within the space between two loudspeakers, the Ramsa Processor has the possibility of controlling sound localization outside the conventional range.

Continuous control of both sound direction and distance is achieved by moving a joy-stick on a four-channel panpot. Further distance control beyond the speaker position and the spaciousness of the sound are controlled by two separate adjacent faders: one alters the ratio between direct sound and early sound reflections associated with distance; and the other controls later reverberations to vary spaciousness.



The Ramsa Sound Localization Processor features eight input channels and two outputs. Four inputs can be controlled by a joy-stick for continuous mixing adjustments, while the remaining four inputs are preset and remain fixed during the mixdown. To achieve a precise feeling of sound distance and spaciousness, as many as six early reflections and latter reverberations can be controlled separately. Direction and sound pressure level of reflections are also pre-adjustable.

PANASONIC
TECHNICS R&B SERIES • RAMSA
50 MEADOWLANDS PARKWAY
SECAUCUS, NJ 07094
(201) 348-7000

for additional information circle no. 68

NEW CONCERT-SOUND SYSTEM FROM CALBRO SOUND

Designed by Calbro Chief Engineer, Dan Smith, the new system is claimed to be state-of-the-art in acoustic and electronic engineering.

In eight years of concert touring, Calbro has found a five-way system to be the most efficient method of sound reproduction. The new system accomplishes this electronically through the use of the newly-design UREI five-way crossover, in conjunction with UREI limiters and White 1/3-octave equalizers. The house system is powered by sixteen Crown PSA-2 self-analyzing amplifiers.

Calbro's five-way approach is carried through to the speaker system by utilizing three separate cabinets: sub-bass, bass and mid-high. Visually identical, each is internally designed to provide the most efficient use of cabinets, as well as

speakers. All speakers and horns are from JBL's new E-Series. The Calbro house system, a total of 30 cabinets, offers a package of visual uniformity with maximum quality, flexibility and efficiency.

Calbro features a sophisticated 40-channel Interface Electronics mixing console. Dan Smith has worked closely with Louis Stevenson, President of Interface Electronics, in developing this custom-built and designed console, which includes eight submasters, three wideband parametric equalizers and LED-VU metering on each channel.

Realizing the importance of the artist's comfort on stage in insuring his best performance, Calbro has taken special care in designing the monitor system. It features Interface Electronics' top of the line 32-channel "super monitor console," which is capable of

We put a lot of Effort into our machines (but not a lot of parts)



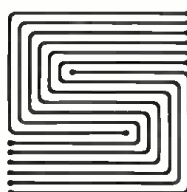
Twenty-five years of research has gone into our design. Our goal has always been to stay ahead of the "state-of-the-art".

We don't use transformers, capstans, or pinch rollers and have continually endeavored to use as few parts as possible, so that we can keep our circuitry simple and reliable. We want as few parts between what goes into the machine and what comes out of it, for a clean signal with as little degradation as possible.

Our recorder/reproducers are carefully handcrafted and assembled. All parts are given a rigorous checkout before leaving the factory.

We put a lot of effort in, so that you can have a machine that's reliable, dependable, and reproduces the sound you record.

We're as close to digital as you'll find, in an analog machine.



STEPHENS ELECTRONICS, INC

3513 PACIFIC AVENUE, BURBANK, CALIF. 91505
PHONE: (213) 842-5116

for additional information circle no. 69

New Products

handling 12 separate mixes. To ensure the smoothest sound possible, each of the mixes is analyzed with a new 1/3-octave real-time analyzer in conjunction with a White 1/3-octave equalizer.

Three types of monitors are available: side, drum, and floor, utilizing JBL E-Series speakers and horns. The five-way side monitors are an extension of the house system, using three separate Calbro cabinets on each side. The four-way drum monitors are designed for close proximity and maximum efficiency in the low end. The floor monitors are three-way low profile cabinets, capable of three tilt angles.

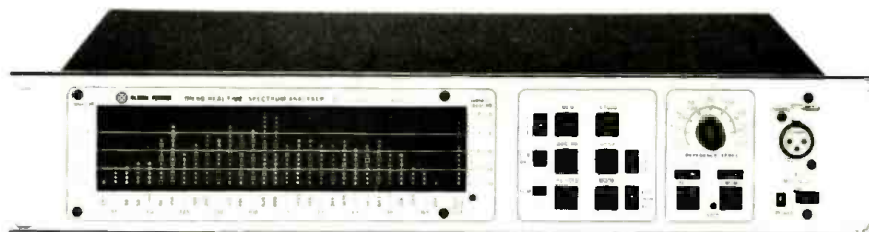
Calbro, in association with Bylites, Inc., can offer an infinitely expandable stage-lighting system, which features a 40 x 30 foot box truss, 120 par lights and a 48-channel, three-scene control board.

CALBRO SOUND SYSTEMS
305 EAST 16TH
LITTLE ROCK, AR 72202
(501) 374-2376

for additional information circle no. 70

KLARK-TEKNIK INTRODUCES DN60 REAL TIME ANALYZER

The new unit features three memories, peak-hold display, selectable display resolution and time constants, and facility for 'A' weighting. The noise source is internal, as is provision for calibration to a specific microphone. An easy to read 30 x 16 high-intensity LED display is featured, with separate display for overall SPL



levels. An RT60 option will be available in Spring 1981.

Utilizing a new generation of high-speed microprocessors, the DN60 Real Time Analyzer is said to provide professional performance and long-term flexibility at an affordable price. All units come complete with a calibrated microphone. Price: \$3,200.00.

KLARK-TEKNIK ELECTRONICS
262a EASTERN PARKWAY
FARMINGDALE, NY 11735
(516) 249-3660

for additional information circle no. 71

EXTENDED RANGE LOUDSPEAKER SYSTEMS FROM JBL

Capable of high acoustic output with minimum distortion, the 4690 Full Range and 4695 Subwoofer are said to be ideal for a variety of permanent and portable applications, including nightclubs, discotheques and theaters.

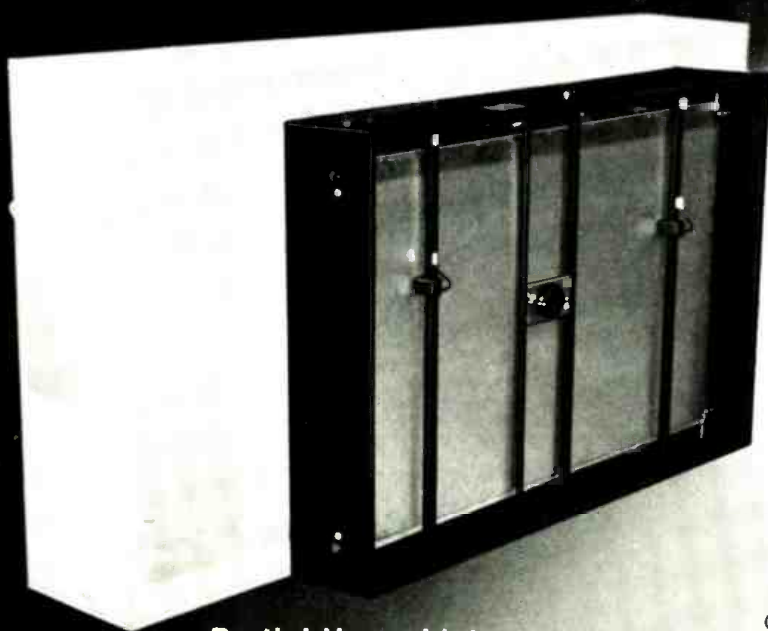
The 4690 is a compact, two-way system engineered for full-range music playback. Components consist of JBL's recently-introduced E140 15-inch low-frequency loudspeaker, new 2306 high-frequency exponential horn, 2410 high-frequency

compression driver, and a specially designed 3101A dividing network. Combining great efficiency, controlled dispersion and wide range response, the 4690 will provide complete coverage of typical listening areas. Quoted frequency range is 40 Hz to 20 kHz, and power handling 400 watts program.



When maximum sound levels of low-distortion bass are required, the 4690 can be used in conjunction with the powerful 4695 Subwoofer. Featuring JBL's new E155 18-inch loudspeaker housed in an optimally tuned reflex enclosure, the 4695 can handle 600 watts continuous program (300 watts sinewave)

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Partial Users List

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Spectrum-Michigan
80's Recording-N.Y.
Cherokee-Hollywood

down to 30 Hz.

The 4690 and 4695 are packaged in 3/4-inch multi-laminate hardwood enclosures coated with durable black polyurethane paint. Rugged enough to withstand the wear and tear of portable use, the enclosures are also structurally suitable for fixed hanging installations. Flush fitting covers, flush-mounted road handles and sturdy polycarbonate corner guards come standard with the 4690 and 4695.

Accessories offered by JBL are the 2903 High-Frequency Power Pack and 5234 Electronic Frequency Dividing Network. Added to the 4690 by simple removal of the baffle board adaptor, the 2903 will increase high-frequency output by as much as 10 dB. The dual-channel 5234 provides a convenient means for bi-amping the 4690 and 4695 where use of both systems is desired.

JAMES B. LANSING SOUND, INC.
8500 BALBOA BOULEVARD
NORTHRIDGE, CA 91329
(213) 893-8411

for additional information circle no. 73

**PANASONIC/RAMSA MODEL WM-8100
CONDENSER MICROPHONE**

To improve the electrical non-linear distortion due to the stray capacity of transducers, Panasonic has developed a push-pull type electret transducer claimed to cancel distortion. Because of this new design, maximum sound input pressure can be obtained up to 154 dB SPL (for 1% THD, phantom power, 100 Hz to 20 kHz). As in all condenser microphones, the upper limit of the dynamic range is determined by the non-linear distortion of transducers and amplifiers.



Model WM 8100's back-electret type design enables the diaphragm configuration to be the same as a condenser microphone, and also improves transient performance by removing the electret material from the vibrating diaphragm. This is said to result in a flat frequency response that extends from 20 Hz to 18 kHz with superb transient characteristics.

Other features include a pre-amplifier with two FETs in complementary design that eliminate distortion. The microphone is

also designed to work with an external phantom-power supply that overrides the battery when connected. (The microphone contains LED lights which indicate when battery or phantom-voltage is below 7 V.) A tone switch can be set to the following positions: Flat: for flat response; Low Cut: V1 and V2 (for vocal applications); High Out: H1 and H2 (for high-output instrumental applications); Subsonic Filter: eliminates vibration noise below 40 Hz.

Model WM-8100's floating suspension minimizes mechanical feedback such as floor noises. Encased in satin nickel plating and metallic finish, WM-8100 weighs approximately 580 grams.

PANASONIC/RAMSA
50 MEADOWLANDS PARKWAY
SECAUCUS, NJ 07094
(201) 348-7000

for additional information circle no. 74

**CON BRIO ADS 200
DIGITAL SYNTHESIZER**

Incorporating eight-inch floppy disk drive, two digital five-octave keyboards, video monitor, digital electronics and a control



console in a single, portable cabinet, the ADS 200 is equipped with 64 digital oscillators (expandable to 256) that can be independently

amplitude- and frequency-modulated by separate 16 stage envelopes. Six different waveforms are available for synthesis: sine, triangle, sawtooth, square, pulse and noise. The ADS 200's synthesis modes include: additive synthesis, phase modulation, frequency modulation and nested phase and frequency modulation.

The synthesizer's floppy disk drive is said to be the fastest storage and retrieval system on any unit. Synthesized voices, programming commands, keyboard activity and tunings can all be stored on a disk and instantly recalled. Any sound or combination of sounds stored on an ADS 200 floppy disk can be assigned to either side of either keyboard. A video monitor presents pictures of individual oscillator frequency and amplitude envelopes, or can

— continued overleaf ...

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AND AND MORE
AND MORE
AND MORE

STUDIO DESIGN,
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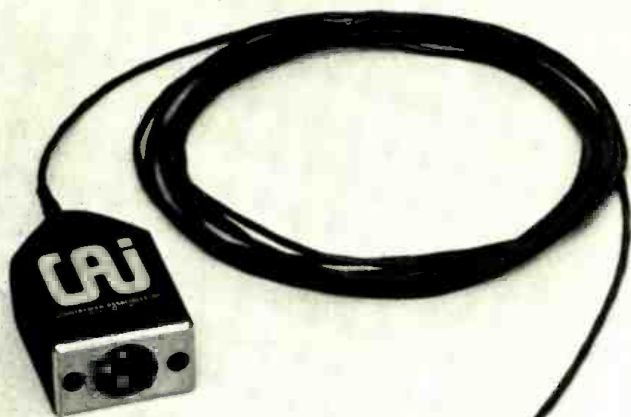
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for additional information circle no. 75

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New Products

alternatively be used to display the contents of any floppy disk.

The synthesizer also provides multitrack record/playback capability. An unlimited number of polyphonic tracks can be recorded, stored on floppy disk and replayed; up to four tracks may be played back simultaneously. A unique music scorer feature displays on the video screen, in conventional notation, music performed on the keyboards. Other features include: real time sustain and vibrato controls, a metronome/click track, an arpeggiator and peak level indicators.

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975 SAN PASQUAL STREET
PASADENA, CA 91106
(213) 795-2192**

for additional information circle no. 78

TWO NEW TASCAM DECKS FROM TEAC

The 22-4 is a compact 4-track, 15 ips recorder with sync, and features function and output select, headphone monitor select, and pitch control. Options include the FP-70 dbx interface, and RP-22 remote pause controls.



The 22-2 stereo machine features expanded scale VU meters, 15 ips speed, independent monitor and record safe/ready controls, detachable head housing, and optional RP-22 remote pause control.

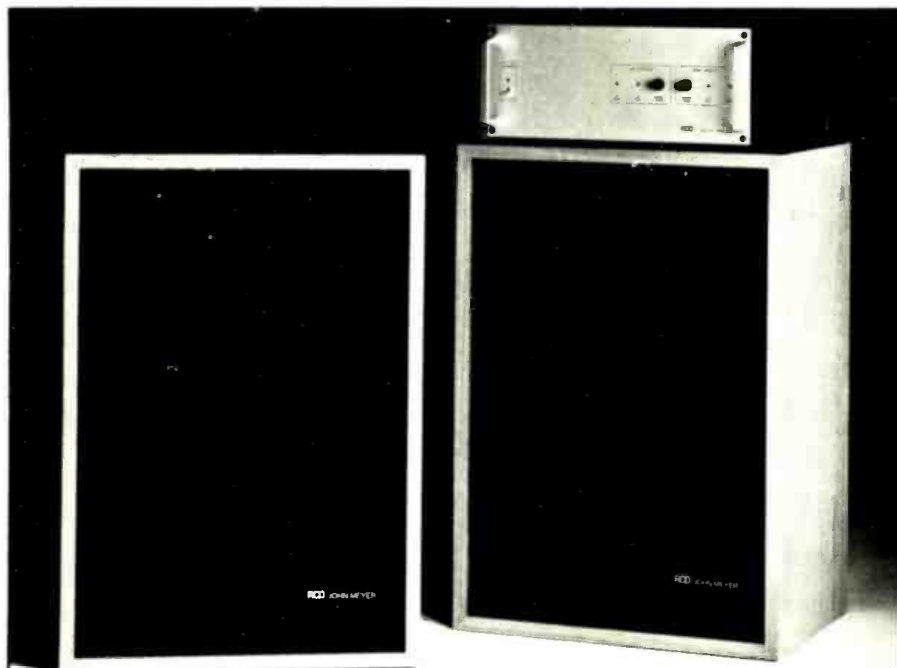
Both units are three-motor/three-head transports with precision moulded reel tables and spring-loaded reel holders. The 22-4 has a suggested retail price of \$1,425.00, and the 22-2 is \$750.00

**TEAC CORPORATION OF AMERICA
7733 TELEGRAPH ROAD
MONTABELLO, CA 90640
(213) 726-0303**

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ULTIMATE SUPPORT TRIPOD STAND AVAILABLE FROM ROLAND

Design of the KT-20 Ultimate Tripod Stand is said to be simple but practical. Since not every situation calls for the same speaker height, the Ultimate Tripod Stand has infinitely adjustable height up to 110 inches. The base diameter is also adjustable, making it ideal for limited space situations; maximum base diameter is 62 inches, which provides good stability for any size speaker.



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An optional four-inch square mounting bracket securely holds any bottom-mounting speaker. Two optional adapters modify the bracket to allow the KT-20 to hold Peavey/Bose-style speakers. Retail price is \$120.00.

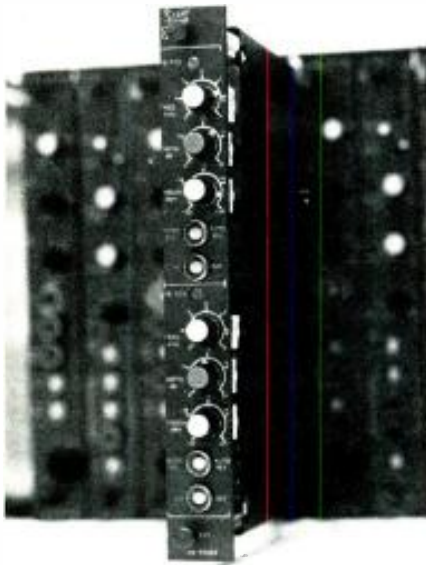
ROLAND CORP. U.S.
1285 MARK STREET
BENSENVILLE, IL 60106
(312) 595-8540

for additional information circle no. 80

**AUDIO & DESIGN S25 DE-ESSER
LATEST ADDITION TO SCAMP RANGE**

Working on a band-splitting principal, the S25 De-Esser module takes the incoming signal and splits it into two components: the "main" and the "ess" band. The "ess" band was defined after many hours of research by the Audio & Design R&D department, using live mike and recorded tapes of varying voice types and combinations.

The side chain has a sharply tuned variable filter which can be swept over the 5 kHz to 15 kHz range, and has characteristics that essentially sense the presence of the "ess"-ness of a signal.



Three controls are provided: Frequency, variable from 5 to 15 kHz; Threshold, variable from -30 dBm to completely insensitive; and Depth (of the notch and the shelf), variable from 0 - 20 dB.

Unlike de-essers that use limiters and pre-emphasis network — and consequently lower the gain overall to minimize the effect to de-essing — the Scamp S25 De-Esser module actually attenuates only the "ess" frequencies which have been selected by the user, within certain parameters. The two channels may be used separately, in stereo, or in series offering the advantage of sensing at two frequencies. List price: \$480.00.

AUDIO & DESIGN RECORDING, INC.
P.O. BOX 786
BREMERTON, WA 98310
(206) 275-5009

for additional information circle no. 81

HIGH-FREQUENCY HORNS AND ENCLOSURES FROM RENKUS-HEINZ

The new high-frequency enclosures are claimed to be solidly constructed and attractively carpeted for maximum wear resistance, and connect easily to any woofer section. One version comes complete with

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other comes with horn and connector plate only, and provides complete flexibility in the selection of drivers and matching high-pass or high- and low-pass networks.

The new two-inch throat horn is based on the proven configuration of other Renkus-Heinz horns. It has a cutoff-frequency of 800 Hz and is designed to accept the Renkus-Heinz SSD 3300 or other two-inch throat drivers with standard four-hole flange mount.

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17891 SKYPARK CIRCLE
IRVINE, CA 92714
(714) 540-3154

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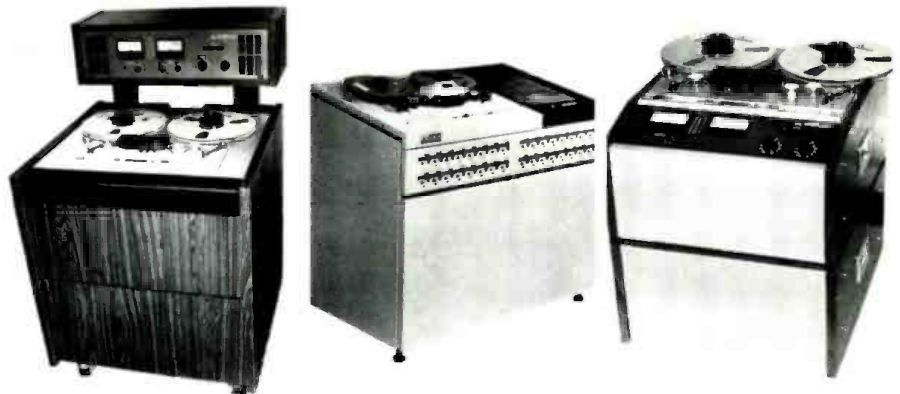
Cables are available in five lengths, from 5 to 100 feet. Marking costs as little as 25-cents per cable.

WIREWORKS CORPORATION
380 HILLSIDE AVENUE
HILLSIDE, NJ 07205
(201) 686-7400

for additional information circle no. 84

MITSUBISHI ANNOUNCES PRICES FOR DIGITAL RECORDERS

Now available ex-stock for immediate delivery, the X-80 portable 2-channel PCM recorder is priced at \$25,000, the X-80A console 2-channel PCM recorder is \$27,000, and the DDL-1 digital delay unit \$9,000. The first delivery of the X-800 32-channel PCM recorder is expected very shortly. Mitsubishi also reports that it is completing its line of professional audio hardware in a few months with the introduction



of a PCM electronic editor and a completely digital mixing console.

For the next two months the company is offering what it describes as a very exciting and unique opportunity to the professional recording industry. For a period of two weeks it will allow the use of their X-80 PCM system for recording and mastering projects at no charge. All the company asks is inclusion of its logo on the record jacket, and 100 copies of the release for promotional and evaluation purposes.

This service is subject to availability and approval, but will provide an important opportunity for a studio to gain hands-on experience with digital recording equipment.

MITSUBISHI ELECTRIC SALES AMERICA, INC.

7045 N. RIDGeway AVENUE
LINCOLNWOOD, IL 60645
(312) 982-9282

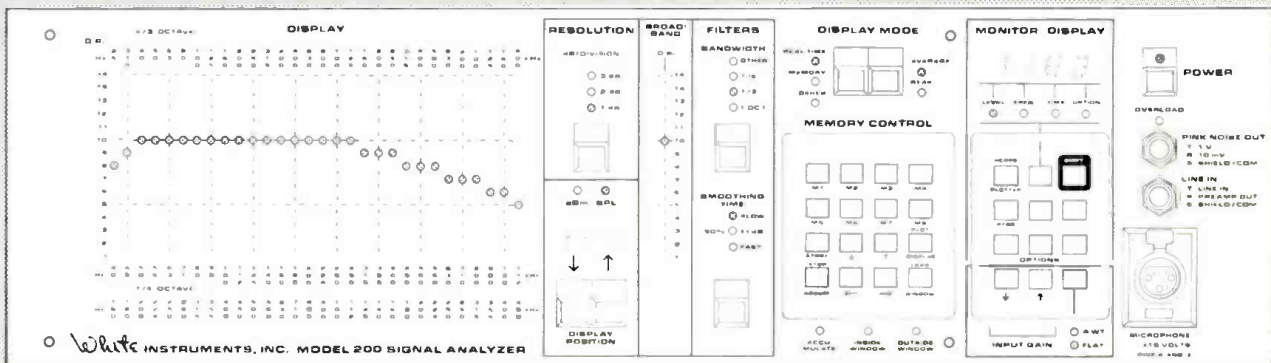
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PANASONIC/RAMSA RECORDING MIXING CONSOLES

Providing 12 to 16 inputs and four group outputs for four- or eight-track recording, the WR-8812 mixer's important features include 100 mm straight line faders, three-band adjustable frequency equalizer, extremely flexible input and output facilities, and all-modular construction.

Input modules also feature electronically balanced mike input circuits, input level switch for mike, mike-pade and line with trim control, phase switch, phantom-power switch and high, mid and low adjustable frequency equalization, insertion patch point, direct output, peak indicator, channel assignment switch with panpot and lockable post-fader solo button.

The group module provides return input at each group, and dual direct line inputs for mix down and send. The echo send module includes two echo return inputs with level control, panpot and buss assignment, send 1



EXPANDABLE SYSTEM 200 SIGNAL ANALYZER

MICROPROCESSOR CONTROL: Front-panel operation of the SYSTEM 200 SIGNAL ANALYZER is **Software Dependent.** Everything the analyzer does, including the future, is the result of running a **Computer Program.** It is expected to be revised to add new features.

MODULAR IN CONCEPT: Most of the SYSTEM 200 SIGNAL ANALYZER plugs together with connectors. The advantage of this architecture is that modules can be quickly extracted from the mainframe for service. Exchanging modules with the factory minimizes downtime and makes system updates **simple and inexpensive.**

EXPANDABLE: The SYSTEM 200 SIGNAL ANALYZER'S mainframe carries **three unused card slots.** These positions are reserved for future options which will simply plug into the analyzer and expand its capabilities. Options presently in the **prototype stage** include: 1) **Load Into Memory** software allowing the user to load his own programs into one of the analyzer's eight memories and then compare it in different ways with real time; 2) **Band Limited Noise Generator** which will allow the user to excite a sound system only in the band pass he

wishes to study; 3) **Interface Port** allowing the SYSTEM 200 SIGNAL ANALYZER to communicate with the outside world.

INTERCHANGEABLE PLUG-IN FILTER SETS: Filters are the heart of a test line analyzer. The SYSTEM 200 SIGNAL ANALYZER'S filters are supplied on cards which can be quickly installed in the MAINFRAME. Three filter sets are currently available:

- 200-01-00:** 30 three-pole, one-third octave filters on 15 dB centers from 25 Hz through 20 kHz meeting **A.N.S.I. S1.11, 1971, CLASS III**, switchable to 10 three-pole, octave band filters on 15 dB centers from 31.5 Hz through 16 kHz meeting **A.N.S.I. S1.11, 1971, CLASS II.**
- 200-02-00:** 30 two-pole, one-sixth octave filters on 15 dB centers from 40 Hz through 1.12 kHz. This filter set matches the one-sixth octave sections of our **Models 4301 and 4303 Active Equalizers.**
- 200-03-00:** 30 two-pole, one-sixth octave filters on 15 dB centers from 160 Hz through 4.5 kHz. This filter set matches the one-sixth octave sections of our **Models 4240, 4310 and 4311 Active Equalizers.**

The analyzer will accommodate the 200-01-00 filter set plus either the 200-02-00 or 200-03-00 filter set simultaneously. Conversion between the two one-sixth octave filter sets requires only two additional filter cards. Custom filter sets for unique applications can be designed. The SYSTEM 200 SIGNAL ANALYZER need never become obsolete with changing spectrum resolution standards.

EIGHT NONVOLATILE MEMORIES: The inclusion of **8 MEMORIES** in the basic SYSTEM 200 SIGNAL ANALYZER was not coincidental. They add considerable speed and convenience to the daily use of the analyzer. When you turn off the power, a nickel-cadmium battery keeps the memories **alive** for future reference.

3 SMOOTHING TIME CONSTANTS: The user can apply either **SLOW, 90%:1dB** or **FAST** smoothing rectifiers to the filters via front panel control to provide optimum measurements in a given room situation.

AVERAGE AND PEAK MODE PROCESSING: The SYSTEM 200 SIGNAL ANALYZER processes the incoming signal in **average** and **peak** modes **SIMULTANEOUSLY.** The user can switch between the two modes at any time. The display can show **one or more** transients or waiting for the filters to **resettle.** Memory functions are also executed in both modes. The user can display real time or memory data in both modes, at once, using a special **DUAL DISPLAY** feature.

11 MEASUREMENTS: The SYSTEM 200 SIGNAL ANALYZER is programmed to simultaneously make **three** **EXTRAPOLATIONS** based on 1) on the first 15 dB; 2) second 15 dB and 3) first 30 dB of incoming signal decay. Successive measurements can be **automatically averaged.** Measurements can be made through **any filter** installed in the mainframe or broadband, using any combination of **average or peak** modes and **slow 90%:1dB** or **fast** smoothing time constants. Amplitude data in real time is available on the rear panel to drive a storage oscilloscope or a strip chart recorder.



instruments, inc.
P.O. BOX 538 AUSTIN TX 78767
512-892-0752



and 2 with level control, and panpot and master echo level control.

In addition, the WR-8812 Ramas Recording Mixing Console is equipped with a full eight-channel monitor module, talkback module and such other features as XLR-type connector for mike inputs and pin jacks for all other inputs and outputs, and four 14-point 3-colored LED bar graph meters.

Ramsa Recording Console

A highly flexible unit, the new WR-8210 console offers 10 inputs and four group outputs for four- and eight-track recording. Other features include three-control variable frequency equalizer providing high, mid, low

frequency adjustments, EQ bypass switch, channel mute, insertion patch point, direct output, and peak indicator on each input, and stereo effect input with level control and bus assignment switch.

Utilizing its unique system, the WR-8210's "sub-in" section can be used for monitoring during recording, as well as creating a stereo echo send during the mixdown. The panel also offers four 14-point LED bar graph meters for group output, panel stereo headphone jack,

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XLR-type connector for mike input and RCA pin jack for other inputs and outputs.

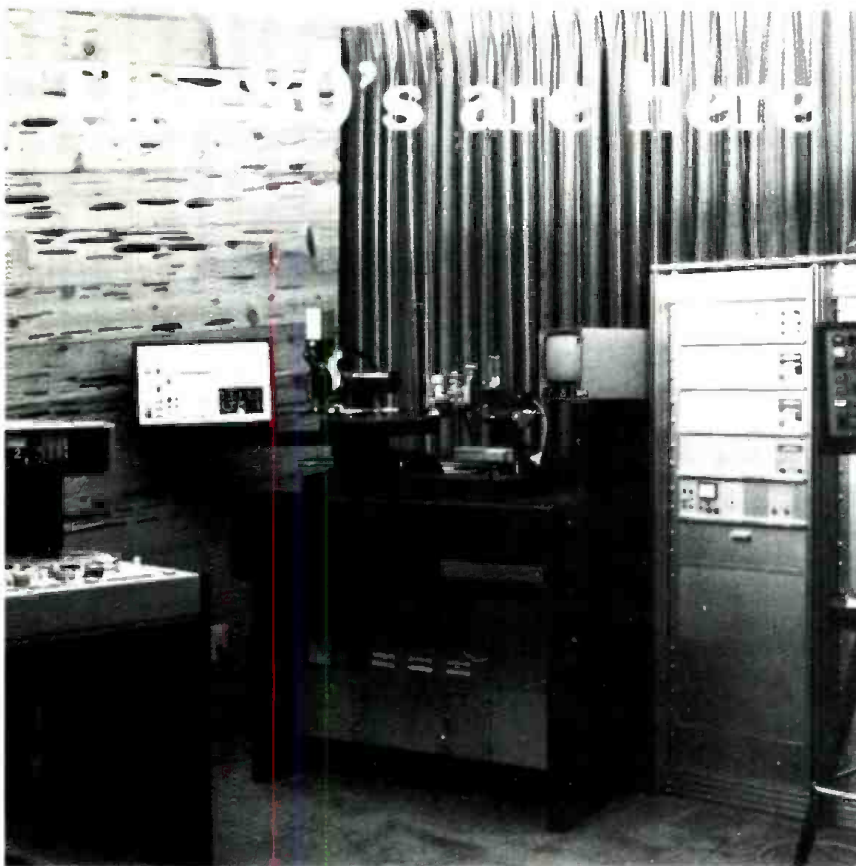
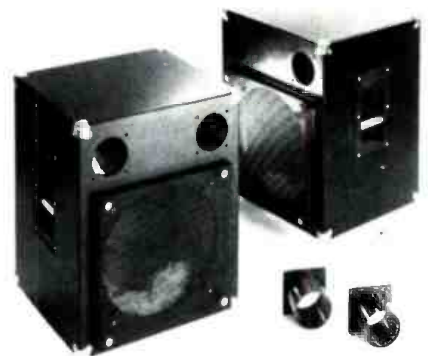
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for additional information circle no. 88

NEW VENTED BOX CABINETS FROM EASTERN ACOUSTIC WORKS

The new VB Series with interchangeable tuning assembly allows a single cabinet to be used with most of the commercially available bass drivers, while providing optimum performance that will satisfy over 90% of potential vented box application. The new range was designed to allow the user to get "off the shelf" pricing and delivery on semi-custom systems, easily update the system, and maintain proper alignment should a change of drivers ever become necessary.

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New Products

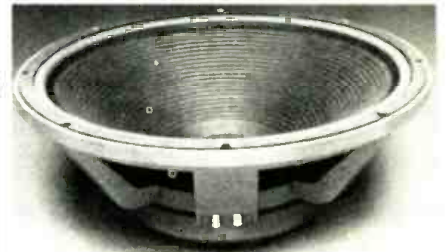
laminated birch with 18 plies to the inch, thereby decreasing the chances of chipping or shattering on exterior surfaces. Internal surfaces are lined with 3½-inch damping material to absorb reflections, while internal bracing minimizes vibrations, even at high drive levels.

The VB-125 is intended for use with a single 15-inch driver, appropriate for on-stage, studio bass guitar systems or low-frequency near-field concert sound applications. The VB-225 Series has three options: one box designed for two 12-inch bass drivers; one accepting one 15-inch and one 10-inch; and another two 15-inch drivers. The VB-335 Series can house one 18-inch driver, one 18- and one 12-inch, or one 18- and two 10-inch drivers.

Standard features include scuff and water resistant exterior, recessed handles and reinforced corners, hardware and quick-change clamp for efficient conversion.

EASTERN ACOUSTIC WORKS
59 FOUNTAIN STREET
FRAMINGHAM, MA 01701
(617) 620-1478

for additional information circle no. 91



JBL PROFESSIONAL SERIES LOW-FREQUENCY LOUDSPEAKERS

The new 2240H Sound Reinforcement and 2245H Studio Monitor are 18-inch loudspeakers that feature JBL's recently-developed Symmetrical Field Geometry (SFG) flux-stabilized magnetic structures, new high temperature adhesives, and composite voice coil formers. Both units are rated at 600 watts continuous program.

Equipped with a new die-cast aluminum frame and integrally stiffened cone with cloth surround, the 2240H offers high power handling capability, minimum distortion, and optimum low-frequency linearity. Sensitivity through the midrange is controlled for balanced high-efficiency and bass response. As a result, the 2240H performs well in ported enclosures or as a horn driver. Frequency range is a quoted 30 Hz to 2 kHz.

The 2245H is designed for use in custom studio monitors or other applications requiring high sensitivity and high power handling capacity, and low distortion. Like the 2240H, it also incorporates a new die-cast aluminum frame and integrally stiffened cone. The motor assembly of the 2245H is equipped with a long, one-inch deep voice coil for maximum excursion linearity. Frequency range is a quoted 20 Hz to 2 kHz.

JAMES B. LANSING SOUND, INC.
8500 BALBOA BOULEVARD
NORTHRIDGE, CA 91329
(213) 893-8411

for additional information circle no. 92

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New Products



CERWIN-VEGA SW-18 STUDIO MONITOR

The new SW-18 is a precisely calibrated low-frequency control room monitor, designed to augment and, it is claimed, dramatically improve the performance of any available studio standard. The system consists of a special-purpose 18-inch driver (189SC Stroker,™ available in 4 or 8 ohms), mounted in a direct radiating vented enclosure, tuned maximally flat to 28 Hz. An auxiliary high-pass filter and bass equalizer is also provided.

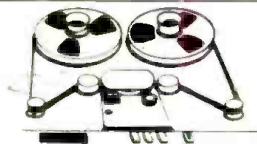
Bass response is said to be exceptionally well-behaved, with no low-frequency peaking when operated under 1/2 to 3/8-space conditions, and is extremely flat over its nominal operating bandwidth of 30 Hz to 100 Hz (±1 dB). Any harmonic distortion at 30 Hz is under 1% with inputs of 150 watts or less.

Heart of the new system is the Cerwin-Vega 189SC Stroker,™ designed for use in the highest quality sub-woofer applications where exceptionally linear, low-distortion output is required into the 20 - 30 Hz region. Of special interest is an adjustable, dual-spider alignment system, which allows precise longitudinal stabilization of the voice-coil in the gap (patent pending).

The SW-18 is designed to utilize low-frequency bi-amplification at a crossover point of 100 Hz or lower. Crossover function between an SW-18 and standard monitor may be accomplished by cascaded Cerwin-Vega CX-2 low-level passive filter sets.

CERWIN-VEGA
12250 MONTAGUE STREET
ARLETA, CA 91331
(213) 896-0777

for additional information circle no. 93



book report

SOUND RECORDING PRACTICE

A Handbook Compiled by the
Association of Professional
Recording Studios

Edited by John Borwick

This book is a compilation of twenty-five chapters by twenty-one authors — all of whom

are British. The Forward declares that its purpose is to "provide a useful digest of the present state of the recording art," for those engineers and producers who don't have the time to sift through all the magazines, books and brochures. It also claims to meet the needs of novices in the various professions. This seems to be what the book is best suited for. In fact, this is the book's second edition, the first having been published in 1976, which means that all the articles had to have been started no later than the middle of 1975. That makes a lot of it around six years old to begin with. For the second edition two new chapters were inserted; one on Remote Control and Automation; and the other on Digital Techniques.

The first chapter is the Program Chain. It has a clear definition of what a new entrant would need to be familiar with in order to grasp the

overall picture. There are several other fairly good chapters, including The Microfilm Circuits, Mixing Consoles, Extra Facilities (Outboard Gear), Tape Machines and Disc Cutting. After these chapters, a lot of the book seems to be mostly of use to the second engineer or tape-op who is still figuring out where all the pieces go. For someone who knew nothing about recording, the book would be over his head. On the other hand, anyone who had been at it for more than a few years, and had done any studying on his own, would find most of the book to be information that he should have known already in order to be at least of minimal competence.

I guess I'm speaking more from the engineer's point of view. The book could be more valuable to someone wishing to understand the recording functions in order to improve their

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own performance in the studio (i.e. musicians or producers). It is also, of course, slanted with a peculiar European bias (excuse me). Not to say that that's bad, but just that some of their methods are a lot different from ours. It seemed that a lot of the material was not on the cutting edge of today's high-technology. After all, a lot has happened in the last six years. Many of the illustrations were dated, and perhaps a third of the charts could have been clearer. If they expect to sell this outside England they could

have included comparable terminology from other countries.

To me, the best chapter is the one on Classical Music, by Trygg Tryggvason, and Speech and Drama, by Derek Taylor. They are two areas with which I personally have had little contact. I thought the Classical chapter to be possibly the best written of all. I'm sure other readers will find other chapters as useful, depending on what it is that's missing from their experience. I am also sure that all the gentlemen authors are noted for their expertise in their particular field, but in each chapter we get little more than an overview. Some chapters are not as useful to the recording engineer; more material in the pertinent chapters would have been. (The chapter on producing, for instance, would have been more useful to a lot more engineers if it had covered a contemporary session instead of a classical one. And did we really need a chapter on tape duplication?)

Several of the authors, when explaining why they did some procedure, would often point out only their particular form or format, leaving out the general content. Maybe this was due to the necessary brevity of the chapters. One equipment manufacturer felt he had reviewed all the possible features that might be included in his product; nevertheless he did not review all the possible features available then or now. Or take the case of the author who said he always uses a U-47 for guide vocal because "it [presumably the leakage or 'spillover'] may add a little presence . . . on the final mix." How much presence can it add to the mix if the rough vocal is replaced by the Master Vocal as it usually is?

All or most of this information has been already published in much more comprehensive books, such as Runstein's *Modern Recording Techniques*, (a bit outdated now itself but still much more informative) and Woram's *The Recording Studio Handbook*. Magazines and periodicals are the only ones that can truly be up to the minute with new product information. To me, this is the kind of book that might do well in a college library or as a guide for someone building his own small studio. The problem with any book of this type is that everything changes every six to twelve months; I'm already waiting for the book on totally-digital studios.

Michael Boshears



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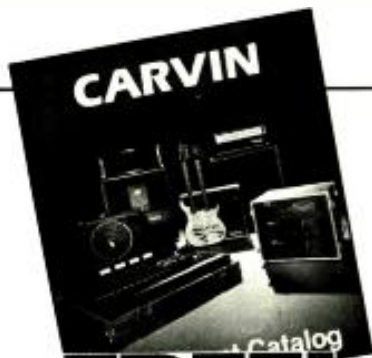
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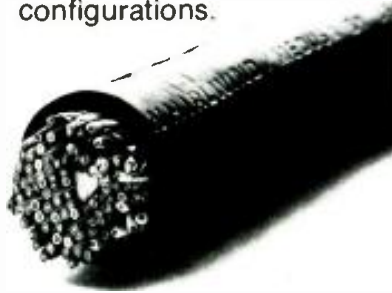
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MAKER OF THE MICROPHONE AWARD TO AVERY FISHER

Audio pioneer Avery Fisher (right) has become the seventeenth recipient of the Maker of the Microphone Award, presented annually by Oliver Berliner, grandson of Emile Berliner (inventor of the microphone and the disk record), for "an outstanding contribution to the world of sound." Immediately after the close of World War II, Avery Fisher introduced the first mass-produced high fidelity consumer audio products which led to the massive hifi equipment business of today. The trophy depicting Emile Berliner's first microphone, disk record and gramophone, will be presented but twenty-five times, commemorating the fact that Mr. Berliner was only twenty-five years of age when he invented the loose-contact microphone.



DEATH OF APRS CHAIRMAN JACQUES LEVY

Jacques Levy died on Friday, October 17, aged 68. He will be missed and mourned by his many friends in the industry and the world of music.

At any early age Jacques' flair as an entrepreneur involved him in organizing gramophone recitals held in a local hall.

During World War II he served with the Armed Forces as the Army's Official — one and only — sound recording engineer. Sound from Forces concerts was recorded direct to discs. There were no retakes nor overdubbing, and the art was to change machines at a suitable pause.

On cessation of hostilities Jacques and his brother created Levy's Sound Studios in Central London. The business was eventually sold to CBS, and for some years he worked for that organization as a divisional manager. He left to assume the managing directorship of London's Command Studios; a remarkable project that was, perhaps, a little ahead of its time.

For over twenty-five years Jacques Levy had been chairman of the Association of Professional Recording Studios, and was instrumental in guiding that organization from a small group of amateurs to a unique Trade Association of which there is no equal worldwide.

MOBILE FIDELITY SELECTS BASF TAPE FOR ORIGINAL MASTER RECORDING™ CASSETTES
Herb Belkin, President of Mobile Fidelity Sound Lab, has announced the selection of BASF's Professional II chromium dioxide tape for use in the company's soon-to-be-issued line of Original Master™ high-fidelity cassettes. The new cassettes, like Mobile Fidelity Sound Lab's

Original Master Recording™ LPs, will be state-of-the-art limited editions. They will be recorded at Mobile Fidelity's new tape duplicating facility housed in its Chatsworth, California, headquarters.

Original Master Recording™ high-fidelity cassettes will mark a "first" in the technology of pre-recorded cassettes, utilizing one-to-one real time cassette transfers from an original master tape. An exclusive tape transfer process developed by Mobile Fidelity Sound Lab is responsible for this breakthrough.

For the initial tape release, Mobile Fidelity will be issuing titles in cassette format previously available on Original Master Recording™ albums: Supertramp's *Crime of the Century*; Pink Floyd's *Dark Side of the Moon*; Steely Dan's *Aja*; Earl Klugh's *Finger Paintings*; John Klemmer's *Touch*; and Zubin Mehta and The Los Angeles Philharmonic Orchestra's *Star Wars and Close Encounters of the Third Kind*.

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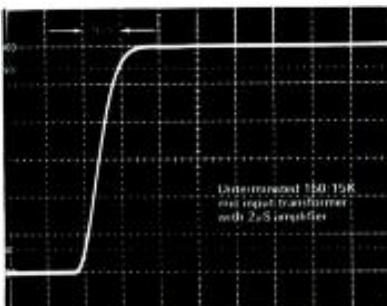
Howard Massler, president of The Bestway Group, has announced the formation of a new subsidiary, Randee International Productions, a full-service operation formed to fill the needs of small record companies and individuals. Allen Sherman was named vice president/operations.

Randee will arrange for minimal single and album pressings at a reasonable cost, eight-track and cassette duplication, art work, printing, fulfillment and mailing, music publishing, local, national and international distribution, record promotion — literally everything needed to issue a record on a reasonable budget.

"With the surge of small, 'boutique' and ethnic labels," Sherman stated, "and the growth in the number of individuals who have something they want to get on record, the need for a company like Randee International Productions was becoming essential. People who want to press small quantities often have nowhere to go or are overcharged because no one wants to bother with minimal orders. Yet, it

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is important to the industry that these people have their opportunity to be heard and at a price that does not penalize them for not being able to start out with huge financing. It's equally important that this be done by professionals who want to encourage them, not rip them off."

Randee International Productions is the latest expansion move by The Bestway Group, which is located in Mountainside, New Jersey, and whose numerous branches include a pressing plant, Bestway Products, Inc., warehousing facilities, fulfillment centers, an injection molding plant, and Wonderland Records.

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SPARS ANNOUNCES NEW MEMBERSHIP STRUCTURE

Murray Allen. (*Universal Recording Studios, Chicago*) the newly elected president of the Society of Professional Audio Recording

Studios (SPARS), has unveiled details of their new membership structure.

Regular Membership includes those in business at least two years and having at least one 24-track recording facility, and/or a state-of-the-art disk mastering establishment, and/or a facility providing audio for video film with on-line capability of 24 channels. Membership dues are \$1,000 per year.

Affiliate Membership includes all other professional audio commercial recording facilities. Membership dues are \$500 per year.

Advisory Associate Membership includes any company presently engaged in providing services and/or supplies for the recording industry, not qualified for membership in any of the above categories. Membership dues are \$2,500 per year.

Associate Membership includes any company or individual presently engaged in or utilizing the services of the recording industry, not qualified for membership in any of the above categories. Membership dues are \$250 per year.

... continued from page 24 —

STUDIO UPDATES

■ **SUNSET SOUND** (Hollywood, California) has acquired a new EMT 251 digital reverb unit and recently saw the completion of **NICOLETTE LARSEN'S** new album for Warner Brothers. **TED TEMPLEMAN** repeated his role as producer, while **JIM ISAACSON** engineered. **ALBERT HAMMOND** was also in Sunset laying down tracks for his new CBS LP, produced by **JIM ED NORMAN** and engineered by **ERIC PRESTIDGE**, while **DENNIS KIRK** was down the hall mixing **BETTE MIDLER'S** *Divine Miss M* soundtrack album for Atlantic. 6650 Sunset Boulevard, Hollywood, CA 90028. (213) 469-1186.

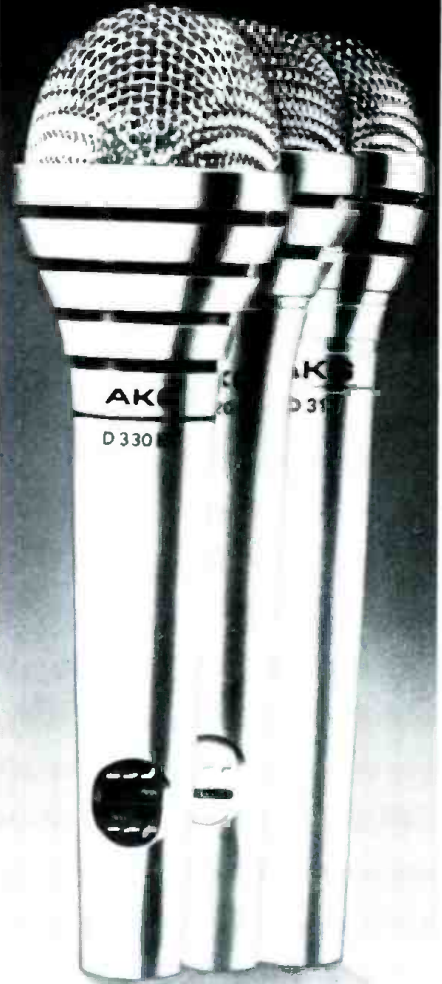
■ **TRACK RECORD** (Los Angeles) has upgraded its operation with the addition of an MCI 24-track recorder with AutoLocator. The newly 24-track operation has also added a Kawai seven-foot grand piano to the studio, which features UREI Time-Aligned™ monitors, Ecoplate™ reverb, DeltaLab DL-2 and Lexicon digital delays, and outboard Kepexes™ and limiters. According to owner/engineers **BOB SAFIR** and **TOM MURPHY** the totally live room has recently recorded such artists as **BRIAN WILSON**, **CHRIS MC VIE**, and **DENNIS WILSON**. 5249 Melrose Avenue, Los Angeles, CA 90038. (213) 467-9432.

— ACTIVITY —

ARTISAN SOUND RECORDERS (Hollywood, California) is recording Motown Records artist **SYREETA** as she does solo vocal overdubs for the main title of the feature film *Loving Couples*. Cutting activity by **GREGORY FULGINITI** at Artisan has included the new **IAN MATTHEWS** LP and the soundtrack album of *The Stuntman*. 1600 North Wilcox, Hollywood, CA 90028. (213) 843-8096. □ **CALIFORNIA RECORDING STUDIOS** (Hollywood, California) has been recording the new **NORM SALEET** single for RCA with **TED GLASSER** producing, while **TEDDY CHRISTOPHERSON** has been laying down tracks with producer **BUMPS BLACKWELL** and engineer **JOHN BRADY**. 5203 Sunset Boulevard, Hollywood, CA 90027. (213) 666-1244. □ **CAN-AM RECORDERS** (Tarzana, California) was the mixing location for **NICK GILDER'S** *Rock America* album. The LP, co-produced by Gilder and **KEN MANSFIELD**, was mixed by Can-Am engineer **LENNY WILLIAMSON**. Also in the studio is **FAST FONTAINE** being produced for EMI-America by **PAUL ROTHCHILD**. Engineering on the sessions is being handled by **BILL GAZECKI**. 18730 Oxnard Street, Tarzana, CA 91356. (213) 342-2626. □ **DAVLEN SOUND STUDIOS** (Universal City, California) reports activity includes: **MADAME & WAYLON** recording tracks for their upcoming TV special with conductor **GARY SIMMONS** and **CRAIG GOLDIN** producing and **JEFF BORGESON** engineering; and Atlantic recording artists **SISTER SLEDGE** overdubbing strings and horns with **HUMBERTO GATICA** behind the console with producer **NARADA MICHAEL WALDEN**. 4162 Lankershim Boulevard, Universal City, CA 91602. (213) 980-8700. □ **HOUSTON RECORDING** (Cucamonga, California) supplied its remote truck to the L.A. Street Scene this past Fall, recording such artists as **THE TWISTERS**, **THE KING BEES**, **THE BUS BOYS**, and **SANDY BROWN**. Engineering the dates were **RICH HOUSTON** and **CHRIS HUSTON**. The van was also used by **LEE OSKAR** to record his recent stint at Pasquales for an upcoming live album. Huston and Houston were behind the board with **GREG ERRICO** producing the LP. A recent staff addition to Houston is **PAULA BLEVINS** to the position of sales representative. 9340 Foothill, #32, Cucamonga, CA 91730. (714) 987-0379. □ **At KENDUN RECORDERS** (Burbank, California), **REO SPEEDWAGON** has finished lockout sessions in Studio D, tracking, overdubbing, and mixing their new Epic LP. **KEVIN CRONIN** co-produced with session engineer **KEVIN BEAMISH**. Mastering is now being handled at Kendun by **KENT DUNCAN**. Also in the studio,

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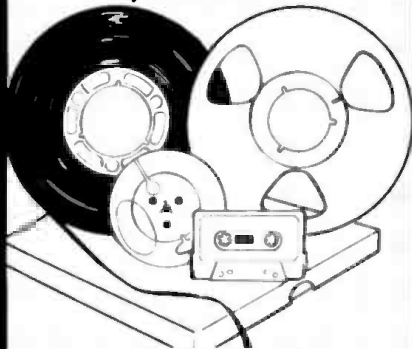
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STUDIO DATE

Southern California . . . ACTIVITY . . . continued —

RUFUS is producing their new MCA LP with engineer JOHN STRONACH, while mastering on the new two record set from HEART has been completed by JOHN GOLDEN on the Sony digital system. MIKE FLICKER supervised on the CBS release. Duncan also performed mastering chores on the latest DOOBIE BROTHERS single "One Step Closer," and on NICOLETTE LARSON'S latest LP, both for producer TED TEMPLEMAN and Warner Brothers. 619 South Glenwood Place, Burbank, CA 91506. (213) 843-8096. □ MONTEREY SOUND STUDIOS (Glendale, California) is overdubbing LEE RITTENOURS' new Elektra-Asylum album co-produced by HARVEY MASON and DAVID FOSTER, and engineered by DON MURRAY. Rittenour is also in the studio mixing his "greatest hits" package, while DENICE WILLIAMS has just finished the final mixes on her latest album for American Recording Company with THOM BELL, producing and DON MURRAY engineering. 230 South Orange Street, Glendale, CA 91204. (213) 240-9046. □ MUSIC LAB STUDIOS (Hollywood, California) is currently recording tracks for ALEX CIMA'S new album, *Electric City, Hollywood, CA*. □ NSP STUDIOS (Hollywood, California) recently had producer ARTHUR WRIGHT and Motown vice president and A&R head LEE YOUNG, SR., in for final mixes on the upcoming NOLEN & CROSSLEY album, which was produced by Wright and HAL DAVIS. 6362 Hollywood Boulevard, Suite 216, Hollywood, CA 90028. (213) 462-6524. □ PAUL AKINS (Santa Barbara, California) reports the availability of his 16/8/2 track mobile recording van for lease-option/rent. The facility is housed in a Winnebago Motor Inn with all standard RV accessories and a 7 kw generator for self-contained operation. Recorders include a 3M 16/8 machine and an Ampex two-track unit; the van can also accommodate video and broadcast links. 1121 Chino Street, Santa Barbara, CA 93101. (805) 965-4808. □ ROOM 335, (Los Angeles) LARRY CARLTON'S private MCI-equipped studio, has been the recording site for the past seven months for BILL MARTIN'S debut album on Lorimar Records. The singer/songwriter is being produced by Carlton himself with JAY LEVY acting as executive producer for Lorimar. *Los Angeles, CA*. □ RUSK SOUND STUDIOS (Hollywood, California) has been recording the CAPITOLS, formerly known as GORILLA, with JACQUES MORALI and MIKE ROX producing and JUERGEN KOPPERS at the board, while LEE GARRETT has been producing himself in tracking and overdub sessions for his upcoming album engineered by MONTE SOLOVY. STEVE WOODS recently finished his album at Rusk, produced by JACK WHITE with Koppers engineering. 1556 North La Brea Avenue, Hollywood, CA 90028. (213) 462-6477. □ THE MUSIC GRINDER RECORDING STUDIO (Los Angeles, California) has REX SMITH in recording for Leber Krebs management, with LEWIS ANDERSON producing and GARY SKARDINA behind the board. Also laying down tracks at Music Grinder is CHUBBY CHECKER with JOHN KOVAREK engineering and EVAN PAGE producing for Musicon productions. 7460 Melrose Avenue, Los Angeles, CA 90046. (213) 655-2996.

Hawaii:

■ THE WINERY RECORDING STUDIO (Haiku, Maui, Hawaii) is now open, offering 24-track studio and mobile recording as well as video production and post-production services. The operation boasts an Allen & Heath console feeding an Ampex MM-1100 24-track recorder. Two-track machines are by Ampex and Scully, with JBL, Altec, and Auratone monitors utilizing Crown and Dynamic Compliance amps. Among the processing equipment can be found AKG reverberation, dbx compressor/limiters, MXR Double/Flanger, Eventide Instant Phaser™, and Omni-Craft noise gates. Mikes are by AKG, Shure, Electro-Voice, Neumann, and Sennheiser. A variety of keyboards and guitar amps are also available in-house. R.R. 2, Box 639, Kaupakalua Road, Haiku, Maui, Hawaii 96708. (808) 572-1560.

Canada:

■ COMFORT SOUND RECORDING STUDIOS (Toronto, Ontario, Canada) has expanded its operation to 16-track with the purchase of an Ampex MM-1200 recorder, and is now also offering 16-track remote recording. The new mobile services were provided to record portions of the Heatwave Festival for Lauron Film Productions and a concert by RONNIE HAWKINS for Henry Less and Associates. THE BOOMTOWN RATS, TODD RUNDGREN, and BURTON CUMMINGS are other clients using Comfort Sound. 2033 Dufferin Street, Toronto, Ontario, Canada M6E 3R3. (416) 654-7411.

Great Britain:

The Association of Professional Recording Studios announces the following members:

■ PRODUCER'S WORKSHOP (London, England) opened for business this past Spring, and features a 20' x 22' recording area and a 12' x 14' control room centered around a Raindirk 26 x 24 console linked to an MCI JH-110 24-track and Studer B62 mastering machines. Amongst the ancillary equipment are an Eventide Harmonizer™ and Instant Phaser™, EMT echo plate, Klark-Teknik DN34 Analogue Time Processor, and dbx compressor/limiters. Monitoring is handled by Crown-powered JBL speakers. JUDY LONDON is a co-owner of the studio. South West London, England.

■ EAST ANGLIAN PRODUCTIONS (Essex, England), a voice-over and commercial operation that has been in business for five years, houses a 12 square

STUDIO IS DATE

foot recording area with a fully-equipped 24-track facility currently under construction. The present control room houses a Pye SM-8 mixer linked to TEAC and Studer recorders. Monitoring is via a KEF/Quad system with an Audio & Design F760 Compx compressor/limiter and Master Room III spring reverb unit found in the side rack. EAP is owned by resident engineer **RAY ANDERSON**, Essex, England.

■ **THE BUZZ MOBILE** (Hereford, England) is an eight-track mobile recording vehicle comprised of a 14-foot converted caravan towed to remote venues behind a van. Hardware in the trailer consists of a 16-input Studiomaster console feeding TEAC Tascam 80-8 half- and Brenell Mini-Eight one-inch machines. A Bandive Great British Spring reverb, MXR Pitch Transposer, Eventide Harmonizer™ and Rebis noise gates and compressor/limiters are also to be found in the unit. A closed circuit television system provides visual communication with the recording area. Owner **MARK THOMPSON** adds that current plans call for an upgrade to fully equipped 16-track in the near future. Hereford, England.

■ **THE ROYAL COLLEGE OF MUSIC** (London, England) has been granted an educational membership in the APRS, and boasts a fully equipped 8-track control room that can be used for sessions in a full sized concert hall, recital hall, opera hall, and the Museum of Instruments, all adjacent to the college. The board is a Raindirk 10 x 14 linked to TEAC 4-track machines and a Brenell Mini-8 multitrack. Quad Electrostatic speakers are powered by H/H amps for monitoring. **LAWRENCE CASSERLEY** is the studio director for the Royal College of Music. London.

■ **CASTLE SOUND STUDIOS** (Edinburgh, Scotland) announces installation of an Amek M2000A/2500 console. In 28/24 format the new console joins their Lyrec TR532 24-track and Studer B67 2-track (2) as well as Ferrograph SP7 and ReVox A-77 decks. Castle is located in picturesque farm country just 12 miles south of Edinburgh. The studio is split into three sections: dry acoustic area with ceiling traps, a large floating iso-booth for drums, vocals, etc., and a large live area finished in timber and glass. Total area is around 1,000 square feet, fully air conditioned. Peripheral equipment includes AMS DMX 15-80 digital delay, AMS flanger, Scamp rack with SO1 complimiters, F300 gates, S23 autopanner, AMS Pitch Shifter, AKG BX20E, and Master Room MR1111 reverb. Neumann, E-V, Beyer, Calrec, AKG and Sony microphones are available. Musical instruments available free of charge include the Yamaha C-3 grand piano, Hagspiel Honky-Tonk grand piano, Mellotron, ARP Odyssey, Premier drum kit. *The Old School, Park View, Pencaitland, East Lothian, Scotland. Telephone: (0875) 340143. England.*

Holland:

■ **DALI PRESS BV** (Nederhost den Berg, Holland) has become a member of the APRS of Great Britain. The three-studio complex has been in business for seven years, and recently upgraded its main facility to 24-track with the installation of a Neve 8078 console with Necam floppy disk automation. A Lyrec TR532 24-track recorder is interfaced with a Studer 2-track mastering machine. Effects units include an Eventide Instant Flanger™ and Harmonizer™ Allison Gain Brain™ Lexicon Prime Time™ and UREI limiters. Monitoring is by means of Eastlake TM-3 enclosures powered by Crown amplifiers. Studio 2 is a 16-track operation currently being refurbished, while Studio 3 is used for vocal overdubbing. *Nederhost den Berg, Holland.*

Spain:

■ **ESTUDIO ESCORPIO** (Madrid, Spain) has installed a new MCI JH-636 automated 36 x 36 console with light meters. The board was installed by MCI's Spanish representative, Singleton Productions of Barcelona. According to studio manager, **LUIS COBOS**, the **ORQUESTRA MONDRAGON** was the first production on the new panel. *Madrid, Spain.*

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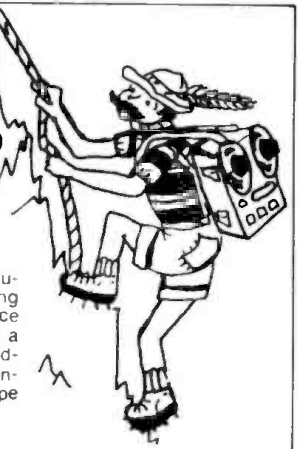
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NEW SPARS OFFICERS

In addition to the election of Murray Allen as President of Spars, David Teig (*Atlantic Recording Studios, New York*) was elected Vice-President and Secretary, Guy Costa (*Motown Hitsville, Los Angeles*) was elected Vice-President and Treasurer. Regional vice-presidents, Nick Colleran (*Alpha Audio, Richmond, VA*), Mack Emmerman (*Criteria Recording, Miami*), Robert Lifton (*Regent Sound Studios, New York*), Wally Heider (*Filmways/Heider Recording, Hollywood*)
 Founding president, Joseph Tarsia (*Sigma*

Sound, Philadelphia) has been elevated to Chairman of the Board. Christopher Stone (*Record Plant, Los Angeles*) has been appointed Assistant to the President.

A.M. PONIATOFF, AMPEX FOUNDER, DEAD AT 88

Alexander M. Poniatoff who founded Ampex in 1944, served as president of the corporation until 1955, when he was elected chairman of the board. He resigned as Chairman of the board in 1970.

Mr. Poniatoff secured his place in the history of magnetic recording twice during his long life. The first breakthrough occurred in 1947 when Ampex, reduced to just eight employees in the post World War II recession, introduced the first practical magnetic audio recorder in the United States. The technical milestone helped launch the multi-billion dollar recording industry.

That development was followed in 1956 by introduction of the first practical videotape recorder that revolutionized the television broadcast industry.

Poniatoff was born in Kazan, Russia, on March 25, 1892. During an interview when he was 84, Poniatoff recalled that he saw his first horseless vehicle, a locomotive, when he was seven. "I decided right then that I would build these locomotives," he told the interviewer.

He attended the University of Kazan, The Imperial College in Moscow, and the Technical College, Karlsruhe, Germany, obtaining degrees in mechanical and electrical engineering.

He was a pilot in the Imperial Russian Navy during World War I, and then in the White Russian forces that were defeated during the revolution. He escaped to Shanghai, China, in 1920 and worked as an assistant engineer for the Shanghai Power Company until 1927, when he immigrated to the United States. He became an American citizen in 1932.

DATATRONIX, INC. LICENSED TO MANUFACTURE API PRODUCT LINE

In early August 1980 the assets of Automated Processes, Inc. were sold at public auction. Since that time there has been considerable confusion and false claims concerning both the manufacture of, and legal rights to, the API professional product line.

Kappa Systems, Inc. of Arlington, Virginia, purchased the company name, all design rights and all manufacturing documentation at public auction. On September 10, 1980, Kappa Systems executed a licensing agreement with Datatronix, Inc. of Reston, Virginia, for the manufacture and marketing of the entire API

product line. This is the only licensing agreement in existence.

While this is a new venture for Datatronix, the company is no stranger to the API product line. For the past two years Datatronix has manufactured much of the API product line for both API and API customers. Modules are currently in production at Datatronix and will be available through a network of national and international distributors. All API drawings, test procedures and test fixtures are in the possession of Datatronix and are being used to insure the exact duplication of the original API product.

In addition to providing existing API audio products to the recording and broadcast industries, Datatronix is undertaking an aggressive R&D program to develop new products. Any questions concerning the availability of API products should be directed to David Brooks at:

DATATRONIX
 2100 RESTON AVENUE
 RESTON, VIRGINIA 22091.
 (703) 620-5300.

SESCOM, INC. ANNOUNCES SESCOM EUROPE

Franklin L. Miller, president of Sescom, Inc., Las Vegas, Nevada, has announced the formation of Sescom Europe, effective January 1, 1981. The new division will stock and market the extensive line of Sescom Audio Accessories throughout the U.K. and Europe from its base at 21 London Road, Berks., England. The new facility may be contacted by telephone at (0734) 345265, or by Telex number 847374 (PANOP G).

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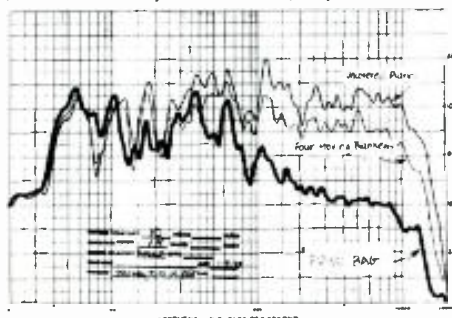
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STRESS

IN THE RECORDING STUDIO

understimulating work environments, and has been linked with ill health. Time pressures are well known to anybody associated with recording. This is particularly so in session work, live concerts, TV and radio shows. Studio time is now very, very expensive, and the pressure to complete the job can lead to feelings of overload. Conversely, when there is no time for experimentation, an engineer is forced to use tried and trusted techniques that are known to give adequate results. This can introduce an element of boredom into the work, and lead to feelings of frustration and dissatisfaction if an engineer is not given the opportunity of exercising his or her creative energies.

Automation may also result in an engineer

being under utilized. Long working hours, a large proportion of which are taken up with rehearsal while the tape recycles itself automatically, mean that engineers find themselves bored — no wonder that smoking and drinking are needed as a stop-gap.

In a way, there is little excuse for making a mistake under these circumstances. Nevertheless, mistakes are made, performances accepted that are not truly representative, concentration is not as high as it should be, wrong decisions are made — influenced, perhaps, by a little too much alcohol and fatigue. And yet, this situation is paradoxical. Quite a few artists do their best work under such adverse conditions. To restate what was said at the outset: without a certain amount of stress we can become understimulated and bored. But when that delicate balance of the coping mechanisms is upset, harmful stress can easily result.

B) Role in the Organization

Other sources of occupational stress are role conflict (conflicting job demands), responsibility for other people, and rule ambiguity (a lack of clarity about work). These factors may be of particular interest to those involved in large corporations, such as TV and radio networks. An example of role conflict may occur when a sound engineer discovers that, upon reading through his schedule, on a Tuesday he's due to be at the race meeting, followed by a current affairs program, and then back in the studio at night. Wednesday, he's scheduled to handle sound on a multi-miked show, set up for an orchestra, three commentators, backing tapes, and video — all going live on air. However, he can relax in the evening at the dog races, or it could be football. Thursday is the rock show, followed by news, a cookery spot, and pets corner . . . This is perhaps what might be described as lack of role clarity and role demand, in that an engineer is in some ways required to be a sound producer/supervisor, but paid as an engineer.

Dealings with people create stressful situations, too. Like the over-anxious director on an all-day telethon presentation that expects an engineer to pick up on microphone the host/presenter has chosen by mistake, and who on camera appears to be miming dialogue. Or the opera producer who will not allow microphones to be seen under any circumstances; the sound reinforcement/mobile recording conflicts that can arise when a concert is being covered by film, TV, record company and lighting rigs, and so on; the freelance engineer/producer that is landed with interim equipment not up to the standard that he or she is accustomed to — all these and many more are well-known stressors.

C) Career Development

The impact of over- or under-promotion can be a major source of unease, as can status incongruities, lack of job security, thwarted ambition and salary deficiencies. Status congruence, or the degree to which there is job advancement (including pay grade increments) has been found to be positively related to effectiveness. Over-promotion (that is beyond one's maximum level of competence) and under-promotion both cause stress, as does limitations of promotional opportunities and career mobility. Such a situation can create disruptive competitiveness which, under certain circumstances, can hinder group cohesion. Dissatisfaction with pay, of course, can be a major stressor, and extremely disruptive in

terms of corporate relations.

The phrase, "You're only as good as your last record," perhaps highlights the problem of job security within the studio situation. Engineering is a young persons' business. As you get older, pressures of promotion become apparent. "Up or out" is another phrase relevant to some organizations, and which ensures that studio personnel can relate to the client not only in terms of age but also outlook.

D) Relationships At Work

"I love it, I love it, I love it; I hate it, I hate it, boy do I hate it!"

Relationships within the studio environment between colleagues, management, subordinates, and clients can be, and frequently are, the cause of much stress and strain. Poor relations with others, precipitated by role ambiguity, lack of support, pay deficiencies and differences between colleagues and clients; all these factors compounded by closeted work environments, can be hazardous.

Engineers are required to maintain a good attitude at all times. The client is always right; what they want is what they get. An engineer may witness the posturing, volatile egos, acute anxiety attacks, psychological traumas — yet still remain amicable, impassive and in control. They must tolerate producers and artists who suffer anal retentivity; in other words, those who hold on to everything and will not let go in their pursuit of the "final cut."

E) Organizational Structure

The politics of organization, together with the lack of effective consultation between operators and management, and non-participation in decision making, can also make life difficult. The hierarchical structure of record companies in dealing with people who are only ever a voice on the telephone, may lead to months being spent on producing a product that is eventually rejected out of hand without explanation. This can easily cause frustration, despondency and resentment. Restrictions on behavior and red tape can cause strain; the large corporation that abides by rules — "Do this; make sure of that; this not allowed; this procedure, that procedure; fill this in: submit the requisition in triplicate; it'll be approximately three weeks before anything can be done." You've heard it all before!

F) Health Factors

Physical and mental health can be seriously jeopardized by all of the above examples. Together or singly, they can contribute in a significant way to the health of an individual. In most professions such stressors have been associated with a rise in the incidence of drug abuse, hypertension, heart disease, diabetes,

minor illnesses (for example, asthma, hayfever, and migraine), mental illness and impaired job performance. In relation to studio engineers, it would be of great interest to discover the incidences of illnesses (both physical and mental), as well as the degrees of drug abuse. The latter is of particular interest, in light of both potential job stressors and the potential exposure to subcultural groups that tend to have easier access to drugs.

G) Effects On Social And Family Life

Research has shown that there is a positive interaction between stressors at work affecting both family and social life, as well as *vice versa*. For the studio engineer, long hours and shift work can cause stress resulting from family and social isolation. In addition, last-minute extended shift work schedules can result in dissatisfaction from spouses and girl/boyfriends

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STRESS

which, in some cases, can easily enhance separation, marital dissatisfaction, and divorce. Also, many studio engineers have strong feelings of job involvement and commitment. This can lead to jealousies from spouses who often feel rationed in terms of time allocation with their partners. Feelings of frustration and anger are also voiced by these "Studio Widows," who are tired of cancelled social engagements. Finally, an additional underlying fear that has been voiced by many studio widows is the threat of the "Studio Groupie."

H) Stress And Individual Differences

It is an individual's personality profile, past experiences and variables such as history of family health, genetics and age, that can be instrumental in determining why different individuals respond differently to the same type of stressor. However, social scientists have isolated two specific types of behavior patterns known as Type-A and Type-B; the former having a strong relationship with stress-related disease, especially hypertension and coronary heart disease.

Type-A behavior is characterized by high achievement, striving, hard driving, competitiveness, motivation, time urgency, abruptness of gesture and speech, devotion to work, and a preoccupation with deadlines — factors intrinsic to the job of recording engineer! Type-B behavior, on the other hand, is characterized by the relative absence of the behavior associated with the Type-A person: no sense of time urgency, no free-floating hostility, ability to relax without guilt, and so on.

Thus, in the studio environment, where the emphasis is on achievement of good results, high job involvement and long hours, competitiveness, high motivation and the pressure of deadlines, one could suggest that recording engineers are likely to exhibit Type-A or coronary-prone behavior patterns. Indeed, there are strong indications from previous studies that certain work environments not only enhance, but also reward, Type-A behavior patterns. Certainly, the recording studio environment appears to encourage Type-A versus Type-B behavior patterns.

Conclusion

It is clear that the role of recording engineer is a potentially stressful occupation. By highlighting some of the causes and effects of stress in the studio environment, we hope to make studio personnel more aware of these occupational hazards. Clearly, more empirical research is required in order to isolate more precisely the specific stressors experienced by recording engineers, the effects on personnel, and methods of reducing these stresses. □ □ □

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The console designers at Harrison Systems have identified many traditional inefficiencies and have eliminated these in the design of MR-2.

Printed-circuit boards have been made smaller (thus, less expensive) through the use of double-sided artwork and a more meticulous, time-consuming design process.

Almost all hand-wiring in the frame has been eliminated. Mother-board-mounted multi-pin connectors are used for inputs and outputs.

Seldom-used features (like Quad) have been eliminated and replaced with more desirable and useful features.

Module width has been reduced to 40.6 mm (1.6"), thus reducing metal-work cost for a given console size.

In other words, every small detail of the MR-2 design has been critically optimized for efficiency. This efficiency does not mean, however, a reduction in signal-handling quality or reliability. In fact, just the opposite is true.

A radical new multiple-ground system is at work to even further reduce induced noise.

Modern "dielectrically isolated" switches are used for all logically controlled switch functions.

Patch points now operate full line level (+4 dBu or +6 dBu) and are isolated and balanced.

These are only a few of the reasons that allow us to confidently say that MR-2 is the most efficient, cost-effective console ever offered by anyone to the industry.

We think you will agree and make it your choice as well.

 **Harrison**
NOW MORE THAN EVER

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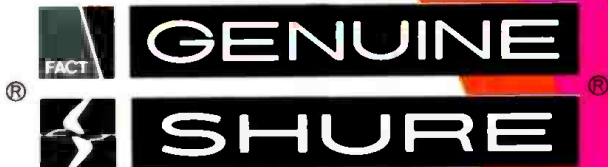
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There's so much new about these professional microphones we can only touch the highlights. Exclusive "picture perfect" SUEDECOAT™ Tan or Ebony matte finish looks great—*permanently*. Significantly smaller, exceptionally light in weight; yet so extraordinarily rugged and reliable we call them the "Light Heavyweights." They feature the crisp sound that makes Shure the world's most widely used professional performer microphones.



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