

**Profile:
Studio Designer
John Storyk**

ICD 08560
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MODERN RECORDING

SERVING TODAY'S MUSIC/RECORDING-CONSCIOUS SOCIETY

VOL. 5 NO. 1
OCTOBER 1979

A Session With **PETER FRAMPTON**

**THE ELECTRIC
PRIMER
-Part II**

LAB REPORTS:
Ashly Audio SC-50
Limiter/Compressor
AudioControl C-101 EQ
& Spectrum Analyzer
Spectro Acoustics
200SR Power Amp

HANDS-ON REPORT:
TEAC/Tascam 80-8 Recorder



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RECORD REVIEWS**

THE LONG AND THE SHORT OF SOUND REINFORCEMENT.



You know about the long part. Separate components can keep your hands full, what with the extra help and time needed to get your sound reinforcement act together.

Now for the short part. The Yamaha EM-200 and EM-300 stereo output integrated mixers. They leave you free to concentrate on the creativity of your job, not the mechanics of it.

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from a compact source that is easy to set up and operate.

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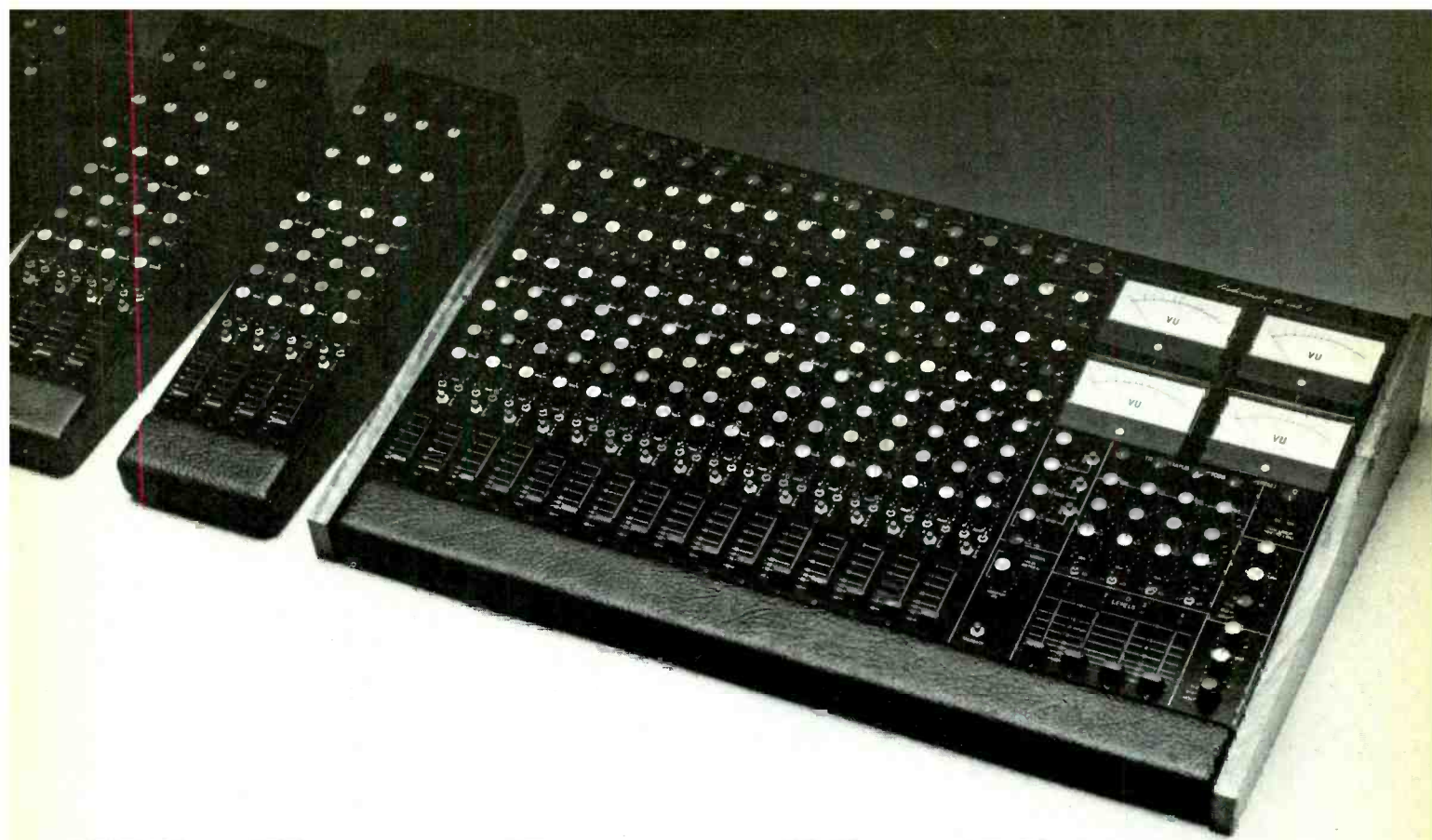
The EM-200 and EM-300 give you the short-cut to reinforcement that won't short-change the quality of your sound. They're convenient to set up, operate and locate... at your Yamaha dealer now.



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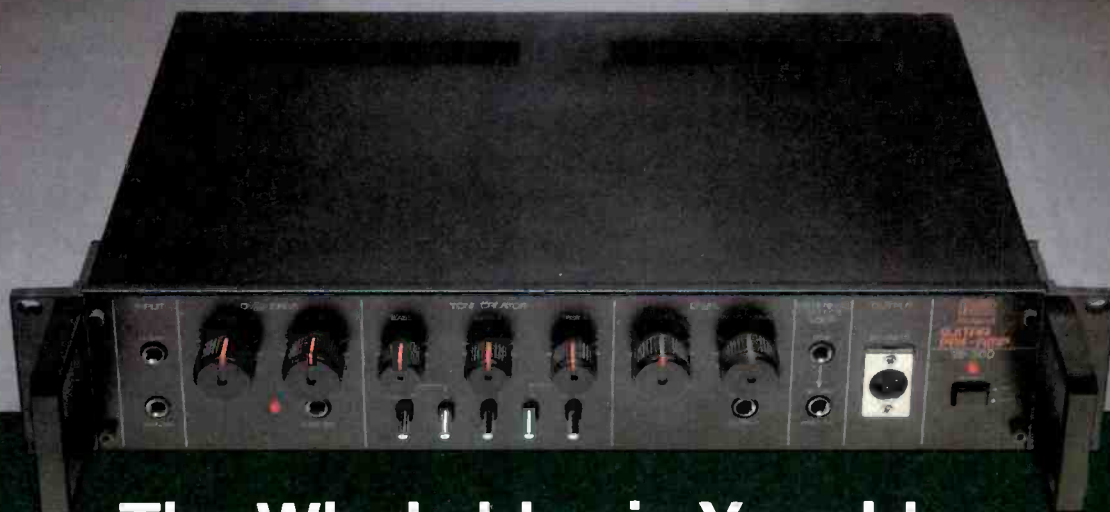
Now that our new 16X8 mixer and 800C stereo power amplifier have joined our already superior 12X2B and 16X4 studio quality boards, there is really no excuse to for not visiting your closest *Studiomaster* dealer today to check this all out. He won't leave you hanging, either!

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The Whole Idea is Your Idea.

Music has come a long way in the past few decades. But with amplifiers, it's been pretty much the same old thing—an amp in the top of a wooden box with some speakers mounted in the bottom. The only real change has been from amp manufacturers who have designed *their* own sound into their amps. But now, Roland has designed a system of amplification that designs *your* sound. We call it The Roland Rack.

The key ingredient in the Roland Rack is you. Because the modular design of our system lets you build your sound from the ground up. So, for the first time, you can have an amplifier that's exactly what you need.

The Roland SIP 300 Guitar Pre-Amplifier, for example, lets you contour your own sound; rather than rely on your amplifier's. Color the tonality with three

highly sensitive tone controls plus a series of hi and lo filters.

Roland's discrete component technology allows all the advantage of tube-type pre-amps, with none of the drawbacks. The Overdrive section supplies an incredible 42 dB gain, and virtually no gain in undesirable noise. What's more, you can enjoy rich harmonic distortion, even at relatively low volumes. And the special effects loops are extra special—one before the pre-amp stage, and one after.

The SIP-300 performs well with any quality power amp. Of course, if you don't want to settle for just any power amp, try Roland's SPA 120 or SPA 240 Stereo Power Amps. And for bass guitar, there's the SIP 301 Bass Pre-Amplifier. The Roland Rack System also includes a Stereo Flanger, Vocoder,

Pitch-to-Voltage Synthesizer, Digital Delay, and the incredible Dimension D.

This kind of versatility covers a lot of sound, but not a lot of space. In fact, one of our nicest features comes after the music's all over. Just close the door to the rugged rack case, and carry all your sound off stage in one trip.

The Roland Rack System. It's Your Idea.

Enclose \$1.00 for a copy of the Roland Rack catalog.

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MODERN RECORDING

OCTOBER 1979

VOL. 5 NO. 1

SERVING TODAY'S MUSIC/RECORDING-CONSCIOUS SOCIETY

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THE ELECTRIC PRIMER

—Part II

By Peter Weiss

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More on the basics of electricity, that elusive thing that makes all our recording equipment go. If you missed Part I in our last issue, go out and find it because this series will surely help you to understand the equipment you use. [Mr. Weiss and the "Electric Primer—Part III" will be on hiatus next month.—Ed.]

A SESSION WITH PETER FRAMPTON

By Nina Stern

50

While other artists not as talented or popular make a habit of being too egocentric to talk to the public that has given them their fame, Peter Frampton is still trying to do best by his fans. A relaxed interview and look into Frampton's latest LP, *Where I Should Be*.

PROFILE: STUDIO DESIGNER

JOHN STORYK

By Don Ketteler

58

Since his initial project, that of building and designing Electric Lady Studios—"The House that (Jimi) Hendrix Built"—John Storyk has become one of the most popular studio designers. In this interview he details some of the problems and solutions he has encountered while plying his craft.

COMING NEXT ISSUE!

Travels with YES
Building a Dual Limiter

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Cover Photo: Bob Jenkins
Frampton Photos: Bob Jenkins
Storyk Photo: Howard Sherman

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LETTERS TO THE EDITOR

MR BLUNDER!

MR BLUNDER!

MR BLUNDER!

In last month's September issue there were two egregious typographical errors within the Hands-On Report of the TAPCO C-12 mixer.

First, the real blunder. On page 82, the last sentence of the "Field Test" section should have read: "With nominal (0 VU) levels through the board there was *no* audible degradation of audio quality when listening through the unit." The missing word "no" was the very important culprit.

Also, on page 84, fourth paragraph, fifth sentence, the sentence should have read: "In order to avoid slewing induced distortion a slew rate ratio of 0.5 (minimum) to 1.0 (conservative) has been recommended."

These typographical errors significantly change the results of the C-12 mixer report. We strongly suggest that our readers, now properly informed, please go back to the September issue and read the report once again.

Our apologies to TAPCO and our readers for the blunder, and any embarrassment that may have been caused.

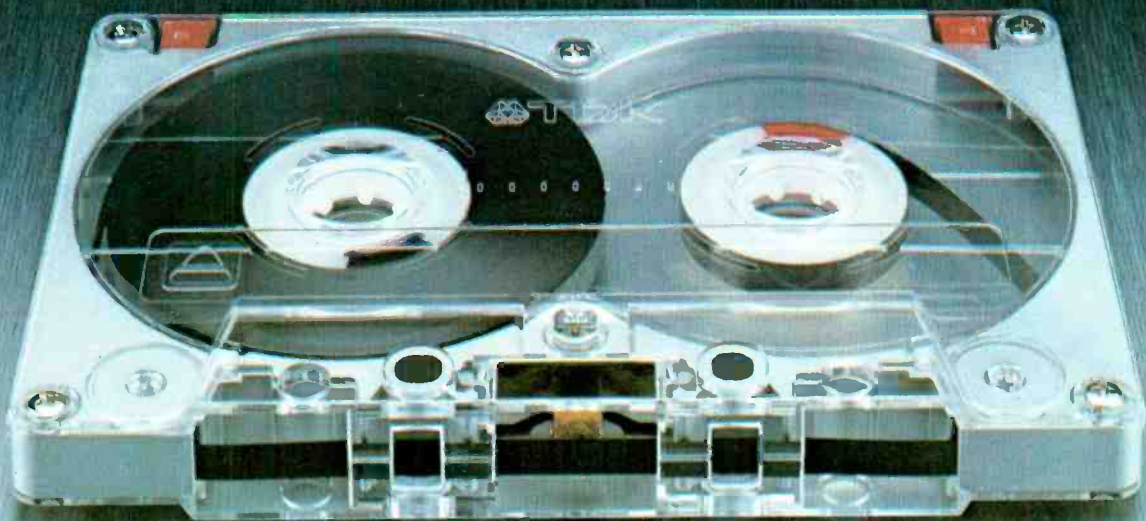
Scoping with the Jitters

Re: "Scoping in on Azimuth," p. 30, *Modern Recording*, July 1979: In general, the idea of using an oscilloscope for azimuth alignment is a good one. There are, however, some cautions and definite limitations in the method presented by Moysiadis in the July 1979 issue. There is also a much superior approach if one has access to a dual-channel 'scope.

The cautions are these: Because there is phase jitter between any two tracks in the playback, the ellipse is continually changing shape. It keeps collapsing and expanding, and it is very difficult for the observer to be certain of the significance of any error observed. For example, is the phase shifting from +30 degrees to -30 degrees, or +30 degrees to +10 degrees, or . . . you name it. The approach is also subject to gross errors (360 degrees) unless there is great care taken, as discussed by Moysiadis.

If there is access to a two-channel 'scope, the alignment is easier, faster and less subject to error, to say nothing of the fact that it's more accurate. The signal from track 1 is used as the reference track, and the scope is synchronized to it. The display must be chopped; alternate sweep will not work — the output from track 2 must be shown *relative* to track 1. The average position of track 2 is the amount of misalignment, and the amount that the waveform shifts back and forth, quite continuously, is the phase

Introducing TDK metal. The Music Mirror.



The era of metal particle tape has arrived. Metal-ready cassette decks are already in the stores, and more are on their way. There are also a number of metal cassettes on the market, and all of them have a high coercivity and remanence — their magnetic energy is roughly four times that of the best oxide tapes. But that does not mean that all metal cassettes are alike. Not by a long shot.

TDK's metal cassette, MA-R, looks, feels and performs like no other cassette. That's why we call it "The Music Mirror." We've used advanced manufacturing technology to solve the problems inherent in metal tape. If left untreated, metal particles oxidize upon contact with water vapor and oxygen in the atmosphere — they actually "rust." TDK has developed a unique way to coat each and every particle with a process that protects them from the atmosphere, even at the critical exposed edge of the tape. The result is a tape that is resistant to oxidation. In fact, the overall stability of MA-R is well within the limits that have been set for conventional cassettes. But superior tape is only

part of MA-R's story. TDK's new Reference Standard Mechanism is so revolutionary in design and performance, that its influence will be felt for years to come.

For starters, there's the one-piece, die-cast metal main-frame. Metal is far more resistant to warpage than plastic, and unibody construction eliminates performance differences between the A and B sides. The frame and mechanism are sandwiched between two clear covers held in place by six computer-torqued, double-threaded locking screws that will not slip because of vibration.

MA-R's amazing mechanism is visible for all to see, thanks to a transparent slip sheet. Our unique double hub-clamp is an integral part of a strong and circular tape storage system. (MA-R's two clamps are color-coded red and black, as a visual reference).

Our newly-designed, seamless, water-wheel-type rollers rotate around stainless steel pins, which are micro-polished for circularity. Our new dual-spring pressure pad assembly allows for more flexibility, yet provides more hor-

izontal support for uniform tape to head contact. MA-R even includes removable, replaceable erase-prevention lugs, a new standard in protection and flexibility.

Ask your TDK dealer to show you the new MA-R cassette. Hold it in your hands and feel its weight. Look at the ingenuity and precision of the shell and mechanism. Then listen to it perform in one of the new metal decks. All your senses will tell you that this isn't just another new cassette — it's one of the memorable audio products of our time. TDK Electronics Corp., Garden City, N. Y. 11530.

© 1979 TDK Electronics Corp.



TDK MA-R

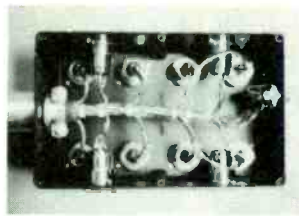
The machine for your machine.

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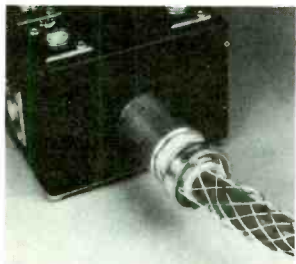
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CAVEAT EMPTOR. Let the buyer beware.

All multi-cable connectors are not created equal. Some of them may look alike on the surface, but a closer examination of the design and components will show a marked difference. A professional will know the difference; if not now, then in time to come. The Whirlwind Medusa will hold up under abusive day in and day out treatment.



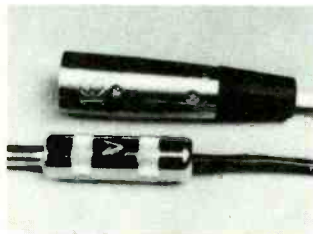
Medusa systems are available in five basic configurations, or with many custom options depending on your specific needs. Multi-pin connectors at either end permit quick connect and disconnect. Impedance matching line transformers can be included for greater line flexibility. Storage options include the Medusa Wheel and two different road cases.



We feel it's important to take a close look at the Medusa and at the competition. Look inside the junction box. How were the connections made: Do they look like they will withstand the kind of torture you will put them through? And what about the strain-relief? Our heavy duty wire mesh strain-reliefs are double reinforced and are at both ends. Check to see if the cables are color coded (by subgroup) on the sends and returns.

This could save you time and aggravation. Only Whirlwind uses cable custom made to our specifications by Belden for increased life and versatility. We individually hand stamp the plug ends for easy identification; We don't use wrapping which can come off. We've designed our Medusas with independent grounds to eliminate ground loops.

But we're not telling you all this to scare you. We feel confident in the way we design and build our products. Besides using the best possible cable and connectors, we back our Medusas with the Whirlwind full two year guarantee. That should ease your mind and let you concentrate on your music. So don't worry, beware and buy Whirlwind.



Shown above is the standard Medusa 15 with 100' cable, 12 mikes in, and 3 sends.

whirlwind

Whirlwind Music Inc.
P.O. Box 1075
Rochester, New York 14603

CIRCLE 110 ON READER SERVICE CARD

jitter. You can't do much about the jitter, unless there is a need for maintenance. It is highest in cassette decks, particularly with bad tape. You can, however, adjust the alignment to put the average of the track 2 waveform right over that for track 1. In fact, that's the best way to look at the traces, one laid over the other. Adjust horizontal sweep for a convenient scale; I usually use 30 degrees per division. Alignment within a few degrees at 10 to 20 kHz is easily accomplished with most recorders. Checking all tracks in a stack can be done very quickly—always keeping track 1 (or your choice) as the reference. Start off at a lower frequency, of course, and zero phase there to prevent 360 degree errors at the desired alignment frequency. Try it; you'll like it.

—Howard A. Roberson
Sound Measurements
Pittsfield, Ma.

Performing azimuth alignment on a tape machine with as much phase jitter as you describe in your example, and applying highly professional techniques to cassette decks are causes that David (Moysiadis), upon our inquiry, considered sort of pointless: one need not go to ten times the trouble to achieve merely a fractional amount of greater accuracy. It's rather like tuning a Volkswagen Beetle to Ferrari specs.

Using the dual-trace scope, in David's opinion, is also no more accurate a method—though it can be faster, as you say. Thanks for writing.

Pepperpike Plea

I've subscribed to your mag since its premier issue, and think it's great. I really like your profile section, and the way you select some relatively obscure people, e.g. Allen Toussaint (MR, April 1979), to do profiles on.

Now it's time for some more, particularly Lowell George and more importantly, Frank Zappa.

Frank, more than anyone, deserves some just time. He has always been treated as a novelty or a joke. He is partially responsible, but the man's output and talents are equal to none that I can think of currently.

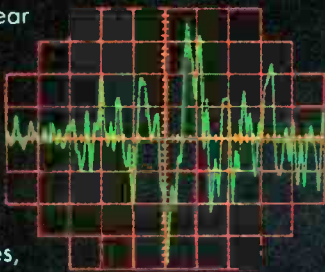
So how about an article on Frank?

—Jeff Kanter
Pepperpike, Ohio

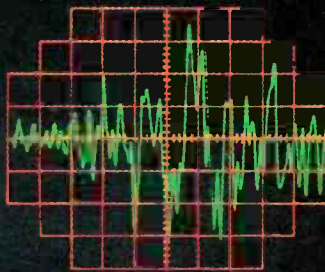
Although the highly-lauded and multi-talented Allen Toussaint is a man we would hesitate calling "relatively

While our competitors were listening to Technics Linear Phase speakers, we introduced phase two.

When Technics introduced Linear Phase speakers two years ago, we took the audio world by surprise. And why not. After all, Technics Linear Phase speakers were the first speakers to actually show you waveform fidelity. Not simply with tone bursts and sine waves, but by actually comparing the waveforms of live musical instruments



Piano Waveform.



Piano Waveform reproduced by SB-7070.

to the output waveforms of our Linear Phase speakers.

Now with the 3-way SB-6060 and 4-way SB-7070 (shown below), Technics takes you to phase two. Because compared to our first Linear Phase speakers both give you wider frequency extension, flatter frequency response and even more phase linearity, which means even better waveform fidelity.

How did we make such good speakers even better? We started with BASS (Basic Acoustic Simulation System), an IBM 370-based interactive computer system. With it, Technics engineers can do what they only dreamed of doing in the past: Calculate the sound pressure and distortion characteristics of transducers without physically building and measuring countless prototypes.

Next we took these computer-derived drivers and combined them with Technics unique phase-controlling crossover network. And of course we staggered the drivers to align their acoustic centers precisely.

It's easy to see the result of all this technology. Just compare the waveforms. On the left is a waveform of a live piano. On the right, the piano as reproduced by the SB-7070. That's waveform fidelity.

Listen to the 4-way SB-7070. What you'll hear is its smooth transition between low, midrange and high frequencies. Then notice the bass response. It's deep and tight. With much more punch, better definition and even less IM distortion than its predecessor. That's because when the upper bass

frequencies are handled by a separate driver, the woofer does a much better job at handling the lower bass frequencies.

You'll also hear vocals that are smooth and natural. That's because the SB-7070's high-midrange driver was designed with "free edge"

construction to avoid coloration of the critical upper-midrange frequencies.

And by adding a new, smaller tweeter with improved dispersion characteristics, the SB-7070's high-end frequency response was extended to 32 kHz.

Technics 3-way SB-6060 and 4-way SB-7070. For music that sounds like it was originally played. Live.

All cabinetry is simulated wood.

Technics

Professional Series

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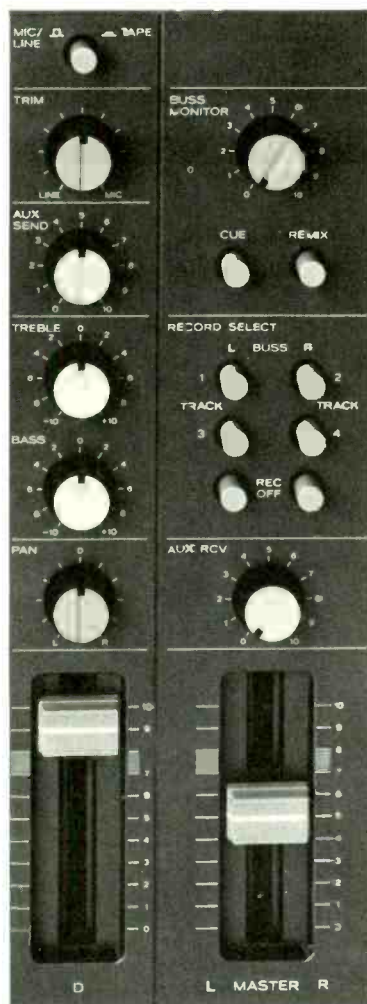
**INTRODUCING
THE
FIRST 15" X 18"
STUDIO.**

Now you can have the essential functions and flexibility of multitrack recording in one compact, self-contained unit. It's called the Model 144 Porta-Studio™ and it lets you record basic tracks, overdub in sync and remix to stereo. On standard cassette tape.

TEAC engineers created a totally unique format for Porta-Studio. Four tracks in sync on cassette tape at 3-3/4 ips. It's fast, simple, reliable and economical. Rehearse on it. Learn on it. Create on it. Just plug in a microphone or instrument and go to work on it.

Porta-Studio's versatile 4 x 2 mixer section gives you mic/line/tape switching, trim control, high and low EQ, fader, pan and Aux Send for each input. The failsafe group switching matrix lets you record on up to two tracks at the same time. And there's a master fader that gives you overall level control during recording and mixdown.

The full-logic cue system in Porta-Studio lets you hear everything you're doing all the time.



Input and tape cueing, monitoring for recording or mixdown are all available. And every signal can be metered. Coming or going.

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So see your dealer for a demonstration of the very affordable Porta-Studio. Nothing else in the world puts so much multitrack function into so small a package.

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CIRCLE 125 ON READER SERVICE CARD

obscure," we will agree that he has been not well exposed in the national media in the past.

On the other hand, you say you've been a subscriber to MR since its premier issue. How come you missed our "Profile: An Interview with Frank Zappa," published back in March, 1978?

Mystery Mic

I am a home recording enthusiast of the type who cannot afford the high price of many excellent microphones but could afford the \$7.86 "mystery" microphone called "Dingle" mentioned by Ken Klinger in the March MR interview with him. I read intensely the whole of the excellent interview and became quite interested when Ken Klinger explained the "Dingle" microphone only to find after reading on that he declined to name the manufacturer because he said it was a secret.

If it hadn't been for Ken Klinger's apparent desire to taunt all of the less affluent recordists with the "Dingle's" great microphone qualities and incredible price he could have just sat around guarding his case of secret microphones

and spared us the curiosity.

If the "Dingle" has all the great qualities alluded to by Klinger, I think the poorer of the recordists should be let in on the secret. I for one would purchase a few "Dingles" and feel sure other home recordists would do the same. I'm positive the manufacturer would appreciate the added business.

Thank you for your time in this matter. I am new to your magazine as I have only purchased two issues so far, but have been greatly impressed.

—Scott Moldenhauer
Mantorville, Minn.

Did you have a question?

(The "Dingle" is due to be revealed shortly, according to the writer working on this assignment.)

Swatch Book Tailored for Tapers

Where can I obtain a "Tape sampler," i.e., a chart or book containing sample swatches of all the various recording tapes made, so that specific tapes can be identified by color and feel?

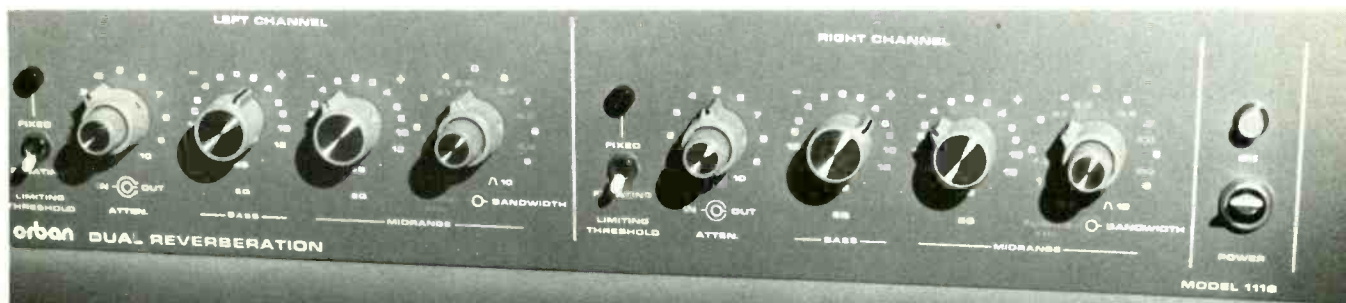
We use a lot of surplus around here,

and it is next to impossible to identify the tapes as to manufacturer and number. Also, it would be a great convenience to be able to select new tapes by color, style, etc. We esthetes adhere to the conviction that technical ratings and specifications determined by instruments do not tell the entire story, and neither do they hint very much as to the precise chemical composition or blend. This can be appraised by color, shade, density, "feel," etc. in ways that facilitate a much more satisfactory choice or selection of recording media.

Of course, the "tape sampler" needed would have to be international, containing samples of all the recording tapes manufactured and sold today. We could also make comparisons. Technical data should be included, more or less briefly. Our knowledge and understanding of recording tapes will not be complete without such a sampler.

—Paul W. Hipsley
Chicago, Ill.

We know of no such thing on the market. But if you're buying surplus tape, find out what it is from the folks you're buying it from. Another thing



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CIRCLE 100 ON READER SERVICE CARD



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Sound Guard. Everything else is a lot of noise.



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*We have the test results to prove it—write us and we'll send them to you.

CIRCLE 127 ON READER SERVICE CARD

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you could do is make up your own chart with samples of the tapes you generally come across.

Precise chemical composition is generally a prized secret, and manufacturers who feel they've got a winning combination usually hesitate hinting at this to avoid being duplicated by another marketer. So it's highly unlikely that you'll find this information even direct from the source. We're still trying to figure out how Hellmann's gets their mayonnaise to taste that way.

Greedy for Stereo

What, if any, "rumors" do you folks hear along the lines of a future for stereo television? Particularly towards the home application on the current VCRs (maybe something along the FM "(L + R) + & - (L - R)" lines, if the audio bandwidth can handle it... the hardware should be simple and let the FM tuner do the de-matrixing). Also, with the "soon-to-be-introduced" video disc, maybe we'll start seeing video/stereo albums! Think of the special effects—the shifting

scenes—the panoramic possibilities of such a format with sight and sound!

Thanks for what I am sure are long, hard hours between your covers... would you be willing to negotiate a lifetime subscription?

—P. Greedy
Ridgecrest, Ca.

We hear rumors of VCRs due with 2-channel audio capability, but before stereo television comes about, one must do one's own camera work to make use of it.

The future for stereo television, in these United States, at any rate, is in the hands of the FCC (In Japan, of course, great strides have been made in the realm of stereo TV.) at this point.

The Commission will eventually be submitted data on the technical aspects of stereo TV by a committee studying the topic. The FCC moves in slow and mysterious ways, though, so developments may be something less than fast-breaking.

Just a Note from the "Other" Side

I commend you on publishing one of the best audio magazines to be had. I especially enjoyed your Fleetwood Mac and ARS articles and hope to see more such "hot" issues.

I have been playing bass for some years, but have recently become interested in the "other" side of the music business. Your mag is intriguing to both seasoned pro and amateur.


Your record reviews are getting better and more informative. After all, what does excellent production mean if the music is trash?! I hope you will soon publish new info on metal tape and that eight-dollar "Dingle" mic. (Although people who can afford truckloads of \$1000 Neumanns don't really need bargains like that, if indeed it is a bargain!)

—Jeffrey A. Boudreau
Fitchburg, Ma.

Power Pop

I read the Steve Row review of 1994 in "Groove Views" of June 1978's *Modern Recording* quite by accident... I just want to say *thank you* for listening and writing such great stuff!!! Reviews like Steve's are like beams of sunlight in the sometimes cloudy world of music. [The writer was guitarist with 1994 and on the 1994 album Steve Row reviewed.]

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Maximally Flat 18dB/Octave Butterworth Filters
Crossover frequency continuously variable from 100Hz to 16kHz with a single knob
Power turn on/turn off Transient Suppression
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CIRCLE 88 ON READER SERVICE CARD

Enough poetry...I am now, however, in a new band called Johnnie Coolrock. We are presently in L.A. working on the club scene and an album deal, etc. This band hails from Chicago, as I do, and is not quite as heavy metal as 1994—I think everyone is calling it "Power Pop"—catch us if you can sometime, and thank you again for the review. I'll keep "playing my guitar a lot," and you keep up the writing and see what happens....

—Steve Schiff
Los Angeles, Ca.

Reviewer Row asked us to convey that he is sorry the band didn't stay totally together, as you indicate, and expressed good luck to the other members of the band. If 1994 itself is indeed defunct, though, Steve Row is one reviewer, at any rate, who says he "laments the passage of a short-lived group with promise."

The Benefits of Mainlining

I was wondering if you could give me some idea as to what the JHD Audio

"Mainline" does. My friends have told me about it, but I still don't find it very clear. Anything you can tell me would be highly appreciated. (Does it produce higher quality "live" recordings?)

—Joe Fitzpatrick
Newport Beach, Ca.

Probably, you'd get the best idea from a listen. So if one of your friends uses the "Mainline" you're in luck. Information we have from the manufacturer is that the product maintains signal quality in spite of long cable runs, and that it improves microphone performance. So, according to JHD, yes, it will produce higher quality "live" recordings.

Thunder Bay Comments

I just read your article on Kansas (July 1979) and I thought it was great. The recording techniques mentioned were informative and interesting.

I think your mag is fantastic. You always manage to be informative and yet often humorous.

I was wondering if you could see about doing an article on Led Zeppelin either in the studio or on the road. After ten years they can show us all a few tricks of the trade.

Mike Oldfield might be interesting to look into. I think he's the closest thing around to a one-man orchestra.

Anyway, thanks for a great mag and keep up the spirits.

—Liz Lukie
Thunder Bay, Ontario

P.S. I loved "The Studio Glossary" (September 1978).

Thanks for writing. We try to keep abreast of where our readers' interests lie, and to follow up on suggestions and requests for particular articles and subjects. Stay tuned.

Digital Inquiry

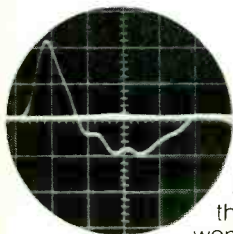
Could you please notify me of any recent or impending articles dealing with the modern trend of digital recording?

—Robin M. Christopher
Willunga, So. Australia

Our most recent and in-depth coverage of digital recording was in our May 1979 issue ("Jazzing Up PCM"), available from our back issue department for \$2.50. Send a bit more for overseas airmail.

AND NOW, A WORD ABOUT OVERLOAD, FROM SENNHEISER'S MD 421:

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Whatever your application—sound reinforcement, recording or broadcasting—consider our MD 421. Besides freedom from overload, you'll discover its precise cardioid directionality, rugged design and wide, smooth response give you superb results. Even under difficult conditions.

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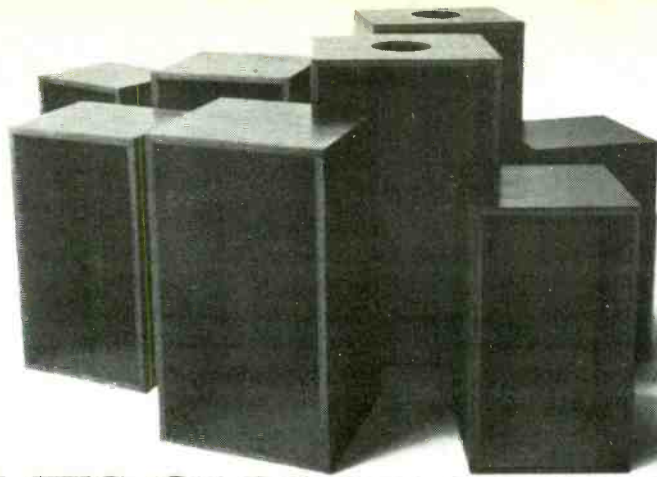
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CIRCLE 49 ON READER SERVICE CARD



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You'll never hear a sound out of these die cast aluminum frames.

long-throw voice coil let you hear even the deepest notes exactly the way the musicians

recorded them.

Of course, we could go on and on about the fact that every HPM speaker element has a cast aluminum frame, instead of the flimsy stamped out metal kind. Or about our special compressed wood cabinets that have better acoustic properties than ordinary wood cabinets.

It's features like this that begin to explain why unlike speakers that sound great on only part of the music,



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HPM speakers sound great on all of it. And this virtue isn't something you'll find in only our most expensive HPM speaker. It's found in every HPM speaker.

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TALK BACK

"Talkback" questions are answered by professional engineers, many of whose names you have probably seen listed on the credits of major pop albums. Their techniques are their own and might very well differ from another's. Thus, an answer in "Talkback" is certainly not necessarily the last word.

We welcome all questions on the subject of recording, although the large volume of questions received precludes our being able to answer them all. If you feel that we are skirting any issues, fire a letter off to the editor right away. "Talkback" is the Modern Recording reader's technical forum.

Clarifying Comments

I'd like some clarification on the subject of H-pads for microphones.

In *The Audio Cyclopedial* by Howard M. Tremaine (published by Howard W. Sams and Co., 1969) on pages 238 and 241, H-pads employ grounding to the "exact electrical center" of the shunt resistor. No one else, including those who have commented on this subject in your magazine, details it in quite this way. (See diagram below.) Both methods have worked well for me, but I wonder if one method might be superior to the other in certain situations (i.e., high RF fields)?

By the way, my method for realizing the "exact electrical center" of the shunt resistor is to halve the value of it and attach ground between the two substitute resistors (see diagram.)

Thank you for your time and efforts—and most of all for your fine publication.

—Tom Young
S. Salem, N.Y.

First, we should point out that most "balanced" inputs or outputs on a mixer are not balanced in the strictest sense

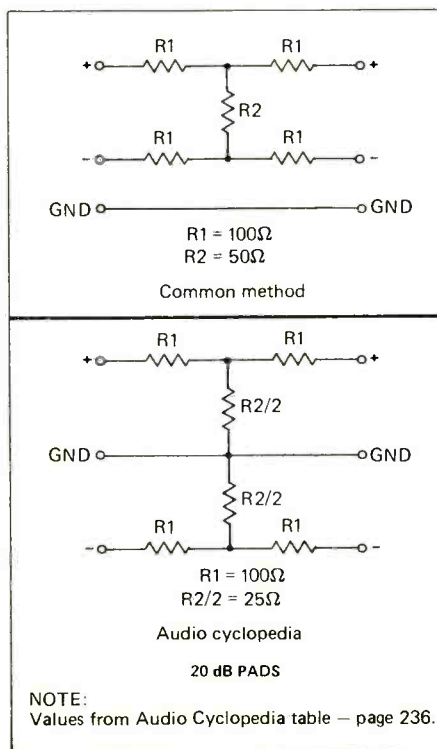
of the word, but rather are "floating." This means that the two signal-carrying wires (typically pins 2 and 3 in systems utilizing XLR-type connectors) are at a high-impedance from the system ground (which is available on pin 1 of the XLR). Of course, the impedance across the two signal-carrying lines is low (the usual 50-250 ohms), but the point is that neither signal line is "referenced" to the system ground as in the "true" balanced pair. Both floating and balanced lines operate pretty much the same otherwise.

A "true" balanced line should have better noise immunity, but this will depend upon the quality of the system ground. Installing a "center-tapped" H-pad (such as described in *The Audio Cyclopedial*) in a "floating" mic line might improve noise rejection, but this will depend upon an accurate match of

all resistors that have the same value (in ohms). Precision (1% tolerance may not be enough; .5% or even less should be used) resistors are required. Alternatively, you can use a digital ohmmeter to select a matched set from a batch of regular 5% tolerance resistors; the absolute value of the resistors is not as important as the match between similar-valued resistors. Careful selection will allow the resistors to match within .1%. Also, the system ground needs to be of high integrity, but that's a good thing to have anyway.

The more common "floating" H-pad has the gigantic advantage of allowing "phantom powering" of condenser microphones. The center-tapped H-pad will drop the phantom power voltage from its usual 24 or 48 volts to practically zero! Since the "floating" pad will operate in a "balanced" system, it appears to be the more universal of the two arrangements.

—Brian Roth
Technical Editor
Modern Recording
and Rick Chinn
Product Specialist
Tapco
Redmond, Wa.



Dr. Doolittle, I Presume?

When I record my ARP String Ensemble (direct, most of the time), I get a lot of unwanted noise and my recordings sound something akin to a pet shop. Any suggestions on how to get rid of this noise—short of throwing out my String Ensemble and renting a full orchestra—will be gratefully accepted!

Until that time, I remain, ornithologist in despair,

—Daniel Rheault
Montreal, Quebec

Perhaps the best way to eliminate your problem is to point out some possible

reasons for the noise that you are experiencing in your recordings.

You might be recording with the String Ensemble volume pedal. Although the volume pedal works well in "live" performance, its use in the studio is limited since it has a direct effect on the signal-to-noise ratio which can cause undesirable hiss on tape.

Are you recording using the output II jack? The output II jack provides a lower output voltage and therefore reduces the optimum signal-to-noise ratio. It also adds a colored effect to the quality of the string sounds which may or may not be desired. A flatter frequency response and greater signal-to-noise ratio can be achieved using output level I.

Another possibility I feel I must mention is an electrical failure in the modulators. One of the symptoms that is commonly found in defective modulator circuits is when a modulator begins to produce "popcorn noise" (your "pet shop" sounds).

The difficulty you are experiencing can easily be diagnosed and repaired by an ARP Authorized Service Center. The ARP service center for Montreal is Ravary Electroniques, which is located at 354 Rue Inspecteur-SS205, Montreal, Quebec, Canada H3C 2K7 (telephone number 514-866-0209). A complete list of ARP authorized service centers can be obtained by calling or writing the ARP Factory Service Department.

Hopefully, one of the ideas mentioned here will prove helpful to you. If I can be of any further assistance, please contact me at ARP.

—Stephen G. McLaughlin
Service Manager
ARP Instruments, Inc.
Lexington, Ma.

Guaranteed Performance

Will you please give me some information on Ampex 291 recording tape? Specifically, I would like to know how it compares to Ampex 456. I have heard that it is the same as 456, but since the same size reel of 291 costs about four dollars less, I'm rather dubious that the two tapes could be the same.

Also, what should I use to clean the heads of my TEAC 2340 tape deck? Denatured alcohol or the solutions marketed by TEAC, Ampex, etc.?

Thank you very much! Looooove your magazine!

—Larry Robinson
Los Angeles, Ca.

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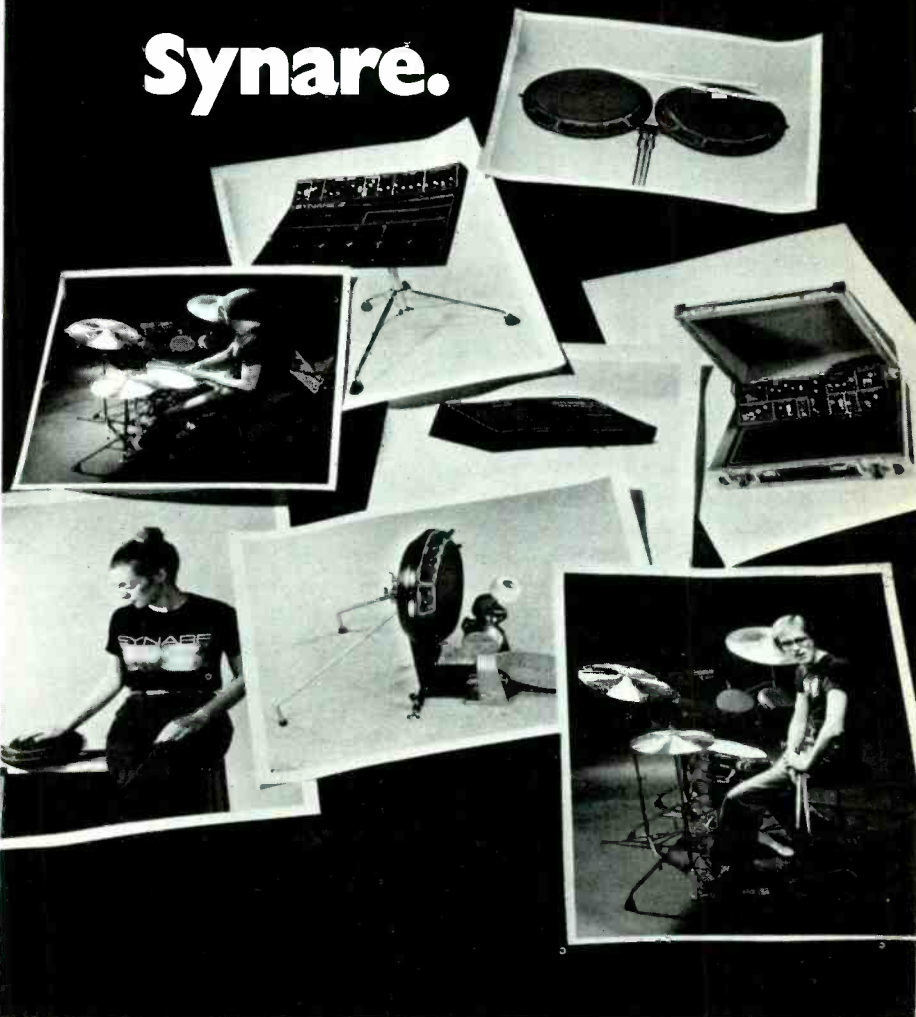
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CIRCLE 113 ON READER SERVICE CARD

George Armes, Manager of the Magnetic Tape Division of Ampex Corp., who, you'll recall, is a frequent contributor to this column, was called for consultation on this question. Quite briefly, the basic fact is that Ampex 456 and 291 are not the same tape.

Ampex 456 is a top-of-the-line, state of the art mastering tape. It is manufactured to stringent specifications and its higher price stems in part from Ampex's guarantee that 456 will continue to perform up to these standards through normal use.

Ampex 291, on the other hand, is an economy grade recording tape. While it is a fine tape for most purposes, it is not manufactured to meet the same extremely high requirements for which 456 is designed. The tape you choose depends upon your project, your needs and your budget.

As for the cleaning question, it has reared its head (no pun intended) before—and resulted in much controversy. (See Letters To The Editor, November 1978, "Cleaning Dilemma," page 6). George's rule is quite simple: "when in doubt, clean them." How often depends upon how often you use your

recorder and in what environment. A clean, controlled, air-conditioned studio environ will allow you to clean the heads less frequently. Naturally, in a home studio where one might expect more humidity and dust, cleaning should be scheduled more often. George also recommends any of the commercially available cleaning solutions—they are, for the most part, quite similar and perform in a like manner.

Roomful of Blues

I am a *Modern Recording* reader originally from Paraguay, South America, now living in the United States. I came to the U.S. two years ago to take a special course in audio recording at Brigham Young University in Provo, Utah. Before that, I had worked for two years in a recording studio in my own country (an 8-track facility). I must have been doing a good job, because in the period of time that I worked there the number of customers doubled, but despite this, I was never satisfied with the product we turned out.

The guy that owns the recording studio built it as a listening room; it

was never designed to function as a studio. It was like a basement in that it had very low ceilings, it was completely carpeted and it was quite small (9' x 20'). The control room didn't have any acoustic treatment at all, but it was a good size. When I first began, he had an Altec 1220 mixing board, an Otari 7000 two-track and two Studer-Revox A-700s, Tannoy speakers, a Phase Linear amp, five Neumann U-87 mics, one AKG 414, three Sennheiser mics, two small pen-like Neumann mics and two AKG BX-10 chamber and also with a Dynacord delay line.

As you know, the 1220 is a reinforcement board, mono of course, so when we recorded a rock group, we had to make miracles to get an acceptable sound. We recorded the basic tracks (drums, bass, some guitar or keyboards) and then the vocals, etc. It worked out pretty well because we would have the band rehearse the song three or four times so we could get acquainted with the different parts of the song. We worked that way for six months, until the owner of the studio bought a Teac/Tascam 80-8. This piece really



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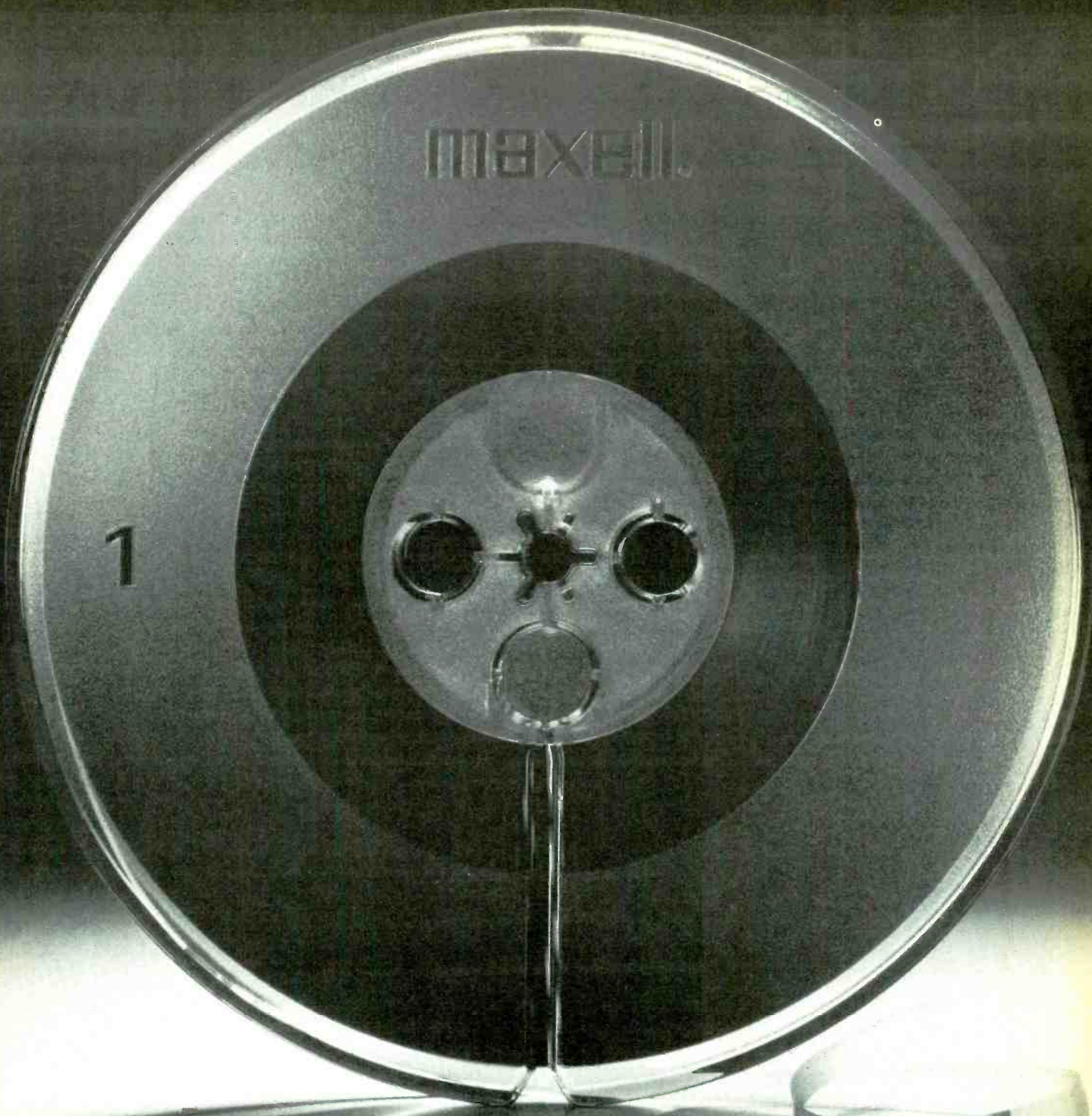
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CIRCLE 142 ON READER SERVICE CARD

simplified our methods, but, ironically, this was also when my problems began.

I don't know why, but I could hardly ever get a good bass sound. It was always too low. The frequency of the notes was "flat" and low, so I had to work with the EQ a lot. I thought at the time (now I know) that the room had a lot to do with it.

When we had all the tracks together, we mixed them with Auratone speakers using MXR noise reduction devices. They always had a good, clear sound in the room—great! But when we played them outside the room, they were full of distortion, peaks all over the place (always reading +2 dB), too high in frequency, without body or presence and all out of range—what did we do wrong? What was the problem? What I mean is, all the instruments and vocals were in perfect level but we didn't have that presence in the bass and that made it sound hard and without body. In the mixdown, I always got a reading on the bass (the meter read it) but it was never evident in the final product—why?

—Augusto G. Gomez
 Pomona, Ca.

Your description of the physical aspects of the room suggest a sequence of dimensions that could produce the problems you describe. The length 20', width 9' and height 8' have resonant modes that are too closely clustered. These modes probably cause you to hear exaggerated emphasis at one frequency and cancellation or drop in level at others. Trying to correct these problems with equalization causes poorly balanced tapes. This is always embarrassing the first time you play your mix in another control room.

In order to solve an acoustic problem you must correct it acoustically, either by changing the room or cerebrally adjusting what you hear to what the room is distorting and then mixing accordingly. Most engineers must often use this "Kentucky Voicing" technique if they work in several different rooms. Professional real-time analysis can verify what your ear has told you.

The second type of problem indicated would be inappropriate gain staging. The system you describe certainly seems adequate for quality performance, except for the mating of the 1220 Altec to the Tascam 80-8.

As you stated, the 1220 is a mono, P.A.-type board. Therefore, its inputs are mic level (very low, -50 dB), and its outputs are +4 dBm (high, with 18

dB of headroom). The 80-8 is a -8 dBm (input/output nominal) machine, right in between mic levels and +4 line levels and therefore not ideal, as is, for either. Its inputs must be padded to accept the 1220's +4 dBm output, and its outputs must be impedance matched and padded beyond the pads available on the console inputs themselves.

If the 80-8 incorporates a DX-8 (noise reduction) unit, the problems are multiplied since the DX-8 must see a -8 dBm (-10 dBv) signal maximum. (Please remember that dBv is a reference to voltage, which is 1 volt into 600 ohms equals 0 dBv. dBm is a reference to power, which is 1 milliwatt into 600 ohms equals 0 dBm. The Teac/Tascam equipment is referenced to dBv, whereas the Altec, and many other manufacturers, use dBm as the reference.) Otherwise it will erratically trigger in expansion and compression as well as wreak havoc upon your program information (breathing, etc.).

If gain staging, impedance and level matching are not exercised and carried out completely and correctly, you may try to compensate via equalizers or other processing equipment. However, this type of compensation may create many phase incoherencies, equalization ringing and harmonic distortion.

In conclusion, if the room isn't perfect and the budget is low, then *analyze, understand and aurally compensate* as you mix but by all means, keep on mixing. Take the time to *compare interface and level compatibilities* in your system, then *adjust them accordingly*, until best results are achieved.

For more information on acoustics and how to compensate for those that are less than ideal, check out the article by Jeff Cooper, "How To Build a Recording Studio for Under \$500," which first appeared in the Dec/Jan 1976 issue of *Modern Recording*.

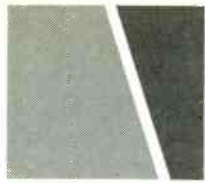
Please feel free to contact me for more suggestions as the specifics of your problems become more apparent.

—Barry Ross
 Chief Engineer
 The Express Sound Co., Inc.
 Costa Mesa, Ca.

Loading Up Those Amps

I have a question regarding audio amplifiers and the effects of impedance loads on audio amplifiers.

It is generally written that amplifiers deliver more power into higher impedance loads—as lower im-



fact: you can choose your microphone to enhance your productions.

Shure makes microphones for every imaginable use. Like musical instruments, each different type of Shure microphone has a distinctive "sound," or physical characteristic that optimizes it for particular applications, voices, or effects. Take, for example, the Shure SM58 and SM59 microphones:

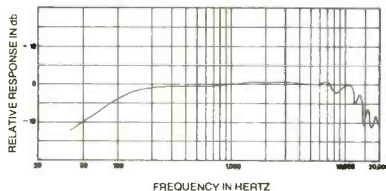


SM59

**Mellow, smooth,
silent...**

The SM59 is a relatively new, dynamic cardioid microphone. Yet it is already widely accepted as a standard for distinguished studio productions. In fact, you'll often see it on TV . . . especially on musical shows where perfection of sound quality is a major consideration. This revolutionary cardioid microphone has an exceptionally flat frequency response and neutral sound that reproduces exactly what it hears. It's designed to give good bass response when miking at a distance. Remarkably rugged — it's built to shrug off rough handling. And, it is superb in rejecting mechanical stand noise such as floor and desk vibrations because of a unique, patented built-in shock mount. It also features a special hum-bucking coil for superior noise reduction!

Some like it essentially flat...

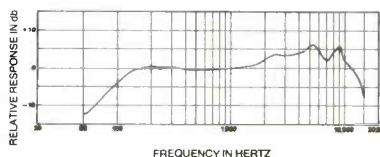


SM58

**Crisp, bright
"abuse proof"**

Probably the most widely used on-stage, hand-held cardioid dynamic microphone. The SM58 dynamic microphone is preferred for its punch in live vocal applications . . . especially where close-up miking is important. It is THE world-standard professional stage microphone with the distinctive Shure upper mid-range presence peak for an intelligible, lively sound. World-renowned for its ability to withstand the kind of abuse that would destroy many other microphones. Designed to minimize the boominess you'd expect from close miking. Rugged, efficient spherical windscreens eliminates pops. Lightweight (15 ounces!) hand-sized. The first choice among rock, pop, R & B, country, gospel, and jazz vocalists.

...some like a "presence" peak.



professional microphones...by



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Manufacturers of high fidelity components, microphones, sound systems and related circuitry.

CIRCLE 118 ON READER SERVICE CARD

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pedance loads shunt the output signal to ground, yet I have tried to drive a high-impedance load (a network-passive EQ) with a 4-watt power amp, designed to work into 8-ohm loads, with *no more increase in signal than with a standard line-level amp driving the network!* This same 4-watt amp will drive an 8-ohm speaker to loud levels, so why can't I make it drive my high-impedance network?

—Louis Perry
Aiken, S.C.

It is not true that amplifiers deliver more power into higher impedances. The power delivered into a load impedance is given by:

$$P (\text{output power}) = \frac{E^2 (\text{output voltage})}{R (\text{load impedance})}$$

From this equation, we can see that larger loads draw less power. The high input impedance of your equalizer (usually greater than 10,000 ohms), doesn't require a large amount of power. The maximum "E" (output voltage) of a 4-watt amplifier capable of driving 4 ohms is:

$$\begin{aligned} E &= \sqrt{\frac{PR}{}} \\ &= \sqrt{4 \text{ watts} \times 4 \text{ ohms}} \\ &= \sqrt{4 \text{ volts}} \end{aligned}$$

The nominal "E" output voltage of a line amp at +4 dB is 1.6 volts. The power drawn by the input of the equalizer is much less than 1 watt, whether driven by the power amplifier or the line amplifier.

In summary, it is possible to use the 4-watt amplifier in place of the line amp. However, you will not utilize the power capabilities when driving a load requiring very little power.

—Ron Lynch
General Manager
Octopus Audio
Toronto, Ontario

Elimination and Enhancement

Since I live in an apartment building, I cannot have my guitar amp too loud or have any loud jam sessions. As a result, I do a lot of low-volume recording, sometimes without enough VU meter deflection. I guess I don't have to tell you what playback reveals! I'm wondering if a mic line amp would help

and if you could possibly recommend a couple of models. I usually use a Sennheiser 421 mic, but I'd like to know if I would need a different mic line amp for different mics, say an AKG or a Shure.

When I record now, I mic my amp direct to a Teac A3340S and I sometimes wind up recording hum or buzzing from my Marshall amp. Will a mixer help to reduce this or perhaps even eliminate it altogether? Will a mixer do the job of a mic line amp, or would I still need to boost the mic signal then go through the mixer to the deck? Will the mixer amplify any unwanted sounds or the noise the mic picks up or can I eliminate them with the mixer?

—John D. Myke
Ottawa, Ontario

Because of their high input sensitivity, Marshall amps have a tendency to pick up and amplify unwanted hum and noise. Although the hums and noise will not totally be eliminated by its use, I suggest using a good grade of braided shielded cable from your guitar to the amp and that you keep the length as short as possible.



CONSIDER THIS: A parametric equalizer without low, mid and high band restrictions. The Audioarts Engineering Model 4200 is a four section stereo parametric equalizer; each section is a dual range filter. **CONSIDER** an equalizer that can handle full +20 dBm studio levels, regardless of equalization setting, but which also has a low-noise preamp input to allow musical instruments to plug directly into those same studio effects. The Audioarts Engineering Model 4200 is a professional no compromise parametric equalization system.

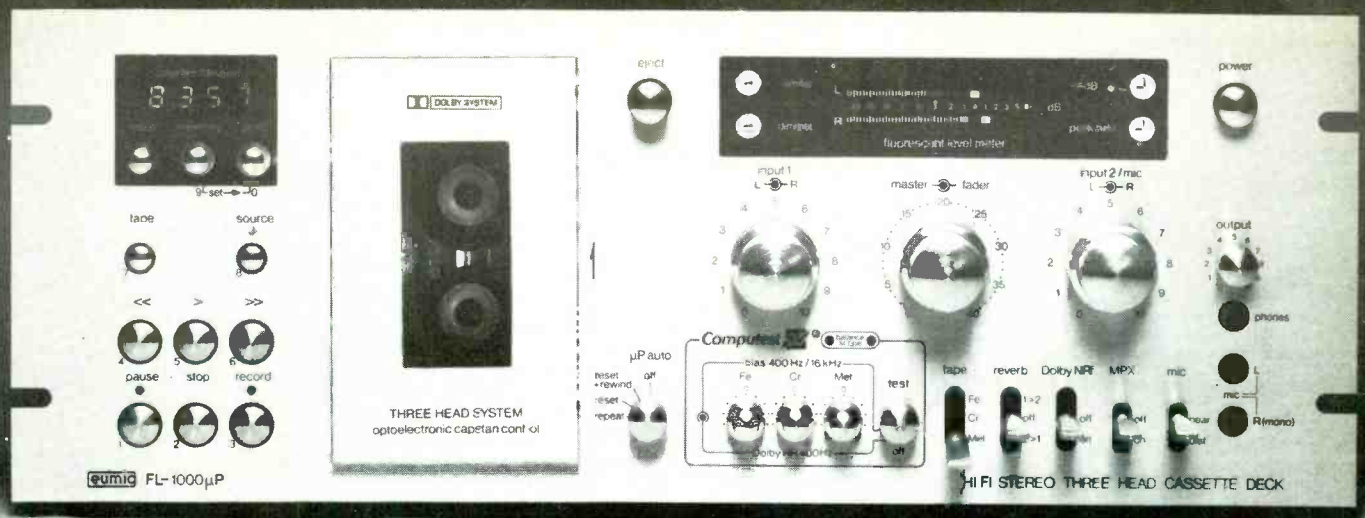
- four dual range filter sections
- EQ bypass switch for each section
- Master Equalization bypass switch
- LED overload indicator
- input gain control
- line level input jack (+20 dBm)
- instrument preamp input jack
- line output jack (+20 dBm into 600 Ω load)
- reciprocal equalization
- 3½ inch rack mount
- Model 4200 (stereo) price: \$599
- Model 4100 (mono) price: \$335

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Designed and built in U.S.A.

CIRCLE 47 ON READER SERVICE CARD



Calling the FL-1000 a cassette deck is like calling a Ferrari transportation.

The owner of a Ferrari knows his car is much more than transportation. It'll get you there, but with a difference. A difference that comes from years of dedication to building precision machinery with an emphasis on performance and pleasure.

Similarly, anyone who uses the new Eumig FL-1000 immediately recognizes how much better it is—and how much more it does—than any other cassette deck. Much like the Ferrari, it is built for total satisfaction, to give top performance and instant response, where the competition just... works.

The FL-1000 has the most sophisticated microprocessor ever used in a cassette deck. It's so sophisticated, in fact, that it can be directly interconnected with most popular minicomputers through its standard IEEE buss for data storage and retrieval or automated music programming. The microprocessor provides logic-perfect tape transport supervision, plus automatic programmable stop and repeat. There's even an automatic searching mode to select any programmed point on the tape just by punching digits on the keyboard. The tape counter is purely electronic, with digital readouts, and the motor automatically slows when it approaches your selection and stops at the perfect point so you hear only what you programmed.

Our Computest automated test system and 400Hz and 14kHz test oscillators help you set optimum bias, equalization and Dolby™ levels for any tape, including the newest pure metal formulations. And our superb switchable limiter circuit—absolutely

undetectable in operation—assures distortion-free recordings with any tape or sound source.

Instead of clunking solenoids, the FL-1000 uses two electronically controlled motors for mechanical functions and to move the tape. The capstan motor incorporates Eumig's unique optoelectronic control. Instead of heavy flywheels and cumbersome belts, we use a low-mass disc with 2500 precisely photo-etched lines that are read by an optical sensor at the rate of 15,000 pulses per second. Speed correction is instantaneous, and wow and flutter are kept to an insignificant 0.035%.

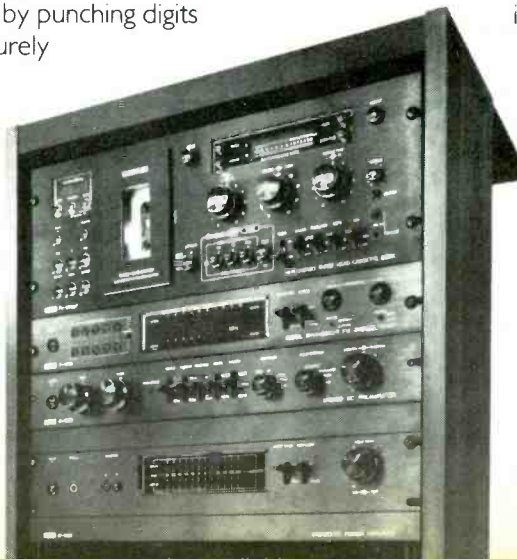
Naturally the Eumig FL-1000 has three heads and double Dolby for true monitoring. And added flexibility is provided by two mixable stereo inputs with a cross fader, reverb without patch cords, fixed and variable outputs, fluorescent level meters with peak hold, and even a read-out that says "END" when the tape is finished.

If you want to understand and appreciate a fine car, a test drive is best. It's much the same with the FL-1000; so visit your Eumig dealer to audition the FL-1000 and the companion tuner, preamp and power amp. To set the right mood, make the trip in a Ferrari.

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CIRCLE 149 ON READER SERVICE CARD



I think a mixer is the way to go in your case since it will give you the advantage of equalization, multiple input channels for further use, and patching facilities for outboard equipment. A mic line preamp is not needed with the mixer, but make sure the mixer you purchase has balanced mic inputs.

Although the mixer will amplify any noise that the mic picks up, you will have a better chance of eliminating some of it with the equalization on the mixer and with the patching facilities on it you can add other outboard gear such as noise gates, graphic equalizers, parametric equalizers and other electronic marvels to further eliminate the noise and enhance your sound.

—George R. Minol
Audio Engineer
Universal Recording Corp.
Chicago, Ill.

Modifications for Musicians

I am trying to put together a musician's cue mix for my home 8-track recording studio. Presently, I am using a TEAC Tascam Model 5 mixing board, a TEAC 80-8 tape deck and a TEAC Tascam Model 1 mixer for overdubs on the 80-8.

I want to balance the cue output on

the Model 5 and possibly the outputs on the Model 1, as well. Is there a transformer I can purchase to make this modification? If so, where can I purchase them and how should they be installed? I realize this would void the guarantee on the units, but I have a background in electronics and would like to install the transformers.

Your help would be greatly appreciated. Thanks for an excellent magazine.

—Terry Reardon
San Diego, Ca.

The Model 5 cue output or the Model 1's outputs *can* be adapted to balanced operation. However, this cannot be accomplished with a line transformer *only*. A low-power amplifier must be incorporated with the line transformer into each individual output. Due to the extensive re-engineering required, such as circuit additions and physical changes, a modification of this kind becomes costly and time consuming. TEAC does not authorize field modifications, and, as you have noted, it will void the warranty on the unit.

I suggest that you use an external line amplifier which will 1) convert unbalanced to balanced operation and 2)

provide the necessary output level. TEAC offers one such unit, Model LA-8. The LA-8 is an eight-channel unit designed for this type of interface problem. If you don't need eight channels of line amplification, here are a few facts that will help you to choose a proper line amplifier:

The unit must have an unbalanced input with an input impedance of 10K ohms or greater.

It should be able to amplify a -10 dBm signal to +4 dBm. A variable gain control is helpful in obtaining the output level desired.

The output must be balanced and able to drive a 600-ohm load.

—Dale Dalke
Technical Correspondent
TEAC Corp. of America
Montebello, Ca.

Shedding Some Light on the Scheme of Things

I realize that you are primarily a sound-oriented publication, however, I have a question on lighting that I hope you can assist me with as it is affecting my sound system.

I recently purchased a Lightmaster 601 lighting board by Zero 88 Lighting



AUDIOARTS ENGINEERING

Model 1500 Tuneable Notch Filter - Feedback Suppressor



CONTROL FEEDBACK

THE MODEL 1500 was engineered to solve the problems of feedback where conventional filters fail:

- (1) **TUNEABLE** — Meaning you tune the filters exactly to the offending frequency, while leaving adjacent frequencies unaffected;
- (2) **NARROW BAND** — 1/6 octave; much narrower than any graphic equalizer, so you remove only feedback, without disturbing tonal balance in program material;
- (3) **SPECIALIZED DESIGN** — The Model 1500 has five identical filter sections, each covering 52 Hz to 7.3 KHz, thus eliminating the "low-mid-high" band restrictions imposed by other general purpose equalizers. This ensures plenty of control, no matter what frequencies you need to process.

- Five identical tuneable full range filters 52 Hz to 7.3 KHz, 0 to -16 dB notch depth
- Front panel gain control
- Overload LED
- IN/OUT switch
- Separate color-coded controls (no concentrics or sliders)
- Balanced input (accepts unbalanced sources)
- 7 pushbutton switches (each w/LED indicator)
- Direct rack mount
- +20 dB output
- Optional transformer balanced output
- No test equipment required



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Drawing upon their unequalled 30 year leadership in magnetic recording technology, Tandberg's TD 20A open reel tape recorder extends their traditionally superior level of performance to even further limits—to even beyond the present capabilities of today's magnetic recording tape! This is due to Tandberg's exclusive ACTILINEAR Recording System, which not only provides up to 20 dB headroom margin over existing tape, but is specifically designed to be used with the new high coercivity tapes that will appear in the market in the near future—including the soon-to-be-available metal particle tapes. No other quality open reel tape recorder can make this obsolescent-proof claim today.

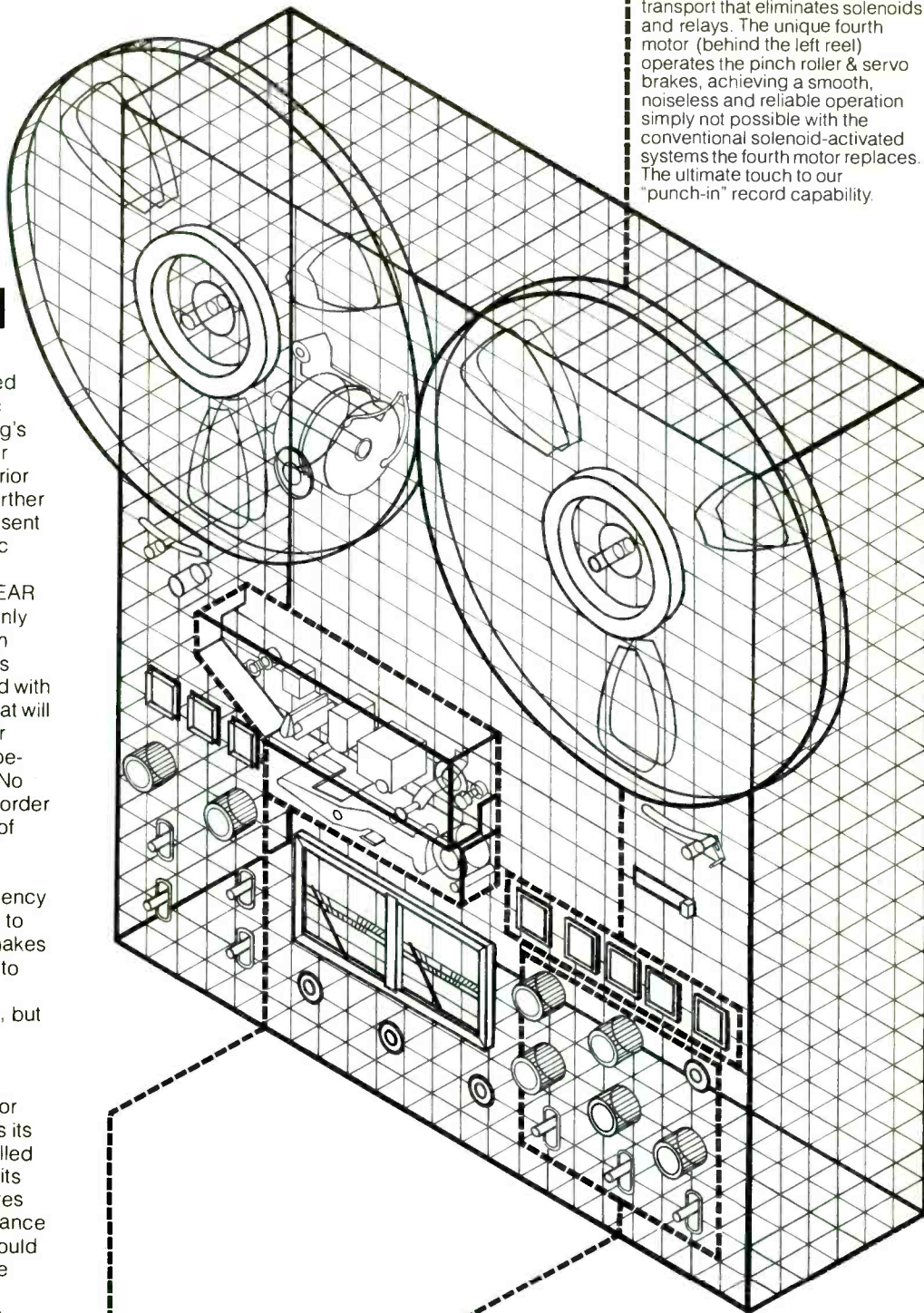
The ACTILINEAR Recording System's extremely linear frequency response ("ruler flat" according to some test reviewers) not only makes the TD 20A essentially immune to slew-rate limiting and transient intermodulation distortion (TIM), but also means better transient response and lower distortion overall.

Adding to the TD 20A's superior level of quality & performance is its unique PROM computer-controlled four-motor transport, as well as its many standard operating features that permit a degree of performance and control flexibility that you would expect only from Tandberg—the world leader in tape recorders.

Visit your authorized Tandberg dealer for a demonstration of the TD 20A. Check our *guaranteed minimum specifications* and rate them against any other manufacturer. Combined with the unsurpassed ease of operation & control, the TD 20A is probably more tape deck than you actually need. Isn't it the way things should be?

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Tandberg's exclusive PROM computer-controlled four-motor transport that eliminates solenoids and relays. The unique fourth motor (behind the left reel) operates the pinch roller & servo brakes, achieving a smooth, noiseless and reliable operation simply not possible with the conventional solenoid-activated systems the fourth motor replaces. The ultimate touch to our "punch-in" record capability.

Tandberg's unique ACTILINEAR Recording System, offering up to 20 dB headroom margin over existing tape. And easily adjustable for use with the new high coercivity tapes to come, so your TD 20A is obsolescent-proof!

Still more features: Four line input mixer + Master gain control with pre-set, Self adjusting input amplifier, Front-panel bias adjustment, Mic sensitivity switch, Channel Sync & Sound-on-Sound, "Free" mode & Edit/Cue facilities, Infrared-controlled motion sensing device, Professional scrape-flutter filter, Separate power supplies for operational functions & audio functions, and Peak-reading equalized meters that have been graphically redesigned for easier reading.

Optional PCM infrared wireless remote control for an ease of operation that doesn't tie you down to the length of a cable. Plus automatic start & stop via a timer switch (optional).



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The new Stak-Rak modular interlocking case system allows you to safely stack equipment as high as you like, yet lifts apart for easy transportation. 6' of loaded Stak-Raks fit into any compact car. Exclusive mounting rails front & rear, with slots instead of pre-drilled holes, allow installation of any type of 19" equipment, even those with non-standard heights.



All Stak-Raks have a scratch-resistant finish, heavy duty handles, louvered tops for ventilation and are 16" deep. Three sizes — 7", 10" & 14". The 14" comes with a removable hinged door, casters, and will support up to 880 lbs.

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CIRCLE 141 ON READER SERVICE CARD

Ltd. The problem is that it buzzes and, also, the sequencer isn't functioning properly. Can you give me a hint as to why this is happening and how I can correct it?

I'd also like the address of the company as I don't have a schematic for the board. Can you help me out with this?

—Roger Binette

The Show-Pro Corporation
Duluth, Minn.

Ah, we're good at answering simple questions—for the more complex ones, we're going to refer you to John Gates of Capron Lighting and Sound. In answer to your last question, our advice is to get down to your local Post Office and check out the First Class Air Mail rates to Britain. Zero 88 Lighting, Ltd. is located at 115 Hatfield Rd., St. Albans, Hertfordshire, mail code AL14JS. If, in the interest of immediacy you wish to call them, they can be reached at (0727) 63727. Now, here's John! —Ed.

You seem to have overlooked the benefits of going back to the place where you originally bought the equipment. Your dealer should be able to help you a great deal faster than any magazine, but we'll give it a good try.

First, a good rule of thumb for lighting (and sound) equipment: If you can not diagnose an equipment problem yourself, don't attempt to correct it yourself. A schematic would be useful in testing control circuits (like the sequencer you mentioned), but only if you had some idea of what to look for. Note: the time to ask for a schematic is when you buy the equipment.

Second, another good rule of thumb: always check with the dealer or distributor where you bought the equipment initially when you have equipment problems. The original dealer is usually better equipped to expedite service and repairs than a dealer who does not sell that particular brand.

If the original dealer cannot service the equipment, he should be able to help you find alternative service. However, sometimes repairs must be handled by the factory. Again, your dealer should be your first stop.

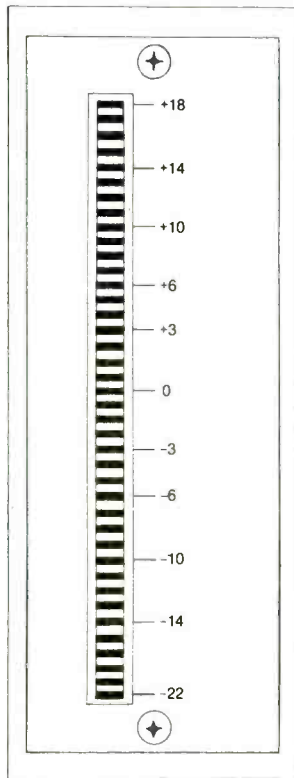
Third, have any equipment malfunction—suspected or real—looked at by competent service personnel immediately—and take advantage of all warranties and guarantees. Make sure you understand them before you buy the equipment.

Now to your "problems." The buzz-

Coming Soon to the Sound Workshop Series 1600...

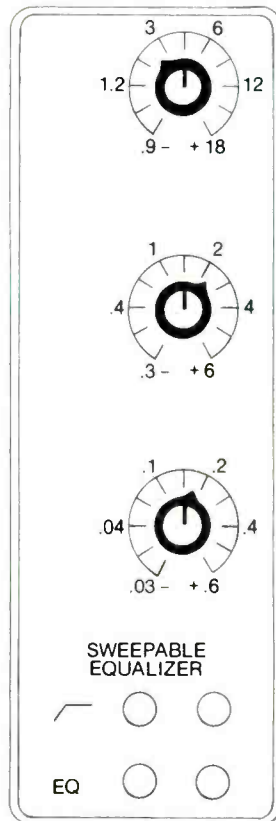
New Options.

High Resolution Metering



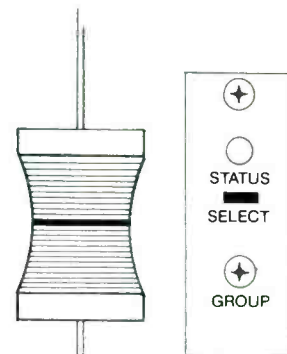
The Sound Workshop Series 1600 is now offered with a High Resolution Meter/Output Module. The 40 segment light bar meter features a 40dB dynamic range, built in spectrum analyzer, and peak, average, and peak/hold modes. (The standard LED column meter is now available with peak reading capability and the Series 1600 can also be fitted with standard mechanical VU meters.)

New Sweepable EQ

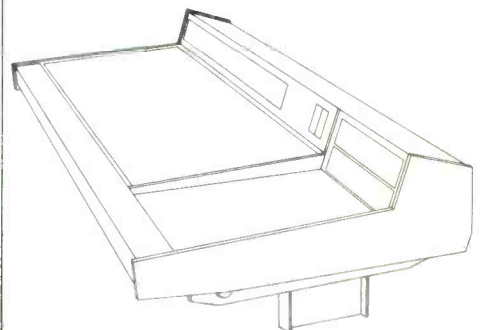


In addition to the standard 15 frequency equalizer and the full parametric EQ, a new sweepable equalizer is available for the 1600. Functionally it is identical to the parametric EQ without variable "Q." Three bands are offered, each with a 20:1 frequency range, and a boost/cut capability of 14dB. As with all Sound Workshop equalizers, the new sweepable EQ is fully stable in all parameters and is totally musical in its action.

Super Group



Planned as an option for ARMS Automation is Super-Group; a unique, user oriented grouping system, which provides input subgrouping, limited only by the number of inputs in the console. Super-Group allows instant visual indication of group assignment and status and can be retro-fitted into existing ARMS Automation systems.



**The Series 1600
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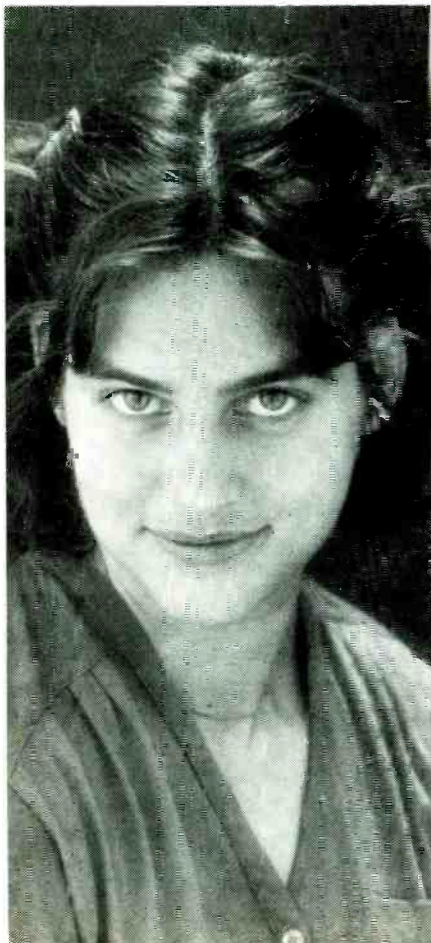


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CIRCLE 134 ON READER SERVICE CARD



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The **ASHLY** Package is a high performance line of professional signal processing equipment. It includes parametric equalizers, peak limiter/compressors, electronic crossovers, a musical instrument preamp, and a keyboard input processor.

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CIRCLE 84 ON READER SERVICE CARD

ing you refer to could be the mechanical vibration of the "chokes" on the dimmers. It could also be electronic "hash" of RF (radio frequency) emissions from the SCR's or Triacs. A properly filtered dimmer, powered by an electrical service with a good ground, should be mechanically and electronically quiet and should not interfere with your sound system.

However, even the best dimming system can affect a sound system with "ground loops." These "ground loops" are caused by interconnecting sound system components with multiple ground paths. A sound system should have *one* common ground path for *all* components to avoid dimming-system interference.

I can't diagnose or repair your problems in this column, but you should now have enough information to get headed in the right direction.

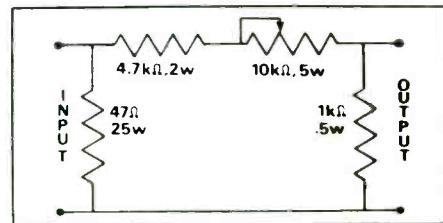
—John C. Gates
Customer Services
Capron Lighting and Sound
Needham Heights, Mass.

Convenient Conversion

How can I convert the auxiliary speaker output of a guitar amplifier into a usable mixer input signal (either high- or low-impedance) to get a direct sound when recording?

—Jerome Mascaro
Hollywood, Fl.

The accompanying schematic is for a resistive network that will pad down the auxiliary speaker output from a music amplifier. The total loss in the network, with the 10k (logarithmic taper) variable resistance at maximum value is approximately 90 dB. The loss



can be varied from this maximum figure by adjusting the 10k variable resistance. This circuit will work between an amplifier output designed to work into 8 to 16 ohms and an unbalanced Hi-Z input of *at least* 10k ohms.

—Peter Weiss
Contributing Editor
Modern Recording



MODERN RECORDING

HOW TO CHOOSE FROM SOME OF THE CHOICEST MICROPHONES WE'VE EVER MADE.



ECM-33F

ECM-150

ECM-260F

ECM-990F

ECM-56F

ECM-23F

Among recording professionals, Sony is widely recognized as an expert on microphones. That's because we're continually applying new technology to deliver better sound.

Our latest innovation is the exclusive Back Electret condenser microphone capsule, which delivers response truer than ever thought possible.

You can get this capsule in a variety of Sony mikes. And that's a bit of a problem: it's hard to know which mike is appropriate for your recording needs.

Therefore, let us clear up any confusion:

MICROPHONES THAT ARE AT HOME IN YOUR HOME STUDIO.

If you're involved in the music business and have a home studio, you need a microphone as professional as the rest of your equipment.

For all-purpose recording, we recommend the Sony ECM-56F. It's a uni-directional Back Electret condenser mike with excellent transient response, good for close miking of both instruments and voices.

For recording instruments only, the uni-directional Back Electret condenser ECM-33F

is ideal. It provides flat frequency response over the entire range, and picks up amplified and non-amplified instruments equally well.

Both of the above plug into mixers for multi-channel recording.

LOCATION MIKES, FOR STUDIO SOUND WITHOUT THE STUDIO.

But suppose you want to record on location. At a rock concert, say, or a performance of your church choir or glee club. Sony has mikes that, combined with your tape recorder, practically make up a portable studio.

Take the ECM-990F, an especially versatile and lightweight stereo Back Electret condenser mike. You can vary its directional quality to adapt for everything from solo voice to small groups to full orchestra.

Or choose an ECM-23F. It runs more than 6,500 hours on a single AA battery, and it's uni-directional. Use a pair when you want to create a stereo effect. The ECM-23F also incorporates Sony Back Electret technology.

RECORD FOR RECREATION AND STILL RECREATE NATURAL SOUND.

Maybe you just need a mike to use at

home, to record family sing-alongs. Or someone's performance on guitar or piano, for your own enjoyment.

You can still get a Sony Back Electret mike at a very affordable price. It's the ECM-260F, which plugs into a tape recorder and makes whatever you record—instrumentals, singing or speech—sound true to life.

For greatest versatility, use our ECM-150 omni-directional condenser mike. It's Sony's tiniest mike, smaller than a dime in circumference, and you can clip it to the fingerboard of a guitar or use it as a lapel or tie tack mike. (Incidentally, it's great for business conferences or any occasion when you want the mike to be inconspicuous.)

Whatever you need to record, and wherever you need to record it, there's a choice Sony mike to do the job.

And now that you know which mikes to choose, all you need to do is see your Sony dealer.

SONY

We've never put our name on anything that wasn't the best.

THE **PRODUCT** SCENE

By Norman Eisenberg

ADR EXPRESS LIMITER

Audio & Design (Recording) Ltd. has a new "Express Limiter" which employs four pots for controlling input, output, attack and release. All other functions are controlled by six gold-plated leaf-spring momentary buttons—including compressor ratio, expander and selection of meter functions to read output or gain reduction on left channel, right channel or the sum of both. The meter was especially designed by the firm's own R&D department. Turning a twist-lock at the rear provides access to the unit's PC board which, together with the front panel, may be slid out of the case. The unit is rack-mountable as well.



CIRCLE 14 ON READER SERVICE CARD

HAFLER AMPLIFIER KIT

David Hafler (who founded Dynaco years ago) now has a company under his own name which is offering the model DH-200, a stereo power amplifier in kit form. The unit is rated for 100 watts per channel, continuous average power into 8 ohms, 20 Hz to 20 kHz, both channels driven, and with distortion less than 0.02 percent. Rise time is given as: 10 kHz, 60 volts peak-to-peak square-wave, 10% to 90%: 2.5 μ sec. Slew rate is listed as: 10 kHz, 60 volts peak-to-peak square wave: 30 V/ μ sec. Says the company, the model DH-200, which is tested under "active load" conditions, produces insignificant intermodulation distortion (IIM) at half power, in contrast to some others that produce higher IIM distortion at lower power output levels.

CIRCLE 15 ON READER SERVICE CARD

FERROGRAPH TEST UNIT

The Ferrograph RTS2 is a new audio test instrument designed to measure frequency response, S/N ratio, distortion, cross-talk, wow and flutter, drift, erasure, input sensitivity, output power and gain. Providing functions that normally would require several instruments, the RTS2 is offered for use in professional studios as well as in service departments. Its applications include use with tape recorders, amplifiers, disc reproducers, dictating machines, sound on film, and so on. According to Ferrograph, the unit is fairly easy to set up and to use. Each measurement is selected from an array of pushbuttons. The device weighs 14 pounds and is a little over 17 inches wide.

CIRCLE 16 ON READER SERVICE CARD

MXR COMPANDER

Using only one basic control—an in/out switch—the MXR Componder is said to double the dynamic range of most open-reel and cassette tape decks. It works by compressing the dynamic range of signals being recorded, and expanding the signals during playback. By this technique, says MXR, noise is dramatically reduced: quiet passages are heard more clearly, and yet musical peaks come through too. The price of the Componder/Mod 19 is \$150.



CIRCLE 17 ON READER SERVICE CARD

SPEAKER KITS FROM KEF

KEF Electronics is offering two of its speaker systems in kit form. Drive units and crossover circuits are pre-mounted and wired on the front baffles. Assembly thus involves construction of the enclosures and fitting the baffles to them. One system is the model 104aB which employs a mid-bass drive unit, a tweeter and an acoustic bass radiator. Maximum power rating on program material is 100 watts. The other system is the Cantata, a full three-way system with a power rating of 150 watts.



CIRCLE 18 ON READER SERVICE CARD

JSH LINE AMP AND...

JSH Laboratories, Inc. of Tucson, Arizona, has announced its model A line amplifier. The device provides inputs and switching facilities for the Model T, or other independent, phono preamp, two high-level sources and two tape recorders. Included is a three-band equalizer with adjustable parameters. The Model A drives low-impedance loads, including speakers. Tape outputs are buffered.

For bi-amplification JSH offers the model PLX21 stereo active crossover. It may be had with a choice of 62.5, 250, 500, 800, 2500 or 6500 Hz (standard values of crossover frequency), or with any value of crossover available on order. The buyer may choose non-adjustable or factory adjustable crossover frequency, as well as a slope of 12 or 18 dB/octave.

CIRCLE 19 ON READER SERVICE CARD

NIKKO EQUALIZER; NEW AMPS

Nikko Audio has announced a 6-band, 2-channel graphic equalizer, the model EQ-2. Center frequencies are 40, 125, 400, 1.25 k, 4 k and 12.5 kHz. Each slider has a range of ± 12 dB. Rack-mountable, the device is priced at \$200.

Nikko also has added the Alpha VI stereo power amp (\$1400) rated for 300 watts per channel at 0.01% THD. The unit is rack-mountable.



CIRCLE 20 ON READER SERVICE CARD

UNI-SYNC SOUND LEVEL METER

Uni-Sync has announced its SLM-2 Sound Level Meter, which features six switchable ranges of 70, 80, 90, 100, 110 and 120 dB, allowing measurements for 60-126 dB in all. The SLM-2 has an A weight for response to human ear in checking compliance to safety regulations. It also has a C weight which provides flat response in making acoustical analysis measurements. There is a slow and a fast response setting for average and peak readings, respectively. The unit is powered by a nine-volt battery, and there is a built-in test indicator for battery strength. An output jack enables connection to external test equipment, and the unit may be mounted on a tripod via a connection for that purpose. Price of the unit will be approximately \$60.



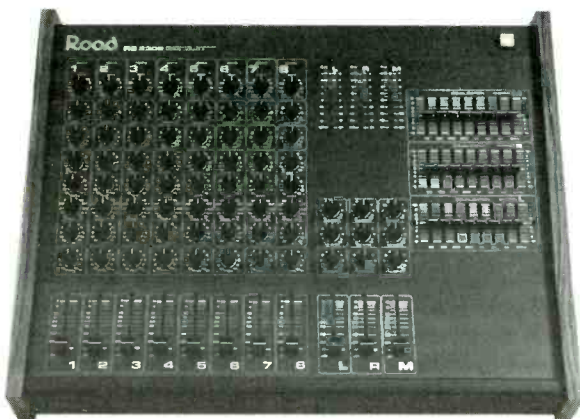
CIRCLE 21 ON READER SERVICE CARD

ROAD MIXING CONSOLES

Models RS 2308 and RS 2412 are professional mixing consoles from Road Electronics, Inc. of Los Angeles. The former model has 8 input channels. Its master section includes right and left stereo outputs, and monitor output. The midrange is selectable from 100 Hz to 10 kHz. The latter model has 12 input channels. Its master section includes left and right stereo outputs, with A and B monitor outputs; high midrange is selectable from 1 to 10 kHz.



Features common to both models include transformerless differential input amplifiers; both balanced XLR inputs and unbalanced 1/4-inch jack inputs; "parascan" tone networks; channel gain control; monitor send buses; linear input and output faders on mains and monitor; patching for channel in/out, external effects and EQ; 8-band graphic equalizers; 600-ohm balanced output capability; LED indicators; master presence, reverb, effects blend controls; and more.



CIRCLE 22 ON READER SERVICE CARD

COPYRIGHT GUIDE

Just out is a book titled "Musician's Guide to Copyright." Written by three California lawyers, it explains the fundamentals of copyright law in the U.S. (including the changes introduced by the Copyright Revision Act of 1976), and goes into details of obtaining a copyright, duration and transfer of a copyright, income from music and infringement problems. Appendixes include examples of government forms and related information. The book is bound in soft cover and contains 86 double-column pages. It is available from Bay Area Lawyers for the Arts (BALA), Fort Mason, Building 310, San Francisco, Ca. 94123 for \$7.50 plus \$1.50 for handling, postage and tax. [Why don't they simply say it costs \$9?—Ed.] According to one of the authors, the proceeds of the book go to BALA, described as a nonprofit organization dedicated to giving legal assistance to artists, including performing artists such as musicians.

CIRCLE 23 ON READER SERVICE CARD

PANASONIC'S "ANGROM"

"Angrom" is the name of an ultra-thin microcassette tape developed by Panasonic which uses a metal film applied by an evaporation process that makes its recording density a claimed ten times greater than that of conventional magnetic tape. The "Angrom" tape length for a microcassette recorder is 50 percent longer so that three hours recording is possible, as opposed to the two-hours from standard tape. Despite its thinness, "Angrom" is said to be very tough, and with improved mid- and high-frequency response.

CIRCLE 24 ON READER SERVICE CARD

E-V ISSUES "PA BIBLE"

A new guide to P.A. speaker systems, issued by Electro-Voice, is intended, says E-V, to serve as a problem solver. Titled "The PA Bible," it is written with the performing musician in mind, but is said to be also useful to the dealer who sells contract sound installations to discos and other related music environments. The guide may be ordered for \$1 from: "PA Bible," Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich. 49107.

CIRCLE 25 ON READER SERVICE CARD

BEATMETER HELPS MIX RECORDS

From Disco Tech Inc. of Pittsburgh, Pa., comes word of a new Beatmeter, a device that visually indicates the beats of two selections which are shown as flashes of light. With this unit, says Disco Tech, a beat match can be achieved faster and more easily than with traditional headphone-monitoring cueing methods. Likely users are disc-jockeys (radio and Disco), recording engineers, record producers, audiophiles and "even novice spinners."

Turntables connect to rear-panel jacks, and two more cables link the device to a mixer. Weighing 17 ounces, the Beatmeter unit measures 9 $\frac{3}{8}$ inches wide and 5 inches high.

CIRCLE 26 ON READER SERVICE CARD

INNOVATIONS

Our concern in this department is of course new products. Every now and then, however, we encounter some items that are really innovative. One such, which may be part of a new product trend, is the combination real-time analyzer and graphic equalizer. This is a "two-in-one" unit that is designed to provide the functions of what formerly have been entirely separate (and higher-cost) devices. Obviously, there are some compromises vis-a-vis true professionalism, but in view of the combo unit's relative simplicity, compactness, and low price, it is probably more important to emphasize its positive aspects.

For the first time, a good measure of serious room-tuning now can be carried out by a fairly large number of sound enthusiasts. In addition to the Audio Control C-101 [See this month's Lab Report section], there's a similar mode device from JVC. This is the model SEA-80, priced at about \$600. And Soundcraftsmen has announced news of a new model soon to be released.



Another innovation is Nakamichi's "half-speed" cassette recorder. The model 680 runs at $\frac{1}{2}$ inches-per-second and, with metal tape, boasts specs that come very close to those of top models at 1 $\frac{7}{8}$ ips. The 680 also can be used at the standard 1 $\frac{7}{8}$ ips speed for even better performance. A three-head design, the model 680 has logic control and random access capability.

Since the slower speed means double the program length time for a given length of tape, it obviously offsets the higher cost of metal tape. Price of the 680 is \$1350.



A third unique item is the hybrid headset just released by AKG. The new model K-340 combines electrostatic and dynamic sound elements to cover the frequency ranges that AKG feels each is best suited for. The electrostatic element handles signals above 5 kHz; the dynamic portion reproduces signals below that frequency. Since the former element is a small electret foil it needs no external voltage supply and no adapter, and so the K-340 may be



plugged directly into the standard headphone jack found on recorders, amplifiers, etc. The sample that I auditioned sounded great. It has the full clean bass of AKG's former top model (the K-240) plus middles and highs that are audibly clearer and smoother. Tonal definition is excellent; it is clean but it does not have the over-etched quality sometimes felt with all-electrostatic headphones. Price of this unit is about \$150.

MUSICAL

NEWSICALS

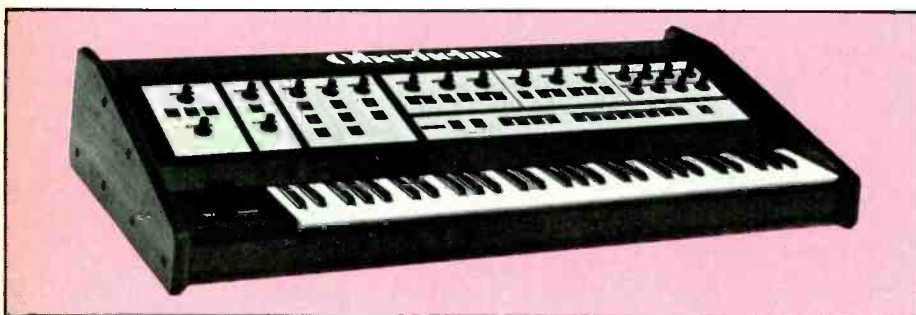
SYNTHESIZER EQUIPMENT

The Oberheim OB-X is a fully programmable four-, six- or eight-voice polyphonic synthesizer from Oberheim Electronics. The OB-X is micro-processor-controlled for maximum versatility in a truly portable package. The system has memory storage for up to thirty-two programs, plus programs may be stored directly on a tape cassette allowing the musician to build up a library of patches. A five-octave keyboard is used with the OB-X, which also features auto tune, polyphonic portamento, polyphonic sample and hold, noise generator and dual modulation levers. Each of the various polyphonic voices has two voltage controlled oscillators and an ADSR en-

addition to the 13 note pedals are seven foot operated logic selector switches with LED status indicators. One of these switches and an associated control knob select the length of the note's decay, while another switch selects the Hold mode to provide a very long (approximately sixty second) sustain time. Harmonic distortion and percussive attack are also available along with more conventional controls including tuning, volume and tone.

CIRCLE 2 ON READER SERVICE CARD

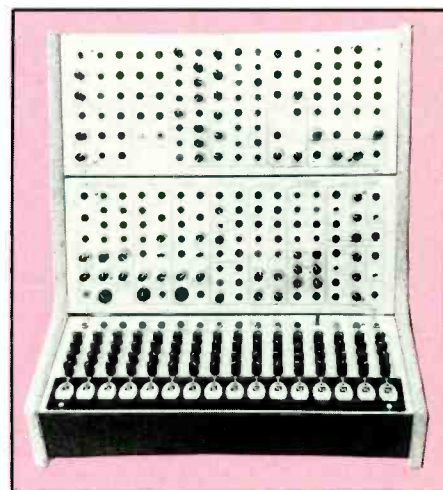
News comes from Serge Modular Music Systems of their new Series 79 synthesizer system. The Series 79 is a compact, self-contained system housed in three panels. Unlike most comparably-sized synthesizers which



CIRCLE 1 ON READER SERVICE CARD

New from Multivoxx/Sorkin Music is the MX-150 Basky Foot Pedal Bass Synthesizer. This is a 13-note unit with an octave shift for 8' or 16' sounds. In

are essentially pre-patched, the Serge system uses an interesting scheme of patch programmability within the various functional modules. This is said to allow the same degree of versatility from a relatively small system that would require a much larger system based around separate, fixed-function modules in a modular synthesizer function. Functionally, the Series 79 boasts up to nine VCOs (counting the variable Q filter, which can be used as an oscillator), and five VCAs (counting the Wave Multiplier), and a variety of signal processors including a low-pass/high-pass/band-pass/notch voltage-controlled filter with variable Q and three control inputs; phase shifter



CIRCLE 3 ON READER SERVICE CARD

with manual and voltage control and four outputs; wave multiplier; sub-harmonic generator; amplitude modulation; and linear and exponential frequency modulation. The Series 79 also features a touch activated keyboard sequencer to provide control voltage sequences in one of three patterns: 4 sequences of 16 steps each, 16 4-step sequences or a single 64-step sequence. The manual keys can be used independently or in combination with the sequencer.

MUSICAL INSTRUMENT ACCESSORIES

Audio Integrated Development, Inc. has a product known as the Play-Along which will be a boon to all those musicians who like to play along with their records but who don't want to go to the trouble of setting up their normal amplification system. The Play-Along has two pairs of RCA connectors on it which would normally be used to connect the device between the preamp and power amp or in the equalizer or tape recorder loop of the musician's stereo system. The player then connects his instrument to the 1/4-inch jack on the Play-Along and adjusts the level control to vary the

amount of his instrument which is mixed with the regular stereo signal. The unit uses a FET preamp circuit to provide clean, quiet preamplification of the instrument, and to produce a tube-like sound quality when overdriven. A 20 dB pad is included in the design to allow clean amplification from high output sources when desired. The Play-Along is powered by a 9-volt battery, and is small enough to fit in a typical guitar case.

CIRCLE 4 ON READER SERVICE CARD

SOUND REINFORCEMENT EQUIPMENT

American Acoustic Labs recently debuted their PRO line of speaker systems. The PRO line comprises ten models including floor monitors, vocal columns and modular low-frequency and high-frequency units. Modular units include single and double 12-inch and 15-inch woofers, a fourteen driver piezo-electric tweeter array and a 70° radial horn/driver plus piezo tweeter combo unit.

CIRCLE 5 ON READER SERVICE CARD



DRUMS AND ACCESSORIES

Yamaha has only been in the drum business for a little over a year, but as we have come to expect from the Japanese company they have established a position as important innovators in the field. Yamaha's concept has been to design a fully integrated line of drums, accessories and hardware which they call "System Drums." There are two basic series of drums in the Yamaha line-up, the YD-9000 drums which feature all-birch laminated shells for a crisp, bright, responsive sound, and the YD-7000 series which uses various other woods in their laminated shells for a heavier sound and somewhat deeper response. A unique additional feature of the YD-9000 series floor toms is that they are tunable while playing for greater ver-

satility or quasi-tympani sounds. Both lines use a unique Air-Seal lamination process which is said to produce a stronger shell with improved tone and sustain, and feature springless tuning lugs to eliminate the sympathetic vibrations that often cause annoying rings and buzzes. Both lines are available in natural, black, white, chrome or mirror silver finishes, and wooden and metal snare drums are available to complement either system.

On the hardware and accessory side, Yamaha has designed all-new items for non-slip positioning, silent operation and maximum strength and reliability. The high-hat stand, for example, is fully adjustable for position and tilt with locking adjustments, and uses a fully adjustable, heavy-duty pedal with nylon bushings for silent and virtually jam-proof operation.

CIRCLE 6 ON READER SERVICE CARD

Tama Drums has announced a new, top-of-the-line bass drum pedal known as the King Beat 6755. The King Beat is a heavy-duty design constructed pri-

marily of high-pressure die-cast alloy for maximum strength without excessive weight. The return spring is traditionally a weak spot of bass drum pedals, so the King Beat uses a special compression spring which has been tested to 3 million cycles without failure. The spring is contained in a sealed housing to keep dust out and lubricant in and is actuated by a special cam for smooth, quick operation; spring tension is externally adjustable without tools. The footboard of the pedal is curved to fit the contours of the drummer's foot, and features a heel height adjustment which is independent of all other adjustments.

CIRCLE 7 ON READER SERVICE CARD

Star Instruments, Inc., one of the innovators of percussion synthesizer systems, has introduced a new, low-



cost percussion synthesizer which can be mounted on the rim of any drum to produce a synthesizer signal without the bulk and expense of a full percussion synthesizer system. With the Synare Sensor, any bass drum, snare, bongo or tom-tom can become a synthesizer simply by clamping the Synare Sensor to its rim. The compact electronic sensor picks up the vibrations of the drummer's stroke transmitted through the rim and translates them into a variety of popular synthesizer sounds. Unlike some other add-on synthesizers, the Synare Sensor does not touch the drum head; it attaches to the rim of the drum on the side opposite the drummer so that it does not get in the way. An optional foot pedal is available to switch all Sensors in use on and off. With the Synare Sensor, a nine-volt battery and an amplification system (such as an instrument amp or a P.A.) are all that's necessary to produce synthesizer sounds from any drum kit.

CIRCLE 8 ON READER SERVICE CARD

MICROPHONES

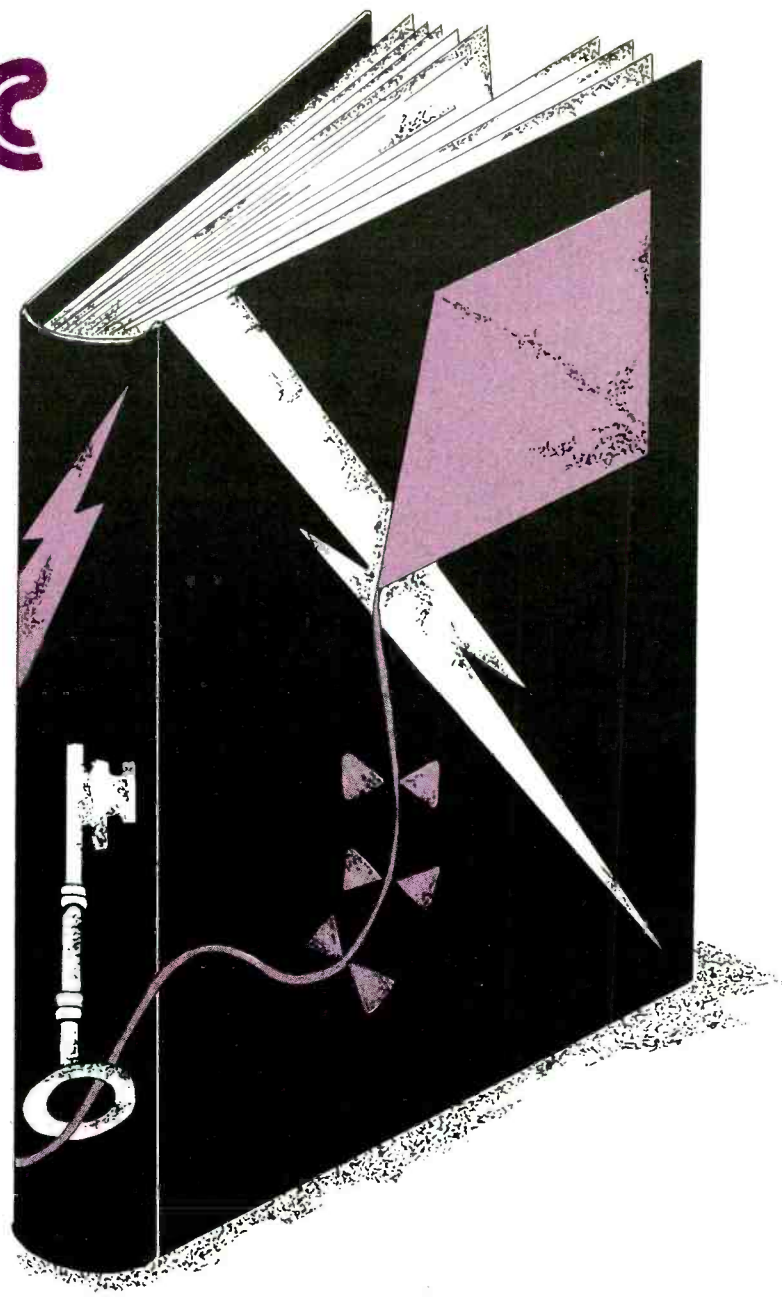
Electro-Voice, Inc. has announced a new super-cardioid dynamic mic, the RE18. The new mic is a descendant of the well-known RE15 and RE16 models and boasts the same frequency response and polar pattern as the earlier models. The main advantage of the RE18 is its freedom from handling noise which was achieved by careful design of the capsule mounting and isolation system. Like all Electro-Voice mics, the housing is a slender but rugged metal tube, and the RE18 features a two-stage Acoustifoam pop/blast filter beneath the rugged metal grille screen.

CIRCLE 9 ON READER SERVICE CARD



The ELECTRIC Primer - Part II

By Peter Weiss



This is part two of "The Electric Primer." We began this feature in last month's (September) issue. The article, as briefly outlined in the previous issue, is intended to provide the "Why" behind why recording equipment operates the way it does.

We will be covering a substantial number of formulas and laws in the beginning of this multiple-part article and then explaining how all these sometimes confusing details apply to audio and recording as we see it on a day to day basis.

MR hopes that the readers will not get bogged down with the mathematics involved; we feel that those of you handling complex recording equipment should have no problems with the straightforward presentation. Drop us a line and let us know your feelings on the matter.—Ed.

As mentioned towards the end of last month's thrill-packed episode, the idea of electrons moving around a complete path (circuit) and "experiencing" potential differences along the way (West Coast electrons, of course, *share* these experiences) is a very important one. To help get a grip on this topic a review of the concepts of voltage and potential difference is in order.

According to last month's discussion, a potential difference (also called

electromotive force, or voltage) exists between two differently charged points. A voltage will exist under these conditions even though there is no current or movement of electrons. This view of voltage or potential is fine for discussing sources of voltage and electrons such as batteries, but it is necessary to investigate a different notion of voltage, called "voltage drop" in order to take full advantage of Ohm's Law in examining D.C. circuits.

The example circuit from Part I is shown pictorially in Fig. 1 and schematically in Fig. 2. From Ohm's Law:

Current (I) = Voltage (E) ÷ Resistance (R)

Substituting the values shown in the schematic:

$$I = \frac{10 \text{ volts}}{10 \text{ ohms}}$$

I = 1 ampere (abbreviated "amp")

Starting from the negative terminal of the battery, the current can be considered as flowing through the resistance, back into the positive terminal of the battery, "through" the battery* and out the negative terminal again. It is at this point that an additional definition of voltage or potential is required. This expanded definition is consistent with previous ones, and runs as follows: *A voltage, potential difference, or emf exists between two points if an electron moving from one point to the other either gains energy (as in passing "through" a battery) or loses energy (as in passing through a resistance).*

The initial limited definition of voltage is sufficient to describe the potential difference between the battery terminals, but the new version must be called in to account for the potential difference that was stated (in Part I) to exist between the ends of the resistance. The old "cop-out" explanation that this voltage exists because the battery terminals are connected to the two ends of the resistance is not enough. Employing the new expanded concept of voltage, it can be said that in passing through the resistance the moving electrons that make up the current *lose energy*. This "lost" energy is not really lost at all, but is given off, in the case of a bulb filament, as heat and light. Because of this loss of energy in the resistance, a potential difference exists between the two ends. A potential difference between two ends of a resistance caused by a current flowing through that resistance is called "voltage drop." Voltage drops are real, in the sense that they are measurable, and are related to currents and resistances by Ohm's Law.

Before continuing with voltage drops in general, we must detour briefly to look at an important result of the voltage-drops-as-energy-loss concept. With the world energy situation looking the way it does, it seems almost sacrilegious to talk about energy loss, but the kind of energy we're examining is not exactly the kind one has to sneak past the sheik. The energy lost by electrons moving through a voltage drop (or gained by electrons passing "through" a battery) can be computed by using a formula

*Electrons don't really travel "through" the battery, but for our purposes it's easier to consider them doing so than to explain what actually happens.

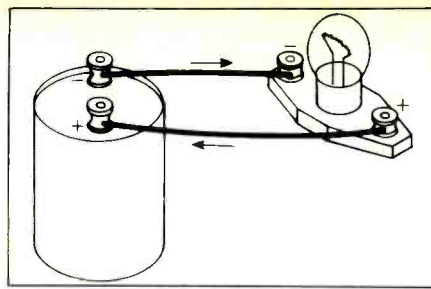


Figure 1

from physics which states:
(electrical) energy = charge × voltage

• • •

Energy as a measurable quantity is a little tricky to handle (except, it seems, for utility companies), so a more useful quantity, "energy-per-unit-time" (energy ÷ time), or *power* is used to describe how much useful work we can expect an electric current to perform in a given period of time. This same measurement will also disclose how much heat, light or mechanical energy a particular circuit element will make available to its surroundings in a given period of time. How, though, is the amount of energy-per-unit-time, or power, measured or calculated? We can develop a formula for this quantity in terms of easily measurable circuit values simply by working a mathematical trick on the formula for electrical energy,
energy = charge × voltage

We are interested in energy ÷ time, and if we divide the left side of the equation by "time," we must do likewise to the right side. So,

$$\text{power} = \frac{\text{energy}}{\text{time}} = \frac{\text{charge} \times \text{voltage}}{\text{time}}$$

Big deal. But, the right side of the equation can be rewritten (see "Math Notes"):

$$\text{power} = \frac{\text{energy}}{\text{time}} = \frac{\text{charge}}{\text{time}} \times \text{voltage}.$$

This still doesn't look like much help, unless we focus in on the term "charge/time". In Part I, the amount of electric current flowing past a point was defined as the amount of charge passing that point during a given interval of time. The formula for electric energy refers to moving charge, so the term "charge/time" is really equivalent to *current*. Now:

$$\text{power} = \frac{\text{energy}}{\text{time}} = \text{current} \times \text{voltage}$$

Using standard symbols, $P = I \times V$. This power formula can also be used to determine the power delivered by a source. In that case, the "V" should be changed to an "E" to represent an applied voltage instead of a voltage drop.

Another version of this formula is developed by replacing V or E with its Ohm's Law equivalent, $I \times R$. Then,

$$P = I \times I \times R$$

or

$$P = I^2 R$$

In the example circuit, $I = 1$ amp, $R = 10$ ohms, $E_b = 10$ Volts.

For the power supplied by the battery, $P = I_T \times E_b$

$$P = 1 \text{ amp} \times 10 \text{ volts} = 10 \text{ watts}$$

For the power dissipated in the resistance $P = (I_T)^2 \times R$

$$P = 1 \text{ amp} \times 1 \text{ amp} \times 10 \text{ ohms} = 10 \text{ watts}$$

The unit for power is the watt, named for an Englishman (James

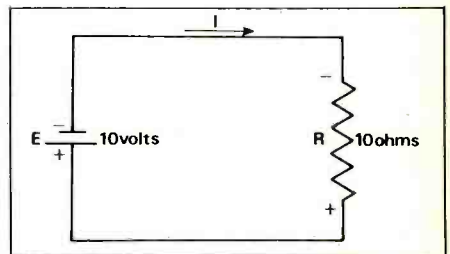


Figure 2

Watt, 1736-1819) who had practically nothing to do with electricity but a lot to do with the study of heat, work and power. Note that the power dissipated in the resistance is equal to the power supplied by the source.

Electrical devices are rated in watts, as to how much power they consume, dissipate or can dissipate. For example, ordinary house-type light bulbs are rated in watts of heat and light dissipated when connected to the recommended voltage. This rating also indicates how much power the light bulb will require from the source (and how much money the source will require from you). Actually, this last parenthetical statement is misleading. Not the money part, but what the money is paying for. Utility companies charge their customers for electrical *energy* consumed. They publish their rates in terms of cents per kilowatt-hour. At least we can be grateful it's not *dollars* per kilowatt-hour. Yet. A kilowatt-hour is, in formula-type language:

power \times time

But,

$$\text{power} = \frac{\text{energy}}{\text{time}}$$

and

$$\frac{\text{energy}}{\text{time}} \times \text{time} = \text{energy}$$

And that's what we pay for.

• • •

An example of a power rating that defines the maximum power that a device can safely handle is the rating given to components called resistors. These components are used when a specific value of resistance is required in a circuit. Besides being marked to indicate actual resistance, resistors are rated in watts or fractions of a watt according to their physical size. Larger resistors, regardless of actual resistance, can dissipate more heat, and therefore more power, than smaller resistors. If the wattage rating of a resistor is exceeded, the component will burn up. The sizes (and therefore the wattage ratings) of commercially produced resistors are standardized so that with a little practice users can spot required wattage ratings visually.

From looking at the formula for power in the form

$$P = I^2R$$

we can get a neat explanation of why the connecting wires in the example circuit (and in all other example circuits to come) are neglected in the discussions. For now at least, the connecting wires will be considered as having *zero resistance*. This is not exactly true in practice, but in most practical cases the wire resistance is so low as to be negligible. The three versions of Ohm's Law do not lend themselves to cases of zero resistance *and* current flow:

$$I = E \times R$$

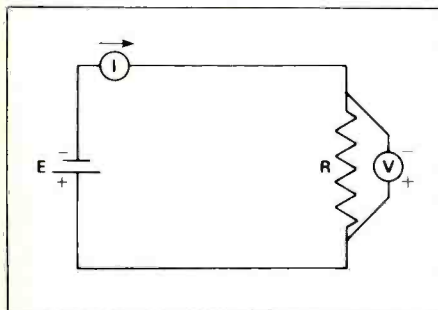


Figure 3

$$R = \frac{E}{I}$$

$$E = \frac{I}{R}$$

However, the formula for power, $P=I^2R$ gives no trouble at all. Using the current from the example circuit (1 amp) and the resistance of the connecting wire, which is zero:

$$P = (I_r)^2R$$

$$P = 1 \times 1 \times 0$$

$$P = 0 \text{ watts}$$

Not exactly earth-shaking, except when you consider that *zero power* dissipation means *zero energy loss* and therefore *zero voltage drop* across the length of the connecting wire. The connecting wires can therefore be ignored.

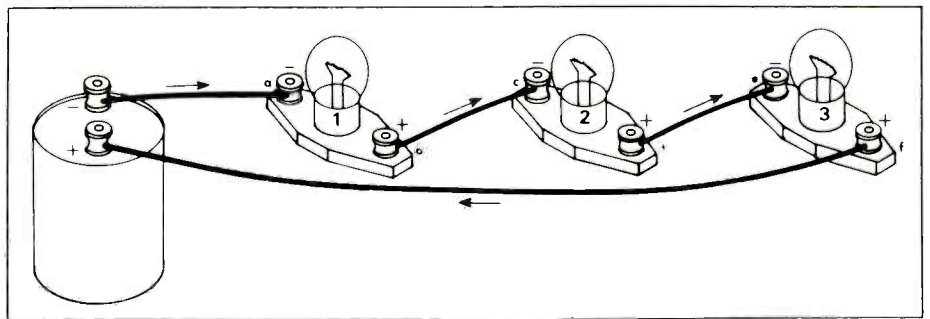


Figure 4

In practical situations, wire resistance becomes meaningful mostly in cases of extremely long runs or of wire that is carrying current near the maximum safe current for that wire. These last two points will be explained fully in future articles.

• • •

And now, back to voltage drops. In Part I, the following statement was made: "The sum of the potential difference around a complete circuit is zero." This statement is true, and of fundamental importance. However, considering our definition of voltage drop, we can rephrase this to read, "The sum of the voltage drops around a closed circuit is equal to the applied voltage." This is definitely the case in the circuit of Figs. 1 & 2. From Ohm's Law we know that the current in the circuit is 1 amp. The current "creates" a voltage drop between the two ends of the 10-ohm resistance. This voltage drop (a real voltage that can be mea-

sure) can also be found from application of Ohm's Law.

$$V = I \times R$$

$$V = 1 \text{ amp} \times 10 \text{ ohms}$$

$$V = 10 \text{ volts}$$

Since the applied voltage (in this case the battery voltage, E_s) is 10 volts, the voltage rule holds up. This rule is known as Kirchhoff's Rule for Voltages (named after Gustave Kirchhoff, 1824-1887).

Kirchhoff did not confine himself only to considering voltages. He also discovered a rule for currents. This rule is also demonstrable, although perhaps a little too simply, in the circuit of Figs. 1 & 2. This rule states: *The current entering any single point in a circuit is exactly equal to the current leaving that point.*

Pick a point in the example circuit, any point. If the chosen point is along one of the connecting wires, it is certainly true that the current entering is 1 amp and the current leaving is 1 amp, since the current in the entire circuit is 1 amp. This is so because electrons, although they will share an experience, are reluctant to share their own spaces. Electrons will not bunch up or spread out around a circuit, or in any circuit element or wire, when current is flowing. But that's okay. Electrons are perfect just the way they are. Kirchhoff's Rule for currents is a direct result of this "incompressibility" of moving charge.

• • •

To what use will we put all of these laws and rules? It is traditional that early in the process of discovering the delights of D.C. circuit theory newcomers be required to learn how to figure out voltages, currents, power dissipations and effective resistances

for circuit schematics that look like Oriental rug weavers' pipe dreams. Our readers will not be asked to endure this kind of initiation rite. However, an understanding of how resistances combine in different interconnection configurations, and how voltages, currents and power dissipations are distributed in these configurations, is a valuable tool for handling future topics that must be dealt with.

• • •

In the upcoming discussions of circuit configurations, references are made to voltages, voltage drops, currents, resistances and power dissipations. These values are labeled in a straight-forward way, both in schematics and in the text. Resistances are represented by the standard schematic symbol and labeled using upper case "Rs" with numbered or lettered subscripts. Voltage drops between the ends of individual resistances are labeled with upper case "Vs" having subscripts corresponding to the appropriate resistance subscript. Applied voltages are represented by "Es" with subscripts. Currents are labeled using upper case "Is" with subscripts, and power dissipations using "Ps" with subscripts. Using this scheme, "V₃" represents the voltage drop across the resistance "R₃," and "I₃" represents the current flowing through R₃. Current subscripts will not always correspond to resistance subscripts, but in any case the labeling will be clear.

For purposes of clarity in schematics, voltages and currents are represented by the devices used to measure these values. Voltmeters are shown as circles containing a V with the proper subscript, and ammeters (current measuring devices) as circles containing Is with subscripts. These meter symbols are used to indicate the existence of measurable voltages or currents, not the presence of an actual meter in the circuit. Fig. 3 is the circuit of Figs. 1 & 2 redrawn with voltmeter and ammeter symbols in the proper places. Note that the voltmeter is connected across the points between which the measured voltage drop exists, and the ammeter is connected into the conductor through which the measured current flows.

In practical cases these measuring devices are connected as shown in Fig.

3: voltmeters "across" the voltage to be measured, with no disruption of the circuit required, and ammeters inserted into the circuit. With the preliminaries now out of the way, the discussion of circuits can begin.

Fig. 4 is a representation of a circuit made up of a battery, three light bulbs and interconnecting wires. Fig. 5 is a schematic of this circuit. Note that if a bulb filament should break, a complete circuit would no longer exist, no current would flow and *all* the bulbs would be dark. In this circuit configuration the filaments are said to be connected *in series*.

In the circuit of Fig. 5, the battery voltage E_B is known (E_B=16 volts), as are the resistances of the individual filaments (R₁=12 ohms, R₂=6 ohms, R₃=14 ohms). We want to find the total current, I_T, the total power dissipated in the circuit, P_T and the power dissipated in each resistor (P₁, P₂, P₃). From Ohm's Law we know that:

$$I_T = \frac{V_T}{R_T}$$

Again V_T=E_B=16 volts, but what about R_T? The circuit of Fig. 5 can be redrawn to show R_T replacing the combination of R₁, R₂, & R₃, and this is done in Fig. 6. However, the way in which R₁, R₂ and R₃ combine to form R_T is still not known. A guess can be made, that since I_T flows through R₁, R₂ and R₃, the total resistance of the combination might just be the sum of the individual resistances. This is plausible but guesses are not enough. A precise and sure way of discovering how resistances combine *in series* is to apply the laws and rules discussed so far in these pages.

• • •

From Kirchoff's Rule for Voltages it is known that the sum of the voltage drops (V₁, V₂, V₃) around a closed circuit is equal to the applied voltage (E_B). Written in the form of an equation (see "Math Notes"):

$$E_B = V_T = V_1 + V_2 + V_3$$

Ohm's Law can be used to rewrite each of these voltages as a product of a current and a resistance. Since V_T is measured across R_T, it can be represented by I_T × R_T. Similarly, V₁=I_T × R₁; V₂=I_T × R₂; V₃=I_T × R₃. So:

$$I_T \times R_T = I_T \times R_1 + I_T \times R_2 + I_T \times R_3$$

The portion of this equation to the

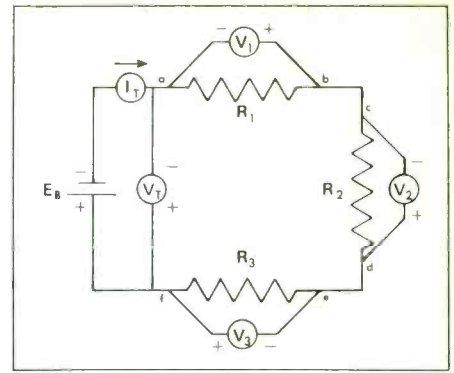


Figure 5

right of the equal sign is a bit complicated, but it can be simplified (see "Math Notes"):

$$I_T \times R_T = I_T (R_1 + R_2 + R_3)$$

According to the rules for working with equations, I_T can be eliminated from both sides of the equation by dividing both sides by I_T. This process leaves:

$$R_T = R_1 + R_2 + R_3$$

Not bad guessing, after all. Now that R_T can be found,

$$R_T = R_1 + R_2 + R_3$$

$$R_T = 12 \text{ ohms} + 8 \text{ ohms} + 10 \text{ ohms}$$

$$R_T = 32 \text{ ohms}$$

I_T, P_T, V₁, V₂, V₃, P₁, P₂, and P₃ can all be found. Here goes:

$$I_T = \frac{V_T}{R_T}$$

$$I_T = \frac{16 \text{ volts}}{32 \text{ ohms}}$$

$$I_T = \frac{1}{2} \text{ amp or } .5 \text{ amp}$$

In any simple-series circuit the current is the same throughout the entire circuit.

For the voltage drops:

$$V_1 = I_T \times R_1$$

$$V_1 = .5 \text{ amp} \times 12 \text{ ohms}$$

$$V_1 = 6 \text{ volts}$$

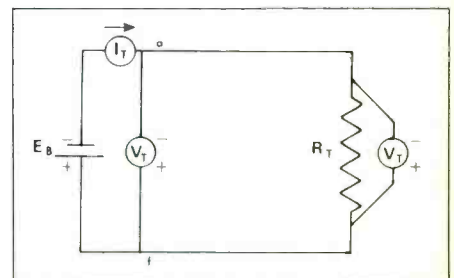


Figure 6

$$V_2 = I_T \times R_2$$

$$V_2 = .5 \text{ amp} \times 6 \text{ ohms}$$

$$V_2 = 3 \text{ volts}$$

$$V_3 = I_T \times R_3$$

$$V_3 = .5 \text{ amp} \times 14 \text{ ohms}$$

$$V_3 = 7 \text{ volts}$$

$$E_b = V_T = 16 \text{ volts}$$

and

$$V_T = V_1 + V_2 + V_3$$

$$V_T = 16 \text{ volts} = 6 \text{ volts} + 3 \text{ volts} + 7 \text{ volts}$$

$$16 \text{ volts} = 16 \text{ volts}$$

Kirchhoff was right!

For the power delivered by the battery, P_B :

$$P_B = I_T \times E_b$$

$$P_B = .5 \text{ amp} \times 16 \text{ volts}$$

$$P_B = 8 \text{ watts}$$

For the power dissipated in the circuit, P_T :

$$P_T = (I_T)^2 \times R_T$$

$$P_T = .5 \text{ amp} \times .5 \text{ amp} \times 32 \text{ ohms}$$

$$P_T = (.25 \times 32) \text{ watts}$$

$$P_T = 8 \text{ watts}$$

Now for the individual power dissipations:

$$P_1 = V_1 \times I_T$$

$$P_1 = 6 \text{ volts} \times .5 \text{ amp}$$

$$P_1 = 3 \text{ watts}$$

$$P_2 = V_2 \times I_T$$

$$P_2 = 3 \text{ volts} \times .5 \text{ amp}$$

$$P_2 = 1.5 \text{ watts}$$

Math Notes

Fractions

The fraction bar is actually a division sign, signifying that the top number (called the numerator) is to be divided by the bottom number (called the denominator):

$$\frac{\text{numerator}}{\text{denominator}}$$

If the top number is larger than the bottom number the result of the division will be a number greater than 1. If the top number is smaller than the bottom number the result will be less than 1.

Examples:

$$\frac{1}{2} \text{ means } 2\sqrt{1.0} = .5$$

and

$$\frac{4}{2} = 2\sqrt{4} = 2$$

Other rules:

$$\frac{\text{anything (except zero)}}{\text{the same anything}} = 1$$

$$\frac{\text{anything (incl. zero)}}{1} = \text{the same anything}$$

$$\frac{\text{zero}}{\text{anything (except zero)}} = 0$$

$$\frac{\text{anything}}{\text{zero}} \text{ is meaningless}$$

Multiplying fractions is easy. Just multiply the numerators together to get the numerator of the answer, and multiply the denominators together to get the denominator of the answer. For example:

$$\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} = \frac{1 \times 2 \times 3}{2 \times 3 \times 4} = \frac{6}{24}$$

The answer of 6/24 is correct, but it can be

transformed into a simpler equivalent fraction which is also correct. Look at the intermediate step:

$$\frac{1 \times 2 \times 3}{2 \times 3 \times 4}$$

Aren't $1 \times 2 \times 3$ and $2 \times 3 \times 1$ identical, that is, equal to 6? They *are* identical, since order in multiplication (of fractions or anything else) doesn't affect results. So,

$$\frac{1 \times 2 \times 3}{2 \times 3 \times 4} = \frac{2 \times 3 \times 1}{2 \times 3 \times 4}$$

Now,

$$\frac{2 \times 3 \times 1}{2 \times 3 \times 4}$$

can be written as if it were the result of multiplying three fractions:

$$\frac{2}{2} \times \frac{3}{3} \times \frac{1}{4} = 1 \times 1 \times \frac{1}{4} = \frac{1}{4}$$

To recap:

$$\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} = \frac{1 \times 2 \times 3}{2 \times 3 \times 4} = \frac{2 \times 3 \times 1}{2 \times 3 \times 4} = \frac{6}{24}$$

$$\frac{2 \times 3 \times 1}{2 \times 3 \times 4} = \frac{2}{2} \times \frac{3}{3} \times \frac{1}{4} = 1 \times 1 \times \frac{1}{4} = \frac{1}{4}$$

Both 6/24 and 1/4 are correct, and are the same number.

Dividing fractions is a little trickier than multiplying them, but not much. What does the term $1/1/2$ mean? According to our definition of the fraction bar it means $1/2\sqrt{1}$. How many halves are there in 1? Two. Then $1/1/2 = 2$. To illustrate a short cut for this type of division write 2 as

$$\frac{2}{1}. \text{ Then } \frac{1}{1/2} = \frac{2}{1}$$

As a general rule, whenever a fraction appears in a denominator with 1 as the numerator, invert the fraction to get an equivalent number which is easier to handle. Other examples:

$$\frac{1}{3/4} = \frac{4}{3}$$

$$\frac{1}{2/3} = \frac{3}{2}$$

$$\frac{1}{\text{something}}$$

is called the *reciprocal* of that something.

When both numerator and denominator are fractions, the division process indicated by the main fraction bar is based on the facts just explained. For example:

$$\frac{2/3}{1/2} = ?$$

This means $1/2\sqrt{2/3}$. The original complicated fraction, which has fractions in both numerator and denominator can be re-written in an equivalent form:

$$\frac{2/3}{1/2} = \frac{2/3}{1} \times \frac{1}{1/2}$$

$$\text{But } \frac{1}{1/2} = \frac{2}{1} \text{ and } \frac{2/3}{1} \text{ is } \frac{2}{3}$$

Now the original problem, which was a division of fractions can be handled as a multiplication of fractions. So,

$$\frac{2/3}{1/2} = \frac{2}{3} \times \frac{2}{1} = \frac{4}{3}$$

Adding and subtracting fractions is simple when the fractions have the same denominators. Just add numerators and keep the "family" denominator. Example:

$$\frac{1}{3} + \frac{1}{3} = \frac{2}{3}$$

When fractions with *different* denominators have to be added or subtracted, the fractions must all be transformed into equivalent fractions all having the same denominator. To add $1/2 + 1/4$, we must first see that $1/2$ can be written as $2/4$. Then $1/2 + 1/4$ becomes $2/4 + 1/4$ which is $3/4$. Things are not always this simple (see the formula and numerical example for parallel resistances in the main text).

$$\frac{1}{6} + \frac{1}{12} + \frac{1}{4} = \frac{1}{R_T}$$

in this case, we find that

$$P_3 = V_3 \times I_T$$

$$P_3 = 7 \text{ volts} \times .5 \text{ amp}$$

$$P_3 = 3.5 \text{ watts}$$

$$P_1 + P_2 + P_3 = 3 \text{ watts} + 1.5 \text{ watts} + 3.5 \text{ watts}$$

$$P_1 + P_2 + P_3 = 8 \text{ watts} = P_T$$

Another rule is contained in this last addition: *The total power dissipated in a circuit is equal to the sum of the individual power dissipations and also equal to the total power supplied to the circuit.*

• • •

There is one other basic configuration of circuit elements to discuss, and such an arrangement is illustrated in Fig. 7. The circuit consists of a battery and three light bulbs, as before, but the method of connection is different. Each of the bulbs is connected to the battery terminals ("across" the battery terminals). This configuration is called a *parallel* combination. Note that if one filament should break, current will continue to flow through the other two. If two should break, current will still flow through the

remaining filament. Fig. 8 is the schematic of this circuit. Once again, the applied voltage E_B is known ($E_B=12$ volts), as are the individual filament resistances $R_1=12$ ohms, $R_2=6$ ohms and $R_3=4$ ohms. The values to be found are: R_T , I_T , I_1 , I_2 , I_3 , P_1 , P_2 and P_3 . First, it will be helpful to represent the portion of the circuit made up of the parallel combination of resistances by the equivalent total resistance— R_T . Fig. 9 shows this substitution. Note that R_T is between points a and f. Thus, $E_B=V_T=12$ volts. Also, referring back to Fig. 8, $V_T=V_1=V_2=V_3$, since all of these

$$\frac{1}{6} = \frac{2}{12} \quad \text{and} \quad \frac{1}{4} = \frac{3}{12}$$

Substituting,

$$\frac{2}{12} + \frac{1}{12} + \frac{3}{12} = \frac{6}{12} = \frac{1}{2}$$

Not too bad, but what about something like

$$\frac{1}{3} + \frac{1}{7} + \frac{1}{5} ?$$

Here, the denominators are not neatly related to each other as in the previous example. How do we find a suitable denominator? The easiest way to find a new denominator that all of the original denominators will divide into evenly is just to multiply the denominators together — $3 \times 7 \times 5 = 105$. Then convert

$$\frac{1}{3} \text{ to } \frac{?}{105}, \quad \frac{1}{7} \text{ to } \frac{?}{105}, \quad \text{and} \quad \frac{1}{5} \text{ to } \frac{?}{105},$$

In order to perform this miracle we must establish some rules about the most important tool in math—the equation. An equation, which has two groups of terms, one on each side of an equal sign, relates the two groups of terms by stating that they are *identical*. (A group of terms may have only one term.) The statement

$$\frac{1}{2} = \frac{2}{4}$$

is an equation in which all terms are known, and this equation is certainly true, but can we prove it?

If an equation is a statement of identity, then whatever mathematical processes are done to one "side" of the statement (to the left or the right of the equal sign) must be done to the other "side" in order to maintain the "truth" of the statement. To "prove" that $\frac{1}{2} = \frac{2}{4}$

we will use this "both sides" rule.

$$\frac{1}{2} \stackrel{?}{=} \frac{2}{4}$$

First, multiply *both* sides of the equation by 2 or

$$\frac{2}{1} \times \frac{1}{2} = \frac{2}{4} \times \frac{2}{1}$$

This leaves

$$\frac{2}{2} = \frac{4}{4} \quad \text{or} \quad 1 = 1$$

The "truth" of this last statement is tough to dispute and proves the truth of the original statement

$$\frac{1}{2} = \frac{2}{4}$$

How can we use these facts to find a number in an equation where one is missing such as

$$\frac{1}{5} = \frac{?}{105} \quad \text{or} \quad \frac{1}{3} = \frac{?}{105} \quad \text{or} \quad \frac{1}{7} = \frac{?}{105} ?$$

The process is exactly the same, except that we treat "?" as a number. Let's start with

$$\frac{1}{5} = \frac{?}{105}$$

Multiply both sides by 5:

$$\frac{5}{1} \times \frac{1}{5} = \frac{?}{105} \times \frac{5}{1} \quad \text{or} \quad 1 = \frac{5 \times ?}{105}$$

Now multiply both sides by 105:

$$105 \times 1 = \frac{5 \times ?}{105} \times \frac{105}{1}$$

which gives $105 = 5 \times ?$. Now divide both sides by 5 again:

$$\frac{105}{5} = \frac{5 \times ?}{5}$$

$$21 = \frac{5}{5} \times \frac{?}{1}$$

$$21 = 1 \times ?$$

$$21 = ?$$

Therefore,

$$\frac{1}{5} = \frac{21}{105}$$

Similarly it can be found that

$$\frac{1}{3} = \frac{35}{105} \quad \text{and} \quad \frac{1}{7} = \frac{15}{105}$$

Then

$$\frac{1}{3} + \frac{1}{5} + \frac{1}{7} = \frac{35}{105} + \frac{21}{105} + \frac{15}{105} = \frac{71}{105}$$

There are other math rules and symbols in this month's article that also will come up in future articles. One of the most important will involve parentheses. Enclosing a group of terms in parentheses indicates that the entire group is to function in an equation or formula (a type of equation) as a single term. Also, if an operation, such as multiplication by a number, is indicated to be performed on a group of terms in parentheses, this operation must be performed on *every term* within the parentheses. For example: $4 \times (3 + 2 + 5)$ means $4 \times 3 + 4 \times 2 + 4 \times 5$. The multiplication by 4 is "distributed" among all the terms. It makes no difference whether the multiplication or the addition is done first:

$$4 \times (3 + 2 + 5) = 4 \times 10 = 40;$$

$$4 \times (3 + 2 + 5) = 4 \times 3 + 4 \times 2 + 4 \times 5 = 12 + 8 + 20 = 40,$$

but it is important to know what the parentheses symbol means. Terms inside parentheses will not always be known numbers, but may be letters representing unknown quantities. An example of this is found in the portion of the text dealing with the development of the formula for resistances in parallel.

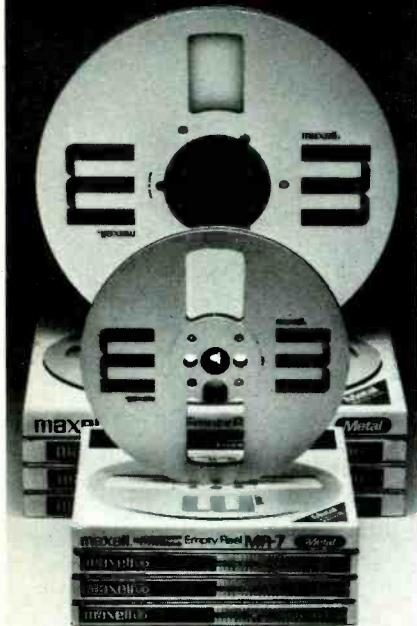
Other mathematical situations will come up in the future, especially when we cover alternating current (coming soon; watch your local listings). As these topics are dealt with, appropriate math notes will be given.

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voltages appear across points a and f. But how R_1 , R_2 and R_3 combine to form R_T is not known, and is not immediately evident from the schematics.

In order to find I_T from Ohm's Law, $I_T = V_T / R_T$, an expression must be found for R_T —the effective total resistance of the combination of R_1 , R_2 , and R_3 . To begin this process, trace the flow of current through the circuit, bearing in mind Kirchhoff's Rule for Currents and the fact that if a current— I_T —flows out of the negative battery terminal, the same current (I_T) flows into the positive battery terminal. In the piece of connecting wire between the negative battery terminal and the point marked "a," the current is I_T . At point "a" the current divides, with I_1 flowing through R_1 , and the remainder, $I_T - I_1$, flowing from a to b. At "b," this current divides, with I_2 flowing through R_2 and the remainder, $I_T - I_1 - I_2$, flowing from b to c. This current— $I_T - I_1 - I_2$ —is I_3 , since there is no other path to follow.

From here, I_3 and I_2 recombine at point "e," and the resulting current, $I_2 + I_3$, combines with I_1 at "f," resulting in $I_1 + I_2 + I_3$. From "f" to the positive battery terminal the current is I_T . The verbal description just given is an example of an application of Kirchhoff's Rule for Currents.

Backtracking a bit, we found that the current flowing from b to c— $I_T - I_1 - I_2$ —was equal to I_3 . Setting up an equation to express this relationship gives:

$$I_3 = I_T - I_1 - I_2$$

Adding I_1 , and then I_2 to both sides of the equation:

$$I_1 + I_2 + I_3 = I_T - I_1 - I_2 + I_1 + I_2$$

or

$$I_1 + I_2 + I_3 = I_T$$

This is a true statement, as can be seen from the current-tracing procedure.

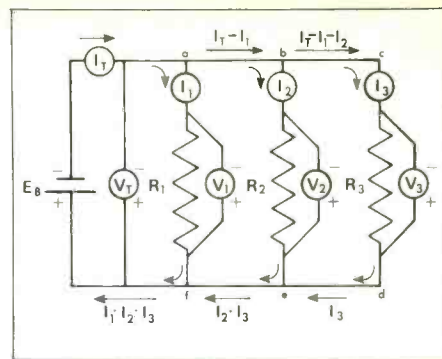


Figure 8

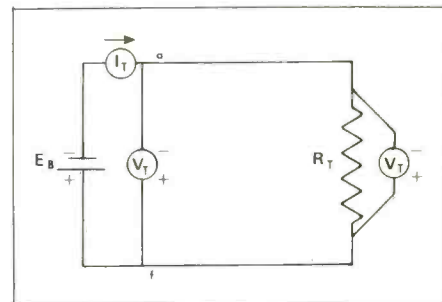


Figure 9

We could find I_T by finding I_1 , I_2 and I_3 individually (remember $V_B = V_T = V_1 = V_2 = V_3$), using Ohm's Law:

$$I_1 = \frac{V_1}{R_1} = \frac{12 \text{ volts}}{12 \text{ ohms}} = 1 \text{ amp}$$

$$I_2 = \frac{V_2}{R_2} = \frac{12 \text{ volts}}{6 \text{ ohms}} = 2 \text{ amps}$$

$$I_3 = \frac{V_3}{R_3} = \frac{12 \text{ volts}}{4 \text{ ohms}} = 3 \text{ amps}$$

Note that the greatest current flows in the branch with the least resistance. (Electrons are also known to be self-indulgent and lazy.)

Then:

$$I_T = 1 \text{ amp} + 2 \text{ amps} + 3 \text{ amps}$$

$$I_T = 6 \text{ amps}$$

From this information we could then find R_T from Ohm's Law:

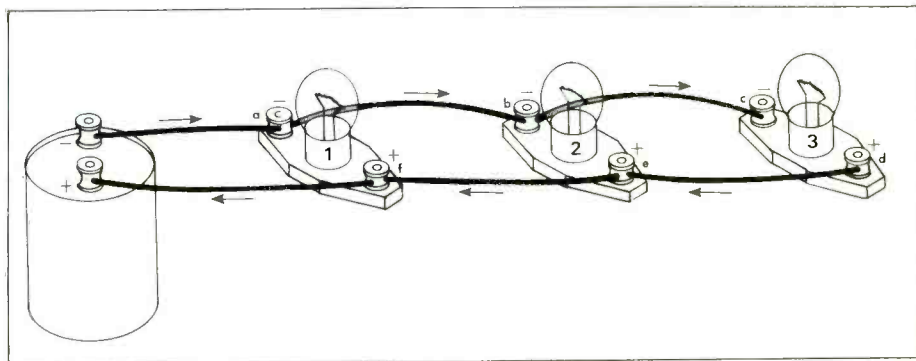


Figure 7

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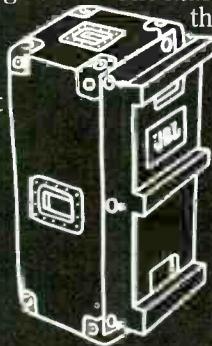
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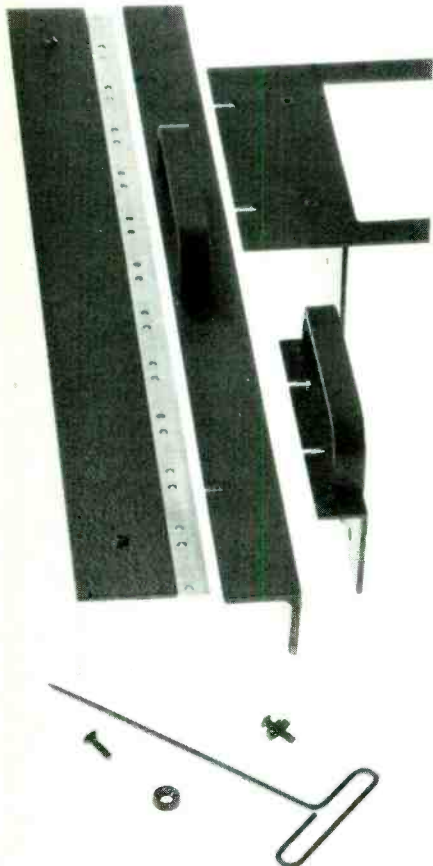
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CIRCLE 41 ON READER SERVICE CARD

$$R_T = \frac{V_T}{I_T}$$

$$R_T = \frac{12 \text{ volts}}{6 \text{ amps}}$$

$$R_T = 2 \text{ ohms}$$

This value for R_T must be correct, but it would be more useful to investigate how R_T can be found from the values of R_1 , R_2 and R_3 . Returning to the original current-summing equation:

$$I_T = I_1 + I_2 + I_3$$

we must start with only the applied voltage

$$(E_B = V_T = V_1 = V_2 = V_3 = 12 \text{ volts})$$

and the individual resistances (R_1 , R_2 and R_3) as known quantities. First, we will rewrite all the currents in the current-summing equation as quotients of voltages and resistances:

$$\frac{V_T}{R_T} = \frac{V_1}{R_1} + \frac{V_2}{R_2} + \frac{V_3}{R_3}$$

or, since $V_T = V_1 = V_2 = V_3$:

$$\frac{V_T}{R_T} = \frac{V_T}{R_1} + \frac{V_T}{R_2} + \frac{V_T}{R_3}$$

Simplifying the right side:

$$\frac{V_T}{R_T} = V_T \left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \right)$$

Dividing both sides by V_T leaves:

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

This is the general form for the total effective resistance of a simple parallel combination of resistances. This formula is valid for any number of resistances in parallel:

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4} + \dots + \frac{1}{R_n}$$

Substituting the values for the individual resistances in the example circuit:

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$\frac{1}{R_T} = \frac{1}{12 \text{ ohms}} + \frac{1}{6 \text{ ohms}} + \frac{1}{4 \text{ ohms}}$$

Finding a common denominator for the right side:

$$\frac{1}{R_T} = \frac{1}{12} + \frac{2}{12} + \frac{3}{12}$$

$$\frac{1}{R_T} = \frac{1+2+3}{12}$$

*The "n" subscript indicates that the formula can contain any required number of terms.

$$\frac{1}{R_T} = \frac{6}{12}$$

$$R_T = \frac{12}{6} = 2 \text{ ohms}$$

which agrees with the Ohm's Law result. Note that 2 ohms is a lower resistance than any of the individual resistances making up the combination. This is always true for parallel combinations and is a very important point to remember, since many applications of this fact will come up during future discussions.

Now for power dissipation:

$$P_T = I_T \times V_T$$

$$P_T = 6 \text{ amps} \times 12 \text{ volts}$$

$$P_T = 72 \text{ watts}$$

$$P_1 = I_1^2 R_1$$

$$P_1 = 1 \text{ amp} \times 1 \text{ amp} \times 12 \text{ ohms}$$

$$P_1 = 12 \text{ watts}$$

$$P_2 = I_2^2 R_2$$

$$P_2 = 2 \text{ amps} \times 2 \text{ amps} \times 6 \text{ ohms}$$

$$P_2 = (4 \times 6) \text{ watts}$$

$$P_2 = 24 \text{ watts}$$

$$P_3 = I_3^2 R_3$$

$$P_3 = 3 \text{ amps} \times 3 \text{ amps} \times 4 \text{ ohms}$$

$$P_3 = (9 \times 4) \text{ watts}$$

$$P_3 = 36 \text{ watts}$$

$$P_1 + P_2 + P_3 = 12 \text{ watts} + 24 \text{ watts} + 36 \text{ watts}$$

$$P_1 + P_2 + P_3 = 72 \text{ watts} = P_T$$

Too much excitement can be hazardous to your health; so in the interest of reader safety we will end here, and resume the merriment in next month's issue.



The following books served as source material for this article, and are suggested reading for those interested in obtaining additional information.

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CIRCLE 139 ON READER SERVICE CARD

a session with **PETER FRAMPTON**

By Nina Stern

Peter Frampton began work on [his most recent release] Where I Should Be early in 1979 at Cherokee Studios, located in Hollywood. After several months of recording, with interruptions and "various engineers... sort of falling through," Frampton re-teamed with [his] long-time chief engineer Chris Kimsey and the two moved the project to Filmways/Heider [also in Hollywood] for completion.

Tim Boyle, who seconded for Kimsey, comments on the Where I Should Be set-up and the Frampton/Kimsey production philosophy.

Modern Recording: Peter has produced all his solo albums, hasn't he?

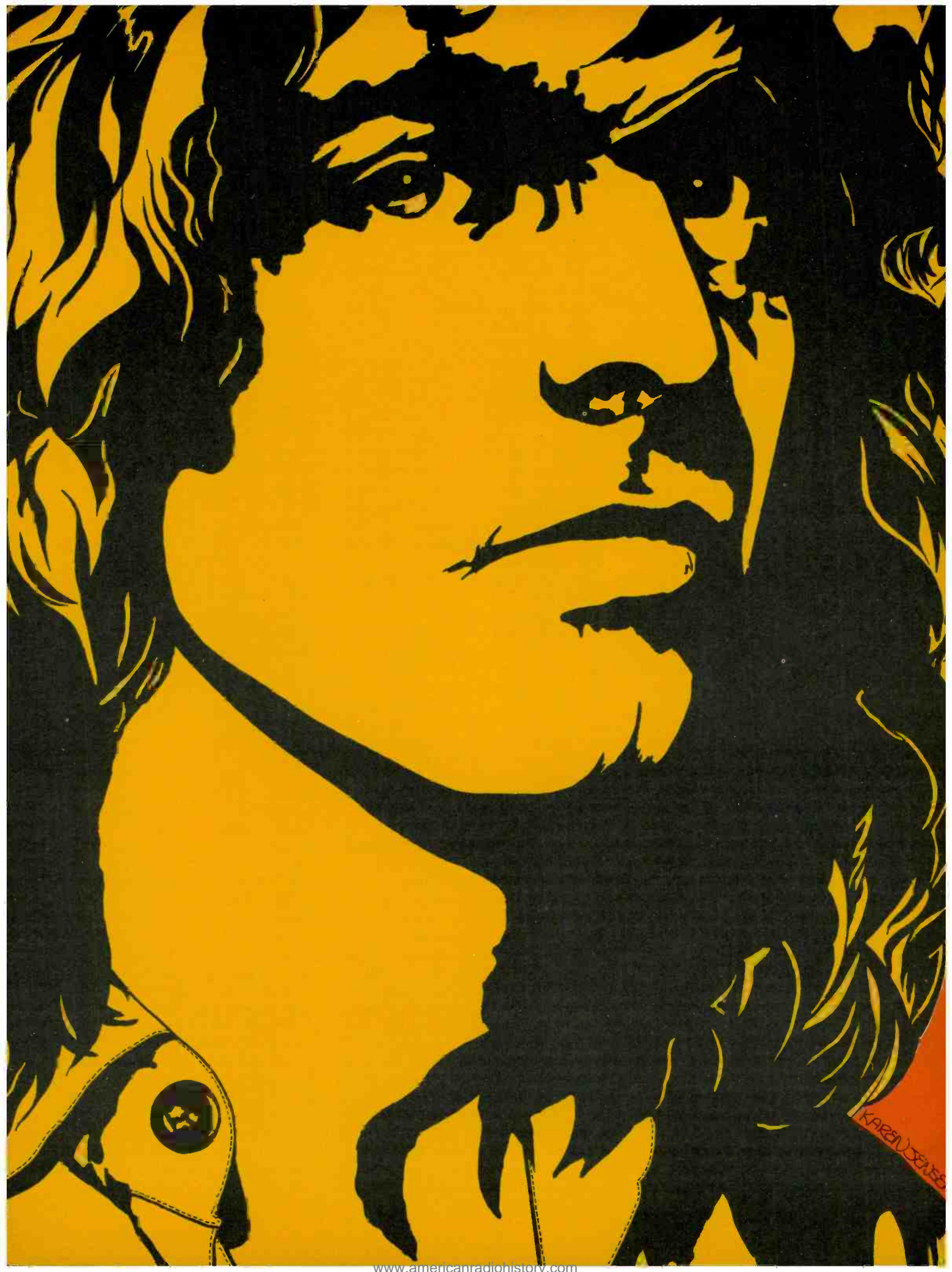
Tim Boyle: Yes. It's unusual, but he's really on top of it. He does a real good job as a musician. He's real quick, most of his stuff is one-takers. And he knows engineering as well—he knows enough to do a real good job. He and Chris Kimsey are co-producers on this latest album.

Peter's involved in recording and mixing the album. In fact, he engineered one of the tunes himself. The project started in Cherokee Studios and he engineered a lot of that. Tony D'Amico did a lot of the engineering on the first part of the album; he did a great job as well.

Since we've been here [Filmways/Heider], we've done five tracks, of which we've kept four for the album. That all happened in less than a week—we did the basic tracks in four of five days, and since then, it's been overdubs. There've been lay-offs here too—we had to leave this studio and go to Sound City, where we've done six days. But that really slows down the process, you know.

Actually, the project was begun the first of the year, but there's been time off. Peter's accident had something to do with that, too. Plus, when Chris and I started we re-did two or three of the tracks. If things had gone differently, had Chris been available at the start





KAREN JOHNSON

... it would have taken half this long (over four months studio time).

MR: This is the first album he's done all in California studios, isn't it?

TB: Yes. Peter's worked a lot in New York studios and a lot in Olympic in England. He talks a lot about that. In fact, he's said that this is the first studio (studio B at Heider's) that even approaches Olympic Studios. He is really happy with the room here. Number one is that he likes the big-sized room. The English approach to recording is that they like distance miking, especially on the drums. They enjoy big sound and bigger control rooms.

M.R.: Have you maintained a basic set-up, or sound, in the studio?

TB: Well, speaking about the tracks that Chris and I have worked on, basically what we did was take half this room and put the drums towards the center so that there's a half-moon effect, the drummer looking straight at the control room. We put the bass on the far side, then Peter's guitar, then on the other side of the [drum] kit there's another guitar like, say, Steve Cropper, who played on the album, then piano, organ, all the keyboards—including a Wurlitzer, an acoustic piano, a Fender Rhodes. Then later we did a lot of overdubs with the Yamaha CS 80 piano, that was after the whole set was broken down. The basic lay-out stays the same, though. We set it up once and leave it that way. What that [set-up] does is let everybody see each other—and it gives the opportunity of close sound, even though you are doing some distance miking. There's not a lot of separation; you don't have a lot of phase problems. It's really incredible. They put two mics about twenty feet in the air—two AKG C414s—and back twenty feet, so the hypotenuse from the drums is about 40 feet. And they actually do get a stereo effect, you can hear the right and left side of the kit.

This room is big for a recording studio, but it's not big for a sound stage. Americans use big rooms for big orchestras, small rooms for bands. The English like big rooms for everything. It's just a different approach to recording.

MR: Are there "live" vocals?

TB: In some cases "live," in some cases overdubbed. In the tune "Sad Affair," a really lovely tune, a ballad, Peter did a "live" vocal. He's an incredible "live" singer and he loves the "live" sound.

MR: How is he miked?

TB: If there's a chance that it's going to be a "live" vocal, we use the [Shure] SM56. It is a good microphone and it has good directionality. Most vocal overdubs are done on the [Neumann] U47s. Heider's actually has some of the best around. There is a tube used in that mic—a VF-14 tube—which is no longer made. There's a later version solid-state tube, but it doesn't sound nearly as good. Heider's located a number of the original tubes several years ago, though, so we have new VF-14s in all our U47s. They're truly phenomenal; they sound absolutely great!

MR: Where were they found?

TB: In Germany. Someone with the company at that time located them. They're extremely expensive—I think they're over \$200, just for the tube. I think we got about 15 of them. We've used U47s on strings, on percussion, on all the vocals, as guitar microphones during this project; there's not a thing you can't do with them, and they are extremely accurate.

MR: Do you do any direct recording of the guitars?

TB: None on guitars; it's all miked.

MR: Any delay or special effects with the guitar recording?

TB: Yes, a very interesting set-up on Peter's guitar. The lay-out for what he calls his "live" sound utilizes a [Fender] Bassman amplifier and an Ampeg amplifier and a Leslie guitar amp as well. It's got four sources and four microphones. Chris came up with a spacing effect for the microphones; it's an amazing sound. The solo on "Sad Affair" is an example of that. The Leslie comes in and is switched out during the solo.

We used two U47s for the Bassman and the Ampeg and we use a 47 on the top of the Leslie and an SM56 on the bottom of the Leslie. Since it's an overdub situation, Peter's the only one in the room. We place the Bassman on the floor, the Ampeg either on top or behind it on a stool, but definitely higher than the Bassman—with the two mics facing right in front of them. There's a spacial relationship that changes depending on what sound they want; they move one of the mics either further back or further in. Then over to the left about five feet we put the Leslie, with the 47 facing right at the Leslie and the 56 right on the ground ... about five feet apart. That's basically the lay-out. They worked a while for the right sound.

MR: Does he do any "live" guitar

work on any of the tracks?

TB: Yes, there's a lot of "live" guitar, and "live" piano, too. Peter played piano on "Sad Affair" and overdubbed the guitars. On the rock and roll tunes, he does them all "live." He doesn't throw anything away. What I mean is, when Peter does something it's in tune and it's right. He is a very accurate guitar player. He's got a good ear, and he plays in time very well. I never realized what an excellent musician he is till I worked with him on this.

MR: How are the drums miked?

TB: We used two C414s for the distance mics; a Sennheiser 441 for the kick drum; two mics on the snare, a KM84, I think, on the top and an SM56 underneath—but that 84 might have been a 421, it's one of those two. On the high-hat, a 421; we individually miked all the tom-tom drums, with Sennheiser 421s; and a single kit mic, a U47 that hangs right over the center of the kit. The track assignments are kick drum, snare drum, toms—which is a combination of all the tom mics—kit, which is that one mic and then the room mics I mentioned.

Chris' approach to drum mics is quite interesting, it's quite different than most Americans'. He doesn't stereo his drum kit, except through the distance mics, and what it does is keep the drums big and solid. Even when you switch down from stereo to mono, the drums are still there and they're right. It's the same approach he used on Charlie Watts, on the *Some Girls* project.

MR: So what goes on the basic tracks, then?

TB: We take the drums—all the drums—we keep the bass, rhythm guitar, acoustic piano and possibly the "live" vocal.

MR: How are the pianos miked?

TB: We did some interesting things. Chris took one of my suggestions, which was a nice thing. He used two C414s for the piano—high end and low end—miked close up to where the dampers are, up towards the front of the piano, and he used a PZM [Pressure Zone Mic] plate mic, a Wahrenbrock [Wahrenbrock Assoc., 9609 Cheddar Street, Downey, Ca. 90242], which is a square plate pick-up mic. It's the first pick-up mic I've ever heard that actually works. We used it on a couple of tunes, closing the top of the piano, during the basic tracks especially, and covering it. So what you have is the two mics and the plate mic taped to the lid of the piano, which

is then closed. They're even buying a couple of those PZM mics for the road. They're good and they're cheap too. I think in a couple of years people will find out about them.

So, we've got three tracks of piano, the plate mic and then stereo. Also, on some piano overdubs that we did, we used the same approach. The C414s and the lid open and a distance mic, which was a U47, seven or eight feet away from the piano itself.

Most of the "live" rhythm guitar stuff was done single mic through a single amplifier and everything was partitioned off, to minimize leakage. The set-up for when we do overdub guitars is much more elaborate.

MR: What steps do you take to minimize leakage?

TB: Well, it's not *real* tight; we don't go for a real tight sound. Chris uses leakage very well. It's a natural occurrence and if it doesn't phase, then you have no problems using it. But basically there's baffles between everything. What we used extensively were the big foam baffles, real dense polyurethane foam. We essentially baffle off the amplifiers, but leave the front space open. With the drums, we put a large cage-like baffle behind them to prevent the sound from clattering against the far wall. The only leakage problems we had were with the organ Leslie, which was very loud. With that, we actually had to build a little house out of those foam blocks, two on the side, one on back and one over the top, and the mics inside. That pretty much solved it. We control leakage into the piano by closing the top, putting pads over it and positioning the baffle from the floor around and up the side so nothing could leak up into it.

MR: What are the special considerations working in a large room, for anyone not used to it?

TB: The main thing is that it enhances your ability to get a good "live" sound. "Live," as opposed to "studio," sound basically means when you're on stage, you don't baffle things off—every instrument and voice is mixed together. The sound comes at you as a blend; it's sometimes hard to clearly differentiate piano from guitar, for instance. Whereas, in the studio, you can box them in a small, dead, quiet room, with lots of baffles in between each set-up.

Chris and Peter aren't really into that [isolated effect]. I'm sure they feel it's unnatural. When you go to a rock concert, you don't hear this distinct

stereo, it's not really musical, it's really more mechanical to have everything isolated in its own little spot.

MR: Tell me something about the equipment here in the studio.

TB: The monitors here are the UREI time-aligned units. We just built them up into the wall recently. We have a Neve 32-input console, 24-out. It's about seven years old and has an extremely intricate monitoring section and individual EQ section, unlike the newer 8076 and 8078 Series. I think ours was custom-designed for RCA's use. Our multi-tracks are Ampex MM 1200s; we have the M24 Dolby Series package. Our mastering machines are Ampex ATR 100s. We have two tracks and four tracks. We also have available to us other equipment, such as 3M M79 multi-track machines.

MR: Do you personally have any

treats his drums the way he does. Also, if you listen for it, his miking approach and his minimal EQ. He'll tend to roll off, not add EQ. He wants a full, accurate sound.

There are strings on three of the songs, horns on four, background singers on three—but it's not a lot, it's not a super lush LP. In fact, it goes the other way. With this album, Peter wanted to show people his roots. Peter is a rock 'n' roller and I think he wants people to know him as a rock 'n' roller.

I guess to sum up I'd say Peter's basic approach is the "live" feel. He taught a lot of people what can be done with a "live" recording. He comes from a background that was heavily performance oriented. Humble Pie did a lot of tours! He realizes that music is first of all for the people. That basically is why he makes records the



All in a day's work: Frampton, Chris Kimsey and engineer Tim Boyle at Filmways.

equipment preferences?

TB: I'm really into the Neve; it's very intelligently made, very quiet. And I like the Ampexes. They have had troubles, but basically they work very well. You put them in a room and start a project, and they'll work for the whole project.

MR: How would you describe Peter and Chris' basic recording philosophy in making this record?

TB: Chris and Peter's approach is to really make it sound good no matter where you're listening to it. When they do a mix, they immediately listen back in mono, because a lot of people are going to listen to Peter Frampton on the air. That's probably why Chris

way he does—to make people rock, to make them happy.

Later on during the sessions for Where I Should Be, MR had the opportunity to sit and converse with Peter Frampton and first engineer/co-producer Chris Kimsey.

MR: Chris, have you worked with Peter on all his projects?

Chris Kimsey: All except *Frampton's Camel*. I only worked on about two tracks of that album.

MR: With this one, you came in about half-way through the project?

CK: Yeah. I was working in Nassau with the Rolling Stones and we finished earlier than we thought. Peter found out that I was free and he asked

me to come out and work with him.

MR: This is the first one that you're co-producing on?

CK: Well, I was credited on *Wind of Charge* as Associate Producer, but this is the first one I'm co-producer on.

MR: Peter, I didn't realize you've produced all of your solo albums. Isn't that unusual in the business today?

Peter Frampton: Well, I think that at one point, just before the "live" album came out, the record company (A&M) said, "If this one doesn't go, you're gettin' a producer." That was it! They gave me one more chance, and luckily it went.

MR: Do you consider yourself very technically oriented? Or have you relied on Chris for a lot of that?

PF: Well, I'm basically a gadget freak. Chris knows a helluva lot more about it than I do because that's his main thing, but I do have my own studio and I can do the things myself. But it's always nice to have Chris around, because when you do it all yourself you become totally insulated. It's very difficult to see where you might be going wrong. You need another voice to keep you on the right track. I might say something and Chris will say, "Yeah, we'll do that," or he'll suggest something different. It goes both ways. I am pretty technically minded, though.

MR: This album started out at Cherokee and now you're finishing here at Heider's . . . how did that change happen to come about?

PF: Well, when I found out that Chris was available to come and help . . . he knew this studio. And, in fact, we were running out of time at Cherokee because various engineers who were supposed to work on the project sort of fell through . . . that's why it's taken a little bit longer.

MR: I read that you usually spend about six weeks on a record . . .

PF: Yeah, we used to [laughs]. The last album (*I'm In You*) I think was about two and a half months—or was it three months?

CK: Three.

PF: The quickest album we ever did was the *Frampton* album. We did thirteen tracks in eight days, which was the fastest we'd ever worked. It was just one of those things. It was the right time, I suppose. We did it in a castle in Gloucestershire. We used a remote—it was really a lot of fun. I would like to do that again sometime.

MR: Tim said this room is like an English studio because it's a big room . . . that most American studios have

small rooms for bands and only big rooms for orchestras. Is that your preference, Chris?

CK: Yes, I like working in big rooms; I don't like small ones. I like [a] nice big ambient sound. If the studio's treated properly acoustically, then you don't get a lot of leakage. If you mic things sensibly and think about it, you don't have any more leakage than you have in a smaller studio.

MR: Who are the band members on this album?

PF: For the first time in a long time—since the very first album—I used my basic rhythm section, which is Stanley Sheldon and Bob Mayo, Stanley on bass, Bob on keyboards and guitar. I don't have a permanent drummer at the moment, so I used Jamie Oldaker from Eric Clapton's band. But when Chris came out I wanted to do some more tracks and Chris suggested that we recut a couple of the things I'd already done without him, which I agreed with.

We got a couple of different bass players and a different drummer. We used Steve Miller's drummer, Gary Mallaber, and [bassist] Donald "Duck" Dunn from Booker T and the MG's and Eddie Watkins, who's really a great session bass player. Some of the other people are [guitarist] Steve Cropper, the Tower of Power horn section, backing vocals by the Waters family. Gene Page did the string arrangements. Steve Foreman did the percussion, which is the first time we've actually used a percussionist. Usually, I'd go out there with a tambourine and do it myself. Again, Chris suggested, since he's done a lot of other work since then, that we get a percussionist in and it was amazing. We'd always before used the drummer in the band or I'd done it.

MR: Is it all original material?

PF: There are two old Sam and Dave songs ["You Don't Know Like I Know" & "May I Baby"], and a couple of the songs I wrote with Bob Mayo and one with Rodney Eckerman, but they are basically all my tunes.

MR: I'm curious to hear what direction you've taken this time out. I noticed on the liner notes of the last album you say that Little Feat is one of your favorite bands and that you modeled "Won't You Be My Friend" on the album after their sound, so to speak. Have you followed in that direction or have you followed more the old rhythm and blues sound, as in some songs on *I'm In You*, for example, Jr.

Walker's "Road Runner?"

CK: I'd say this time we've captured more of a "live" sound. It's out front more, more heavy rock 'n' roll. More guitars, which is good, because Peter's such a good guitar player. A heavier rock direction. Even a "shuffle" which is heavy!

MR: Any disco sound?

CK: Well, it's not really a disco track, but there is a song that's got sort of a bump beat—which I suppose could be taken as disco, although we didn't intend it that way. It's a good, danceable rhythm. There's only one acoustic track, which is called "Take Me By The Hand."

PF: Yes, it's the one I did at home. "Hobbitland" I've called the studio; the ceilings are so low that tall people can't stand up in it! I'm really thrilled that we used one [a track] that was recorded there. The reason that I got the studio together in the first place was because I'd done "I'm In You" (the title track) on a Revox in one night with just one Sony mic, one limiter and one EQ and recorded it at 7½ on an old echo tape from Electric Lady. We tried to re-do "I'm In You" I think three or four different ways, playing with the band, just doing it with the piano and voice, and then in the end we went right back to taking the original tape and bumping it up to the 24 track.

MR: Your studio is in New York?

PF: Yes, I have it in the basement of my house.

MR: And what equipment do you have in there?

PF: I have a 3M 24-track, an Otari 8-track, a Studer 2-track. I have more money invested in Eventide than most name studios do; various limiters; an echo plate; various mics, Neumann mics; and the board is an altered Quantum board. JBL 4333 monitors—I also have about six or eight pairs of [JBL] L100s. And now I'm thinking of buying a pair of the UREI time-aligneds that are in this studio.

MR: How do you relate to the fact that your "live" album was your breakout album?

PF: Well, it's almost dangerous to have a "live" album be your breakout album because what that meant to me was that I still hadn't proven myself in the studio. I'm the sort of person that . . . I love being in the studio, but I prefer being on the stage, usually. There's an instant rapport with an audience. You get to know if people like it straightaway, rather than with a studio album, where you have to wait

three months and then you hear it on the radio and all of a sudden it's no longer a personal thing, which is what you did it for in the first place.

I think *I'm In You* was probably the most strenuous [album to record] mentally, physically, in every way, because, as I said, I hadn't really proven myself to myself in the studio. It was in a completely different direction from where the "live" album was, which might have been a psychological thing. But this album is really back on the track, it's like a complete stage act—a new stage act. God knows it's

what I needed, because I can't keep playing the "live" album all my life! You know, you get a little bored playing the same songs over and over . . .

MR: What are your tour plans when the album comes out?

PF: About the first few weeks of June we'll go out for about six weeks to two months.

MR: What sound company do you use when you tour?

PF: Clair Brothers. Ever since I saw Elton John and the Stones use Clair . . . I couldn't believe the sound. I don't think any of the real loud rau-

cous rock 'n' roll bands use Clair . . . I go for quality and I think they're the best around. Once I've found someone that's good, I tend to stick with them. They've been really good to us. Their monitors are always terrific, which is probably a band's pet peeve.

MR: So, getting back to the album, most of the songs on the album contain a similar flavor?

PF: There's a lot of variance, but it's generally up and happy. Even the ballad, "Sad Affair," is uptempo; even though it's a sad song, it's got a happy feel to it. One of the songs that I wrote with Bob Mayo, "We've Just Begun," is sort of laid back and funky, and "Take Me By The Hand" is the acoustic song. From there on it just starts to go up . . . there's the "almost disco" one, and the shuffle, which is really up there, "She Don't Reply," which is an out-and-out rocker, and the one we're finishing off tonight, which doesn't have a title yet, is almost Led Zeppelin-ish but it's not, it's Peter Frampton, actually . . .

This album sort of spans the whole once-and-for-all of what I do—from acoustic to heavy rock 'n' roll. The only other album that had as much variance, I think, was *Wind of Change*. This one definitely goes in both directions. It goes as outrageous as my "Jumpin' Jack Flash" on the "live" album, and it goes down to acoustic.

MR: Are you picking singles before the album comes out? What is your relationship with the record company as far as that goes? Do you have some in mind already?

CK: Yeah, we've got *five* in mind [laughter] . . .

PF: [laughing] We don't have enough *B sides*! Of course, we're being very presumptuous, but it's true!

CK: Yes, there are a number of singles, but the one we'd like to release first is the one which gives the impression of the "stronger, new Peter Frampton." Instead of releasing the ballad first and making it sound like an *I'm In You* album, we want to release the really strong rock 'n' roll songs and then hit with some of the other ones.

PF: We've got to take several other tracks, which didn't make it on the album, and make some *B sides*.

MR: What about sequence? Is that very important to you?

PF: Yes, especially on this album.

MR: Do you have a formula that you generally follow?

PF: You go through various ones, I think. We go through different phases



Co-producer of the sessions, Chris Kimsey, concentrating at the board in Studio B.

of whether we should put out the one we think is going to be the strongest first, which we've ended up doing, to thinking, "No, maybe we should put something that's even more rock 'n' roll first." It's very difficult, because based on what I've seen when I've been in radio stations, dj's always seem to put the first track on the first side on, then they take it and they flip it to the first track on the second side, then they go back to the first side and play a few bars of each song just to see, to test it out. But definitely, they go for the first track first side and first track second side, so you have to be very careful to start the first side off with something that you think is universally attractive to all tastes.

MR: Do you think it's important to pick your singles, or have you thrown them out and then made your choice after a few weeks based on the consensus from the field?

PF: That [the latter method] is usually what I've done in the past. With this album, though, they're stronger, so we know that this one track called "I Can't Stand It No More" will be chosen . . . I think. Usually, what you do is watch those little sheets that tell you on a weekly basis what all the radio stations are liking and what the request lines are and that is generally a very good way to tell. You'd feel pretty stupid putting out something that wasn't even picked by the dj's. You know that they're picking them themselves and also listening to what the people phone in for. So it's usually a very good barometer of what the people want.

MR: Sounds like this album is maybe less a departure for you than a going back to your roots.

PF: Well, I'm definitely going to places I haven't been before on this album; I've never done a "blues shuffle," for instance. I'm not really going back, but then I guess in a way it is because I've been through all the hubbub and shell shock of the success and come back really feeling strong and wanting to play like never before. It is like starting again, but from *now*. It's not really so much looking back . . .

MR: I don't mean looking back as much as getting in touch with your roots again . . .

PF: Exactly.

MR: Do you have any unnamed stellar performers on your album, as on the last one? No "Glimmer Twin" or anyone like that?

PF: Oh, you've been listening to somebody? I don't know, we don't know yet. I don't think so, it's too late actually at this point.

MR: Do you ever see yourself producing someone else's album, or have you already?

PF: I did one with a friend of mine, Andrew Brown, for a guy, a friend of mine called Roger Moon, a long time ago. It ended up sounding a bit like me. I'd like to [produce], but I don't really have the time at the moment. I'm just getting back into what I'm supposed to be doing—but, yes, I'd like to. It would be nice probably ending up doing one at my house. But I'm happy just doing me at the moment.

MR: Are you feeling nervous about the release of this?

PF: Always; that never changes. I know it's good, though, and I don't think there's going to be vipers out there waiting to bite. With *I'm In You*, I knew straightaway, whether it had been good, bad or indifferent, or *extremely* good, I knew the critics were just going to pull it to pieces, which they did. I expected it, but even when you expect it, it's a blow when that happens. With this one, I don't really care—though I know I will—if they do put it down. But I don't think they will; I think they'll say, "He's still got it! He's rockin' again!"

MR: Chris, with the Rolling Stones, are you producing?

CK: Well, contractually, engineering. Although I'd like to think I help them produce as well. I get along very well with them. They're never in the control room; they're just out playing, and then when they come in, they like everything that they hear. It's really engineering, but I do put much more into it than just engineering.

MR: Are you always for the "live" sound, or does that depend on the act you're working with?

CK: It depends on the act. With Peter it's great, because he likes to hear that sound—it's the sound that portrays him the best.

MR: Your preference is to record the guitars "live?" Have you been able to do that all the way through this album, Peter?

PF: Yes. The more that I can play "live," the more that I can sing "live," the better. Even if you don't keep the original vocal, it gives the tracks the "live" feel. The next album, I would really like to have all written and arranged *before* I go into the studio.

CK: It'll never happen.

PF: [laughing] But you can go in and do it like a show, virtually . . .

MR: For this album, how much pre-studio rehearsing did you do?

PF: None. Straight in. Some of the tracks I wrote in the studio. The ballad "Sad Affair" was completely finished when we cut it here and I sang it "live" . . . and we kept the "live" vocal, which I like. It also means I don't have more work to do. But it definitely has a feel to it you can't get any other way.

MR: Heider's has some old U47s with the original tubes that you use for the vocals?

CK: Vocals, and the guitars, and the drums, and percussion . . . We use them all the time.

PF: It's an amazingly true microphone! There's something about that 47. When Stevie Wonder came in to do the harmonica solo on *I'm In You*, I said, "Look, what do you need?" He said, "A 47." And I said, "Great! That's my man," because that's the mic we were going to use. It's incredibly true. Especially now, I've learned even more about it on this album. I'd love to have them for my studio, but they're incredibly expensive as well. It's like buying an old Martin or Les Paul . . .

MR: What instruments did you use on the new album?

PF: Well, there's my Les Paul 3-pick-up, which I've had since the Humble Pie days, a Stratocaster, a Rickenbacher 12-string, Fender Telecaster, a Gretsch Duojet, and I also used Martin Mull's Gibson L5. For acoustic guitar, I used an Ovation.

MR: What about the "talk box" on this album?

PF: I'm not using it on this album. We used it on *I'm In You*, but we used a synthesizer put through it. We tried it on this album, but the way it seems to come across best and the way people are used to hearing me play it is "live." Therefore, there's just nothing we've done that's needed it.

MR: One final question. This is the first time that you've worked in California studios, correct?

PF: Yes.

MR: Why the switch?

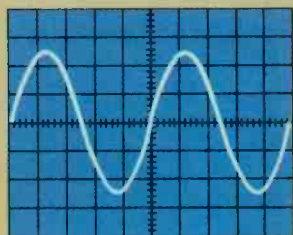
PF: It was cold in New York! And, as we discussed, the first engineer I was going to work with wanted to use the studio at Cherokee. When he didn't engineer, I was still left with the time booked, so . . .



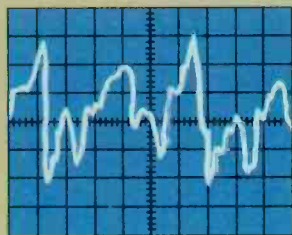
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PROFILE:

STUDIO DESIGNER JOHN STORYK

By Don Ketteler

After graduating from Princeton University's School of Architecture in 1968, John Storyk returned to his native New York City, and a job with the firm of David Todd and Associates. Within three months, he found himself working on, designing, and actually becoming a part producer of a new downtown club called Cerebrum. The club was a very popular avant-garde sensorium of the late 60s which received much attention in the press. This publicity allowed John Storyk, after only four months exposure in New York, to

gain a measure of notoriety. And in turn led to contact with Jimi Hendrix in 1969. Hendrix had been to Cerebrum and through a series of relationships and coincidences Jimi and his manager, Michael Jeffreys, met with and asked John to handle the renovation of what eventually became Electric Lady [recording studios], initially conceived as a nightclub.

Shortly thereafter, Mr. Storyk became an independent designer and proceeded with the design of what unbeknownst to him was to become his first recording studio.

MR: Tell us about Electric Lady's beginnings.

JS: I started designing Electric Lady as a club. [Producer/engineer] Eddie Kramer, who had been producing and recording Jimi, then got involved, and what was going to be a little studio in the back of the club became the club itself. Electric Lady became, on the night before we were to present the plans of it as a club, a recording studio.

MR: Did you have any design experience with recording studios at that point in your career?

JS: No. In fact, at that point I officially announced that I'd never been in a recording studio in my life. Kramer's input was of inestimable value in this regard and the project became a team effort between Eddie, who was chief engineer for years, and brought with him much experience, Jim Marin who was the studio manager, Shimon Ron,

head maintenance engineer, Michael Jeffrey's business manager, Jimi Hendrix and myself.

MR: What sort of input did Jimi have in regard to your design?

JS: Jimi had surprisingly little input; most of it was from Eddie.

MR: In 1969 in New York City there weren't many independent studios—particularly downtown where Electric Lady was. What was the industry situation as you saw it?

JS: In New York, that was when the era of independent studios started. At that point in time you really only had A&R and Media (1970). You didn't have Hit Factory, Sound Mixers, Power Station, Sigma, Automated, MZH, or Plaza as independents. Anybody doing a project downtown, away from the industry center uptown, immediately got a lot of attention. We received attention not only because we were independent and geographically displaced from the industry, but also because of Jimi and Michael's backing and the artist orientation we built in.

MR: What about the particular problems you encountered in building Electric Lady?

JS: Certainly, by today's standards, if I were to go down to Electric Lady and look at it as a potential studio space I would recommend that they seriously reconsider it. To be under a movie theater, on top of a river, a hundred yards from a subway, and in a basement location without an elevator ... it's hardly what I'd call an ideal situation to begin with. I guess it was really a break for all of us that no one recognized those disadvantages. Just consider that the Minetta River, unknown to us, was smack under studio B! When we went to jackhammer to dig some footings for walls we struck water inches below slab.

MR: Studio construction in general must be difficult in New York.

JS: New York is actually pretty good training for learning where to put studios where they're not supposed to be; L.A. is the exact opposite situation. In L.A., studios are usually built in self-contained buildings owned by the studio operator and are on the ground. They have no basements and are of wood construction, which gives them serious cost effective advantages. They don't use block, and are not forced to use metal studs. Whereas in New York, you run up against a number of problems.

Block as construction is very expensive and can't be done on most floors anyway because of the weight considerations, which is why I always look for ground floors. So on this level, builders are usually forced to go with studs. But, in New York, wood stud is actually illegal, while metal studs lend some problems. I find that they [metal studs] sometimes are not stiff enough and tend to not accommodate high mass walls.

MR: Does this give L.A. studios any



advantages?

JS: Yes. Aside from ease of construction and the ability to utilize different techniques, it allows L.A. studios to be a bit ahead of New York in an innovative sense. Since the entertainment industry is centered more in L.A., it makes for more accessible money and a tendency to be more adventurous in electronic and physical design. They may actually spend more per square foot because money's easier to get and because they're more able to make it cost effective. One of the keys to studio construction is to make it stiff and rigid, except in specific instances where you want something to vibrate, as with a diaphragmatic membrane, or a loose baffle or whatever. The fact is, that it's often easier and cheaper to do that in L.A. than in New York. [In L.A.] They take the savings and invest it in more sophisticated techniques and equipment.

MR: So, you've mentioned several construction methods; which do you consider to be the best approach?

JS: Block construction is always the best. What it often isn't is cost effective. As of right now the most cost effective legitimate technique for the basic shell is wood stud construction, high mass skins, internal insulation, etc. Though, if you can get the basic shell up with blocks, sand filled, you've

got a physical advantage. I'm not sure everyone would agree with me on that, but it's always been my feeling that that is absolutely the best structure.

It's worth noting that in some jobs, masonry block may work out cheaper because of the availability of the resources locally and the area's cost of labor. So, the proper answer to what's best and what's right for a given condition may not coincide and may be affected by numerous variables.

MR: What are some of the specific problems with building recording studios in New York?

JS: Other than the fact that it is a city of congestion and its resultant complications, and that the recording industry insists on confining itself geographically, limiting the real estate choices, New York has three big problems: columns, neighbors and height. They are the first things I look for, and then there are about a half-dozen secondary considerations.

MR: What do you consider to be a workable column spacing?

JS: It's very hard to get column-free space in buildings suitable for studios in New York. And when I say column free, I mean a column spacing of at least thirty feet. It seems they're either too close or don't exist at all. It's a big struggle to fit everything in, and not compromise your design while

“ ...accept the physical and volumetric limitations... you can't make a bathroom become Philharmonic Hall... ”

making the columns as inconspicuous and non-sound transferring as possible. It's a geometric nightmare (*See floor plan—Soundmixers, N.Y.C.*).

The second one, neighbors—you've always got them. If you're in a building other than your own, self-contained one, you've got them above and below. You must worry about not bothering them and you've got to worry about them not bothering you. Generally speaking, if you satisfy one requirement you satisfy the other.

MR: What do you consider to be a minimum gross height of a studio?

JS: Height is a problem that everyone has got to be concerned with. My feeling is that in today's marketplace, if you're thinking of opening up a world class studio, to not have at least twelve feet of height radically limits your possibilities. It becomes much harder and more expensive to return your investment cost effectively and competitively. I have done studios in as little as 7'10" (Leon Russell's), and H&L with a gross height of only 9'10", as well as many under 11'0". So there are some exceptions, but if you don't have twelve feet you should think twice. There are a lot of reasons: (1) the general reverberation requirements of the room itself; (2) air conditioning ducting. To start fighting 10' and 10'6", especially in New York where you're going to have to lose height for isolation, means you're just going to get shortchanged.

MR: What are other considerations?

JS: (1) Power. Do you have enough and is it the right kind and is it clean enough. If not, you may have to spend more money on transformers and running pipes; (2) Air conditioning. Is it there, and if not can you add it?

For instance, in most tall buildings in New York, if you don't have a ledge or access to the roof, or you don't have a lot of height so that you can hang air units somewhere, you're going to have to dedicate a certain percentage of your expensive floor space to a machine room. Whenever I go to a site, I see people noticing height, a lot of people clap their hands, everyone can see if the column spacing is o.k., but everyone always wonders why I'm looking at the electric panels or looking out the windows. I'm always looking for the air conditioning. That's

because it's a hassle. In a recording studio in New York today electricity and air conditioning can easily be 40% of the construction budget. And air conditioning ducts and machinery are noisy, take up room and are expensive. The more gracious a solution you can provide in terms of space and height, the cheaper it will be.

MR: Along with all these construction and design considerations now being recognized, how has the recording process been affected?

JS: Studios are getting more accurate. Everybody in the last ten years has certainly learned a lot. It's only two years ago that we could semi-accurately measure reverberation time in a control room—we didn't even have the gear. Real-time analysis, true real-time analysis, is less than ten years old. Any kind of technical accuracy is always a function of the need and the measurement skills. We certainly have them now. We've got gear that demands a more accurate environment and the equipment to measure it. So acoustic accuracy is really the word.

MR: What part of the process or physical plant of the studio has benefited most from this sophistication?

JS: The most progress, and agreement, has been made on the control room. In the beginning people looked to the radio industry for their format, and basically the radio studios were a bunch of boxes with windows—and that became the recording studio. It was all equipment oriented.

Now you're seeing control rooms which are locking in on, interestingly enough, an optimum range square footage. Most of them are in the 400 to 450 square feet range. You will see a certain relationship in the geometry which most people are discovering is optimum. A multi-faceted control room. You will see glass both in plane and in section being tilted and splayed in all kinds of variations. There are all kinds of acoustical techniques going on: the active trap, slat resonators, Helmholtz resonators, compound geometric splays, alcoves for the machines, sound locks that work as isolation booths, etc. The point is, the control room and its immediate surroundings are getting a consistency in level of design thinking, although there are still no totally agreeable

standards—there are lots of concerns.

MR: What are some specific factors or considerations being given more scrutiny in the control room?

JS: People are refining what a control room should sound like. Realizing that the frequency response, now easily measurable, and equalizable to a certain extent, is of course very important. People are realizing that the reverb time is very important. Certainly people are also looking at impulse measurement, time delay spectrometry, energy density systems, phase coherence, time corrected monitors, etc.

MR: Does this all mean we are on the verge of some agreed upon standards for the control room?

JS: Everybody is always saying, why don't we [standardize], but I see agreeing upon a certain range of standards. What I don't see is a cookie cutter approach, including something as specific and as measurable as control room acoustic standards.

Rooms, on some levels, are all the same. I mean, speakers, console, machines, chairs, lights, doors. And as similar as they all are in program and acoustic requirements, there's always going to be a difference. And at best a family of norms, never *the* absolute norm. That's because studios are dealing with music, music involves artists, and that's where there's always going to be a difference.

MR: Where does the recording room, or studio, stand today?

JS: The studio is a much different ball game. Because it can range in program from being able to only record one person, right up to and regularly, recording 150 instruments. The studio room, per se, has a very different approach. There's usually a certain order in figuring how that's done. You must define what you want to do in it and you must interface that with the available space and funds. At that point, you've got to shift into a purely acoustical mode. The reality of the matter is, you can make almost any space a recording room if you're willing to accept the physical and volumetric limitations that the space dictates. What you can't do, is make a bathroom become Philharmonic Hall. What you can do is take the bathroom and, given that you'll ever only be able

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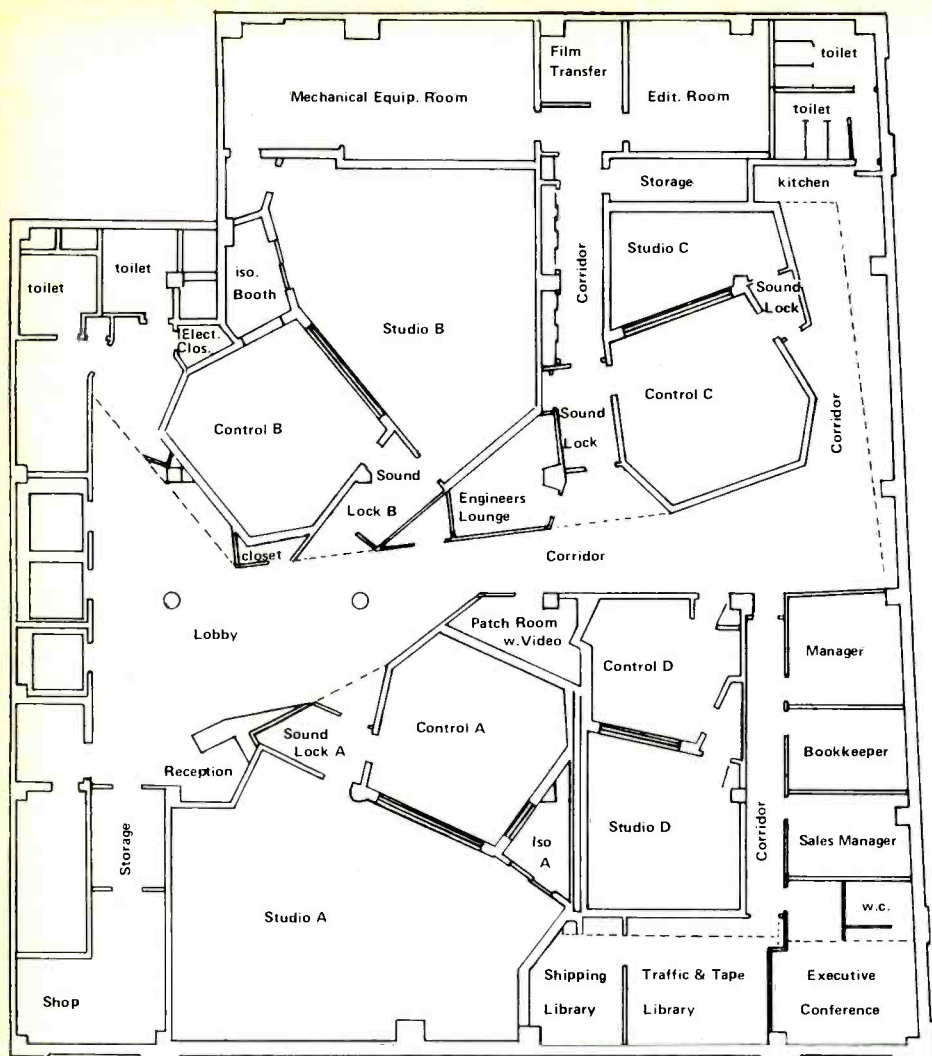
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Soundmixers - Floor Plan

to put two people in, you can make the room "recordable" and maybe even make it look or feel or partially sound like a variety of spaces.

MR: Generally, do clients pay as much attention to the studio/recording room, as to the control room?

JS: I find there is an increasing level of recognition of the importance of the recording room, both as a functioning element of the studio as a whole and in terms of ambiance. In part, because of magazines like this, other publications, textbooks, etc., people are starting to realize that design of the studio room and related construction costs are a significant portion of the studio program as a whole, as well as the budget. As a tool, people are realizing that the recording room is another piece of studio equipment—highly sophisticated, multi-variable and technically changing.

There isn't a major studio in America that isn't constantly redoing and maintaining its environment.

Most major multi-studio complexes in America have a full time carpenter and a shop. It's a never-ending battle, just like electronic maintenance.

MR: Any other observations on the recording room?

JS: Yes. I think you're going to see a return in the studio room design to a technique employed twenty and thirty years ago—variable acoustics. You are seeing people making more use of iso-booths, variable tuning in rooms, drapes, movable slat resonators, throw rugs, and the full range of a well designed room's acoustics (from "live" areas to dead ones).

Simultaneously, you are going to have to see, in all facets of the recording business, a tremendous striving by the people who seriously build studios to try and figure out how to build these studios cheaper. \$120, \$140, \$150 dollars a square foot and up is part of the problem, not part of the solution. Trends in digital and micro-electronics technology are helping to

result in cost savings along these lines, but it must get cheaper so that studio owners will have a chance to make money and to still offer recording time at \$125 an hour in order to enable records—the end product—to be made at some reasonable price. If it [the cost] keeps spiraling, although there's always going to be a need for the high-end studio, it will eventually bring everything to a grinding halt.

MR: Do you see this spiraling cost eventually affecting new artists and the whole "farm team" aspect of the recording company?

JS: What will happen is that the record companies will offer less and less opportunity to newer artists. They'll just keep going with the same old guys. Everybody's got to try and come up to the challenge. For us, since we're specifically interested in construction techniques, we're always trying to do it, always pushing the specs just a little bit more.

MR: You've alluded to support space. Are people taking it seriously enough; do they appreciate its significance?

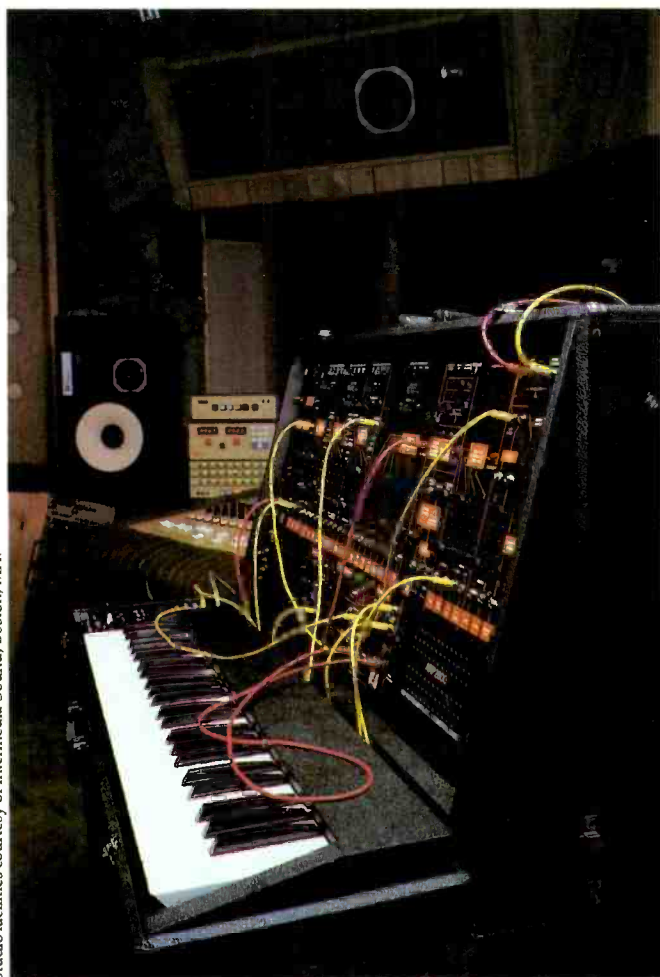
JS: In the last few years, people have started to figure out what it's about. The studio business is like a taxi or a limo business, i.e., you rent it by the hour. It's also a place where you make art. And a place where you do work, you assemble data, business is done. It's an architectural environment. It's just not as simple as: control room, studio, iso-booth, sound lock and reception area and we're done. The net usable acoustical space (the interior of the studio, the interior of the control room) divided by the total gross square footage of the facility would reveal a surprising ratio. It's usually in the neighborhood of .5. In other words, for every square foot of usable net acoustic space, you've usually got one buried somewhere else. The newer complexes that we're working on, in fact, are increasing the amount of support space.

It's a big point. People are starting to understand it. It is what I consider to be the architecture of the recording studio, and not just the kind of cookie cutter approach. The bottom line is, if you show me control room and studio space and that comes out to X, you should absolutely start looking for 2X. And if the air conditioning isn't right and the height isn't right in New York City, and you don't have a ledge to put the compressor on, you better look for

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* (Source: *Billboard's International Recording Equipment and Studio Directory 1978-79.*)



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2.3X, or 2.5X, or maybe even 3X.

MR: We've been discussing studios in general terms to this point. On a more specific level, do your designs differ according to the program or specific intent of the studio?

JS: In New York City in the recording business there are really two kinds of studios: There's the music- or album-oriented studio and then there is the commercial studio, each with its own parameters.

The record studios can afford, and have a need, to be more posh because they're dealing more in fantasy. They're working more at night, there's a more hands-on relationship by the artist, and, in some instances, the artist demands more environmental accoutrements. Whereas the commercial studio is closer to a 9 to 5 operation whose clientele is Madison Avenue. The jingle studio has got to work over and over again—one 3-hour session after another. It must be very durable. In a commercial multi-studio I would, for example, think twice about putting carpet in the hallways. It's got to be tile. Carpet is never going to last because of the traffic. In a music-oriented studio though, you would put carpet down. There are fewer instruments being moved in and out, and when the carpet goes in three years, they'll replace it. I just assume the record studio is going to be a softer, more elegant approach. This is just one simple comparison. Other more compound differences are equipment, lighting, etc.

So yes, there is a difference. If one [studio] is setting up specifically for one or the other [music or commercial] there are certainly different systems and refinements, but the basic acoustic design and principles persist.

MR: It seems you're implying the importance of the prospective operator/owner knowing what he wants.

JS: Generally speaking, if a studio owner can define his needs more accurately, rather than taking potshots at a general market, his studio will benefit. This is actually a very important point, and answers a number of questions—i.e., his program and his needs, his restrictions and limitations and his financial reality should all be known and calculated before he starts. The more they're considered, the better the studio will be. And the more cost effective. It's really the way to get the most out of any studio.

MR: How might this "pro-

gramming" consideration apply to the home-studio and its owner or to the prospective owner?

JS: By defining your needs and your program, you won't end up in something you can't afford. If an individual wants to build a small home-studio, that's a great idea, and we all know why someone would want to do it, but ... if right from the beginning you give me twenty minutes with that person I can make his studio smaller. If you make a studio smaller, it will usually cost less. It sounds so simple, yet people forget it most of the time. Everytime I ask, "How big do you think you want your studio?", if they start to answer in square feet, I say, "No, *people*, how many people do you want to record in that room." People and program are the yardstick to use to put studio size into perspective. This, of course, relates to an architectural savings. If I bring somebody's studio down from 800 feet to 650 by refining and being realistic about his wants and needs, I saved 150 square feet at whatever per-square-foot cost you're working at.

Suppose I do that sort of refinement a number of times. I do it for square footage, equipment package, for materials (we move from \$1.50 per board foot wood to \$1.00), etc. These all are cost savings and they add up.

MR: So planning equals savings and therefore a more obtainable project for someone just getting started?

JS: If you just keep refining your program—I don't mean to be elusive about the point, I feel I am addressing it, because the fact is that there is no one economic panacea.

As to materials, there is no paint you can put on the wall that will keep the sound out, no magic drapes, no magic glass, no magic anything in fact. It's density per square foot per dollar. I don't see any great change. As a matter of fact, if anything, I see no change. Glass is glass. It's been virtually the same for centuries, wood is wood, and so on.

There has got to be a way to put the brakes on costs and it usually comes in planning and design programming. For a designer that's the ongoing challenge: to create space which is acoustically and architecturally correct, and environmentally exciting, while remaining conscious of the economic realities. That's our contribution to the process of making records—reconciling cost to art at the highest level.

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CIRCLE 91 ON READER SERVICE CARD

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Ambient Sound

BY LEN FELDMAN

While We Wait . . .

Those of us who write about audio, recording and sound reproduction have been tantalizing our readers for some months now with promises of a whole new era of recording. Digital tape recording is exciting and newsworthy. So are digital discs, whether they operate using laser optics, capacitance pickups or even with old-fashioned strain-gauge stylus pickups riding in grooves. After returning from this past Summer's Consumer Electronics Show it occurred to me that perhaps we do our readers an injustice. Sure, all of this new digital technology is "just around the corner," but what do we do in the meanwhile?

Several innovative engineers and designers don't seem to be too concerned with the coming of the digital disc and the digital tape recorder. They go right ahead, using regular old analog techniques, and continue to make improvements in the world of recording and sound reproduction. This column, then, is dedicated to those companies and people who, though recognizing full well that when digital recording finally does reach the mass market all of their improvements may be for naught, keep right on working and improving the sounds we record and hear.

The Noiseless Analog Disc

Most readers are probably familiar with the dbx system of compression and expansion. The idea here is to compress program material in a fixed ratio of 2:1, linearly, so that 80 or 90 dB of dynamic range is squashed down to only 40 or 45 dB. In that compressed form, the full dynamic range of any program is easily applied even to the most mediocre stereo cassette deck. Then, if during playback, the converse expansion (again, in a ratio of 1:2) is applied linearly, not only is the full dynamic range of the original music restored, but as a bonus you pick up around 30 dB (yes, 30 dB) of noise reduction!

Nearly four years ago, the folks at dbx reasoned that discs could be made in the very same way and at that time they even went so far as to produce a few. Of course, the hangup is that you *must* use a dbx decoder when playing back such discs. In those days, dbx was a pretty small company and didn't have the clout to see the project through. Now, things have changed

and dbx has its parent, BSR, to support the project. Well, at CES we heard some new dbx-encoded discs and were told that the company is now committed to the idea of dbx-encoded discs and has commissioned many record companies to produce them. Even more important, they have come up with a playback-decoder only, which is much less expensive than their earlier 120 series units which were designed for both encoding and decoding. All I can tell you is that you will not believe your ears the first time you hear one of these discs played. There is just *no* audible surface noise—and the dynamics, easily contained now in normal groove spacing, are awesome. I doubt if the first generation of digital discs (whenever they come) will be able to do much better as far as surface noise and dynamic range are concerned.

More Headroom on Cassettes

The name Dolby is instantly recognized by anyone even remotely connected with sound recording or hi-fi equipment. And I'm sure that Dr. Ray Dolby realizes full well that when digital recording finally arrives, his Dolby B and his Dolby A noise reduction systems will hardly be needed. But that hasn't stopped him from coming up with a brand new idea which he calls Dolby HX (for headroom extension). As you probably know, recording tape behaves quite differently at high frequencies than it does at mid and low frequencies. Increasing bias tends to roll off high-frequency response in a cassette tape, as tape saturation is reached. On the other hand, increasing bias (up to a point) actually increases output at mid frequencies, while at the same time lowering distortion. Manufacturers of cassette decks, saddled with having to supply fixed bias, settle for what is at best, a compromise, often providing three (or now, with metal tape, four) different bias settings for different tapes.

Dolby reasoned that if he had some sort of control signal, which "told" the recorder when high-level highs were present in the music, he could use that control voltage to continuously *vary* the bias, decreasing its level when lots of high-frequency energy appears in the program being recorded. As you may have already guessed, that control signal already exists in any tape

deck equipped with Dolby B. So why not use it for varying bias and thereby pick up as much as 10 dB more of headroom at high frequencies before running into tape saturation. And while he was at it, recognizing that as bias is reduced, overall response of the system will vary too, Dolby used the control signal for a *third* purpose—to reduce high-frequency record pre-emphasis on a continuous and dynamic basis, again, depending upon the instantaneous program content. Admittedly, those are a lot of recording parameters fluctuating all over the place, guided by one control signal, but if you line the whole thing up correctly for a given tape (for which a cassette deck should be factory calibrated in the first place) it really works, and the improvement at the high end is quite audible! Pretty clever, Dr. Dolby!

The people at Tandberg feel that the Dolby HX system has some negative attributes. Even Dolby admits that reducing the bias during those loud high-frequency passages will increase distortion at mid or low frequencies but they [Dolby] argue that you won't notice the increase because the momentary "highs" will mask the increase. Tandberg's newly announced "DynEQ" also deals with the problem of high-frequency tape saturation, but they prefer to monitor and vary only the record equalization and leave the bias fixed. Clearly, if you back off on high-frequency pre-emphasis during record, you don't come up against tape saturation quite as soon—and that translates to more headroom, too. Instead of an increase in high-frequency signal level actually causing a *decrease* in record output level (as it does when you go beyond the maximum record level for highs), you gain several more dB of linearity up at the high end. Having heard a "before and after" demonstration in Tandberg's exhibit at CES, we can testify that this idea works, too, though not providing quite as much additional headroom as Dolby's attack on noise, bias and EQ.

10 dB?, 10 dB! . . . Do I Hear 20 dB?

Have you ever wondered why Dolby limited his consumer-version noise reduction to 10 dB above 5 kHz? Obviously, since Dolby B is a "closed loop" companding system, he could just as easily have designed it for 20 dB or 30 dB, right? Wrong! In a single-band system (designed for low cost and easy repeatability and calibration) any attempt to increase the noise reduction beyond the amounts settled upon by Dolby would result in audible "breathing" or noise-pumping. Going to multiple bands (where companding takes place in different amounts for different bands of frequencies) would have meant a much costlier noise reduction system, and one that, until recently, would have been so costly as to have prevented Dolby from enjoying the universal acceptance that it does.

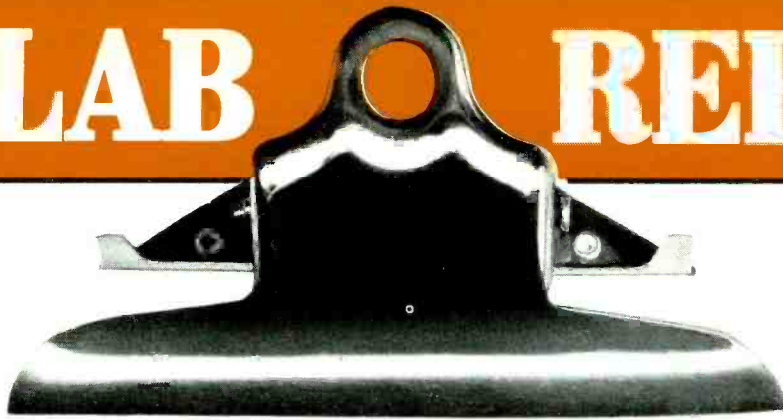
Now, however, Nakamichi, working closely with Telefunken, whose professional noise reduction system, Telcom C4D has been in use in European recording studios for some time, has come up with a new noise reduction system which they call Hi-Com II.

The Hi-Com II system uses a 2:1 compression/expansion ratio to achieve a 20 dB improvement in cassette signal-to-noise. What's more, the largely linear transfer characteristic of the Hi-Com II system makes it relatively immune to mismatches in level, an important feature for consumer applications.

And, because such a high level of noise reduction would result in audible "noise pumping" as we said earlier, the Hi-Com II noise reduction system minimizes this unwanted effect by processing the signal in *two* frequency bands. Admittedly, the use of more than two frequency bands would have provided added insurance against pumping, but benefits had to be weighted against cost and my own listening tests confirm that the two-band system works extremely well with just about any type of program material. Rather than try to incorporate the Hi-Com II system in any decks, for the moment, Nakamichi will be offering the Hi-Com II system as an add-on unit (in much the same way that earliest Dolby noise reduction systems were offered as accessory black boxes). That's not to suggest that you can derive its full benefits with a cheap cassette deck. Nakamichi points out, rather forcefully, that the Hi-Com II should only be used with high-quality cassette decks and with high-quality cassette tapes. According to Nakamichi, the "A" weighted signal-to-noise ratio that is possible using metal-particle tape and the Hi-Com II system is an incredible 86 dB! How about that, all you digital tape freaks out there who are waiting with bated breath for your 16-bit digital recorders?

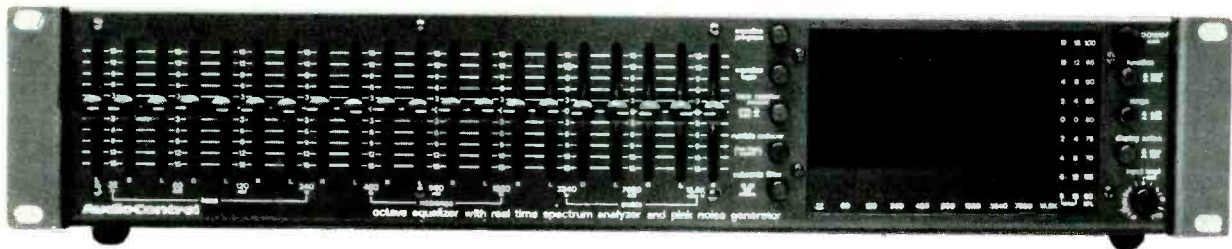
And while we are at it, now that several companies have opted for higher speed cassette decks (3³/₄ ips in addition to the usual 1⁷/₈ ips), and recognizing that increased tape speed indirectly increases headroom and overall dynamic range, imagine what kind of results you will be able to get at the higher speed, using metal particle cassette tape! The only fly in the ointment here, of course, is that with metal tape still costing about twice as much as premium brand oxide tapes, when you double the speed on those two-speed decks from B.I.C., Fisher and Marantz (they all offered them at CES), you are talking about *four* times the cost per recording hour—or half hour—or whatever.

On the other hand, who ever said that digital tape recorders were going to be cheap? At the moment, I am eagerly awaiting receipt of a sample PCM-1 digital tape recording processor which, together with the Beta-Max VCR portable which the Sony people have kindly loaned me, will enable me to get my first hands-on experience with honest-to-goodness PCM (or digital, if you prefer the term) recording. I'll be telling you all about the wonders of digital tape recording in a future column. The only problem I expect to have at the outset is this: where on earth am I going to find any program source good enough to record digitally? Will somebody please send me over a few "live" musicians for these important experiments? Nothing short of "live" program sources will really prove anything when you start talking about the kinds of dynamic range figures that we've been talking about . . .



NORMAN EISENBERG AND LEN FELDMAN

AudioControl C-101 Equalizer/Analyzer



General Description: The AudioControl Model C-101 is a stereo octave equalizer combined with a real-time spectrum analyzer and a pink-noise generator, and it is supplied with a calibrated microphone. Claimed to be the world's first audio instrument that combines equalization with spectrum analysis, the C-101's listed applications include room acoustic analysis and adjustment, tape bias and speaker adjustments, sound pressure level indications, VU meter, equalization of tapes while recording, and of course elaborate tone control adjustments for all program material. The device also includes a "rumble reducer" and a subsonic filter.

The EQ sliders occupy most of the front panel. They are arranged in ten groups (for ten octaves) of left- and right-channel stereo pairs with nominal center frequencies at 32, 60, 120, 240, 480, 960, 1920, 3840, 7680 and 15.5 kHz. The range indicated is ± 15 dB, with detents at the 0 dB points.

To the right of the sliders are five pushbuttons in a vertical row. From the top, these are: EQ in/out; tape EQ; tape monitor; the rumble reducer; and the subsonic filter. The rumble reducer is a low-frequency summation device which combines stereo channels below 200 Hz. The subsonic filter introduces an 18 dB/octave rolloff starting with -1 dB at 25 Hz.

To the right is the display screen which consists of ninety red LEDs (nine LEDs for each of ten rows of octaves), with a horizontal row of 11 green LEDs at 0 dB. The frequency divisions for the red LEDs correspond to the ten octaves of the equalizer section. Verti-

cal markings include ± 8 dB in steps of 2; ± 16 in steps of 4; and from $+60$ to $+92$ dB/SPL in steps of 4.

Finally, to the right of the display are five more controls—four buttons and a knob. The top button turns power off and on to the device. The next selects display function (level or RTA). The third button selects either the 4 dB or the 2 dB steps for the display. The fourth button selects either a "fast" or "slow" display. The knob may be used for input level calibration. The panel is dark brown matte, with soft tan lettering.

The rear contains phono (pin) jacks for pink-noise outputs, inputs and outputs to a tape recorder, inputs and outputs to an amplifier or receiver, a $\frac{1}{4}$ -inch phone jack for microphone input and the unit's power cord. The C-101 may be patched into a tape-monitor loop, or into the "preamp-out, power-amp in" facility on an integrated amplifier or receiver, or in direct hookup between a separate preamp and separate power amp. The microphone supplied with the C-101 bears the legend ADC PM3 and has a cable a little over 20 feet long.

Test Results: In *MR*'s bench tests, the AudioControl C-101 met most, but not all, of its published specifications. The discrepancies, however, were not judged of a nature to significantly detract from its performance in all of its intended functions.

The lab tests indicate that the equalizer section of the C-101 is an accurate, well-designed unit employing "gyrator" inductors (no physical coils that might pick up hum fields), not unlike many other ten-band equalizers we have checked recently. The pink-noise output

may be fed to any high-level audio input. Plugging in the microphone automatically deactivates the line-input circuits so that the analyzer will read whatever the microphone is picking up.

The pink-noise itself was found to be nicely distributed in frequency content (see Fig. 1), with the required 3 dB/octave slope. The measured range of all the sliders is plotted in Fig. 2. Note that the aberration seen in Fig. 2 at the second octave from the bottom was a noise pulse generated by the air-conditioner in the lab, and it should not be interpreted as a flaw in the equalizer's response.

The real-time analyzer section was found to be useful also as an SPL meter. Its two time constants permit easy adjustment of the equalizer (or any other equalizer, for that matter).

Calibration curves were not provided with the supplied microphone, but we were able to substitute a known mic in our tests and found that, at least within the accuracy of the readings possible on the display, there was no substantial difference between the mic supplied and our own calibrated mic. That is to say, when the equalizer's controls were set to produce a flat overall response (on the speakers in the lab), substituting a known microphone with essentially flat characteristics from 30 Hz to 20 kHz did not alter the display.

General Info: Dimensions are 19 inches wide (standard rack-mount); 3¼ inches high; 8½ inches deep. Weight is 7¾ pounds. Price is \$549.

Individual Comment by L.F.: Sooner or later, I have felt, someone would come up with a combination

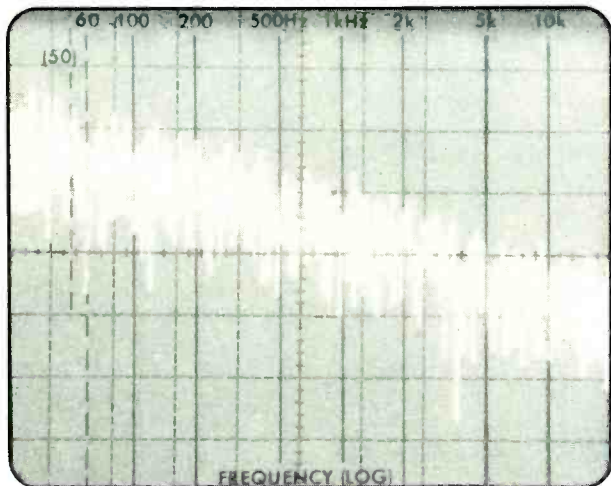


Fig. 1: AudioControl C-101: Frequency distribution (20 Hz to 20 kHz) of pink-noise signal supplied in the device.

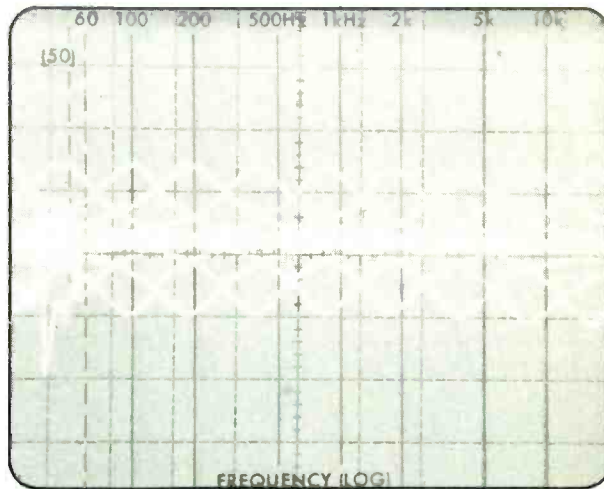


Fig. 2: AudioControl C-101: Range of control of ten-octave equalizer section.

graphic equalizer and real-time analyzer with a built-in pink noise signal source. After all, we have seen the equalizer itself evolve from a strictly professional or studio device to a popular add-on in home audio and in P.A. systems. We also have seen the once super-expensive real-time analyzer come down in price to the point where any sound contractor or person involved in professional audio work either had to be a miser or awfully lazy not to employ one. Inexpensive, electronically controlled LEDs have been, of course, largely responsible for the plummeting prices of real-time audio analyzers. Let's face it—ninety red LEDs and eleven green ones are still a lot less costly than a CRT display tube with its necessary sweep and high voltage circuits.

For all of that, I was really amazed when I first encountered this AudioControl unit at the Winter C.E.S. in Las Vegas. Not so much because some clever engineers had combined two obviously related functions, but because they had been able to do so at the incredibly low price of \$549. The device at that time looked very much like the model just tested. Everything needed to do a complete and accurate job of system and room equalization was there except for the calibrated microphone. That "omission" has now been corrected, and a calibrated electret microphone now is included in the package, at no increase in price.

Among the C-101's features I especially liked are the detents at the sliders' center points, and the fact that the left- and right-channel sliders for the same center frequency are positioned next to each other—I prefer this arrangement over the separate banks of left- and right-channel sliders.

I also found the two time constants for the SPL display very useful for the kinds of observations that I



AudioControl C-101: Rear panel view of unit.

needed to make in using the device.

I have only one minor criticism of the C-101: its screened nomenclature is in very small letters, and is of a dark tan color superimposed on the unit's basically brown finished front panel. I found the nomenclature difficult to read in a normally lit room. This proved especially annoying in view of the fact that the C-101's front panel is equipped with a variety of extra switches, such as the subsonic filter, "rumble-reducer," etc. A higher contrast between the screened nomenclature and the background color of the front panel would make things much clearer. Still for a combination device such as this, priced well under \$600, I guess this minor flaw can be tolerated easily. I come away from the AudioControl C-101 with the same enthusiasm with which I greeted it months ago in Las Vegas. Quite a bargain!

Individual Comment by N.E.: A combination device that is essentially several tools in one always raises the question of whether completely separate tools would be better, admittedly though they cost more and are far less compact and not as readily put into use. In the example of the AudioControl C-101 we have a real "first" that offers an unprecedented number of functions in an audio system and which, because of its compactness, could be permanently integrated with a sound system or—by the same token—could be

readily carried around for in-field work.

I suppose the answer has to be in terms of just how "professional" a particular setup must be in order for the C-101 to be applied to it. The very compactness of the device imposes some physical limits—such as the actual up-and-down distance traversed by the sliders, or the overall size of the busy display. The button switches are fairly small. The legends printed all over the panel are also small, and legibility is hampered by the low contrast between their coloring and that of the panel itself. As for the slider arrangement, I prefer all controls for each channel to be placed together since that way you can handle one full channel more easily. Admittedly this is a personal choice, and others may prefer the C-101 arrangement.

The owner's manual supplied with our sample of the C-101 was not for the C-101 but for the company's models C22 and C25 which, judging from the photo in the manual, are similar to the C-101 but without the real-time analyzer. Be that as it may, I hope that the instructions for the enhanced combination device provide more specific detail on its use, including a clear presentation of the controls and their functions.

To sum up, I don't think that the owner of a professional grade equalizer and a specialized real-time analyzer is going to scrap them for the C-101. On the other hand, a lot of sound enthusiasts, from "semi pro" to "sophisticated audiophile," are bound to be intrigued by this device, particularly in view of its low cost.

In conversation with the C-101's designer, MR was informed that the unit was not developed with the professional in mind. And to remind potential buyers of this point, AudioControl states in print on the C-101's back panel that "this product is designed and warranted for consumer hi-fi use only. Not intended for pro-audio applications."

AUDIOCONTROL C-101 EQUALIZER/ANALYZER: Vital Statistics

PERFORMANCE CHARACTERISTIC	MANUFACTURER'S SPEC	LAB MEASUREMENT
Distortion at 1V, 20 Hz to 20 kHz	0.025%	0.006% at 1 kHz; 0.008% at 20 Hz; 0.008% at 20 kHz
Frequency response	± 0.75 dB, 3 Hz to 100 kHz	± 1 dB, 3 Hz to 39 kHz
Hum and noise re: 1 volt	- 96 dB	- 90 dB
Maximum input	7 V	7 V
Maximum output	7 V	7 V
Input impedance	100 K ohms	confirmed
Output impedance	680 ohms	confirmed
Center frequencies	32, 60, 120, 240, 480, 960, 1920, 3840, 7680, 15.5 kHz	confirmed
Control range	± 15 dB	± 12 dB
Control bandwidth (Q)	2.5	2.5
Subsonic filter slope	18 dB/octave	confirmed
Subsonic filter cutoff	- 3 dB at 20 Hz	- 3.5 dB at 20 Hz
Pink noise output level	100 mV (nominal)	200 mV
Pink noise output impedance	680 ohms	confirmed

CIRCLE 13 ON READER SERVICE CARD

Spectro Acoustics 200SR Power Amplifier



General Description: The Spectro Acoustics model 200SR is a stereo (two-channel) basic or power amplifier rated for continuous power output of 110 watts per channel over the range from 20 Hz to 20 kHz, both channels driven into 8-ohm loads. The front panel contains a detailed LED power output display, plus an attenuator control to reduce the power scale shown by -10 dB or by -20 dB.

The numbering, for each channel, runs: -25 , -21 , -19 , -17 , -15 , -11 , -7 , -3 , 0 and $+3$ dB. The indicated wattage figures for the LED indicators are: 0.3, 0.56, 0.8, 1, 1.4, 1.8, 2.2, 2.6, 3, 5.5, 8, 14, 22, 37, 55, 80, 100, 138, 175 and 200. These figures apply, of course, when the attenuator is left on the "0 dB" position. In the -10 dB setting, the 200-watt marking becomes 20 watts. In the -20 dB setting, the 200-watt figure becomes 2 watts.

With the attenuator button left "out," a pair of green LEDs will indicate clipping points.

The rear of the amplifier contains a pair of phono jacks (pin-type) or left- and right-channel inputs, and five-way binding posts for speaker connections. Both speaker lines are fused, as is the AC mains input. The amplifier has no level controls.

Circuitry consists of self-contained amplifier modules, one per channel. The modules are interchangeable and may be fairly easily replaced if needed.

Test Results: With regard to power output, THD, and frequency response, the Spectro Acoustics 200SR easily met or exceeded its specifications. IM distortion

(by either the CCIF or IHF method) was not specified; the IM measured in our lab was not bad, but not great. The difference in damping factor between that specified and that measured can be attributed to the different frequencies involved. The manufacturer spec'd it at 20 Hz and we check it at 50 Hz. The DF we did measure is, in any event, high enough. Slew rate, spec'd at 20 volts-per-microsecond, was measured as a bit better than 22. As slew rates go these days that is not a particularly high figure, and it probably accounts for the less-than-sensational IM distortion we measured.

During bench-testing, the amp developed a habit of popping its line fuse (though not its speaker fuses). This happened, of course, only when we tried to measure full output into 4-ohm loads at high frequencies—admittedly a condition not too likely to occur in actual use for music programming. In any case, better that the fuses go than the circuit output devices. There seems little chance of the latter with this unit.

The LED display was found to be not totally accurate, but accurate enough to provide the user with a pretty good idea of power levels being fed to the speakers. The green LEDs were judged to be highly useful in that they denote the actual clipping point of the amplifier which, true to a hand-filled notation on a "Verified Amplifier Performance" chart furnished with the unit, occurred at around 180 watts per channel. That is a peak-to-peak signal swing of about 107.3 volts, which is not unreasonable with a supply voltage at the output stages of ± 70 volts under quiescent signal conditions. That high clipping level capability also serves to explain the very large dynamic headroom claimed (3 dB) and measured (2.8 dB) for this amp. While high dynamic headroom is not necessarily a measure of amplifier quality, there is no denying that the 200SR will deliver audibly louder sound than a similarly rated amplifier having a "stiffer" power supply design. Listening tests revealed no "ragged edges" despite the seemingly low slew rate.

General Info: Dimensions of the model 200SR are 19 inches wide; 7 inches high; 12 inches deep. Weight is 26 pounds. Price is \$500.

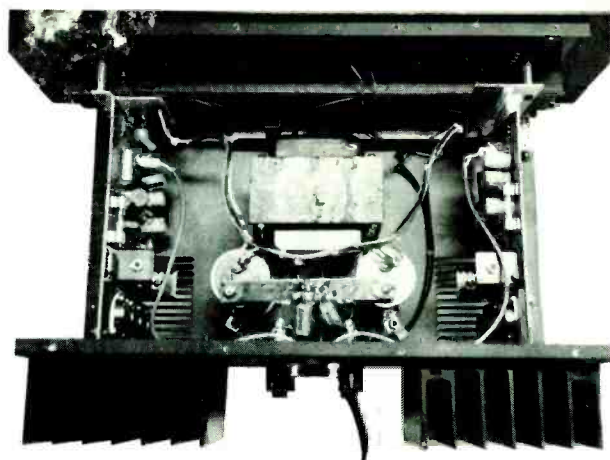


Spectro Acoustics 200SR: Close-up view of connection terminals on amp's rear panel.

Individual Comment by L.F.: This new amplifier entry from Spectro Acoustics has quite a bit going for it, but its chief virtue as far as I am concerned is its low price. \$500 for a 100-watt-plus per channel basic amp that performs as well as this one is something I consider rather a bargain these days.

The performance certificate included with the amp at first turned me off, since I have seen so many similar "certificates" that are pre-printed and pre-signed to make them appear individually hand-written. Well, I can tell you that the one included with my test-sample was hand-filled in and hand-signed. How do I know? Because the distortion numbers filled in by the tester corresponded almost perfectly with the results obtained in our lab tests. How refreshing!

As stated in our Test Results section, the amp's slew rate was, in these days of "fast amps," rather low for an "audiophile" amplifier (which this purports to be) and probably accounts for our relatively poor results with CCIF and IHF IM distortion. CCIF IM distortion is, of course, the 1-kHz "beat" developed by an amp when two high-frequency signals (in this instance, 19 kHz and 20 kHz) are passed through the amp at a combined equivalent amplitude corresponding to rated output. IHF IM distortion is the sum contribution of all the beat components generated when two such signals are passed through the amp. In both tests, the model 200SR showed about 0.5 percent IM—not bad, but not as good as that obtained for some amps that stress slew rate and low TIM. I have found that the IHF IM measurement in particular gives very good



Spectro Acoustics 200SR: Internal view of the amplifier.

correlation with TIM for an amplifier, and is a lot easier to measure (which is why I measure it).

Individual Comment by N.E.: The 200SR seems competent enough for driving 8-ohm speakers to very ample listening levels. There is no 4-ohm spec, and our bench-lab experience with 4-ohm loads at full output would indicate its limitations in this particular area of application. There are, of course, higher-powered amps around and many with lower IM, but at its relatively modest price the 200SR does bear consideration.

SPECTRO ACOUSTICS 200SR POWER AMPLIFIER: Vital Statistics

PERFORMANCE CHARACTERISTIC	MANUFACTURER'S SPEC	LAB MEASUREMENT
Continuous power for rated THD (8 ohms, 1 kHz)	110 watts	144.5 watts
Continuous power for rated THD (4 ohms, 1 kHz)	NA	145.2 watts
FTC rated power (20 Hz to 20 kHz)	110 watts	132 watts
THD at rated output (1 kHz, 8 ohms)	0.08%	0.023%
THD at rated output (20 Hz, 8 ohms)	0.08%	0.032%
THD at rated output (20 kHz, 8 ohms)	0.08%	0.06%
IM distortion at rated output (SMPTE)	0.08%	0.05%
IM distortion at rated output (CCIF)	NA	0.5%
IM distortion at rated output (IHF)	NA	0.56%
Frequency response at 1 watt	± 1.5 dB, 5 Hz to 100 kHz	- 1 dB, 5 Hz to 100 kHz
S/N ratio re: 1 watt, "A" wtd IHF	NA	94 dB
S/N ratio re: rated output, "A" wtd	108 dB	114 dB
Dynamic headroom, IHF	3	2.8
Damping factor	150 at 20 Hz	100 at 50 Hz
IHF input sensitivity	NA	0.12 volts
Input sensitivity re: rated output	1 volt	1.2 volts
Slew rate (volts/microsecond)	20	22
Power consumption, idling	NA	46 watts
Power consumption, maximum	NA	590 watts

CIRCLE 10 ON READER SERVICE CARD

Ashly SC-50 Peak Limiter-Compressor



General Description: Developed primarily for sound-reinforcement and recording applications, the Ashly model SC-50 is designed to control audio signal levels without adding to noise or distortion in the process. It functions by establishing a maximum or ceiling "threshold" level for the loudest peaks in the program material. Signals below this ceiling pass through the device unchanged. However, when the threshold is exceeded, the SC-50 will reduce the gain so that signal peaks remain at the ceiling level. Rather than clipping the peaks, the SC-50 actually turns down the signal level. Thus it functions as a level-control and has no effect on frequency response.

Operating controls are neatly and clearly laid out across the front panel. At the extreme left is the unit's power off/on switch; it lights up in the "on" position. Centered on the panel are a pushbutton limit-defeat switch, and five colored control knobs: Gain, Ratio, Attack, Release and Output. To the right of the last knob is an LED display. The first four LEDs indicate gain reduction and are marked for -20, -10, -6 and -3 dB. The last LED indicates threshold level; when the device is properly adjusted this LED should light up only on the loudest peaks.

The gain control is calibrated from below -30 dB through zero dB to above +30 dB. The output knob is calibrated from "minus infinity" to +18 dBm. The SC-50's detector threshold is fixed at 0 dBV, so that when both the input gain and output level controls are set to their respective zero positions, the device has unity gain, and a peak output of 0 dBV at the threshold level. Varying the gain control will change the effective threshold in an amount opposite to the input gain. For instance, applying +10 dB gain will cause the SC-50 to start limiting at -10 dBV.

The Ratio control may be used to adjust the increase in input level above the threshold in order to produce an increase of 1 dB in output level. The Attack control adjusts the time (from 0.2 to 20 milliseconds) in which the gain is reduced to normal when the input peak level is reduced. The release control may be set over a range of 0.1 to 18 seconds (attack time will always be much faster than release time).

A single-channel device, the SC-50 may be used with a second SC-50, with an appropriate patch cord, for stereo applications. For musical sustain use, the SC-50

may be inserted in the audio signal path between the instrument preamp and power amp.

The rear panel contains five standard ¼-inch phone jacks for input, output, stereo tie and detector patch send and return. The last two jacks permit connecting an equalizer in the SC-50's detector loop to produce frequency-sensitive limiting. Of standard rack-mount width, the SC-50 is protected by a ¼-amp fuse and it uses a power cord with a three-prong (grounding) plug.

Test Results: MR's tests and examination of the SC-50 indicate the device is a precision-crafted unit with great control flexibility combined with extremely low distortion and very high signal-to-noise ratio. Published specs were confirmed or exceeded in our bench measurements.

To illustrate graphically the limiter's action (although admittedly a true appreciation of its action can be obtained only by hands-on experience with it), we came up with the display shown in Fig. 1. It requires some explanation. First, ignore all references to frequency on the 'scope face. Our spectrum analyzer was tuned to a single constant frequency for these experiments, i.e., 1 kHz. Then the trace was sent sweeping slowly from left to right, at a rate slow

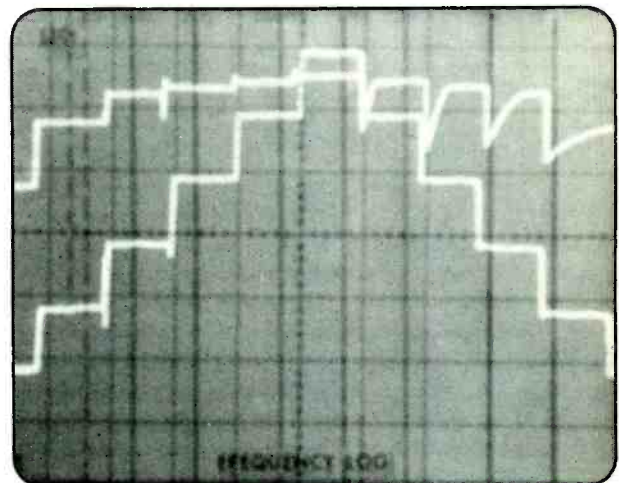


Fig. 1: Ashly SC-50: Displays show input (lower "ladder") and output levels obtained with unit set for fast attack and slow release times (see text).

enough for us to vary an input signal applied to the SC-50 in 10-dB increments.

The "up-and-down-staircase" pattern seen in the lower section of the display represents the input signal. The odd-looking waveform above it represents the signal observed at the output of the SC-50. Note that the first few steps (at the left) are virtually identical for input and output. However, as we cross the SC-50's threshold level, upward steps of 10 dB in input level no longer produce 10 dB changes in output level.

Note too the differences between the attack times at the left, once compression or limiting has begun, and the release times at the right as input signal levels are decreased in 10-dB increments. Of course, an infinite variety of such displays—with different degrees of compression and different attack and release times—could be achieved. Figure 1 shows only one typical set of curves obtainable with the SC-50.

General Info: Dimensions are 19 inches wide; 1¾ inches high; 6 inches deep. Weight is 8 pounds, and price of the unit is \$299.

Joint Comment by N.E. and L.F.: We have long regarded limiters or compressors as necessary evils at best, or as distortion-producing boxes at worst that, in broadcast applications, take the dynamics out of music and make every station sound like "the loudest guy on the dial."

Our basic feelings about limiting and compression remain unchanged, but we will concede that if you have to use a limiter or compressor [and most professional recording studios *do* make them available], this unit from Ashly Audio would be a very good choice. Even when rather extreme compression is used, the distortion and signal-to-noise characteristics of the

SC-50 remain as good as those obtained from many straight-line consoles. Distortion, incidentally, was measured under no-limiting conditions (to match up against the way Ashly specifies it), and then was measured with the limiter on. Even the latter figures we obtained were very low.

The facility for patching in an equalizer is a nice touch. It enables frequencies, which are boosted by the equalizer (which should have approximately unity gain), to be limited earlier (lower threshold), while frequencies which have been cut will cause a higher threshold. The ability to change attack, release and compression ratio over a wide range makes the SC-50 a very practical device to use for a variety of program material, since each type of material (or sound-reinforcing situation) could require different treatment. Fast attack times generally tend to keep transients from overloading a system but they also tend to introduce roughness or harshness when large limiting ratios are employed. Faster release times tend to increase the overall loudness, but they also make the limiting action itself more apparent because of the effect of "breathing" or "pumping." The wide range of adjustments on the SC-50 facilitate tailoring the action of the device for optimum results with any program source, albeit it takes a little experimenting to get it just right.

While we have no basis for comparison (this is, actually, the first professional limiter-compressor we have had in the lab), it seems to us that the Ashly SC-50 is well-priced in light of its highly effective capabilities. While we still wish that certain branches of the audio business did not "need" to misuse such products at all, we do recognize that limiters and compressors have their place. And since they do, the SC-50 seems like a damn good unit to use.

ASHLY SC-50 PEAK LIMITER-COMPRESSOR: Vital Statistics

PERFORMANCE CHARACTERISTIC	MANUFACTURER'S SPEC	LAB MEASUREMENT
Frequency response	± 0.5 dB, 20 Hz to 20 kHz	± 0.3 dB, 20 Hz to 20 kHz
Distortion (THD)	0.05%, 20 Hz to 20 kHz, at 0 dBV 0.2% at +18 dBV, no limiting	0.0035% at 1 kHz; 0.006% at 20 Hz; 0.01% at 20 kHz Limiter on: 0.033% at 1 kHz; 0.05% at 20 Hz; 0.09% at 20 kHz
Hum and noise	-90 dBV (unity gain)	-85 dBV (unwtd)
Gain	± 30 dB	± 30 dB
Attack time	200 msec to 2 msec	confirmed
Release time	100 msec to 2 sec	confirmed
Maximum in/out level	+20 dBm	+31 dBm
Input impedance	10 K ohm, balanced	confirmed
Output impedance	50 ohm, terminated with 600 ohms or greater	confirmed
Power requirements	120 VAC, 50/60 Hz, 5 watts	7 watts

CIRCLE 11 ON READER SERVICE CARD



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CIRCLE 89 ON READER SERVICE CARD

TEAC/Tascam 80-8 Multi-Track Recorder

By John Murphy and Jim Ford

The Tascam Series 80-8 is an 8-track recorder/reproducer designed for versatile multi-track recording. It features an economical half-inch tape format and a fixed tape speed of 15 i.p.s. There is front panel access to many of the calibration controls (bias, EQ, record level, etc.) and the owner's manual gives the user excellent instructions for verifying the machine's performance and carrying out the routine maintenance required to ensure that performance. IC logic and motion sensing are employed in the transport control section. The 80-8 is priced at approximately \$3990.

General Description: The front panel layout is quite simple making the 80-8 a very easy machine to use. Across the bottom of the unit are eight input level controls with the associated VU meter and overload indicator located above. The panel that these are mounted on swings down (upon loosening two screws) to reveal the circuit cards and calibration controls for the eight channels. Above this panel and to the far left is a push button power on/off switch. To the right of the on/off switch is a pushbutton memory rewind control. With this button depressed and the machine in rewind mode, the transport will stop when the index counter reaches "0000." The four digit index counter is located directly above the memory control and is lighted to ensure its visibility in any lighting environment. Proceeding across the front panel, the next group of controls is a row of eight push buttons labeled "FUNCTION SELECT" 1 through 8. Above each button is a red LED that flashes whenever the function select button is depressed. When the machine is entered into the record mode these indicators change from a flashing status to solid on to indicate that recording is taking place on that channel.

There is a group of three interlocking push buttons labeled "OUTPUT SELECT" to the right of the function select switches. These three buttons are individually labeled "INPUT," "NORM" and "MONITOR," and there is a red LED indicator above each. The LED simply indicates which of the three buttons is depressed. The action of the function select controls depends on the position of the output select switch. With the "INPUT" button depressed, the input signals are routed to the outputs. When the "MONITOR" button is depressed the signals from the monitor head are routed to the outputs. With the output select set to "NORM" the output signal for a particular channel depends on the position of the function select button for that channel. If the function select button is depressed then that channel is set to record



and the input signal is routed to the output. If the function select is not depressed then the playback signal from the tape is routed to the output. Thus, with the machine in the "NORM" mode, the function select switches are dual purpose. They act as record enable switches and at the same time they switch the appropriate signal (tape or source) to the output for monitoring. This allows one button punch-in recording. If TEAC's optional dbx noise reduction system is used





then the function select buttons will even take care of switching the dbx between encode and decode modes as necessary. Quite convenient!

There is a latching cue control to the right of the output select switches. The control is lever actuated and defeats the tape lifters during fast wind operations to allow monitoring. It is intended to be used with a light touch (and not latched) however as the signal level is excessive during fast wind. The latch is strictly for defeating the lifters during editing operations.

The transport controls are located to the far right side of the front panel. Both the record and pause buttons have associated LED's to indicate when these modes have been entered. The transport utilizes three motors with the capstan being belt driven by a hysteresis synchronous type motor.

The 80-8 has a hinged head cover which flips up to provide easy access to the heads for adjustment or cleaning. TEAC states that there is a marked similarity of gap lengths required for the record and reproduce functions at 15 i.p.s., and based on this, a combination record/play head is used in the 80-8. Actually, it uses two of them. The first is the record/play head which is used for all normal record/play operations and makes for automatic "sync" recording since there is no time delay between record and play signals. Following this is an identical head just for monitoring the printed signal. The latter head is used only when the "monitor" button is depressed.

The rear panel contains a connector for the detachable line cord on the far left with a switched outlet and fuse beside it. To the right of these is a connector for an optional remote control. Next there are two rows of RCA phono jacks for the eight inputs and eight outputs. At the right of the rear panel is a removable plate which covers the connector for an optional dbx noise reduction unit (TEAC/TASCAM DX-8).

The operator's manual provides valuable information on the theory of operation-maintenance and gives detailed instructions on how to perform the routine maintenance required for consistent high-quality performance. This includes such adjustments as record, EQ, bias and record levels.

Price Versus Performance: The Tascam 80-8 falls under that vague classification of audio equipment known as "semi-pro." This is not so much because of its performance however, but more because of its cost. The true "professional" tape machines (such as those made by Ampex, 3M, MCI, etc.) are quite expensive. A professional eight-track recorder might cost three or four times the price of the 80-8. But is the *performance* of the pro machines three or four times better than the 80-8?

No. The performance of the 80-8 is virtually the same as the pro machines except for the differences due to tape format. The pro eight-track recorders use one-inch tape and therefore have about a 3 dB better signal-to-noise ratio. Also, they usually allow tape speeds of 30 i.p.s. and can provide the improvements in performance that come with the faster tape speed. But they really don't do anything the 80-8 can't do, and their performance is only slightly better simply because they use wider tape. So what advantage do the pro machines offer?

More than anything else the pro machines offer longevity and durability. They get used (and abused!) day in and day out for years on end with only occasional corrective maintenance and still meet their performance specifications. The individual components in the pro machines are first class all the way, right down to the resistors. In comparison, the components of the 80-8 are more in the "budget" category. Such a comparison is terribly unfair however because of the very large difference in prices of the machines.

If we compare the ratio of price-to-performance for the 80-8 and a pro machine the 80-8 would win without question since it delivers the performance of a pro machine at a fraction of the cost. Equipment like the 80-8 has made it possible for many musicians—who would have been economically excluded otherwise—to get into multi-track recording. This is true of semi-pro audio equipment in general. Even though this equipment is expensive, it is not totally beyond the economic grasp of the individual with a serious interest in recording.

Listening and Handling Test: It took two of us to carry the 80-8 from the lab downstairs to the listening room; it's a pretty heavy machine (76 lbs.). We easily interfaced it in the tape monitor loop of our preamp and loaded on a reel of Ampex 456 tape. After putting on one of our favorite direct discs, the record levels were set for about 0 VU with the overload indicator just occasionally flashing. By punching the tape button on our preamp we were able to compare the disc

with its reproduction by the 80-8. We must say that the 80-8 does an excellent job of reproducing even the toughest musical sounds. The only audible difference we could detect was in the bass region. The bottom end sounded just a bit heavy when we switched from source to tape. This is probably due to the 60 Hz peak we noted during our lab test.

We noticed that in switching between input and monitor at the tape machine that the output of the tape machine is muted for a few seconds following the switching action. This is probably to prevent audible pops in the output but it makes it impossible to do rapid A/B comparisons between source and tape using the machine's switching controls. There is also a delay in the machine's operation when it is first turned on. The pause light flashes for about the first 10 seconds the machine is powered on and there is no response to the transport controls. Once the pause light goes out the transport operates normally. Tape handling was smooth and no degree of fast-buttoning could confuse the unit or cause it to spill tape. The motion sensing allows going from fast to wind to play without delay.

Lab Test: When we took the 80-8 up to the lab the first thing we did was to verify the factory calibrations of the bias and EQ controls for Ampex 456 tape. The factory set-up was determined to be good so we proceeded with our tests. A summary of the test results is provided in the "Lab Test Summary" section below.

Our standard test tape revealed a playback response of +3, -1 dB from 30 Hz to 15 kHz. Playback levels for the 8 channels differed no more than about 1 dB. There was a broad 3 dB peak at about 50 Hz in the playback response which can be attributed to head contour effects.

Individual record/playback frequency response curves are provided in Figure 1 for the 8 channels. All of the recording tests were performed using Ampex 456 tape. The low frequency head bump can be easily seen in these graphs. The peak is consistently centered at 60 Hz and rises about 3 dB above the mid range. Above 100 Hz response is ± 1 dB out to about 18 kHz with little variation between the channels. It's too bad head bump couldn't have been tamed a little bit better.

The output level of the machine for the playback of a 0 VU level tone was -8.3 dBV (298 mV), consistent

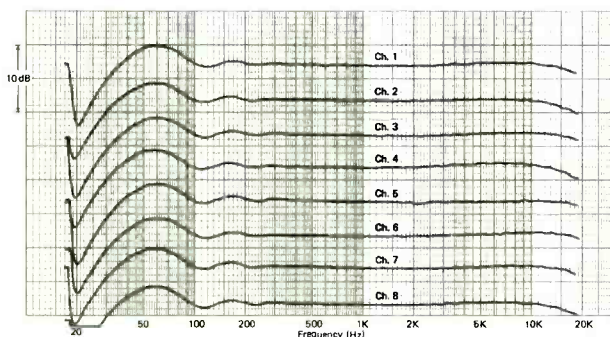


Fig. 1: TEAC/Tascam 80-8: Record/play frequency response at 0 VU.

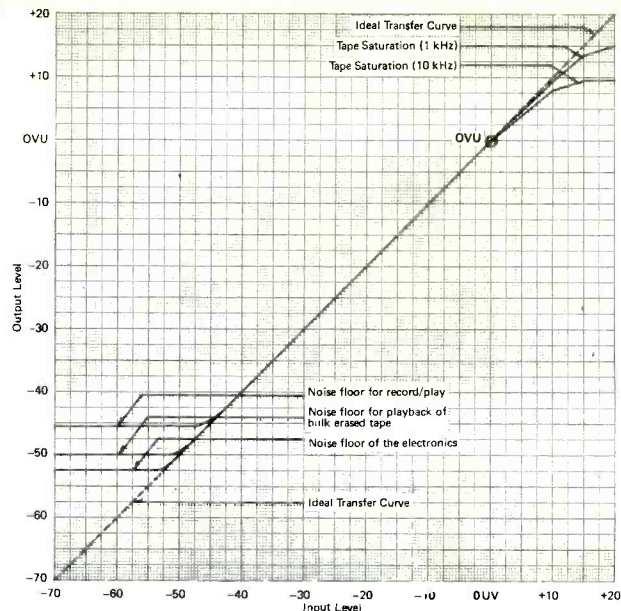


Fig. 2: TEAC/Tascam 80-8: Input/output transfer curve.

with the nominal -10 dB levels of the Tascam series.

The 80-8 will accept input levels from -16 dBV (121 mV) to +33.8 dBV (38 V) for a 0 VU indication. We noted that the overload indicator lights at +8.5 VU.

The record level for a 0 VU signal is 3 dB above 185 nWb/m (Ampex operating level). This provides 11.8 dB of headroom before the total harmonic distortion level reaches 3%. However, the record/play noise floor is only 46.7 dB below 0 VU. Considering this we recommend using pretty hot record levels with this machine in order to stay well out of the noise. However, if the optional dbx noise reduction is used this will not be necessary. Noise from the machine's electronics was -54.7 VU or 8 dB below the record/play tape noise.

The harmonic distortion for the record/play process was masked by tape noise at 0 VU, but it was well below 1%. The machine's electronics had a THD level of .015%, so the record/play harmonic distortion will depend strictly on the tape.

The slew rate limit through the machine's electronics was measured as 2.0 volts per microsecond. Thus the machine meets the "Jung Criteria" for freedom from slewing induced distortion (SID) and transient intermodulation distortion (TIM) for output levels up to 2 volts peak (+13.5 VU).* (The Jung Criteria states that an amplifier will be free from SID and TIM provided it has a slew rate of at least one volt per microsecond for each volt (peak) of output signal swing. For further discussion see the cited reference.)

Conclusion: The Tascam 80-8 is an excellent multi-track recorder. The function select controls make its operation extremely simple by taking care of both the

*J.G. Jung, M.L. Stephens, C.C. Todd, "An Overview of SID and TIM, Part II—Testing," *Audio*, LXIII (July 1979), 38-47.

“Once you get your hands on this machine . . . you’ll see what we mean.”

PERFORMANCE:

Overall Signal-to-Noise: 66 dB unweighted at 520 nWb/m (30 Hz to 18 kHz audio filter).

Playback Signal-to-Noise (electronics): 72 dB unweighted (with audio filter).

Headroom: +24 dB. Maximum Output: +28 dBm.

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Playback Frequency Response (MRL test tape): 31.5 Hz to 20 kHz ± 2 dB.

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ADDITIONAL BENEFITS: Three speeds, dc servo $\pm 7\%$ ¼ track reproduce, full edit capability, over-dubbing, noise free inserts, XLR connectors, NAB/CCIR switching, unique three-position alignment level switch.

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record enable, and output switching functions. This allows one button punch-in recording. Even though there is a slight (3 dB) low-frequency peak in its response the sonic quality is excellent. TEAC provides

a good owner's manual complete with enough information to allow the owner to perform his own routine maintenance. If you're looking for an eight-track recorder check out the 80-8. We think you'll like it.

Lab Test Summary

(Note: 0 dBV = .775 Vrms; all tests were performed using Ampex 456 tape.)

Input Level

Minimum input level for 0 VU indication: - 16.1 dBV (121 mVrms)

Output Level

Output level at 0 VU: - 8.3 dBV (298 mVrms)

Record/Playback Frequency Response

± 1 dB 90 Hz to 18 kHz
+ 3, - 1 dB 33 Hz to 18 kHz

Record/Play Bandwidth (- 3 dB points)

29 Hz to 23 kHz

Noise Levels (20 kHz, filter, unweighted)

Record/Playback = - 46.7 VU (- 55 dBV)
Playback of bulk erased tape: - 50.2 VU (- 58.5 dBV)
Noise from electronics only: - 54.7 VU (- 63 dBV)

Record Level

0 VU is 3 dB above 185 nWb/m
(Ampex operating level).

Total Harmonic Distortion (plus noise) at 0 VU (Record/Play)

100 Hz .59% (mostly noise)
1 kHz .66% (mostly noise)
10 kHz .79% (mostly noise)

Record Level for 3% THD @ 1 kHz
+ 11.8 VU

Electronics Only

Input clips at: + 33.8 dBV (38.0 Vrms)
Output clips at: + 19.0 dBV (6.91 Vrms)

Total Harmonic Distortion (Electronics Only)

	100 Hz	1 kHz	10 kHz	
0 VU	.041%	.041%	.038%	(mostly noise)
+ 10 VU	.015%	.014%	.015%	(true THD performance)

Bandwidth

12 Hz - 68.7 kHz

Slew Rate

2.0 volts per microsecond

CIRCLE 12 ON READER SERVICE CARD



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POPULAR

KIM CARNES: *St. Vincent's Court*. [Daniel Moore, Dave Ellingson, Kim Carnes, producers; Larry Hirsch, engineer; recorded at Sound City Recording Studio, Sound Labs Inc., and A&M Studios in Los Angeles, Ca.] EMI America SW-17004.

Performance: **New, improved**
Recording: **Excellent**

We've known for a couple of years now that Kim Carnes has both talent and good looks, two prerequisites for turning any music biz head in Hollywood. Her previous albums for A&M, while turning up occasionally decent ditties like "You're A Part Of Me" and "Love Comes From Unexpected Places," failed to send either fans or critics into rave spasms. But while Carnes seems pretty laid back and West Coast mainstream, *St. Vincent's Court* contains at least some of the stuff that Ronstadt-Emmylou dreams are made of. Aside from possible commercial impact with singles like "Stay Away," Carnes has achieved an artistic depth and consistency that deserves a second look. And a third.

Kim comes out rockin' with "What Am I Gonna Do," and shouts up a good storm on "Lookin' For A Big Night" and "It Hurts So Bad." The latter, in particular, has a Rod Stewart "Country Comfort" kind of sound, complete with mandolin. Carnes has that same scratchy voice as Rod but, in one man's opinion, she's definitely the better looking

blonde. Whether Carnes will sound this throaty in person is hard to guess, but Larry Hirsch has captured her earthy imperfections perfectly in an otherwise glossy instrumental mix.

There are just enough rockers here to balance a bevy of intimate story ballads. Best of the bunch are "Stay Away" and "Paris Without You (St. Vincent's Court)." The latter is backed by drizzly electric piano (Bill Cuomo) and echoed flute by jazzy Tim Weisberg—a gorgeous setting for the strong torch lyrics. "Stay Away" is less doctored, relying more on poetic irony and a good sales pitch by Kim for its effectiveness. This LP should produce more than one successful single.

Another attractive cut is "Love In Love," a slightly countrified acoustic number that some critics might attribute to the Linda Ronstadt syn-



KIM CARNES: Ready for the big time

drome. But Kim Carnes writes almost all of her own material (she's been recorded by singers from Sinatra to Rita Coolidge), or teams with husband Dave Ellingson for tunes as varietal as the sunny "Jamaica Sunday Morning" and a jazz sax-laced "Skeptical Shuffle." Producer Daniel Moore contributes one very gentle lament called "Take Me Home To Where My Heart Is." This is a strong collection of well-produced songs, with the kind of clout you might expect from Karla Bonoff or Eric Andersen. *St. Vincent's Court* shows off a new, improved Kim Carnes that could be ready for the really big time—including guest shots on Merv Griffin. R.H.

PETER HAMMILL: *The Future Now*. [Peter Hammill, producer; recorded at Sofa Sound, Surrey, England, March 18 to April 4, 1978.] Charisma CA-1-2202.

Performance: **Intriguing, sometimes irritating**
Recording: **Complex**

Being new to the somewhat disarrayed world of Peter Hammill, I had no expectations to be met. Which is fortunate, for this album is, above all else, different. This isn't exactly the kind of album that gets airplay in any measurable amount, despite its many merits.

Hammill, apparently not one to trust his artistic endeavors to the care of others, has taken on himself the role of songwriter, producer, singer, and multi-instrumentalist. The result is an album that through its very personal nature is at times quirky, and con-

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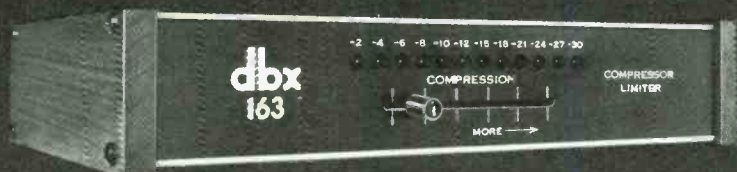
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sistently idiosyncratic, but with many uniquely redeeming traits.

Technically the album is excellent. Hammill makes superbly artful use of the studio without yielding to ostentation. Overdubs are managed skillfully, as they must be when there are as many as Hammill must use, and mixed appropriately. The sound is generally balanced, with emphasis occasionally placed on a particular instrument. Even Hammill's voice is treated as though it was another instrument, which does little to make the lyrics intelligible.

It's very probable that the difficulty in understanding Hammill's lyrics is intentional, since this adds to their already perplexing nature. Both the lyrics and music contain an aura of visionary mysticism that is always interesting. His melodic structures range from banal to thrillingly complex.

Hammill leans heavily on acoustic piano and electronic keyboards, but exhibits a comfortable amount of variety. "Motorbike in Africa" is merely a dreary assemblage of drums and vocals.

The Future Now is, unfortunately, self-limiting. In many ways it's striking, both as an experiment and as a concept, yet much of it has been done before. It's clearly too esoteric for most tastes, so Hammill's considerable ability will be enjoyed by the curious few. M.D.

RICHARD T. BEAR: *Red Hot & Blue*. [Jack Richardson, producer; Eddie Krovin and David Green, engineers; recorded at Blue Rock Studios, New York and Sound Stage, Toronto.] RCA AFL1-2927.

Performance: **Accomplished solo debut**

Recording: **Aphex Aural Excitement**

Bob Seger fans would love this guy. So would a lot of other country-rock rhythm & blues fans. Gruff-voiced pianist Richard T. Bear (alias Richard Gerstein), a vaunted studio musician for the likes of Richie Havens, Carly Simon, Kiss, Steve Winwood, etc., has a sound somewhere in the Captain Beefheart-Bob Seger ballpark, and his music can get out and out inciteful (sic).

"Sunshine Hotel" registers as an enthusiastic, rocking opener, complete with soul chorus, horns, and a goodtime attitude. Right away, session buddies like Les Dudek and Elliott Randall (guitars), Mike Finnigan (organ), and Allan Schwartzberg (drums) begin turn-

ing up with considerable proficiency. Red hot tunes continue with Nicky Hopkins' "Speed On," an oddly humorous "Suicide," and "Bring On The Night."

If this latter cut sounds particularly Seger-ish, there's a good enough reason—Bear's producer Jack Richardson was the man responsible for "Night Moves." Maybe the Aphex Aural Exciter used to mix *Red Hot & Blue* is a technological secret borrowed from Bob Seger's profitable sessions. Whatever the origins, "Bring On The Night" and other tracks have fullness and presence, augmented by the Armin Electric Strings and Brecker Brother horns from time to time.

Along with the aforementioned "red hot" numbers, Bear gets nice and "blue" for some very decent ballads including "The Heart's A Lonely Hunter" and "Susannah '73." Perhaps the best slow one is "Pain In My Heart," a mighty pretty ballad that has just one problem—it includes, however unintentional, direct borrowings from Nilsson's unforgettable "Without You." The line "... Well I guess that's just the way the story goes" is repeated verbatim; same notes, same tempo, same everything. An intriguing *deja vu*.

Bear's singing and songwriting herein could not be considered groundbreaking in any way, but the album impressively captures the essence of rock and dresses it up in rough Southern accents and hints of soul-gospel instrumentation. Response from Bear's initial U.S. club tours indicate that he's as sturdy onstage as on this first LP. R.H.

RAPHAEL RAVENSCROFT: *Her Father Didn't Like Me, Anyway*. [Hugh Murphy and Raphael Ravenscroft, producers; Rick Walton, Edwin Croff, Mark Durnley, John Gallan and Deklan O'Doherty, engineers; recorded at The Workhouse, The Roundhouse Studios, Landsdowne and CBS Recording Studios, Aug-Sept. 1978.] Portrait JR 35683.

Performance: **Occasionally inspired**
Recording: **Mixed reviews**

Raphael Ravenscroft gained a bit of immortality in the pop music world for the electrifying saxophone "hook" he played in Gerry Rafferty's song, "Baker Street." The total effect of the brief measures which featured his solo work was stunning, resembling a musical sunburst. Alas, no such moments can be

found on Ravenscroft's solo recording, although some of his music, particularly his flute music, is quite good indeed.

The album is a strangely mixed bag of musical styles, most of which receive competent, if not outstanding, production. Friend Rafferty is represented by two songs, and some other members of his band assist in the playing. But what is most disappointing is that this album is not a showcase for what many probably thought was to be one of music's rising sax stars.

Ravenscroft does his best work, in fact, when he plays the flute, which has the lead in the title cut and principal accompaniment in "Beautiful Woman," for example. The sax can be heard on the other cuts, but rarely is it out front. When Ravenscroft is featured, he does well, but he is not featured enough.

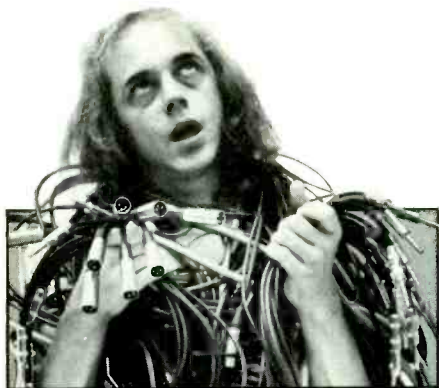
One of the problems with the album is that some tracks are just too overblown. "You Put Something Better Inside of Me," a rather inconsequentially written little Motown-flavored song written (surprisingly) by Rafferty, is too tinny if the treble is turned up and too muffled if the bass is emphasized. The title track is an extremely nice piece of moody music, except for the schmaltzy string charts used after the initial development of the theme. The full orchestral treatment in "Whole Lotta Something Goin' On" seems borrowed from standard soul arrangements.

But not all the album is flawed. Joe Zawinul's "Country Preacher" is a nice little instrumental featuring good keyboard and percussion work, and fine sax playing by Ravenscroft. Sound separation is good, and the instrumentation is distinctly heard. Except for the strings, the title track, too, has much to commend, particularly the flute duet played an octave apart. The melody line coincides with the four-line verses very well, and one only wishes that the lyrics of Rafferty's song could be sung with the music. The lyrics are on the album liner, but the track is instrumental.

An Ian Dury song, "Sex and Drugs and Rock 'N' Roll," is treated almost as a novelty number, with considerable use of a voice box and electronics that gives the piece both humor and substance. Some bizarre musical effects and percussion here. The voice box shows up again on "Give It All You Got," which starts slowly and sounds as if it could have come from the Steely Dan songbook.

Perhaps it is unfair to compare this album with Rafferty's *City to City*. Everything clicked so well in that album

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RAPHAEL RAVENSCROFT: *Mediocre*

that it is unlikely that we shall see one as uniformly interesting and well-packaged as that in a long time. But a little more care could have been taken in Ravenscroft's album. The selection of material could have been better, and the arrangements and production could have been adapted better to Ravenscroft's particular talents with saxes and flutes. The singing, most of it done apparently by Ron Charles Boromeo (no specific credit is given), is not the strongest in the world and also tends to distract from Ravenscroft's playing. This album is not without some redeeming features, but more of them would certainly be helpful. S.R.

TRACY NELSON: *Homemade Songs.*

[Travis Rivers, producer; Don Cobb, Johnny Rosen and Mervin Louque, engineers; recorded at American Studios and Fanta Professional Services Mobile Recording Truck, Nashville, Tn.] Flying Fish FF 052.

Performance: **Gutsy, and with feeling**
Recording: **Just excellent**

This is supposed to be the same person who sang "Tennessee" with the group Mother Earth, but that song pales by comparison to the batch of ten contained here on the latest release by Tracy Nelson. With a voice like partly-congealed honey, Nelson has assembled a tight little blues band, chosen a wonderful array of material and come up with a splendid album.

The album has been recorded so that one cannot forget that it is Tracy Nelson we're supposed to hear. Despite the brashness of the horns or the beat of the drums and bass, her rich voice is never lost and remains out front on each track, (except on one in which she shares the lead with Carlene Carter).

Although the accompanying musicians make a fine blend behind Nelson, they are not swallowed up into a single sound. The horns and guitars remain well separated; the drums and percussion never fade, never intrude; the keyboards retain a freshness and importance in each arrangement in which they're used on this album.

The band probably is a lot larger than it needs to be, considering the gospel and rhythm-and-blues treatment that is used on just about every track. But the band never becomes overblown and never overshadows the Nelson vocal instrument.

The material selection is one of the album's strengths. She opens with a Randy Newman song, "God's Song," and includes a Jimmy Rushing song, "You Don't Need to Move a Mountain," as well as some by some of her contemporaries and one by herself. There's really not a weak track on the disc, if one is open to this earthy kind of contemporary, gospel-tinged blues.

Among the better tracks are "Summer of the Silver Comet," in which the acoustic guitar, bass and electric piano help cushion the sharp edge of her singing; "God's Song" and "You Don't Need to Move a Mountain," both powerful gospel-styled songs, and "Friends of a Kind," which is actually a duet between



TRACY NELSON: *Simply splendid*

Nelson and Carter.

On the last, the two share the lead and trade off, each assuming the lead for one of the choruses. A sparkling embellishment to the arrangement is the addition of an acoustic guitar several bars into the song, and the percussion is especially nice (and prominently featured). The two voices also blend together very well.

Only a few flaws can be found in the recording. Some good saxophone work is almost lost in the last third of "Ice Man" as the drums and bass become more prominent. The short electric guitar phrases in "Silver Comet" tend to get fuzzy at the end of phrases, although this may have been planned. In "She's Taking My Part," the repetitive chorus is almost lost behind a brash horn chart.

But there are some nice touches, too, that make one forget these minor shortcomings. Nelson gives a stirring reading, unaccompanied, to the opening bars of "Mountain," and plays nicely off the chorus in "I've Been There Before," her only composition on the album. The best ensemble sounds can be heard on Diane Davidson's great road song, "Sounds of the City," and the closing track of the album, "Suddenly." S.R.

McGUINN, CLARK & HILLMAN:

McGuinn, Clark & Hillman. [Ron Albert and Howard Albert, producers; Don Gehmen, engineer; recorded at Criteria Studios, Miami, Fl.] Capitol SW-11910.

Performance: **Byrd ups, MOR downs**
Recording: **Glassy**

Original Byrds fans may be disappointed by this reunion, which replaces the power and immediacy of sixties folk-country-rock with a smoother mix of pop hit attempts. But in terms of production, this disc is an engineering gem from Fat Albert, and there are shots of pure inspiration from Roger McGuinn.

An understated Latin pulse (Joe Lala and Paul Harris) gives *McGuinn, Clark & Hillman* a favorable parallel to another prestigious reunion of recent yore, *CSN* by Crosby, Stills & Nash. As for the tunes written by these vets, there's not a poor pick in the package, but one's initial impression may be "so what?" Cuts like "Long Long Time," "Surrender To Me" and "Sad Boy" are enjoyable little country-rockers, but nothing brilliant. And if the Albert

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MCQUINN, CLARK & HILLMAN: Evidence of inspiration on this engineering gem

brothers make one mistake, it's dressing up the average tunes a bit too much.

But even the average tunes grow on you with repeated turntable spins. The boring "Feelin' Higher" is rescued from the doldrums, for instance, by a bristling Latin instrumental jam that ignites the outro. Attention is paid to detail on almost every other song too, with Gene Clark and Chris Hillman writing most of the tunes in an easy country-rock vein. These songs are not meant to be earth-shakers, just mellow cookers by a flock of guys that still sound pretty good together.

But Roger McGuinn contributes far and away the best music on this album, especially with his awesome acoustic rocker "Don't You Write Her Off." Bubbling along on a perky Caribbean motif, this cut absolutely explodes into the kind of chorus that this reviewer inevitably swallows hook, line and sinker. McGuinn later chips in another nice one, the album's beautiful closing ballad "Bye Bye, Baby." This man can still be a fascinating singer-songwriter when he wants to be. McGuinn's post-Byrds solo career has had its ups and downs, the most recent high point coming on *Cardiff Rose* (Columbia PC 34154) right after Dylan's Rolling Thunder Revue. "Don't You Write Her Off" shows

Roger in top form.

McGuinn, Clark & Hillman is definitely intended for a new set of listeners in a marketplace that has changed radically since the Byrds took flight in 1965 with "Mr. Tambourine Man." It is superbly recorded and contains enough excellent material to balance one or two really bland compositions. It's a fairly promising return for three dormant superstars—a hot U.S. tour might rekindle their songwriting burners for an even better second album. R.H.

SALLY OLDFIELD: *Water Bearer*. [Sally Oldfield, producer; engineered by Dave Grinstead at Chipping Norton Studios, England, May 1978; engineered by Ashley Howe and Mark Dearnley at the Roundhouse Studios, May 1978.] Chrysalis CHR-1211.

Performance: **Inspired, beautiful**
Recording: **Crisp, clear and excellent**

Water Bearer is a gorgeous recording, enhanced not only by Sally Oldfield's remarkable voice, but also by her skill, taste and imagination as a composer and arranger. This is the kind of music for the mind that many had

thought was not being made any more.

It is being made, thank goodness, and what a fine product this example is!

The album is the kind that fits only in the "other" category; it blends English folk melody and instrumentation with purely synthesized music with mystical and esoteric references and lyrics. One will detect Eastern influences, too, on some of the tracks, and although he apparently is nowhere to be found on the album, one might even hear some of brother Mike Oldfield's musical devices in the arrangements.

The recording is well crafted, with the proper mix of vocal and instrumental parts maintained at all times. The bass lines occasionally boom, however, and probably could have been somewhat better modulated.

Most of the seven separate songs and suite of four songs are scored for solo voice, instrumental accompaniment and chorus, and Oldfield remains in front of all the songs. She occasionally becomes her own chorus through judicious use of overdubbing. She also adds most of the instrumental parts herself, playing piano, acoustic and electric guitars, Moog bass, synthesizers, mandolin, some percussion, vibes, marimba, harp-sichord and glockenspiel.

Oldfield's soprano voice is joyously pure in its upper registers and takes on a more earthy sound when it drops into the mezzo range. She thinks nothing of singing one phrase in one octave and either dropping or rising an octave to continue the song. She has only the slightest tremolo, which adds to the purity of her singing.

Her skill on guitar also is demonstrated frequently, such as on the beginning of "Child of Allah," which sounds as if it begins with a 12-string guitar (the liner notes say only that she plays acoustic guitars, however), and she plays piano well, too, such as on "Song of the Bow."

But her real skill is shown by the final product, the blend of voice and instruments on material that bears little resemblance to anything that any other female performer has crafted in recent years. The intricately charted arrangements incorporate a variety of percussive sounds and bass that give a richness and vitality to the music. The title track, for example, uses harp, marimba, bongo and cabassa to carry the rhythm. Bass and bongos are used effectively in the "Three rings" chorus of "Nenya," the lyrics of which have been drawn from J.R.R. Tolkien's *Lord*

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of the *Rings* and *Silmarillion*. "Night of the Hunter's Moon" makes effective use of Trevor Spencer's synthesized drums, and becomes, in fact, as close to a rock rhythm as can be found on the album.

Lyrically, the album contains splendid word-pictures and a few burning images that Bruce Cockburn would feel at ease with. Some deeply emotional and personal love songs are contained, as well as some mystical, near-mythological, references. Some none-to-subtle sensuality also is included: "Man of the earth Oh! I'm on my knees/I wanna taste the fire and honey you're making!" (© Betterbron Music Ltd.).

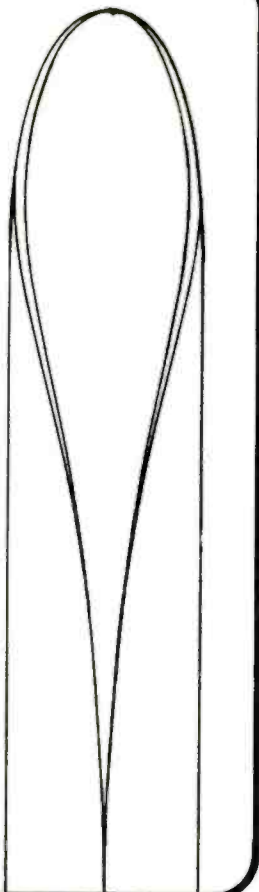
The album is also a finely crafted concept album, in that the songs flow together so well musically, and the songs occasionally contain references to phrases or thoughts found in other songs. "Song of the Bow" contains a chorus, "Taste the fire and honey," that is followed by a song entitled "Fire and Honey." "Nenya" closes with a chorus, "There's a land I can see," that is followed by a song entitled, "Land of the Sun." The first line of that song is "There is a land I can see." Of course, with this kind of coherency, the songs must be linked with strong musical bridges; accordingly, Oldfield has constructed near-perfect bridges.

Water Bearer is going onto my list already for best albums of 1979. S.R.

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TONIO K.: *Life In The Foodchain*. [Rob Fraboni, producer; Nick van Maarth, engineer; recorded at Shangri-la, Malibu, Ca. and The Village Recorder, West Los Angeles, Ca.] Full Moon/Epic JE 35545.

Performance: **Truly sick (just my speed)**

Recording: **Pretty good**

Who let this guy out, anyway? Tonio K. is rock music's latest in a long line of certified sickies, following in the footsteps of such great, forgotten winners as Wildman Fischer and Napoleon XIV. Only, this guy can really rock out.

There's a lot going on in this record. The music backing up Tonio is basically one deliberate blur. Clean, mind you, and distinguishable if you're listening for those things, but busy, busy, busy. There are guitars all over the place, and some of them are doing some nice things. One slide guitarist, in particular, comes through with some burning licks every so often. But you'll pro-

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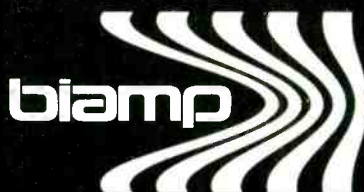
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bably never know who's doing what because six guitarists are listed on the credits—and not by the tracks they play on, either, but in one list on the sleeve. Some of the names are impressive: Albert Lee, Earl Slick and Dick Dale (assuming this is the same Dick Dale as the legendary surf guitarist from the '60's), but I'll leave it up to the trivia freaks to figure out whose solo is whose. Anyway, this is an album of songs—strange, weird songs—not one to listen to for guitar lessons or production techniques.

Whoever Tonio K. is, he's written some of the funniest (I don't know if they're meant to be funny, but I laughed) epic rock songs in some time. This is a record you buy for the lyrics, and only then if you're prepared to be shocked, confused, and occasionally thrown into stitches. There's "The Funky Western Civilization," for one. This is a dance song, in the style of such '60's dance crazes as the hully-gully, the fly, and the frug. Backed by a fuzzed-out rhythm guitar and a few Junior Walker style sax riffs, Tonio recites the instructions to his dance: "You just grab your partner by the hair/ throw her down and leave her there." This is only the first of many such "highlights" (actually, this is the second cut on the record, but the first, the title song, is almost normal compared to what follows).

The recording quality of *Life In The Foodchain* is on par with most any other you'll hear. The musicians are legible, but it's Mr. K.'s vocal that is boosted up to the top. There are a few solos now and then, but there are a lot of words jammed into these nine songs, so Tonio doesn't let anyone get too carried away. And his producer, I assume, was probably fearing for his life anyway, so it's unlikely he made much of an attempt to tamper with this record.

The longest track on the LP, an almost nine minute boogie dubbed "The Ballad Of The Night The Clocks All Quit (And The Government Failed)" is, unfortunately, also the most drawn-out and boring story here. It's got some tight playing on it though, and at one point, the ballad, which is remarkably reminiscent of Dylan's "Highway 61 Revisited," breaks into a sweet country weeper, fronted by a slide guitar which sounds uncannily like a pedal steel.

There are other watermarks of madness here which deserve to be noted. "American Love Affair" is so American it's a march, and the next track, "How Come I Can't See You In My Mirror?" is

a tribute to Tonio's girlfriend, a lady vampire. "Better Late Than Never" features a Garth Hudson accordion solo or two, and "A Lover's Plea" includes the memorable lines: "Think of the children/ I know we haven't got any kids/ But think of if we did/ It would surely upset them." The grand finale is "H-A-T-R-E-D," which begins sanely enough with just ol' Tonio and his lone acoustic guitar. But only seconds later, it turns into the Ramones, and stays that way, till the LP is drawn to a close



TONIO K.: Watermarks of madness

with an appropriate barrage of obscenities, musical chaos, and a cheap shot at Jackson Browne.

Well, let me put it to ya straight—if your heart is weak or your ears are virgin, better stick with Barry Manilow. But if you're sick enough to have read this entire review, you'll probably want to run out and buy this record before your favorite record store closes up for the day. J.T.

JOHN D. LOUDERMILK: *Just Passing Through*. [No producer listed; no engineer listed; recorded at Chappel's Studio, London, England from 1971-1976, except for "Please Jack" and "This World Is Not My Home," recorded at Studio In The Country, Bogalusa, La., 1977.] Music Is Medicine Records MIM 9009.

Performance: **Nice, but nothing smashing**

Recording: **Okay, if you don't mind a bit of surface noise**

Just Passing Through would be a great title for a record by a performer

who spends much of his time on the road, earning his bread and butter by playing the proverbial circuit of small towns and big cities from Tuscaloosa to Walla Walla. He could fill the record with tales of one-night stands and all-day drunken binges, trucks and motels and the rest. That would make sense. But John D. Loudermilk, one gets the impression from this album, is just the opposite in nature. He is a homebody, seemingly content with the easy life he lives, and asking little in return from it. The spiritual tone of his lyrics suggests that Loudermilk is just passing through life, recording what he sees along the way, and then passin' on.

The name of John D. Loudermilk will not be familiar to most, save for hardcore country fans and rock historians fascinated with trivialities. He's written his share of semi-classic songs, among them "A Rose And A Baby Ruth," "Then You Can Tell Me Goodbye," "Norman," and his most popular, the oft-covered "Tobacco Road." Whether any of the tunes on this, his first recording in ten years, will end up semi-classics too is doubtful, but on its own merits, *Just Passing Through* is a pleasant enough offering.

Unfortunately, my copy of this disc was marred by a persistently annoying surface noise, and I'd suggest to this small record company that they find a better quality brand of vinyl in the future if they ever expect to sell any of this stuff. This flaw is all the more bothersome because the music being presented is of the quiet, folksy variety and requires a clean reproduction to be effective.

Despite the expected traditional country and folk overtones in Loudermilk's songs, this is a recording that approaches eclecticism at some points along the way. Loudermilk is apparently enamored with the possibilities inherent in flirting with light classical flavorings in his simple pieces, and the use of those devices draws the LP away from being strictly country or folk as we know it. He uses flutes and strings on almost every cut, mixing them simply, though at times excessively, into his standard guitars, bass, percussion and voice format. There is a vocal chorus here and a dulcimer or mandolin there, but basically this is a country-meets-string ensemble album. The most interesting piece of all turns out to be an instrumental called "Genesis," which throws together a tabla, which sounds like an electric piano, and an instrument Loudermilk calls a dulcilet for a haunting and moving excursion. This is the album's only ex-



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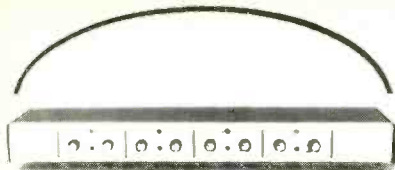


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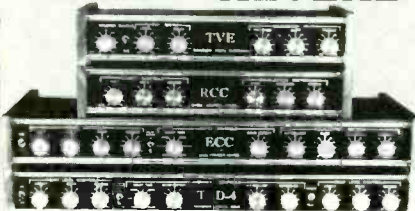
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perimental production number, and as such, is done with a considerably knowledgeable use of recording aesthetics.

More variety, as in "Genesis," certainly wouldn't hurt Loudermilk, but as a singer/songwriter in a traditional mode, he either strikes you or not. Personally, though I can appreciate what it is he is doing, I would find little reason for listening to this record again, having heard it a few times now. It is a pleasing sound, and one recorded as it should have been, but certainly not one to place in the classic file. J.T.

CARL PERKINS: *Ol' Blue Suede's Back.* [Felton Jarvis, producer; Chip Young, engineer; recorded at Young Un' Studio, Murphysboro, Tenn.] Jet Records KZ 35604.

Performance: **Genuine suede**
Recording: **Obligatory corn**

Felton Jarvis writes in his liner notes that "this album was put together by somebody bigger than you and I... the great Producer in the sky," and he's absolutely right that when His all-star band finally comes together up in Hillbilly Heaven, Carl Perkins will be up front rocking. Now that Buddy Holly has been rightfully deified alongside Elvis, it's time for chroniclers of seminal rock to recognize the idiom's other early champions, people like Bill Haley, Richie Valens, the Coasters, Clyde McPhatter, and this cat, Carl Perkins. While his claim to nostalgic fame still springs from that timeless fifties anthem (don't step on my) "Blue Suede Shoes," let it not be forgotten that Perkins' guitar was a direct forerunner of the Eric Claptons, Keith Richards, and tons of subsequent, amputating musicians. And Carl Perkins don't *sing* bad neither!

Ol' Blue Suede's Back comes close to strolling down memory lane, but winds up being more of a tour de force. In addition to a repeat of "Blue Suede Shoes," Carl rocks up classics like "Whole Lotta Shakin' Goin' On," "Be-Bop-A-Lula," "Tutti Frutti," "Rock Around The Clock," and "Shake, Rattle And Roll." True, with the Sha Na Na and *American Graffiti* making the fifties look laughable, or Linda Ronstadt and James Taylor patronizing those great old songs with MOR conviction, you might well suspect Carl Perkins' sudden comeback to be fuelled with

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hopes for financial reward. Maybe that's part of this picture—the twangy vitality of Ol' Blue Suede's performance having a certain camp appeal. But beyond that, it's rare that Chuck Berry/Gene Vincent/Fats Domino/Elvis/Little Richard tunes get this much relevance and artistic life pumped into them. Particularly noteworthy are Perkins' remarks about Hank Williams during "Kaw-liga"—he could very well be describing our long-lost missing link to pre-rock history.

Stomping Jerry Lee-type piano (David Briggs), rockabilly rhythm guitar (Jerry Shook), and raunchy tenor sax (Gayle Whitfield) enliven the primal backing band, while Perkins does his thing on lead electric guitar and big, hully-gully vocals. It's an instrumental blast that producer Jarvis takes down with authentic converberations, imperfections, and corn-ponations. Chip Young captures the loose and partyfied atmosphere without obscuring the deceptively tight and boppin' group interplay. Nearly twenty-five years have passed since the inking of these golden oldies, and that's enough time to gain some perspective on an American art form that some said would surely pass. The way Carl Perkins and colleagues continue to play it on this album, early rock'n'roll has a timeless tribal energy that may never die.

R.H.

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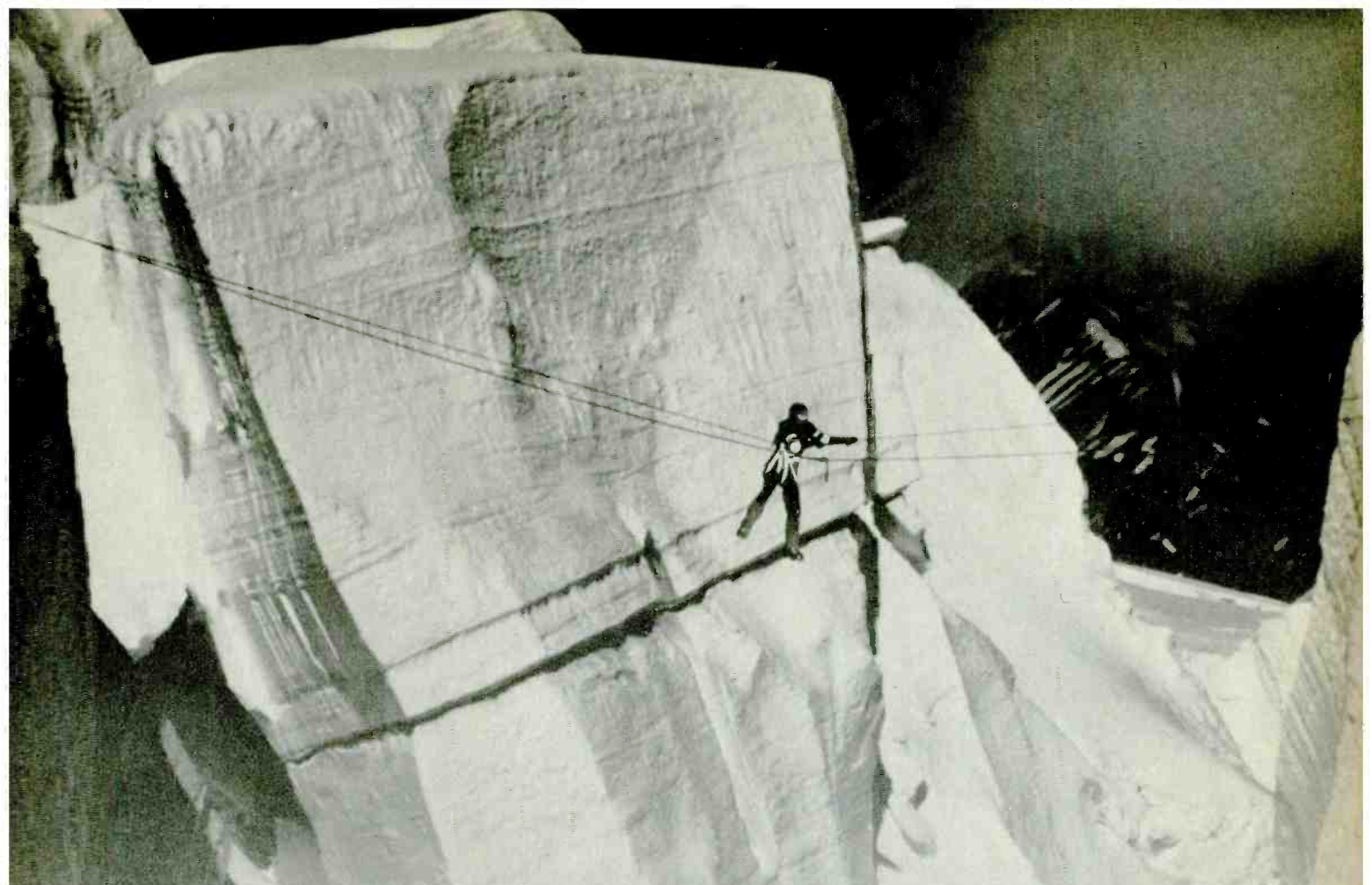
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JAZZ

THE NEW BRUBECK QUARTET: *Live at Montreux.* [Chris Brubeck and Darius Brubeck, producers; D. Richards, engineer; recorded at the Montreux, Switzerland Jazz Festival on July 17, 1977 by Mountain West Studios.] Tomato TOM 7018.

Performance: A new brew in old bags
 Recording: "Live," but not lively

Dave Brubeck was performing with his sons Darius on electric keyboards, Chris on bass and trombone and Danny on drums as Two Generations of Brubeck long before he decided to call the group the New Brubeck Quartet. One would have hoped that the New Brubeck Quartet would have featured a new repertoire, particularly since Darius is a fine composer. Alas, 'tis not so. Most of the tunes on the LP ("Raggy



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Waltz," "Brandenberg Gate," "In Your Own Sweet Way," "It Could Happen To You") are holdovers from the old Brubeck Quartet. But Paul Desmond is dead and Gene Wright and Joe Morello are in other places so it's not the old Brubeck Quartet. Only "God's Love Made Visible" is not a Brubeck Quartet item coming from one of Dave's sacred Oratorios...and I guess "Summer Song" was not really identified with the quartet being a part of the LP *The Real Ambassadors* which combined the talents of Louis Armstrong and Carmen McRae with the quartet.

Some of the tunes, "Brandenberg Gate" and "It Could Happen To You," work better for the New Brubeck Quartet than others such as "Raggy Waltz." But even so, comparisons are not really fair to the Brubeck clan. So entrenched in our memories is the sound of Desmond's alto sax, Wright's bass and Morello's drumming that even the most ardent fan of the New has difficulty in making a fair comparison. As for me I feel that they are separate entities and the only comparisons I would dare to make are that I feel that Dave is a more varied and assured solo pianist today than he was in his quartet days and to point out that it's my feeling that Danny Brubeck is one of the outstanding young drummers, whether he's compared to Joe Morello, Alan Dawson or any other of his contemporaries.

The sound is what I've come to expect from "live" recording situations where either the engineers are stuck with plugging into whatever sound the concert situation is offering or having to make whatever adjustments they may be allowed to under the most trying of circumstances. Even so, at Montreux, Pablo Records under the direction of Norman Granz and Atlantic Records with the able assistance of Gene Paul have done better than this rather dead sound. It may have been the night or the weather or the piano itself, but it does sound more like a safety recording made for after-concert reference by the artist than a first-rate studio job. It's not that bad, but it could have been a lot better. J.K.

DAVID AMRAM: *Triple Concerto*. [Max Wilcox, producer; engineered by Paul Goodman, engineer; recorded with the David Amram Jazz Quintet and the Rochester Philharmonic Orchestra, David Zinman, director.] Flying Fish GRO-751.

Performance: **Exuberant**
Recording: **Flawed**

David Amram may be this era's answer to George Gershwin, given his skillful blending of the jazz and classical styles of music. His triple concerto for woodwind, brass and jazz quintets and orchestra, in the public repertoire for eight years now, exhibits strength in both jazz and classical composition.

One cannot call this recording of the concerto (which is actually a re-release of the 1974 RCA Victor recording) an unqualified success, however. Not enough care was given to the project, and little flaws intrude into the listener's attention and enjoyment.

The opening of the second movement, for example, contains what sounds like an errant tape hiss, which, though very brief, works at odds with the interesting drum and pizzicato passage. In the third movement, one hears several extraneous sounds, like a flutter of pages turning, that probably could have been better muted. The orchestra, too, frequently sounds too large and too dense to suit the kind of intimate interplay that is needed when any of the quintets are performing.

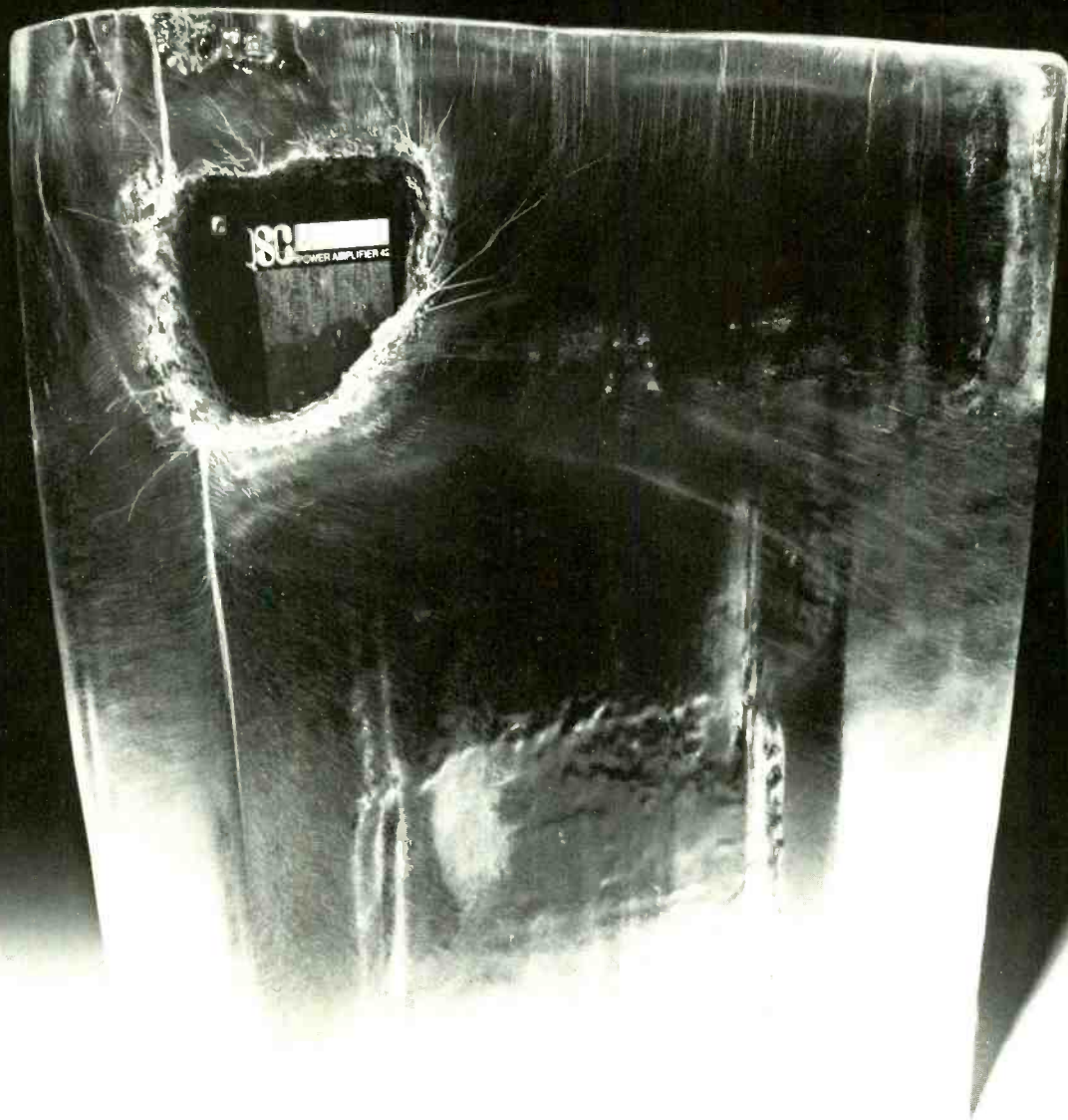
Better separation of some of the instruments also should have been established—the baritone and alto saxes, for example, should have been recorded in the two primary channels. At the end of the second movement, the two saxes, played by Pepper Adams (baritone) and Jerry Dodgion (alto), have a nice passage marred by the lack of feeling that the two instruments are playing off each other.

These are technical shortcomings, however. The material and the playing are first-rate. Amram has incorporated traditional and experimental jazz styles into the framework of a standard three-movement concerto, and only rarely does he lapse into musical pretentiousness.

In the first movement (*allegro con brio*), Amram seems rather tentative in his use of the quintets. He points out in his liner notes that the concerto is scored so that five brass players and five woodwind players who are in the symphony orchestra become the brass and woodwind quintets. (The players, sadly, are not identified.) He uses his own quintet to a much greater extent, particularly Adams and Dodgion. The best ensemble playing comes toward the end of the movement, but the strings are all but lost here.

The second movement (blues) is much

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better for its use of the quintets. Not only do the players in the jazz quintet (Amram plays piano and French horn, Herb Bushler plays bass, and Al Harewood plays drums, in addition to Adams and Dodgion) get their licks in, but the members of the brass and woodwind quintets are given room to play.

The third movement (*trondo a la turce*) is, in some respects, the most interesting of the three, but it also is strikingly different from the two that precede it. Amram has shifted rhythm and style quite abruptly, so that the piece closes on a mid-Eastern note, literally. Amram himself is the featured soloist in this movement, playing a freely unrestrained Pakistani flute, which becomes a jazz flute by the time the piece comes to a close. The movement is built around a simple melody, and the score returns to that melody frequently throughout the segment. A good part of the playing consists of Amram almost scat-singing into the flute, note for note, not unlike the method of Jethro Tull's Ian Anderson. And he engages in a little call-and-response kind of duet with the orchestra before the movement ends. (Other extraneous sounds crop up in this final movement, by the way, but they sound almost planned—just before a long flute solo, one hears what sounds like dragons hissing, once in each channel and once in the middle. The album notes do not explain.)

Two musical excesses ought to be pointed out, too: the first part of the first movement ends with a collapsing frenzy that sounds as if everyone had lost his or her place and tempo. The first part of the second movement, on the other hand, employs full orchestration to swell to an inspiring climax that recalls the sound of Mahler, Bruckner or Richard Strauss. These grand proportions nicely give way to a very Gershwin-esque passage for small ensemble and orchestra.

The recording is brought to a close with a good reading of Amram's "Elegy for Violin and Orchestra," with Howard Weiss as soloist. The piece opens with a gorgeous statement in the strings that intensifies in emotion before the soloist joins. But the rest of the piece mixes a wide variety of styles that seems somewhat out of keeping with what one normally considers an elegy to be. Amram may have meant well with this, but the name "elegy" seems a bit misplaced, particularly when one passage is scored for a tuba or bass clarinet and piccolo, a combination that



DAVID AMRAM: Skillful as Gershwin

almost always sounds comical.

In this recording, the violin is closely miked and tends to sound too brittle or shrill in the upper register. The separation is such that the sound tends to bounce between one channel and the center, and not between channels. And an annoying hiss accompanies the piercing sustained notes at the end. S.R.

ARNETT COBB: *The Wild Man from Texas*. [Jacques Morgantini, producer; recording engineers not listed; recorded at Condoret Studios, Toulouse, on May 6, 1976 and Barclay Studios, Paris, France, May 12, 20 and 30, 1976.] Classic Jazz CJ102.

Performance: "T" for Texas, tenor sax and terrific

Recording: Magnifique

Arnett Cobb is the man they're all raving about today. A recent engagement at New York's Village Vanguard drew raves from the local jazz press and a mixture of incredulity and downright fear from most of the local tenor sax men. Somehow or other, Arnett Cobb, even during his famous years with Lionel Hampton, wasn't the spotlight grabber that his section mate, Illinois Jacquet, was. I don't quite understand why, but with his re-emergence at a recent George Wein Newport-In-New York Festival, he's shown a lot more chops, originality and excitement than we ever noticed before. This record dates from 1976 which would have been just about a year before we heard him during the Newport Festival at the Roseland ballroom in New York.

Arnett is one of the school of southwestern tenor saxophone players that include the likes of Illinois Jacquet and Lockjaw Davis. It's a very iden-

tifiable sound. It was a sound that players like Herschel Evans brought into Count Basie's band and players like Arnett Cobb brought into Lionel Hampton's. Nobody played this particular style any better than Arnett and it shows on this LP of uptempo shouters like "Flyin' Home" and ballads like "Ghost Of A Chance."

It's a biggish band, nine pieces, but outside of Arnett only fellow Ex-Hampton tenorman Eddie Chamblee and Milt Buckner are heard from at much length. Buckner is a special person. Here he plays organ and vibes but his locked-hands piano style (which he made popular during his years with Hampton's band) was the beginning of players like George Shearing and a lot of others. Unfortunately, Buck passed away last year so this record becomes all the more valuable as part of his recorded legacy.

The sound is wonderful, giving you all the guts of the music and even picking up Buckner's habit of humming to himself as he plays vibraphone (so does Hampton, by the way).

Records like this don't happen too often. Everything was right. The time, the place, the studios, the unnamed engineers and, above all, Arnett Cobb.

J.K.

RUSS GARCIA: *I'll Never Forget What's Her Name*. [Producer not listed; engineer not listed; recorded in Los Angeles, November 14, 1955.] Bethlehem BCP 6044.

Performance: Pleasant background Muzak/jazz

Recording: Trombones in the front, everybody else take a back seat

The idea of unison trombones is not a novelty. It wasn't even a novelty in 1955 when Russ Garcia made this recording using Frank Rosolino, Herbie Harper, Tommy Pederson and Maynard Ferguson on trombone plus a typical west coast, out-of-the-Kenton-band rhythm section. As a matter of fact, many of the players on this LP were in and out of the Kenton band with regularity (Rosolino, Ferguson, Stan Levy and Red Mitchell most notably). Stan Kenton had used the unison trombone sound extensively in his dance book and had recorded "September Song" featuring the trombone sound as early as 1951 but you can hear the roots of the trombone sound as



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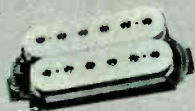
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Jazz soul: "Sweets," "Lockjaw," and the Clayton Brothers

By Nat Hentoff

During Count Basie's night at the 1979 Newport Jazz Festival, one of the most fully realized sets involved the return of Basie alumni Harry "Sweets" Edison and Eddie "Lockjaw" Davis. "Sweets" (who got his nickname from Lester Young) is not a dazzlingly virtuosic trumpeter. Instead, like Basie, his playing is spare — each judiciously selected note making maximum rhythmic and emotional impact. Indeed, everything Harry Edison plays reverberates with sensuous feeling. Yet there is no trace of sentimentality, for his stabbing attack penetrates to the visceral core of the jazz experience. His is classic "hot jazz" improvising; or put another way, "Sweets" distills the very blues-favored soul of this music's tradition, from Louis Armstrong to Miles Davis. And like Miles, "Sweets" learned one of Lester Young's basic lessons: to get people to really pay attention, "always leave some spaces."

"Lockjaw" Davis, while somewhat less laconic than "Sweets," is also powerfully direct and intensely swinging from the very first note. And his big, envelopingly warm but never flaccid tone is in the proud lineage of Coleman Hawkins and Ben Webster. In a new American release on Storyville (a Danish label now being distributed here by Moss Music/Vox), Eddie "Lockjaw" Davis and Harry "Sweets" Edison are joined in a 1976 Danish date by a crisp rhythm section centered on the resilient, expatriate pianist Kenny Drew. It is one of the more emotionally satisfying recordings of this or any year; and the sound-quality is exceptional, making fully vivid the immediacy of these musicians who are always contemporary. Soul is never out of date.

In the course of that 1979 Newport Festival night, one of the pleasures of Count Basie's current, predominantly young band, was 27-year-old bassist John Clayton, a protégé of Ray Brown. A strong but flexible player, who obviously ad-

mires the Count's floating swing, Clayton fits in authoritatively with the enduring Basie principles and creators of jazz time. In a new album, *The Clayton Brothers* (Concord Jazz), John also discloses his improvisatory range in a small combo setting. Nobody in the quintet is older than 30, but they too are compelling practitioners and creators of jazz soul-music.

Co-leader Jeff Clayton, 22, is a stunning revelation. Although at least as musically hip as any tenor saxophonist of his generation, Jeff has a huge tone and beat that relate directly back to Eddie "Lockjaw" Davis and the other explosive tenors of that generation. The younger Clayton is one of those rare players who is totally authoritative from the first unerringly pulsating note. Complementing the brothers' joyful sounds are pianist Patrice Rushen, guitarist Ron Eschete, and drummer Jeff Hamilton (an alumnus of the Woody Herman band). The repertoire includes the blues, of course, and a sizzling "Cherokee." But in everything, the roots of jazz are flourishingly evident.

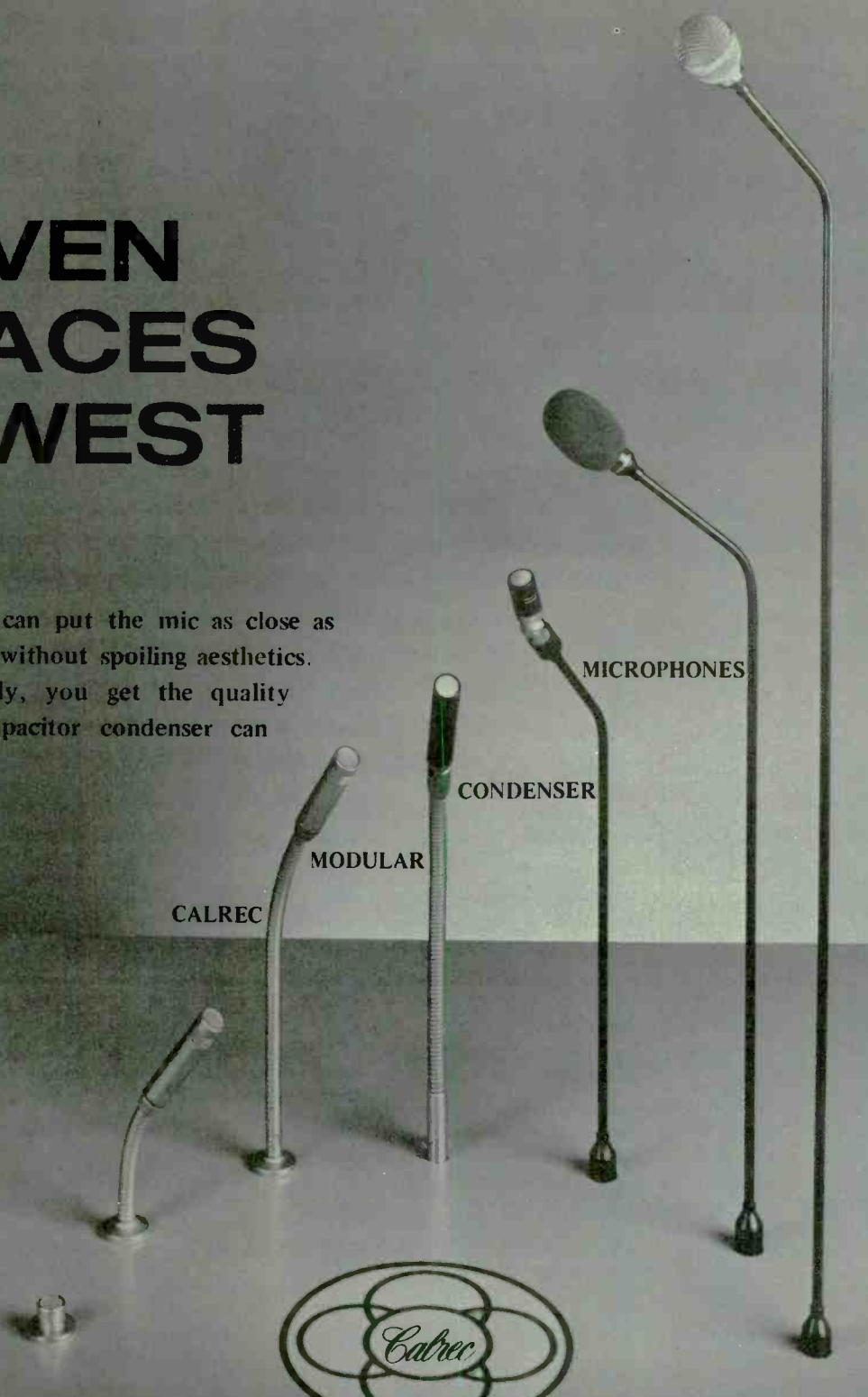
Concord's engineering, as usual, is very "live," flawlessly balanced, crisp, and utterly clear. It is a credit to Concord's Carl Jefferson that he has produced a set by musicians not yet renowned but so manifestly worth recording. And surely, the renown will be soon coming.

EDDIE "LOCKJAW" DAVIS/HARRY "SWEETS" EDISON: *Eddie "Lockjaw" Davis/Harry "Sweets" Edison*. [Ole Matthiessen, producer; name of engineer not given.] Storyville SLP 4004.

JEFF CLAYTON/JOHN CLAYTON: *The Clayton Brothers*. [Frank Dorrities and Carl Jefferson, producers; Phil Edwards, engineer.] Concord Jazz CJ-89.

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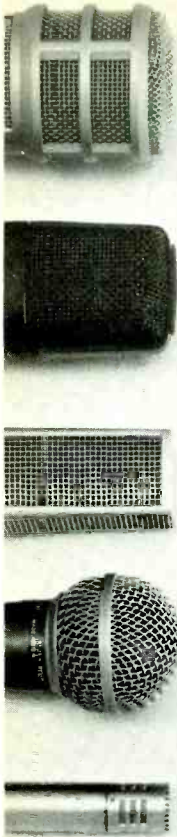


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early as Jack Teagarden's 1939 recording of "Peg O' My Heart," which, as I recall, stuck fairly close to an earlier recording by Red Nichols' Orchestra which is not available for comparison. There was also a trombone band fronted, I believe, by Bill Harris which I heard at the Blue Note in Chicago in the late 1940s which did not record. The success of the J.J. Johnson and Kai Winding trombone band in 1954 was undoubtedly, at least partially, responsible for Bethlehem's decision to follow up with a trombone band under the direction of their ace arranger, Russ Garcia—especially after Jay and Kai left Bethlehem Records and signed with Columbia. To be sure, Ferguson is a name to be recognized today with his chart-topping band turning out hit record after hit record, and Frank Rosolino is certainly in the news after his recent suicide. While Harper and Pederson are less known they are not less excellent. Pederson in particular, with his wild plunges into avant-gardism yet always swinging, is worthy of attention. Unfortunately much of the album is tight, pretty arrangements by Garcia who knows what the job is and how to do it. There are good blowing solos on just about every cut but somehow the ensembles seem to meld into the background of whatever you're doing. It's pleasant, unprovocative music to clean house by. It doesn't take much concentration to enjoy it. Of course the engineers, who remain nameless, knew the gimmick and made sure that nobody intruded on the trombones.

And in case you're wondering how Maynard Ferguson achieved such a distinctive sound on this record, he's playing a valve trombone which affords a totally different attack than does a slide instrument. J.K.

TINY GRIMES: *Some Groovy Fours.* [Jacques Morgantini, producer; Claude Achallee, engineer; recorded May 13, 1974 at Decca Studio, Paris.] Classic Jazz 114.

Performance: **If you don't mind a heavy dose of blues this is the heaviest**

Recording: **Okay, but you may need some bass boost**

I guess all the jazz fans know the Tiny Grimes story—pianist with the Cats And The Fiddle, guitarist with Art Tatum's Trio, early record session with

Charlie Parker. If they don't, it's all there in Andy Sussman's informative liner notes with some added details and anecdotes that aren't all that commonly known. What should be common knowledge by now is that Tiny Grimes is just an incredibly swinging guitarist who plays with a sense of humor and joie de vivre that carry the listener right along with him. If it's not as well known a fact as it should be, it's simply that Tiny Grimes hasn't made enough records lately—not nearly enough. While this record gives a good sampling of Tiny's funky blues playing, that's only a part of the whole picture. Tiny plays a lot more than blues but the people at Disques Black and Blue SARL, for whom this recording was made in 1974, know the French jazz market and they know that blues will sell every time, so Tiny's being stuck into a pigeonhole that only shows a small part of his talent. The only non-blues tune that Tiny is allowed here is Spencer Williams' "I Found A New Baby" which is a lot closer to the sort of material Tiny used to play with the Art Tatum Trio than the relentless, twelve-bar blues that sets the tone for the rest of the present album.

Tiny's cohorts range from the swinging Panama Francis on drums to the limited piano of Lloyd Glenn whose mastery of the blues idiom is beyond question but whose technique elsewhere lacks the facility of an Art Tatum. Bassist Roland Lobigeois is still a mystery to me. He is so under-recorded that it is difficult to tell much about his ability under better conditions. Otherwise the recording is well balanced and Panama Francis' trading licks with Tiny on "Some Groovy Fours" is something to hear. Except for this dialogue between Tiny and Panama the rhythm section does little to distinguish itself. Sometime I'd like to hear Tiny with a more versatile pianist (say Harold Mabern or Dill Jones for example) and a bassist such as Major Holley or Slam Stewart. Panama Francis would be a fine drummer for my dream date. And I'd like to hear them go at some of the same standard jazz tunes that made Tiny Grimes, Art Tatum and Slam Stewart something extra special when they functioned as a trio. "I Found A New Baby" hints at that, but with Glenn's limitations it never really gets off the ground. But until someone does come along and make *the* Tiny Grimes record, I'll be happy with any Tiny Grimes records. So should you, especially if you're heavy into the blues. J.K.

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JULIAN BREAM AND JOHN WILLIAMS: *Live*. **JOHNSON:** *Pavan and Galliard*; **TELEMANN:** *Partie Polonoise*; **SOR:** *Fantasie, Op. 54*; **BRAHMS:** *Theme and Variations, Op. 18*; **FAURE:** *Dolly, Op. 56*; **DEBUSSY:** *Reverie, Golliwog's Cakewalk, Clair de lune*; **ALBENIZ:** *Castilla (Seguidillas)*; **GRANADOS:** *Spanish Dance No. 2 (Oriental)*. Julian Bream and John Williams, guitars. [Peter Dellheim, producer; Edwin Begley, engineer; recorded at Symphony Hall, Boston and Avery Fisher Hall, New York, October, 1978.] RCA ARL2 3090.

Performance: **Stunning**
Recording: **Excellent**

Julian Bream and John Williams are without a doubt the best classical guitarists now before the public, and hearing them play together is a special treat. They've put out a couple of duet records in the past (*Julian and John* and *Julian and John, Volume 2*, both extremely successful musically and commercially) and this new double LP set affords the double pleasure of entirely new repertoire and the excitement of the concert hall. Having been at the New York concert (this was taped in New York and Boston) and having wondered all through the concert whether the recording mics would pick up the extremely noisy audience, I'm astounded to hear how clearly the guitar sound is reproduced and how little extraneous noise there is. Even more surprising is the editing. According to producer Dellheim's liner notes, the last movement of the Faure involves quite a few New York/Boston splices. It's rare for a producer to admit this right on an LP jacket, and perhaps it was a challenge, but try as I might, I was unable to spot a single splice point. The separation here is not quite as marked as on the two Bream/Williams studio discs, but in some of the more contrapuntal moments you can clearly hear Bream (with the more pronounced vibrato) on the left and Williams (drier, more straightforward) on the right. Generally, however, the sound is centered and full bodied.

Musically, this set is an absolute joy. By turns, the playing is elegant (in the Telemann) intensely introspective (in

Williams's fantastic transcription of the *Theme and Variations* from Brahms's *Sextet, Op.18*), hot blooded (the Albeniz and Granados), and even comic (Debussy's *Golliwog's Cakewalk*). Most of the transcriptions were made by Bream and Williams, and nothing is lost in translation. In fact, the most difficult of these, the Faure and the Brahms, sound remarkably well suited to the sound of the guitar.

RCA's surfaces in this set are uniformly clean and quiet. A.K.

SHOWS and
SOUNDTRACKS

ORIGINAL CAST: Eubie. [Jerry Wexler, producer; Jim Boyer and Bradshaw Leigh, engineers; recorded at A&R Recording Studios, New York, N.Y.] Warner Bros. HS 3267.

Performance: **Wild about Eubie**
Recording: **Good, clean sound and theatrical ambience**



ORIGINAL CAST: EUBIE: Giving a tantalizing taste of the Broadway hit show

There's no way this album of a handful of hits from the current Broadway review, *Eubie* is going to equal the experience of being there. A show that doesn't give the audience as much to look at as it does to hear is cheating the ticket buyer. *Eubie* does not cheat the ticket buyer and as such an audio-visual experience some tracks on this LP come off better than others. There's no way an LP can approximate the stage business that goes with routines like "If

You've Never Been Vamped By A Brownskin" or "My Handyman Ain't Handy No More," especially with such visual artists as the Hines Brothers and Marion Ramsey. I won't even try to tell you that these are the best possible versions of these songs as far as records go. I will admit that as far as simply recordings go I prefer Emme Kemp's version of "Handy Man" and Mabel Lee's "If You've Never Been Vamped By A Brownskin" (both on Eubie Blake Music EBM 9) and also Joan Morris' "Dixie Moon" on Columbia. But it isn't just a record because once you've seen and experienced Marion Ramsey's antics on "Brownskin" and the business between Alaina Reed and Mel Johnson Jr. as she sings "Handy Man" and the way Mel Johnson Jr. and the Hines Brothers dance their way through "Dixie Moon" it becomes more than a record. It's a souvenir of a show you enjoyed that you can take home and enjoy again in memories at your leisure.

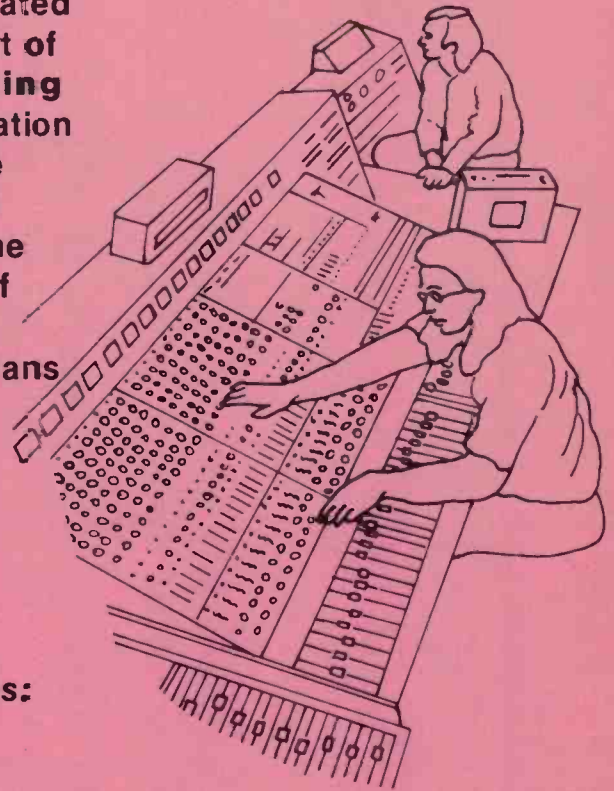
It's surprising, since the record was made at A&R studios, but they managed to retain a good deal of the theatrical ambience of the Broadway show. I

think a large measure of this may be due to the workmanship of the show band—which is so Broadway that it becomes almost campy at times. Yet, who'd have it any other way? Until you've heard drummer Percy Brice press-roll his way through "Shuffle Along" and the marvelous twin pianos of Vicki Carter and Frank Anderson you haven't heard the black Broadway musical of the '20s: *Eubie*. J.K.



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WANTED: Tascam 80/8, Dx-8, model 5A. Pay Cash. Write/call. Guido Focardi, Via F. Paolletti n. 54, 50134-Firenze, Italy, 055/484309.

FOR SALE: One Teac 3300S 2-track recorder with spare set of new heads, \$450.00. Two MXR auto phasers in powered rack, \$350.00. One pair Auratone 5-C speakers, new, in box, \$50.00. Sanyo RD 5055 cassette deck with Dolby, \$105.00. Call (305) 422-0790.

FOR SALE: If you are looking for well maintained recording equipment try calling Criteria Recording Studios, (305) 947-5611. We are always updating our studios and can offer consoles, tape machines, and many other items at a good price.

Model 10 Tascam console 8-track solo, cue system, 12 inputs, earphone panel, talkback, slate (212) 929-3277 or 929-9537, \$3,000.

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Teac/Tascam 80-8 w/dx-8 noise reduction module, model 5 mixer and YTT-1144 test tape 9 months old. Mint. \$5,000.00 (414) 552-9360.

FOR SALE: CRITERIA'S CUSTOM BUILT MCI console that all the hits were cut on. Bee Gees, Eagles, Eric Clapton, Marshall Tucker, etc. 48 inputs, 24 out. Mixdown quad, 2-track and mono, all at one time. Plug-in equalizers, touch switching including solo. Three stereo cue systems, switching for three monitor systems. 33 meters plus phase meter. Above console and one MCI JH-114 tape machine with auto-locator and two MCI JH-110 tape machines; only \$59,000.00 CRITERIA RECORDING STUDIOS, 1755 N.E. 149th St., Miami, Fla. 33181. (305) 947-5611.

If you have a professional multi-track studio, and are interested in becoming a licensed representative for R.I.A.'s Modern Recording Techniques courses, call or write Mr. Chas Kimbrell, R.I.A., 15 Columbus Circle, N.Y., N.Y. 10023. (212) 582-0400. A large profit potential with low operating costs.

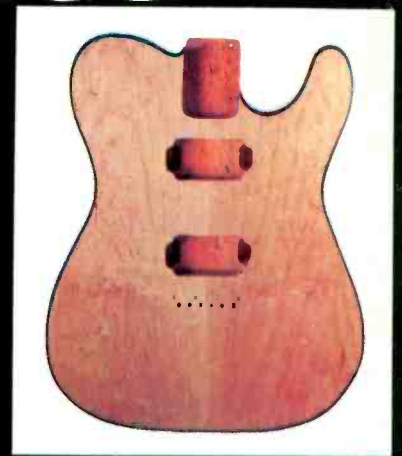
Tascam, Sound Workshop, Teac, Technics Pro, Otari, dbx, MXR, ADS, Eventide, EV, Shure, Maxell, Ampex, Urei, Stax, Sennheiser, Orban/Parasound, Spectro Acoustics, NAD, Ivie, and more! Send for price quotes. ZIMET PRO AUDIO, Dept. MR, 1038 Northern Blvd., Roslyn, N.Y. 11576.

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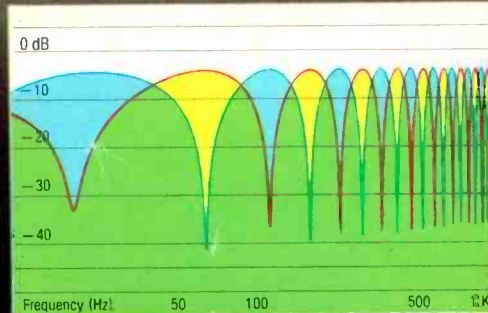
More than a chorus.



The new MXR Stereo Chorus stands alone among conventional chorus devices. Its unique design and sound almost defy description.

The Stereo Chorus utilizes advanced time delay circuitry providing a doubling effect for voices and instruments; one voice will sound like two singing in unison, two like four. As in nature, the voices can vary subtly in pitch. What you get is a natural choral effect. It can be used to thicken the sound, so that six-string guitars sound like twelve-strings. Through the introduction of extreme pitch bending, the Stereo Chorus will produce an intense vibrato, normally unattainable.

Not only is the Stereo Chorus musical and versatile, it also provides a means of achieving realistic stereo enhancement. We've included two outputs with complementary notches and peaks in the frequency spectrum. The exact frequencies which are notched in one channel are boosted in the other. The graph shown is an actual response plot of the two outputs, which illustrates this concept. The Stereo Chorus transforms tones, harmonics and sounds into a lush and shimmering musical environment which surrounds the listener. This differs from similar devices which have one processed output, and one dry output. The Stereo Chorus provides a true stereo image which sounds more vibrant and alive than conventional chorus effects.



The manual control varies the delay time, a width control determines the amount of sweep, and a speed control adjusts the rate at which the delay is swept. A bypass switch provides noiseless accessibility to the dry signal in both outputs.

The MXR Stereo Chorus is equally geared for the studio or the road. We've included

an internal switch which allows the selection of instrument or line level at both the input and output. Its high input impedance reduces the effects of loading when using long lines or other effects devices. Its low output impedance allows you to drive long lines and any other equipment. Superior circuit design has enabled us to maintain a wide bandwidth and dynamic range, ensuring signal fidelity.

The MXR Stereo Chorus is AC powered, ruggedly constructed to withstand the rigors of professional use, and is backed by MXR's reputation and commitment to the music industry. But reading about a product that has no equal is not enough. To appreciate what your music has been missing, see your MXR dealer.

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