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Electronic Musician

February 1994

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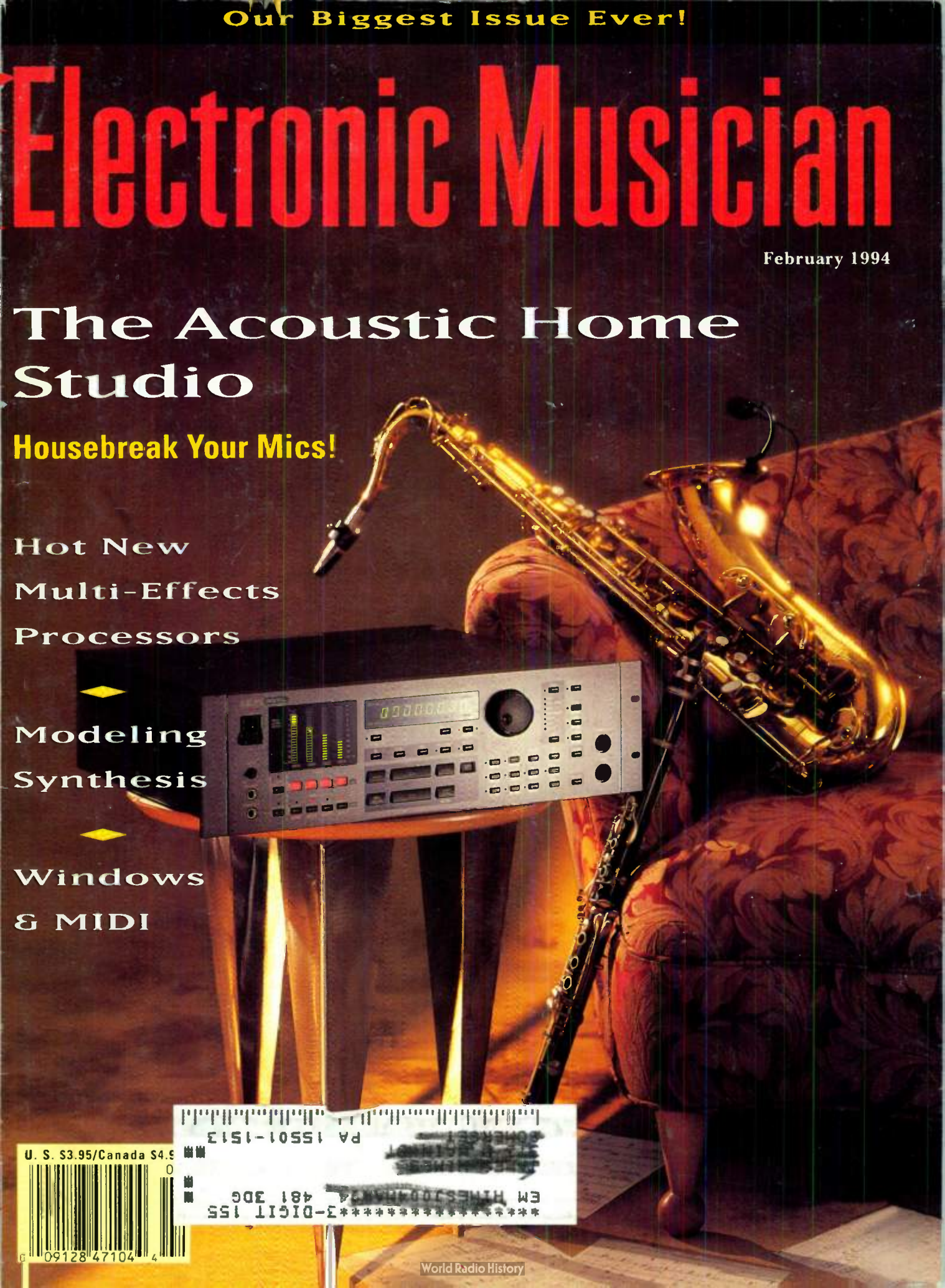

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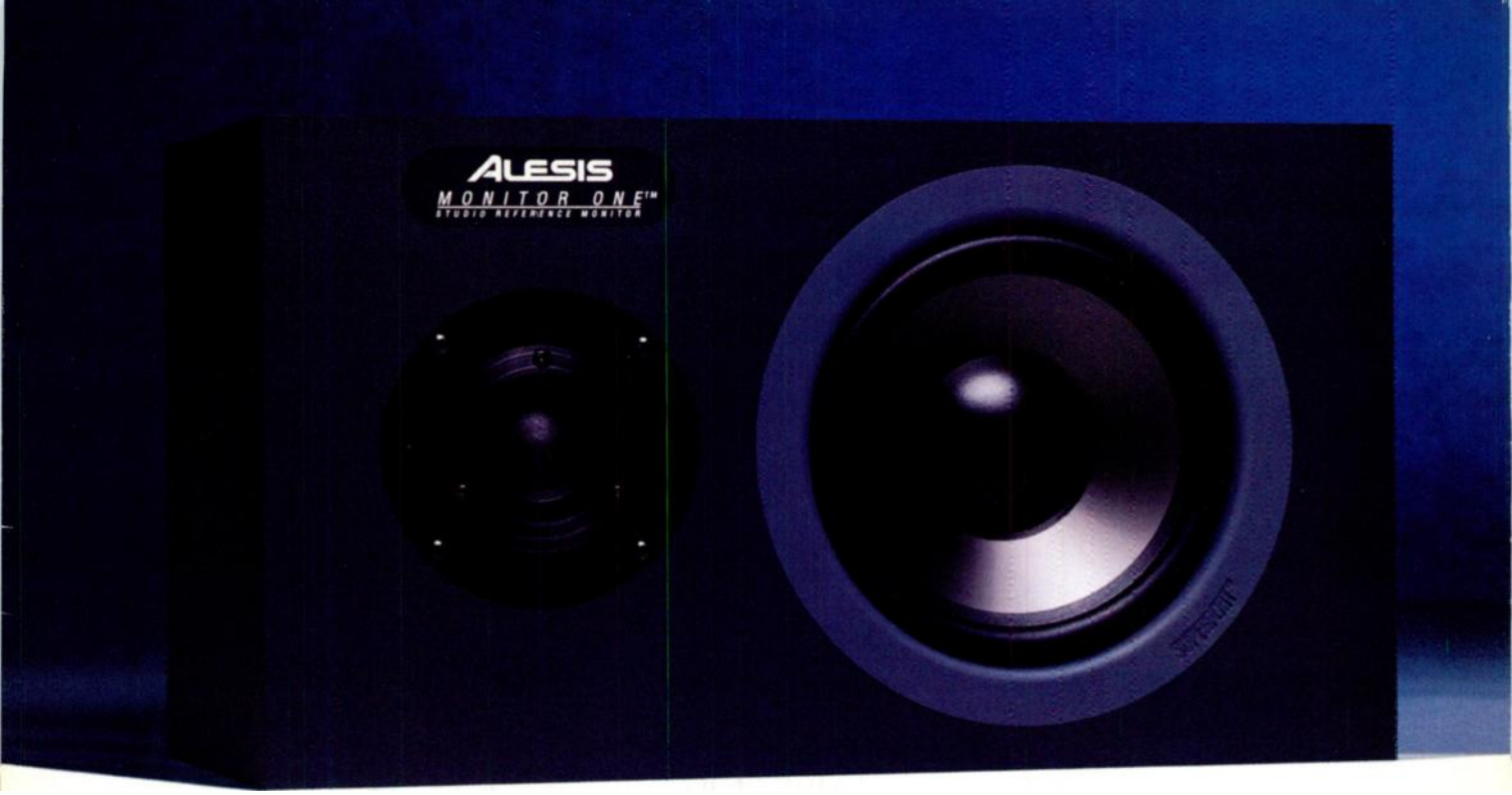
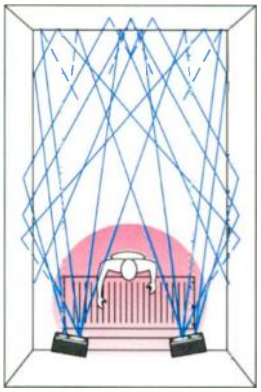


The Truth From

The truth...you can't expect to find it everywhere you look, or *listen*. But when mixing music, hearing the truth from your monitors will make the difference between success and failure. You'll get the truth from the **Alesis Monitor One™ Studio Reference Monitor**.

Room For Improvement

Fact: most real-world mixing rooms have severe acoustical defects. Typical home and project studios have parallel walls, floors and ceilings that reflect sound in every direction. These reflections can mislead you, making it impossible to create a mix that translates to other playback systems. Trying to solve the problem with acoustical treatments can cost megabucks and still might not work. But in the near field, where direct sound energy overpowers reflections, reverberant sound waves have little impact, as shown in the illustration. The Monitor One takes full advantage of this fact and is built from the ground up specifically for near field reference monitoring.



*Does your living room double as your mixing suite? The pink area in the illustration shows where direct sound energy overpowers reflected waves in a typical mixing room. The Monitor One helps eliminate such complex acoustic problems by focusing direct sound **energy** toward the mixing position, **instead of** the love seat.*

Working close to the sound solves the room problem but creates other problems, such as high frequency stridency and listener fatigue (typical of metal-dome and composite tweeter designs). Our proprietary soft-dome pure silk tweeter design not only solves these problems, but delivers pure, natural, incredibly accurate frequency response, even in the critical area near the crossover point (carefully chosen at 2500 Hz).

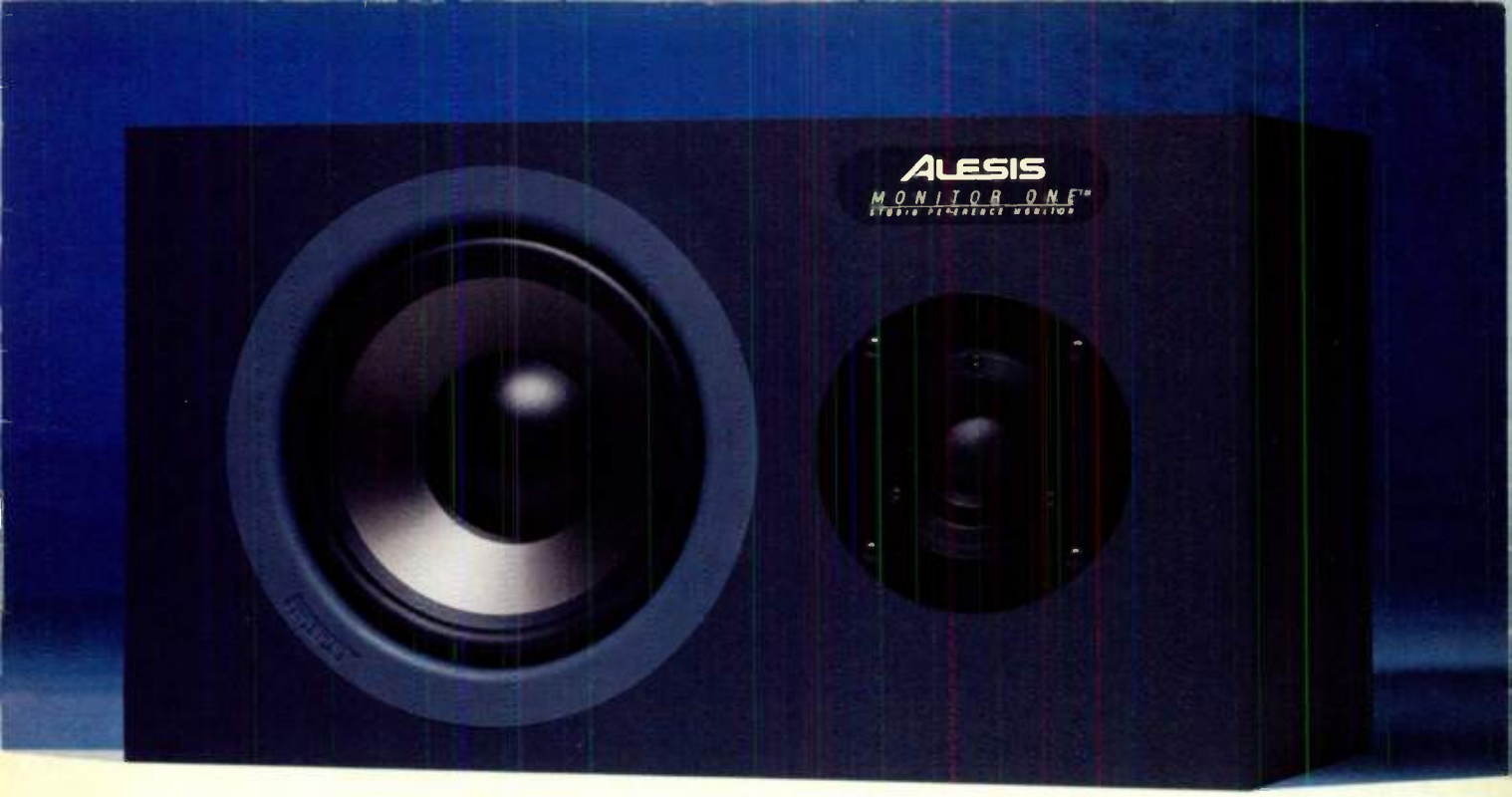
The Truth From Top To Bottom

The Monitor One gives you all the truth you want in the mids and highs, but what about the low end? You probably know that the inability to reproduce low frequencies is the most common problem with small monitors. Most of these speakers have a small vent whose effect at low frequencies is nullified by random turbulence, or they're sealed, which limits the amount of air the driver can move. Such speakers give disappointing results in their lowest octave.

The Monitor One overcomes wimpy, inaccurate bass response with our exclusive SuperPort™ speaker venting technology. The ingenious design formula of the SuperPort eliminates the choking effect of small diameter ports, typical in other speakers, enabling the Monitor One to deliver incomparable low frequency transient response in spite of its size.

Alesis SuperPort™ technology gives you the one thing that other small monitors can't: incredibly accurate bass transient response. No, the SuperPort doesn't have a blue light, but it makes the picture look cool.

The result? A fully integrated speaker *system* that has no competition in its class. You'll get mixes that sound punchier and translate better no matter what speakers are used for playback. Whether you mix for fun or for profit, you want people to hear what *you* hear in your mixes. The Monitor One's top-to-bottom design philosophy is a true breakthrough for the serious recording engineer.



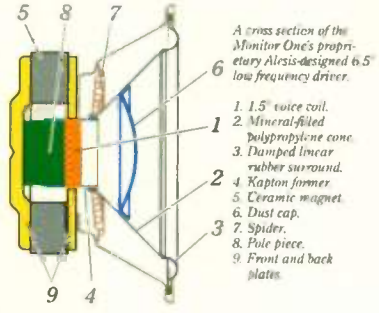
Left To Right

Power To The People

High power handling is usually reserved for the big boys. While most near field monitors average around 60 watt capability, the Monitor One handles 120 watts of continuous program and 200 watt peaks...over twice the power. Also, its 4 ohm load impedance allows most reference amplifiers (like the Alesis RA-100™) to deliver more power to the Monitor One than they can to 8 ohm speakers. That means the Monitor One provides higher output, more power handling capability, and sounds cleaner at high sound pressure levels.
If you like to mix loud, you can.

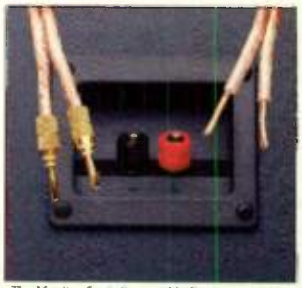
The Engine

Our proprietary 6.5" low frequency driver has a special mineral-filled polypropylene cone for stability and a 1.5" voice coil wound on a high-temperature Kapton former, ensuring your woofer's longevity.
Our highly durable 1" diameter high frequency driver is ferrofluid cooled (costly, but it's the best way to cool a tweeter), to prevent heat expansion of the voice coil which inevitably leads to loss of amplitude and high frequency response. Combined, these two specially formulated drivers deliver an incredibly accurate, unhyped frequency response from 45 Hz to 18 kHz, ±3 dB. The five-way binding posts provide solid connection, both electronic and mechanical. We even coated the Monitor One with a non-slip rubber textured laminate so when your studio starts rockin', the speakers stay put. Plus, it's fun to touch.



A cross section of the Monitor One's proprietary Alesis-designed 6.5" low frequency driver.

1. 1.5" voice coil.
2. Mineral-filled polypropylene cone.
3. Damped linear rubber surround.
4. Kapton former.
5. Ceramic magnet.
6. Dust cap.
7. Spider.
8. Pole piece.
9. Front and back plates.



The Monitor One's five-way binding posts accept even extra-large monster wire, banana plugs and spade lugs. Hookup is fast, easy and reliable.

The New Alesis Monitor One™

You don't design good speakers by trying hard. It takes years and years of experience and special talents that only a few possess. Our acoustic engineers are the best in the business. With over forty years of combined experience, they've been responsible for some of the biggest breakthroughs in loudspeaker and system design. The Monitor One could be their crowning achievement. They're the only speakers we recommend to sit on top of the Alesis Dream Studio™.

See your Authorized Alesis Dealer and pick up a pair of Monitor Ones. Left to right, top to bottom, they're the only speakers you want in *your* field.

The Monitor One is the speaker for the Alesis Dream Studio™. Need more information about the Alesis Monitoring System? Call 1-800-5-ALESIS. See your Authorized Alesis Dealer.
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SERIES

WHATEVER YOU DO — DON'T BUY THE WRONG MIXER.

Especially if you're doing multitrack recording — whether digital or analog. Fact is, a mixer that's not specifically configured with the features essential for multitrack recording just isn't a recording mixer. Bottom line is, general purpose mixers make multitrack recording a nightmare.

You see, mixers that aren't designed and engineered for multitrack recording will torture you with the endless hassle of patching and repatching — every time you track, overdub or mixdown. It's frustrating, wastes valuable time and leaves you tangled in cable.

So before you choose a mixer for your studio — be sure it has the features of a dedicated recording mixer.

IT'S NOT A RECORDING MIXER IF IT DOESN'T HAVE THESE FEATURES.

SWEEPABLE MIDRANGE EQ

Ask for it. Because when it comes time to tailor your sound, you need the flexibility where the action is — in the midrange. The M1500's sweepable midrange lets you isolate specific mid frequencies allowing you to make the subtle tonal corrections you want.

MULTITRACK DECK CONFIGURATION

If you don't have dedicated inputs and outputs for your 8-track deck, where do you plug it in? Without this basic recording configuration you'll be repatching day and night and you won't be able to record on 8 tracks at once. With these inputs, tape monitoring is as simple as pressing a switch. Also, because the TASCAM M1500 is a true 4-buss mixer, you can mix any combination of your input signals to any of the 4 output busses directly to tape.

DIRECT OUT AND GROUP OUT ASSIGNMENT SWITCHES

You gotta have these. Because without them you can't directly send a single input to tape, or record several inputs to one track. But with them, assign your inputs anywhere by pressing a few switches. Best part is, you'll never have to refer to any complex patch diagrams.

ELABORATE MONITORING

In a recording environment you need to hear what's going through your board at all times. With the M1500's comprehensive monitoring matrix you are able to hear any sound source at any time — inputs, tape, AUX sends, anything — it's your choice, just press a switch.

IN-LINE MONITORING

A sure sign of a recording mixer. This lets you monitor your tape tracks at any time without sacrificing an input channel. Just press a switch. With the M1500's dual section not only can you monitor tape tracks, it can be used for additional effects sends, or to double your inputs for virtual tracking at mixdown. And do any of this by flipping a switch.

TRUE TRANSPARENCY AND LOW NOISE

In recording, your signal goes through the mixer several times. And each time it goes through, it is important not to lose or gain anything. Especially an identifiable "mixer sound." Test any mixer for its transparency. Take any signal and bounce it 3 or 4 times on your favorite digital recorder. With the truly transparent M1500, you'd be hard pressed to differentiate between the bounced tracks and the original signal.

At TASCAM, we've been making multitrack recording equipment for more than 20 years. We pack that experience into every mixer we make — and we make more recording mixers than any other company in the world.

For our M1500 Series of recording mixers, the result is an affordable mixing console configured for 8-track recording. A truly transparent mixer that makes tracking, overdubbing, and mixdowns easy. An extraordinarily flexible console loaded with the features and specs you'd expect on consoles costing thousands more.

But the M1500 Series of recording mixers are priced less than many general purpose mixers on the market. They're available in a 16-channel/32-input tabletop version (M1516) and a compact rack mountable 8-channel/16-input version (M1508). So if you're involved in digital or analog 8-track recording, you've just found the best recording console value in the industry.

TASCAM M1508 $999 M1516 $1599

Get your hands on a true recording mixer today: the TASCAM M1500 Series. There's one waiting for you at your authorized TASCAM dealer. Go ahead — test it and play with it. It's your next recording mixer.

TASCAM
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REVIEWS

DEPARTMENTS

Cover: Photo by Robert Perry.
Special thanks to Akai, Leo's Pro Audio, Glenn McNulty, Ramsa, and Z Gallerie.

Performance Art

Or, why do I see the same faces everywhere I go?

PEGGY SUE AMISON

Sometimes an impending revelation is so obvious that you can bump into it, have dinner with it, perhaps even live with it, and still not know it exists. Case in point: I recently realized—in the middle of a live performance—that each member of my band is a present or former **EM** staffer. Duh! (When your audience is a few close friends and an anxious bartender, those clumsy dead spots between songs can trigger some bizarre mental gymnastics.) But the truly startling revelation was how much of our staff maintains pro and semi-pro music careers.

Senior Editor Steve Oppenheimer often does piano and sound-design sessions at my studio, while Tech Editor Scott Wilkinson produces various projects in his home studio, as well as performing in Baroque, renaissance, and classical chamber groups. Circulation Associate Karen Stackpole plays drums with A Rare Thing. Northwestern Advertising Manager John Pledger is a jazzbo guitarist, while Southwestern Ad Manager Dave Reik is a killer keyboardist and session musician. Art Assistant (and keyboardist) Dmitry Panich leads his own band, performing "international music" every Saturday at the Russia House in San Francisco.

Our Bookshelf staff boasts a real star in Anne Eickelberg, bassist for alternative heroes The Thinking Fellers. (Their records get reviewed in *Rolling Stone* and *Spin*, and they pack San Francisco's Great American Music Hall.) Andy Jewett, who was assistant editor on the *Making The Ultimate Demo* book, recently released the premiere LP for his band Erasergun. Bookshelf Customer Service Specialist and occasional **EM** review author Christopher Patton is a busy local producer; and Bookshelf Customer Service Manager Suzanne Abel books a local club and turned me on to my latest production project, Blueland. I even got to play guitar on the title cut of Ariel's *International World*, a band fronted by **EM** contributing editor George Petersen.

So what am I doing here, wasting ink? (No, please stand by for The Point.) Obviously, I'm incredibly proud of the **EM** staffers who are out there burning up floorboards or making noises on tape. But more importantly, this constant presence in sweaty clubs and dark studios colors our coverage of the industry. Our "test lab" is the real world, where real musicians struggle with real problems.

Although I acknowledge the value of specs, no numbers on a printed page can tell me how the gear sounds or if it does what it was designed to do. Is it easy to use? Is it road worthy? Does it deliver great features at a low cost? Before *I* buy a piece of gear—and because I own a recording studio, I buy a lot—I want reports from the trenches, not squeaky clean bench tests. This is why I believe our coverage of recording applications, music-business concerns, and products is truly exceptional. It's practical, it's comprehensive, and it's real! Kudos to products guru Steve Oppenheimer and our great staff and writers. And if you're ever in the Bay Area, come to one of our gigs and say hello. (I happen to know a bartender who could use some company!)

Michael Molenda

Electronic Musician

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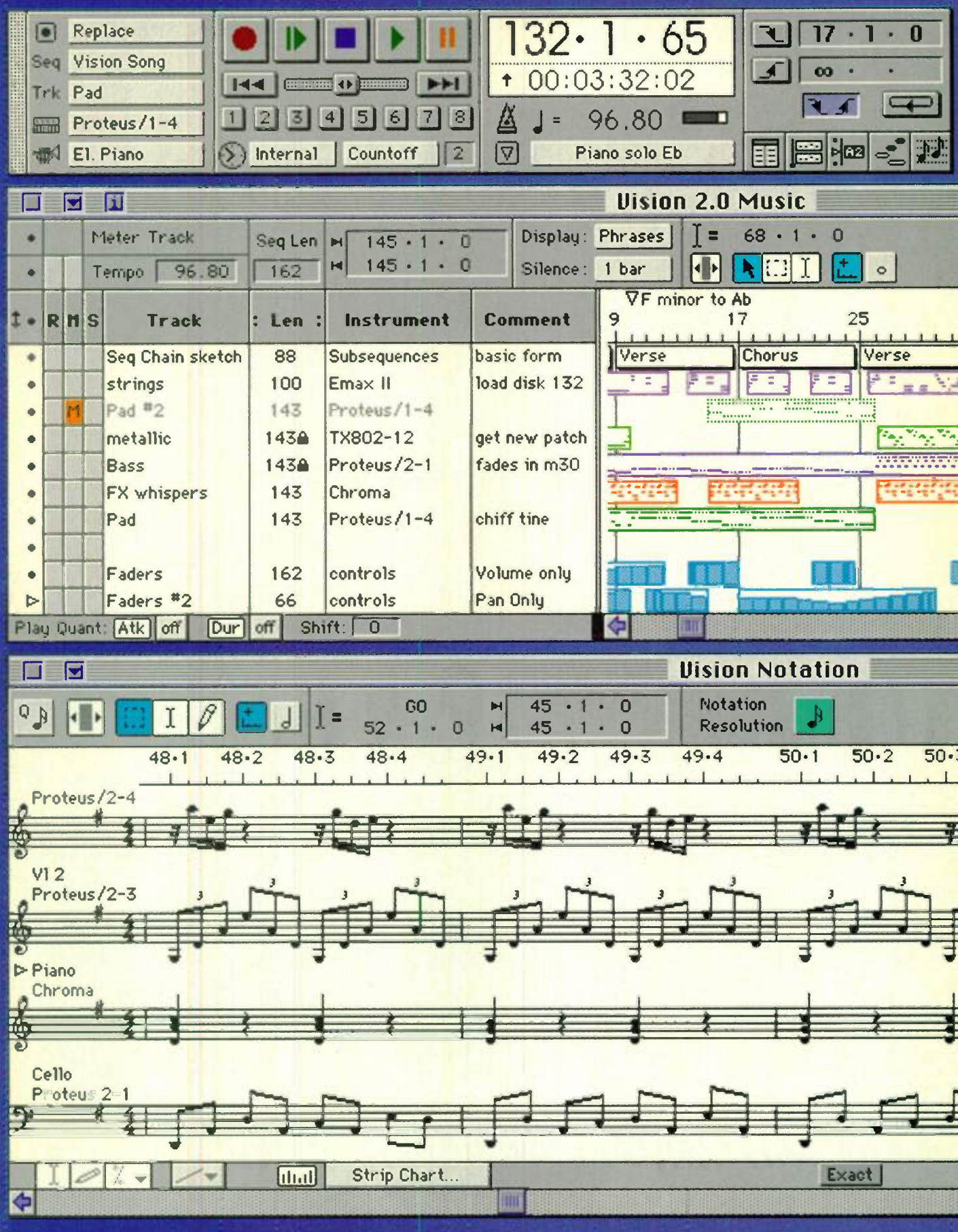

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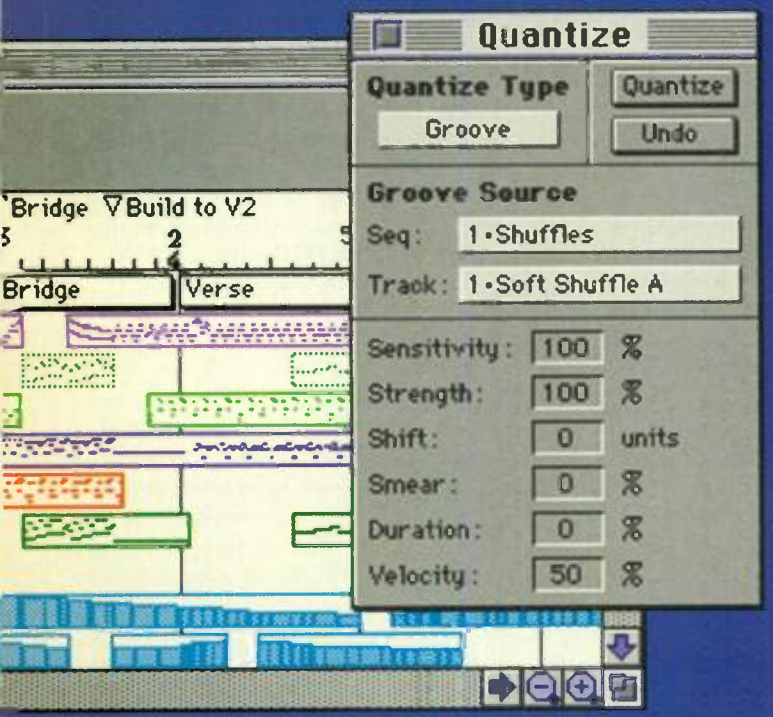

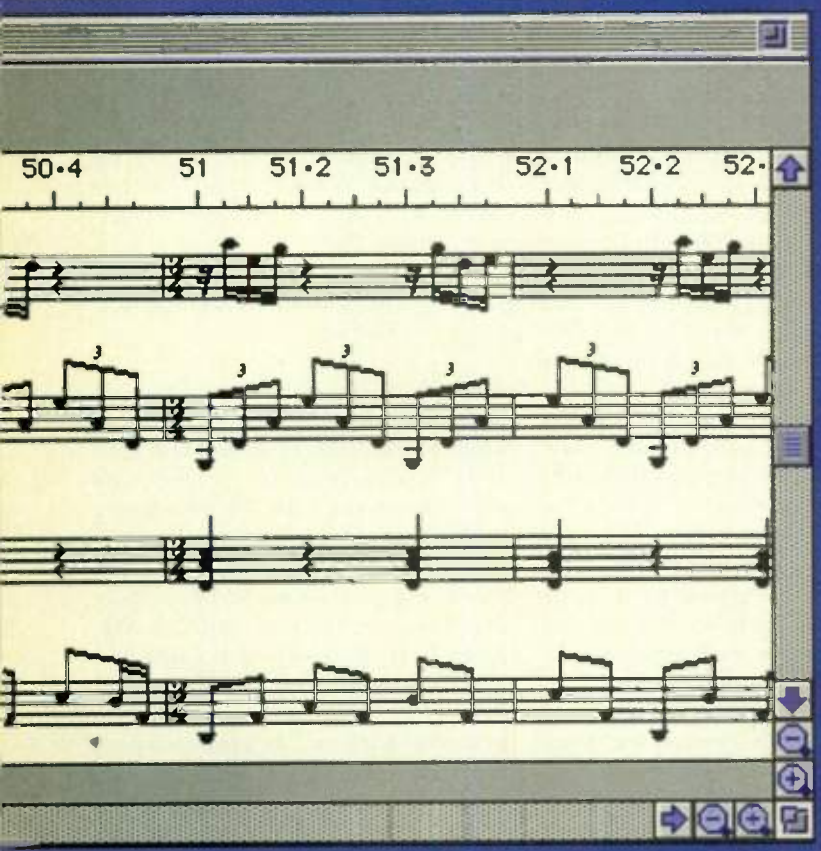

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LETTERS

YABBA ABBA DO

Michael Molenda describes ABBA's "Dancing Queen" as "vapid dross" in "Working Musician: Ten Ways to Kick Start Inspiration" (December 1993). I, for one, am tired of these jaded '70s hold-overs proclaiming to the masses what is classic and what is boring. ABBA's musical success was based on simple, catchy harmonies, although I doubt if anyone would marvel at ABBA's lyrics. With their international sound, ABBA became the largest money-making group in the history of recorded music, at that time. Duran Duran, Erasure, and Roxette are just a few groups who cite ABBA as a strong musical influence.

Apparently, Mr. Molenda lives in his own musical world where all songs should convey some type of message. I admire deeply both Clapton and ABBA; however, to compare "Layla" with "Dancing Queen" and imply "Layla" is superior because it's inspired by an ill-fated love affair is ludicrous. It's people like Mr. Molenda who believe they are God's gift to music, who constantly tell me to "free my mind" as long as it's politically correct and not overly commercial, plastic, or meaningless.

If Mr. Molenda must make musical comparisons, at least he should try to make them in the same musical context instead of taking cheap slams at a group whose successful goal was pure musical entertainment and nothing more.

Greg Purkey
Eugene, OR

Greg—Lighten up! My opinions are simply my *opinions. I'm not "proclaiming" anything. I am just trying to make a point about creative passion. Ironically, I freely admit to loving songs by ABBA, T-Rex, Slade, Duran Duran, and other "purely entertaining" groups. (And, by the way, I'm a jaded '80s hold-over; I was playing in decidedly "unjaded" punk bands in the mid-1970s.)—Michael M.*

BUT CAN YOU DANCE TO IT?

I do not understand what Jeremy Selan's problem is ("Letters," December 1993). He sounds as though nothing done with a computer can be considered music (especially if algorithmic composition has anything to do with it). As a computer musician intimately involved with algorithmic composition, such a view strikes me as uninformed.

Whether something can be called music is more a question of what it sounds like than where it came from. Music is something that happens within the conscious mind. There may be no external stimulus at all, or there may be a stimulus originating in the physical and/or mental exertions of another human being, a bird, water falling from a subterranean ceiling, or any number of sources, including a computer hooked up to a synthesizer. Furthermore, when a group of jazz musicians plays a 12-bar blues in D minor with a fatback rhythm, they are engaging in algorithmic composition. When Mozart said to score the horns a fifth above the bassoons, he was using algorithmic composition.

Using algorithmic composition on a computer still requires a human mind that knows what it's doing. At the very least, the person has to know what sounds good to her or him; and if the person fails at this, the result might be more interesting than what is produced by such people today with no help from computers. If anything, the use of computers could raise the standards of what one must produce if one is to give the public something it welcomes, but at its worst, a democratization of music will probably still raise the overall awareness of music and make it a larger part of everyday life. I consider this a worthy goal, because I believe that music heals, educates, and elevates.

Just as a theorem of mathematics is no less a theorem for having been found with the aid of a computer, a piece of music stands on its own. If one needs to know where it came from before one can figure out whether it's music, then one has missed the point.

John W. Fowler
Santa Monica, CA

TIDBITS

Here's a small idea that might be useful or entertaining. Ever have trouble holding down a loop sample while performing other keyboard maneuvers? Try a "Groove Weight." Visit your local fishing paraphernalia department, and pick up a three-ounce lead sinker. Hammer it into the shape of a finger, and wrap it with black gaffer's tape. Let your new helper hold down the groove while you get busy.

Roger Jacobs
Kapaa, HI

DOCUMENTING DRUMS

Is there a software program available that will document music notation like a piano does, using an electronic drum kit?

Tady Saczkowski
St. Catharines, Ontario, Canada

Tady—I assume you mean, "Is there a program that will convert a performance on an electronic drum kit into music notation?" The answer is yes, as long as the drum kit transmits MIDI Note On messages. Most music notation programs, such as Coda Finale *or Passport* Encore, *accept MIDI messages from any MIDI controller and transcribe them into music notation. However, the process is not as simple as it sounds. No program performs this task perfectly; you must be aware of many things in order to translate a performance on any controller into music notation.*

For more details, see "Computing the Score: Notation Software" in the February 1993 issue and "Modern Manuscripts" (a

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notation software buyer's guide) in the August 1993 issue of **EM**.—*Scott W.*

ROM OR RAM?

I simply don't understand the concept of ROM-based and RAM-based patches and their volatility.

Jeff Newman
Total Sound Productions
Santa Clarita, CA

Jeff—Programs (or anything else) that are written in Read-Only Memory (ROM) are permanently "burned" into the chip. Nothing short of damaging the chip can change data written in ROM. For this reason, it is called "non-volatile" memory. Operating systems for most synths and signal processors, as well as factory patches and factory samples, are delivered in ROM so they won't get accidentally destroyed.

Random-Access Memory (RAM) can be written to, erased, and written to again many times. In general, RAM requires an electrical charge to maintain its memory; if the charge goes away, the memory is cleared. Therefore, it is referred to as "volatile memory." The electrical charge usually is supplied by a battery, capacitor, power supply, or combination of the above. Most user programs for synths and programmable signal processors are stored in battery-backed RAM so you can store, change, or erase the programs, as desired.—Steve O.

KUDOS

It sounds like b.s., but **EM** is our favorite U.S. musician's mag.

Jon Lewin
Making Music Ltd.
London, England

Making Music *is the biggest musician's magazine in Great Britain, as well as the producer of various influential music books.—Diane L.*

continued on p. 14

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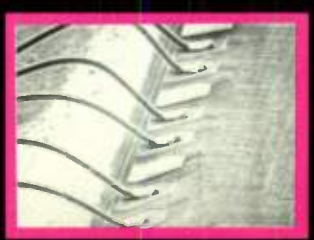
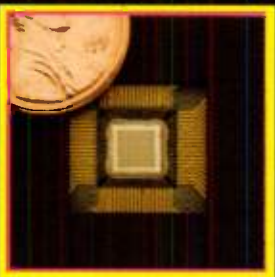
Offering all the effects and the same 24 bit V.L.S.I. engine of the ALPHA SE, the all new DRX-2100 Studio Edition offers hundreds of new studio crafted presets and includes a full function dynamics processor. It features a Compressor, Limiter, Exciter, Expander, Noise Gate, Digital frequency routing and will perform 12 simultaneous audio functions with perfect fidelity at 20 KHZ bandwidth.

DRX 2100 STUDIO EDITION

THROUGH A SCANNING ELECTRON MICROSCOPE, YOU CAN SEE THE GOLD PLATED CONNECTING WIRES THAT ARE WELDED TO THE MICROCHIP.

AT 100 TIMES ITS SIZE, YOU CAN SEE THE IMMENSE NUMBER OF CIRCUITS ETCHED ON THE A.R.T. MICROCHIP. EACH SIGNAL PATH HANDLES A DIFFERENT AUDIO FUNCTION.





THE NEW A.R.T ASIC SUPERCHIP SHOWN IN PROPORTION TO A PENNY. A QUARTER OF A MILLION DOLLARS HAS PRODUCED ONE OF THE MOST POWERFUL CHIPS EVER DESIGNED FOR THE PRO AUDIO INDUSTRY.

ART

THE SOUND OF PERFECTION

THE X-15

APPLIED RESEARCH AND TECHNOLOGY 215 TREMONT ST. ROCHESTER N.Y. 14608 • 716-436-2720 • FAX 716-436-3942

 (continued from p. 12)

LEON THEREMIN 1896-1993

Professor Leon Theremin, inventor of the space-controlled, electronic musical instrument that bears his name, as well as a host of other electronic innovations, died November 3, 1993, at his home in Moscow. He was 97 years old.

Among inventors whose work has shaped the course of electronic music, few have had as wide-ranging an influence as Leon Theremin. As a young student, Lev Sergeivich Termen (Theremin's Russian name) studied both cello and physics. In 1919, he became head of the laboratory of electrical oscillators in the Physico-Technical Institute in Petrograd (St. Petersburg). He invented his space-controlled instrument a year later.

The theremin was one of the first electronic musical instruments. It is played by moving the right hand in the space around a vertical rod to control pitch and the left hand around a horizontal loop to control volume. Because every motion of the player's hands is translated into pitch and volume variations, the theremin is perhaps the most expressive electronic musical instrument.

Dr. Theremin achieved widespread recognition in his native Russia by demonstrating his instrument to Lenin and others. In 1927, after a successful tour of Europe, Theremin arrived in New York. He set up The Theremin Laboratory in midtown Manhattan, licensed RCA to produce his instruments, and sponsored many all-theremin concerts. His students and colleagues included the renowned theremin virtuoso Clara Rockmore, who has concertized widely with major symphony orchestras.

During his stay in the United States, Theremin developed many electronic musical instruments with novel performance interfaces, including a cello-like instrument and a dance platform. He also developed nonmusical devices, such as an early form of color television.

Theremin returned to his native Russia in 1938. He was arrested shortly after that, and spent seven years imprisoned in Magadan, Siberia. During this period and years following, he did much secret work for the Soviet government.

RENEE MOOG

In 1964 he was named professor of acoustics at the Moscow Conservatory, a post that enabled him to perform further research on electronic musical instruments.

Dr. Theremin's vision of responsive musical instruments has influenced generations of instrument designers. Max Mathews, the widely acknowledged father of computer music and inventor of the Radio Drum, has stated that there is a direct connection between Theremin's work and the most recent development in computer-music performance interfaces.—*Bob Moog*

WHILE LABORING

TO PERFECT THE BEST SYNTHESIZER

ROLAND HAS EVER CREATED,

OUR ENGINEERS STUMBLED UPON THE CURE

FOR THE COMMON COLD.

BUT THEY THREW IT OUT

AND KEPT WORKING

UNTIL THEY GOT WHAT THEY WERE AFTER.

And what they were after was a synthesizer whose power, versatility and expandibility are a must for any serious musician. The JD-990 provides incredibly clear acoustic sounds and analog synth textures with the most extensive synthesis controls available. And its intuitive sound manipulation capabilities allow you to create, shape, and form virtually any sound imaginable. All this because our engineers didn't let a Nobel Prize stand in the way of some really great music.

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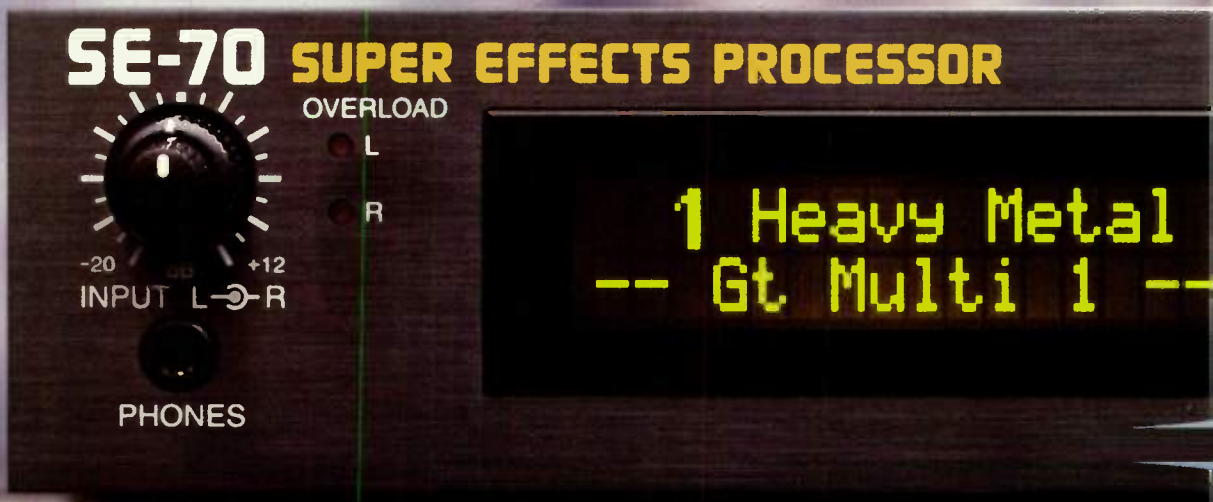
Roland Corporation, US, 7200 Dominion Circle, Los Angeles, CA 90040-3696 (213) 685-5141 Roland Canada Music Ltd., 5480 Parkwood Way, Richmond, B.C. V6V 2M4 (604) 270-6626

Please,
shelter the women,
nail down the furniture,
tie up the dogs,
and just to make sure,
fill out this card

before pressing this button.



	BOSS SE-70	Ensoniq DP/4	Rocktron Intellifex	Yamaha SPX 990	DigiTech DSP-21 Legend	DigiTech TSR-24	Zoom 9050
List	$895	$1495	$1159	$1[illegible]	$799	$799	$799
Max Simultaneous Effects	16	12	3	4	10	Limited by Memory	9
Guitar Pre Amp	Analog	Digital	n/a	Digital	Analog	n/a	Digital/Analog
Independent Effects per Input	Yes	Yes	No	Yes	No	Yes	No
Delay Taps	20	16	8	6	4	4	4
Pitch Shift	12 part	5 part	4 part	3 part	n/a	6 part	4 part
Hum Cancel	Yes	No	No	No	No	No	No
Vacoder	21 Band	Yes	No	No	No	No	No
Guitar/Bass Synth	Yes	No	No	No	No	No	No
Guitar Tuner	Yes	No	No	No	No	No	Yes
Metronome	Yes	No	No	No	No	No	No
Special Functions	Rvt. Spkr Vocal Cancel Feedbacker Duck Delay Slow Gear Sampler Rev. P. Shift	4 Ins/Outs Rotary Speaker	Intelligent Noise Reduction Duckling Delay	XLR Ins/Outs	Foot pedal included	2ST Ins/4 Outs Expandable (est $250-275) Sampler	Rotary Speaker Ducling Delay Slow Gear

Specifications drawn from manufacturers literature or customer service personnel. Prices and specifications may vary. n/a = not available

Because this button activates a 16-bit effects processor with truly unequalled performance and sound quality. The SE-70 functions as a full-blown guitar processor complete with analog distortion and 15 other simultaneous effects. It has guitar and bass synth modes, a 20 tap delay, 60 cycle hum canceller, 12 part pitch shifter, vocoder, rotating speaker, vocal canceller and true discrete parallel processing per input – as well as pristine reverbs, an extraordinary chorus circuit, and algorithms for all instrumental and vocal applications. It even comes with some free advice: some masking tape will keep those valuable paintings from shaking off the wall.

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Outrageous Sound for the Financially Sane!

Don't you think it's time that computer sound met your musical expectations as well as your budget? Presenting Roland's newest member of the *Sound Canvas*™ family, the SC-7 Sound Module—the portable sound module that requires no MIDI interface (and only a little cash).

GENERAL MIDI

Perfect for Apple® PowerBook™ and PC notebooks without expansion slots, the SC-7 is also compatible with General MIDI for the widest software library available.

And you also get FREE software, so you can start making music right away!

Put all this together with the SC-7's 128 CD-quality sound samples, digital reverb, and a built-in stereo mixer, and you've got the ideal sound module for creating music on your desktop--all at a price that will amaze you.

So get to your Roland dealer today and start being musically outrageous no matter how sane you really are!

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WHAT'S NEW

▲ SPECTRAL INNOVATIONS NUMEDIA

Spectral Innovations introduced NuMedia ($1,195), a 16-bit, stereo, digital-audio NuBus card for the Macintosh. Unlike other Mac audio cards, NuMedia uses the AT&T DSP3210 processor and Apple Real-Time Architecture (ARTA) found in the Macintosh Quadra 660AV and 840AV. All features are selected through Apple's *Sound Manager* 3.0.

The card includes stereo, analog I/O on stereo, ⅛-inch minijack connectors, fiber-optic digital I/O, and a stereo minijack mic input. The analog I/O supports sampling rates of 22, 44.1, and 48 kHz. The card supports Dolby AC-2 6:1 audio compression and is bundled with Passport *Producer* 1.2, a CD of audio clips from Killer Tracks, and cables.

The company also offers a DSP3210/ARTA Developer Toolkit (Toolkit $995; with NuMedia card $1,995) that includes DSP3210 Assembler, Linker, a macro library, and a Debugger. Spectral Innovations; tel. (408) 955-0366; fax (408) 955-0370.

Circle #401 on Reader Service Card

▶ JVC XD-P1PRO

JVC introduced the XD-P1PRO DAT recorder ($1,750). The minuscule XD-P1 weighs just 21 ounces (with battery) and measures 3.75 × 1.5 × 6.5 inches. It works with either a snap-on A/D converter or the snap-on, stereo, MU-Z1 digital-output microphone. The unit uses 18-bit, 8× oversampling DACs and has a servo-driven loading mechanism.

The XD-P1PRO features full ID-editing and absolute-time capabilities and does not implement SCMS copy-protection. It also comes with a thumb-size remote transport control. The unit's controls are on one side for convenience, and it has Key Hold and Record Protect switches to avoid accidental triggering.

The line output is an ⅛-inch, stereo minijack, and the remote control uses a ⅛-inch, stereo headphone minijack. Battery life is approximately three hours. The XD-P1PRO system includes the DAT machine, snap-on A/D converter, digital-output microphone, windscreen, microphone pistol grip with

table-stand adapter, ADC module, remote control, cables, and an external AC power supply/charger that works with all voltages and frequencies. JVC Professional; (800) JVC-5825 or (201) 794-3900; fax (201) 523-2077.

Circle #402 on Reader Service Card

▼ DIGITECH GSP-2101

The DigiTech GSP-2101 Studio Tube Preamp/Processor ($999) combines digital effects (using the same DigiTech S-DISC DSP chip found in the TSR-24) with a 12AX7-based tube preamp. The analog section provides compression, EQ, three types of tube distortion, and three types of solid-state distortion. Digital effects include reverbs, delay, flanging, chorusing, EQ, noise gating, tremolo, and auto-panning. The pitch shifter includes "whammy" effects.

With S-DISC technology, any effect can appear at any point in an effects chain, and the chain can include redundant effects (e.g., flange + EQ + distortion + EQ). The number of simultaneous effects is limited only by the number of CPU and RAM blocks in the unit, which can be doubled with an optional PPC card. The 2101 includes 100 factory presets and 100 user memory locations.

A MIDI processor is included, along with MIDI input filtering, Program Change mapping, and real-time parameter changes. Additional features include a tone generator and metronome. An optional foot controller is available.

The 2101 has balanced XLR and unbalanced ¼-inch inputs and balanced ¼-inch outputs. It samples at 48 kHz, using 18-bit, Delta-Sigma A/D converters and 18-bit, PCM D/A converters. The internal processing is 24-bit. Total bandwidth is rated at 20 Hz to 20 kHz (±0.5 dB), S/N ratio at 90 dB, and THD at less than 0.03% (1 kHz). DigiTech; tel. (801) 566-8800; fax (801) 566-7005.

Circle #403 on Reader Service Card

continued on p. 23

8•BUS SERIES

DUE
NEW
GREC

Optional tilt-up METER BRIDGES are globally switchable to see tape return preamps or channel output and include VU meters for main L/R output. MB•24 meter bridge for 24•8 console is $799*. MB•32 for 32•8 is $899*. Our soon-to-be-released 16•8 16x8x2 console's meter bridge will retail for $699*.

Rugged, non-flexing STEEL CHASSIS.

4-BAND EQ with "Expensive British Console Sound." Includes TRUE PARAMETRIC HI-MID, swept LO MID, shelving HI & LO plus 18dB/oct HI PASS (lo cut) filter at 75Hz. Users are raving about the sound quality.

6 AUX SENDS with Solo and Solo LED.

6 STEREO AUX RETURNS. All have 20dB gain, Solo and can be used in stereo & mono. 1 & 2 are pannable & bussable.

MIX B/MONITOR section can be used as an independent stereo out for PA monitor mix, 2-track recording, video/broadcast feed or assigned to L/R mix.

TWO SEPARATE HEADPHONE SECTIONS can be used totally independently of each other. Each features source selection between Control Room & any combination of AUX 3/4, AUX 5/6, Mix-B or External source. Solo allows control room to hear what musicians are hearing in their headphones.

TALKBACK assigns to all submasters, main mix, AUX 1, AUX 2 or Phones 1&2.

SOLO level adjust and ultra-rude LED.

MONITOR section with separate Control Room & Studio levels. Source selection between L/R mix, Mix-B, Tape & External. Can be switched to Mono.

–40 to +10 bar graph LED DISPLAYS for each sub-master & Solo/Main (with main L/R +28dB CLIP LEDs).

EXPANSION CONSOLES let you add channels in banks of 24 to either the 24•8 or 32•8. Expanders have their own internal mix amps so the main board only "sees" one extra channel per expansion console.

Built-in talkback MIC.

Trick BUS SOLO switches send odd-numbered buses to the left speaker and even-numbered buses to the right speaker — unless you've pressed the respective MONO L&R button. When a bus has been mono-ed, SOLO sends the bus to both speakers.

L MIX/R MIX & MONO L&R buttons assign buses to main L/R stereo bus.

All channels have Mackie's renowned discrete, wide-bandwidth MIC PREAMP circuit for ultrahigh headroom & low noise. All mic inputs have RFI choking, ferrite beads and +48V phantom power (switchable in banks of 8 channels).

32•8 console

33/56 24-channel expander console

24•8 console

25/48 24-channel expander console

Optional stand ($295*)

YE OLDE ENGLISH SOUNDE. Greg started out by asking "What is it that makes the finest British mixing boards perform the way they do?" For example, "classic," older English consoles have much wider-band midrange EQ than lower-priced consoles — it really has an effect on overall sound quality. So we incorporated the same capabilities on our new consoles. This also enabled us to add the flexibility of a variable bandwidth control for true parametric HI-MID EQ. It wasn't easy to engineer in the expensive circuitry necessary and still keep our consoles affordable, but we did it.

You'll like the increase in both sound quality and versatility.

We paid the same kind of attention to fader quality. Instead of less-accurate D-taper faders, we commissioned a totally new custom 100mm fader with the logarithmic taper found in mega-expensive consoles.

EVEN THE FEATURES HAVE FEATURES. Naturally each channel has In-line monitoring with split EQ. But our MIX-B Monitor section also has a SOURCE switch to tape off the channel (pre-fader) to create independent mixes for taping, broadcast feeds or headphone mixes. Dual independent headphone sections offer the ability to switch between Control Room and any combination of AUX 3/4, AUX 5/6, MIX-B or External sources. Tape inputs and outputs feature internal

*Suggested Retail Price. Your actua

+4dBU balanced TAPE RETURNS, switchable to to –10dBV unbalanced in banks of 8 returns.

Balanced MIC, bal./unbal. LINE IN, MIC/LINE switch, DIRECT OUT & CH. INSERT on every channel.

Three TAPE OUTPUT jacks per bus (total of 24). +4dBU balanced, switchable in banks of 8 to –10dBV unbalanced.

TO THE UNEXPECTEDLY HIGH DEMAND FOR OUR 8-BUS CONSOLES, WE WON'T EVEN LET MACKIE HAVE ONE YET.

HE WORKED. HE SLAVED. He created the 8-bus console HE always wanted to own. In fact Greg kept adding features until we threatened to whack him upside the head with a rancid salmon. Now the first notices are in from 8•Bus owners: Spontaneous raves from recording studios, PA companies and video post houses. Quotes like "It's so quiet I had to check to see that it was on" and "Blows away my old board that cost $20,000." In other words, Greg really DID succeed at creating the first truly affordable high-headroom, low noise, feature-laden 8-bus consoles. Unfortunately, we can't build them fast enough to meet demand. Unlike our competitors, Mackie can't just order up consoles by the container-load. Instead, we build each 24•8 and 32•8 at our factory in Woodinville, Washington. Even though we're working day and night (and shipping more and more each week), there's still a waiting list at Mackie dealers. Even Greg hasn't gotten one yet! Serves him right for designing so much performance into consoles that retail for $3995* and $4995*. Read on for the deliciously explicit details.

220-watt, Class A POWER SUPPLY with enough juice to also power a meter bridge.

+4dBU to −10dBV level conversion so you can use semi-pro tape decks without the inherent noise penalty found in mixers that operate at −10dBV internal levels.

MACKIE'S SIGNATURE MIC PREAMPS. At the urging of legions of satisfied CR-1604 and MS1202 users, we didn't mess with a good thing. Our 8•Bus consoles' mic preamps deliver −129.6dBm E.I.N. at 0.005% THD with a 300K bandwidth, yet can handle +14dBU inputs without a pad. The consoles' working S/N is 90dBu with 116dB internal headroom. For any application where noise is especially noticeable (such as hard disk or multi-track digital recording), you've found your board — for as little as $3995*!

SOME OF THE FEATURES GREG ADDED SINCE WE FIRST ANNOUNCED OUR 8•BUS CONSOLE LINE*:

- External 220-watt, Triple-Regulated, Low-Ripple Power Supply
- Mic/Line switch on every ch.
- "Triple-bussed" tape outputs
- +4/−10 tape inputs & outputs (switchable in banks of 8)

*Before we threatened to whack him upside the head with a rancid salmon if he didn't stop.

EXPANDABLE AND AUTOMATABLE. Need 24, 48 or even 72 extra channels? Add one or more 24-channel expander consoles (complete with inputs, tape returns and their own power supply) at any time in the future. Just by connecting one cable between the expander and your 24•8 or 32•8 board. External fader and muting MIDI automation will also be available soon.

OPTIMIZED FOR PA AND RECORDING. Along with elaborate monitor capabilities, balanced XLR main outputs and 18dB/octave hi pass filters, you get non-flexing steel construction, fiberglass thru-hole plated, horizontal circuit boards that minimize impact damage, gold-plated internal interconnects, sealed rotary pots and a rugged 220-watt, super-regulated power supply. You won't find more roadable, compact PA boards anywhere.

READ ALL ABOUT IT. Call us toll-free and we'll ship you a comprehensive brochure including application hookups. We think you'll be impressed enough to be willing to wait a little while before you get your 24•8 or 32•8. After all, Greg is still waiting for his.

Conventional faders have a second layer of resistive material that attempts to approximate logarithmic a taper. Our PRECISION NETWORK FADERS are single-layer screened with both the primary linear resistive elements and also a complex auxiliary element to create the true logarithmic curve found in ultra-expensive studio console faders (blue line on graph).

In-line FLIP reverses tape and mic/line inputs between channel strip and Mix-B/Monitor section.

AUX SENDS 1-2 PRE button selects pre-fader/post EQ or post-fader/post EQ.

AUX 3-4/5-6 SHIFT changes 3-4 to 5-6.

SOURCE selects signal source of AUX 3-4/5-6 from channel strip to channel's Mix B/Monitor send so you can build an effects mix (pre or post-MIX-B level) to assign to phones during tracking.

True parametric, 3-control HI MID EQ that has seasoned engineers swooning (quotes and raves on file...we're not kidding). Ultra-wide 500-18k frequency sweep range; bandwidth can be adjusted from a very wide 3-octave width to a very narrow 1/12-octave width. 15dB boost/cut.

LO MID EQ with ultra-wide 45Hz-3K sweep, 15dB boost/cut.

±15dB shelving HI (12kHZ) & LO (80Hz) EQ.

Multipurpose 18dB/oct. LO CUT filter @75Hz. Cleans up "mix mud," cuts PA rumble, creates a "neo-peaking" bass control when used with LO shelving boost.

Independent MIX-B (Monitor) section with pan, level & source. During mixdown, use as extra pre-fader stereo AUX send or double your inputs.

Mix-B SPLIT EQ assigns HI & LO EQ to Mix-B.

MIX-B SOURCE can route the monitor section to an extra stereo output for 2-track taping or broadcast feed during live mixing.

Constant power, buffered PAN pot for rock-solid panning.

Overload LED and Hyperactive −20dB Signal Present LED.

Selectable SOLO with CHANNEL METERING allows soloing in full stereo perspective; displays soloed channel operating level on master L/R meters so input trims can be adjusted for optimum levels.

MACKIE.

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PHONE TOLL-FREE 800/258-6883 • FAX 206/487-4337
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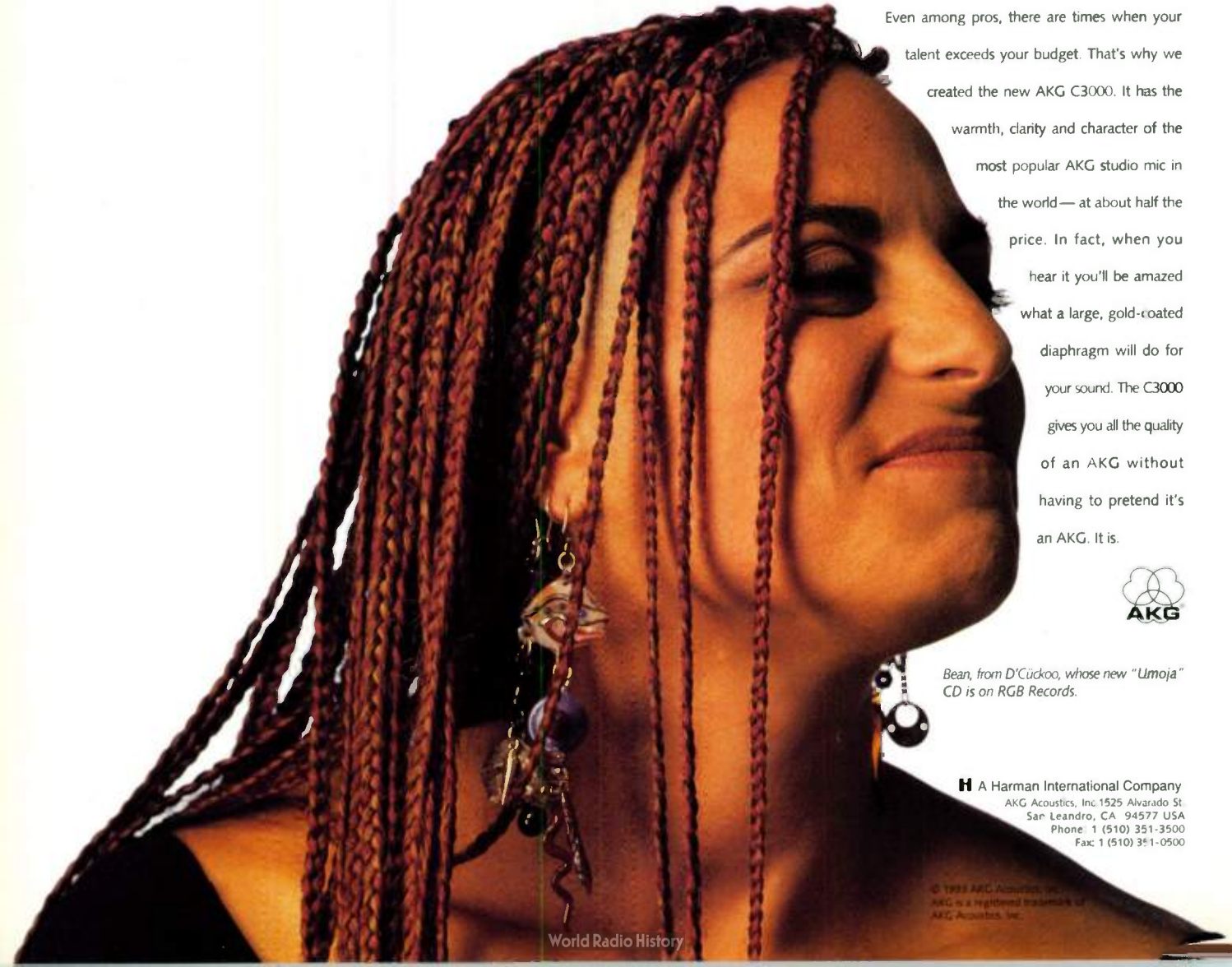
rice, like your mileage, may vary. Prices are slightly higher in Canada.

It's nice to know an AKG studio standard isn't over anyone's head anymore.



Even among pros, there are times when your talent exceeds your budget. That's why we created the new AKG C3000. It has the warmth, clarity and character of the most popular AKG studio mic in the world — at about half the price. In fact, when you hear it you'll be amazed what a large, gold-coated diaphragm will do for your sound. The C3000 gives you all the quality of an AKG without having to pretend it's an AKG. It is.

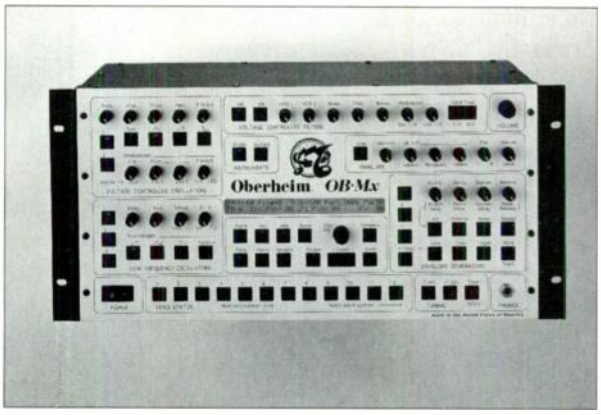
AKG

Bean, from D'Cuckoo, whose new "Umoja" CD is on RGB Records.

H A Harman International Company
AKG Acoustics, Inc. 1525 Alvarado St.
San Leandro, CA 94577 USA
Phone: 1 (510) 351-3500
Fax: 1 (510) 351-0500

▶ OBERHEIM OB-MX

Oberheim is shipping its long-awaited OB-Mx programmable analog synthesizer ($2,149/ 2-voice basic unit; $769/2-voice card). The basic, 5U rack-mount unit is 2-voice polyphonic and 2-part multitimbral, but it can be expanded to as many as twelve voices using 2-voice, 2-part multitimbral plug-in cards. In addition to the synthesizer's stereo mix output, independent audio outputs are provided for each voice.

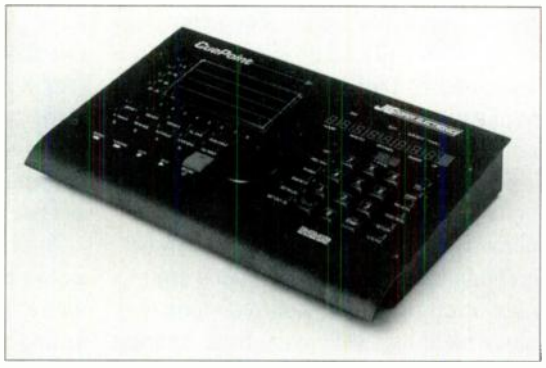


The synthesizer's signal path is entirely analog. Each voice includes two VCOs, two noise generators, four ADSR envelopes, three LFOs, and two resonant VCFs, one of which is a Minimoog filter and the other a classic Oberheim SEM-type filter. The audio oscillators can produce sawtooth, ramp, and pulse waves, with pulse-width control. The LFOs produce white noise, ramp, reverse ramp, and sawtooth waves and feature sample-and-hold.

Complete front-panel control is provided, with 32 knobs, 59 switches, and a 2-line by 40-character LCD. The OB-Mx offers matrix modulation of voice parameters from onboard modulation sources and MIDI controllers, and it supports MIDI SysEx dump and load. Oberheim; tel. (800) 279-4346 or (510) 261-1702; fax (510) 261-1708.

Circle #404 on Reader Service Card

▶ JLCOOPER CUEPOINT



JLCooper's CuePoint ($799.95) is a remote autolocator/transport control that can govern up to four MIDI Machine Control-compatible tape recorders, software applications, and tape machines with serial or parallel control ports. (The latter requires an optional plug-in card.) The device is compatible with the Alesis ADAT, Tascam DA-88, Fostex RD-8, and many hard-disk recorders.

The remote-control device has tape-transport controls and a shuttle wheel, as well as track-enable and track-grouping functions for up to four 8-track decks. Individual red and green LEDs indicate track status.

CuePoint provides quarter-frame-accurate punch in/out, and a Safe Segments feature lets you record on unused track areas while protecting recorded material. There are 99 locate points, which can be entered from CuePoint's keypad, or captured "on the fly," edited, and recalled. You can also chase to a specified SMPTE time or bar and beat.

CuePoint can send SMPTE and MIDI Time Code at the same time, acting as a master synchronizer, or it can be driven by incoming SMPTE or MTC. A large LED display indicates SMPTE times or bars and beats. An optional expansion card lets CuePoint slave to the ADAT without wasting an audio track. JLCooper; tel. (310) 306-4131; fax (310) 822-2252.

Circle #405 on Reader Service Card

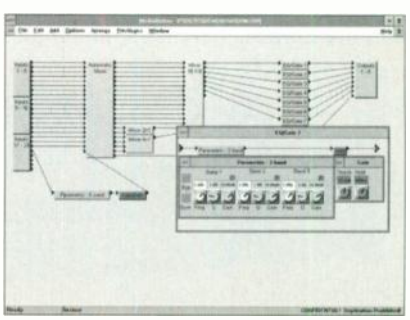
▼ PEAVEY MEDIAMATION

Peavey has announced MediaMation (basic complete system, including computer, well under $10,000), a revolutionary, *Windows*-based, "virtual" sound-reinforcement system. MediaMation replaces an entire P.A., except for source devices, amps, and speakers. The system consists of operating software and one or more MediaMatrix DSP cards that utilize five Motorola 56000-series chips. One card is enough to build a fairly large system; to expand further, you simply add more DSP cards and I/O boxes. (The maximum number of DSP cards is limited only by the number of available PC slots.) The 8-in, 8-out external I/O box contains the A/D and D/A converters and can be ordered with an assortment of connector types.

The object-oriented software lets you select mixing modules, compressors, room delays, parametric EQ, and other processing objects from drop-down menus. Double-clicking on the individual objects accesses their programmable parameters. The modules are connected by clicking and dragging onscreen "cables" with the mouse, in a manner similar to Apple's *MIDI Manager*. An unlimited number of sound systems can be saved as MediaMation files to be loaded and modified as desired.

MediaMation will initially be marketed for sound-reinforcement systems of all kinds, including extremely large installations. However, its development has significant implications for recording studios, home automation, and other environments that could be controlled using DSP-based systems. The system requires an 80386 or better PC with 10 MB of RAM and *Windows* 3.1. Peavey Electronics; tel. (601) 483-5365; fax (601) 486-1278.

Circle #406 on Reader Service Card

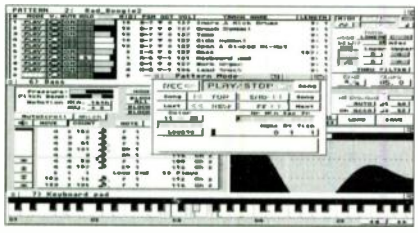


▼ DIEMER SEQUEL

Diemer Development presents *Sequel* ($139), a 32-track sequencer for the Amiga. Independent, 32-track patterns are arranged into a song, with unlimited pattern-chaining. When a pattern is updated, all songs automatically use the new version.

The program offers extensive looping features. Each pattern can include looping tracks, and each track can include multiple loops, with independent start and end points. Loops can be nested within loops, to 256 layers. Layering and multitake (replace) Record looping is provided, and nonlooping tracks can be dubbed over looping tracks. The recording resolution is 192 ppqn.

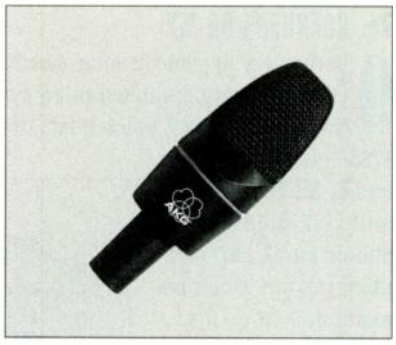
Sequel offers event-list editing of MIDI Note On/Off, Tempo, Velocity, Pressure, and Control Change messages. Blocks of notes can be cut, copied, merged, moved, and inserted. You can quantize to the nearest beat, with adjustable threshold and strength. Note Off times can be quantized independently. The NotationList screen displays scrolling standard music notation and exact tick location during playback. Playback can also be monitored on an onscreen keyboard.



You can combine MIDI instruments and sounds from the Amiga's sound chip, in real time, with keyboard split and MIDI delay. The MIDI setup (channel, Program Change, Volume, and octave) and Amiga controls (internal sound, volume, octave, and stereo pan) can be controlled on the fly from the track list.

Sequel supports General MIDI, imports and exports Standard MIDI Files, and exports tempo maps. It loads IFF SMUS and 8SVX music and sound files. The program syncs to all SMPTE rates via MTC and runs on any Amiga with 512 KB of RAM and AmigaDOS 1.2 or later. Diemer Development; tel. (818) 762-0804.

Circle #407 on Reader Service Card



▲ AKG C3000

AKG has unveiled the C3000 large-diaphragm condenser microphone ($699). Designed for a variety of studio and stage applications, the C3000 offers switchable cardioid and hypercardioid polar patterns. A switchable -10 dB pad and bass-rolloff switch are provided.

The mic is internally shock-mounted—the dual capsules float in a special elastomer suspension—to minimize mechanical and cable noise. An internal windscreen aids outdoor and wind-instrument miking. AKG Acoustics; tel. (510) 351-3500; fax (510) 351-0500.

Circle #408 on Reader Service Card

▼ YAMAHA DMP9

Yamaha is shipping the DMP9 Digital Mixing Processor ($3,199/8-ch., $4,199/16-ch.), a programmable, digital, 3U rack-mount mixer that is available in 8- or 16-channel configurations. The device uses 16-bit ADCs and 18-bit DACs. The digital input section (which accepts 20-bit or 24-bit data streams) accepts one stereo digital signal, in Yamaha or S/PDIF format, which is routed to a pair of input channels or directly to the stereo bus. The available sampling rates are 32, 44.1, and 48 kHz. A BNC connector is provided for external word-clock sync.

Both versions have two sets of stereo, analog outputs, one balanced and the other unbalanced, in addition to a stereo, digital output. Each channel in the DMP9-16 can be simultaneously assigned to two independent stereo output buses; the 8-channel version has only one stereo output bus.

Each channel has an analog, ¼-inch input, and channels 1 and 2 have XLR mic inputs. Each pair of inputs can be independently assigned as mono channels or stereo pairs. Both versions include eight rotary level controls; on the DMP9-16, each knob can be switched to control either of two channels. Each channel in both versions also includes a trim pad; 2-band, 20 Hz to 20 kHz, parametric EQ (±18 dB); channel delay; phase reverse; solo; aux send control, which can be assigned to one of four aux sends; and clip and signal-present indicators. The main analog outputs use balanced XLR and ¼-inch connectors.

Two onboard signal processors provide reverb, delay, and modulation effects, such as chorus and flange. There are four aux sends, two of which feed the internal effects processors, while the other two feed ¼-inch outputs. Two stereo aux returns are dedicated to the onboard effects. The 8-input version also has one external aux return, while the 16-channel version has two external returns.

The user interface utilizes a 16-character by 4-line LCD and data-entry wheel. Input levels are set with rotary knobs and 8-segment LED meters. Levels for the Stereo 1, Stereo 2, Send 3, and Send 4 outputs are metered by 7-segment LEDs. The DMP9 saves EQ settings and "snapshots" of all mix parameters in 50 Scene memory locations, which can be recalled manually or by MIDI Program Changes. All mixing parameters can be MIDI-controlled in real time. At a 44.1 kHz sampling rate, the DMP9's frequency response is rated at 4 Hz to 20 kHz (+1/-3 dB) with THD at less than 0.05% (1 kHz at +4 dB, with emphasis). Yamaha Corporation; tel. (714) 522-9011; fax (714) 739-2680.

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continued on p. 29

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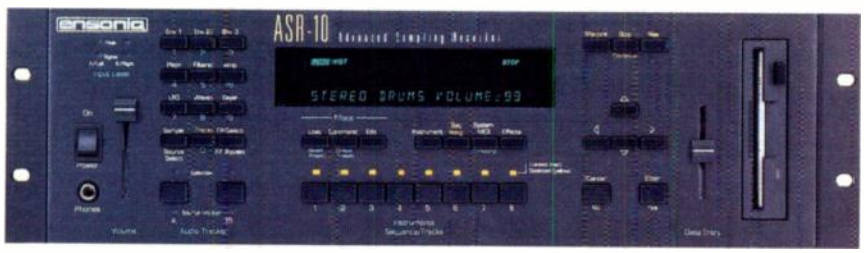

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▼ VALLEY AUDIO MODEL 730

Valley Audio has announced the Model 730 Digital Dynamics Processor ($2,000). The 1U rack-mount device provides digital, stereo, full-range or frequency-sensitive compression; keyable expansion and gating; digital level control; and peak limiting. The Model 730 lets you combine multiple, simultaneous threshold setpoints (knees) and segment ratios to create custom transfer curves. In addition to the usual Threshold, Attack, Release, Ratio, and Gain controls, it includes Setpoint, Slope, Range, Pre-Delay, Delay Hold, Mix, and Stereo Spread. There are 99 user program locations.

The unit includes +4 dBm and -10 dBu analog inputs and outputs (on XLR connectors), using 18-bit converters and a 24-bit internal data path. Digital inputs and outputs include AES/EBU, S/PDIF, and SDIF-2. The unit can mix analog and digital inputs and simultaneously feed analog and digital outputs. All common sample rates are supported. Word-sync ports on BNC connectors are standard, as are RS-232 and RS-422 control ports. MIDI In and Out are included for real-time parameter automation and storage. A hand-held remote offers two assignable linear faders for digital level or parameter control. Valley Audio Products; tel. (800) 800-4345 or (913) 432-3388; fax (913) 432-9412.

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▲ FATAR MP-1

Fatar's MP-1 MIDI Pedal ($450) provides thirteen organ-style footpedals (C to C) that send MIDI note messages. Small footswitches let you change octaves and step through MIDI channels and consecutive outgoing Program Changes. Music Industries Corp. (distributor); tel. (516) 352-4110; fax (516) 352-0754.

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▶ ROLAND SDE-330

Roland is shipping the SRV-330 Dimensional Space Reverb ($1,195) and SDE-330 Dimensional Space Delay ($1,195). Both 1U rack-mount effects processors feature Roland's 3-dimensional sound-localization technology, which was debuted in the RSS 3-D sound processor.

The two units use 16-bit ADCs and DACs, sampling at 44.1 kHz. Internal processing is 30-bit. The input and output levels can be switched between +4 dBm and -20 dBm. The units offer three control jacks and real-time MIDI control. The SRV has 100 user memory locations and 300 factory presets, while the SDE has 200 user programs and 100 factory presets.

Both processors produce a variety of position- and time-based effects, including discrete stereo algorithms. The SRV-330 is designed to emulate natural spaces, generating up to 24 early reflections that can be positioned at up to twelve locations in a circular soundfield. The SDE-330 produces delay effects with up to eight taps that can be positioned anywhere in a circular soundfield. Roland Corporation US; tel. (213) 685-5141; fax (213) 722-0911.

Circle #412 on Reader Service Card

▼ RANE FSC 22

Rane has introduced the FSC 22 Stereo Compressor ($399), the latest in its Flex series of modular signal processors. The half-rack unit can be mounted vertically or horizontally. The FSC 22 features separate threshold and ratio controls for each channel, as well as switchable attack and release time. A Dual/Slave switch lets the unit operate in dual mono, or as a stereo pair. In Slave mode, both channels are equally compressed when either exceeds the threshold, preserving the dynamic spectral balance and stereo image. Dual-function meters display gain reduction or channel output, and an LED overload indicator is provided.

The compressor uses Analog Devices SSM2018 VCAs and features hard-wired (passive) bypasses for each channel. It has balanced XLR and ¼-inch (TRS) inputs and outputs, switchable -10 dBV and +4 dBu levels, and an external power supply. Frequency response is rated at 20 Hz to 20 kHz (+0/-0.5 dB), THD+N at 0.05%, and S/N ratio at 92 dB.

Also from Rane, the FBB 44 Balance Buddy ($259) uses nickel-core audio transformers to convert between -10 dBV levels on RCA connectors and +4 dBu levels on balanced XLR connectors. The Flex-series, half-rack FBB 44 can simultaneously convert two stereo signals, one pair in each direction, or two pairs in either direction. It uses isolation transformers for noise-free, low-distortion conversion. Rane Corporation; tel. (206) 355-6000; fax (206) 347-7757.

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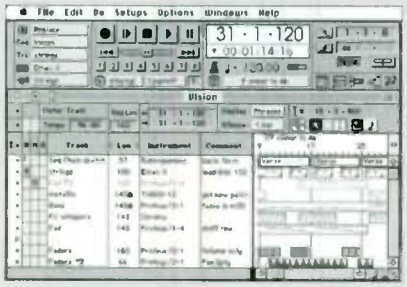
REV UP



▲ OPCODE SYSTEMS

Opcode is shipping *Vision* 2.0 ($495; upgrades $99.95), a major upgrade that adds standard music-notation editing and printing. The sequencer now has a Track Overview that lets you view and edit the entire song file graphically, including chaining subsequences. In Block mode, sections of up to sixteen bars are displayed as rectangles of uniform size; in Phrase mode, you can set a Silence Threshold Length, which lets you see musical phrases that start and end on specific musical boundaries. You can have an unlimited number of sequences per file.

Global Edit Points are available in all editing windows, and comment fields have been added for tracks and sequences. Tracks are now movable for easy reordering, and each track is displayed in a user-selectable color. The new version also implements MIDI Machine Control, and it can send and receive MIDI Time Code. Groove Quantize has been implemented, including support for WC Music's DNA Grooves, and fifty DNA Grooves come with the program.

Opcode is also shipping Studio 5LX, a firmware and RAM upgrade for the Studio 5 MIDI interface/patch bay/processor (ROM upgrade $79.95; ROM and RAM $149.95; RAM only $99.95). The upgrade quadruples the user patch storage (to 256 KB) and adds graphic map-editing for many patch components, including controller curves. It provides Patch Chaining for stepping through nonconsecutive Studio 5LX patches and lets you change patches from any *OMS*-compatible sequencer. You can chain up to six Studio 5LXs per Macintosh. Opcode Systems; tel. (415) 856-3333; fax (415) 856-3332.

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▼ MUSICATOR A/S

Musicator A/S has released *Musicator Win* 2.0 for *Windows* ($299; upgrades from *Musicator GS for Windows* 1.0 $59; from *Musicator DOS* $99). The integrated sequencing and notation program now supports 32 tracks, 32 MIDI channels, and 32 staves of notation. Support has also been added for SMPTE and MIDI sync and multiple MIDI ports. The program now provides "on-the-fly" and automatic punch-in/out, multiple Record modes, and transcription of any tuplets. An automated mixer has been added, and many notation features have been enhanced. Musicator A/S; tel. and fax (510) 251-2500.

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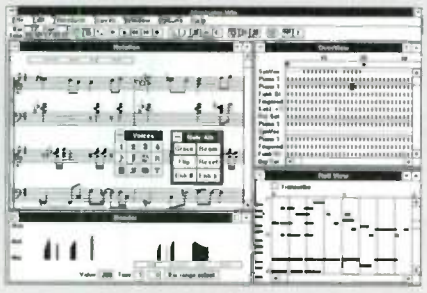

STEINBERG/JONES

Steinberg/Jones is shipping *Cubase Audio for Falcon* ($999), which lets you record eight tracks of digital audio using the Atari Falcon030 computer. The only additional hardware required is a SCSI hard disk. The Falcon's eight audio channels can be used for hard-disk recording, as a drum-sample player, and for RAM-based playback. The computer's onboard DSP lets you add digital effects, such as reverb, delay, or EQ. The program includes all the *Cubase* sequencing and *Cubase Score* music-notation and score-printing functions. Steinberg/Jones; (818) 993-4091; fax (818) 701-7452.

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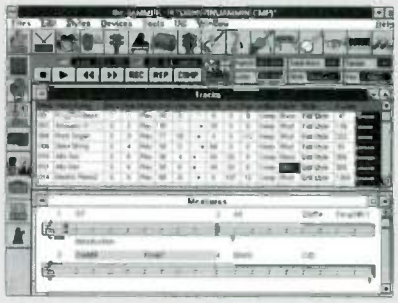
▼ SOUNDTREK

Soundtrek introduced *The Jammer for Windows* (Standard $99; Professional $199; upgrades $60 and



$75, respectively), an improved version of the DOS-based music-composition and accompaniment program. Both Standard and Professional versions come with 125 Band Styles and a 256-track sequencer, but only the Professional version provides detailed control over the Style of each Musician on each track. The upgrade adds graphic animation, colorful toolbars and icons, support for polyrhythms, new and better graphic views of measures, and chord-entry via mouse or keyboard. Soundtrek; tel. (404) 623-0879; fax (404) 623-3054.

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DYNAWARE

Dynaware is offering *Ballade for Windows* ($99.95), a 16-track version of the company's Mac and DOS sequencer. The program offers piano-roll and notation editing, score printing, Wave file playback (with support for QSound 3-D sound processing), a 16-track MIDI mixer, and General MIDI and Roland GS support. It can be controlled with voice commands, using Creative Labs's *Voice Assist* software, which works with any sound card that has a mic input. Dynaware; tel. (415) 349-5700; fax (415) 349-5879.

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PRO FILE

Digital Barn Dance

Recording Kate Bush and The Red Shoes.

By Michael Molenda

Kate Bush's music is so theatrical that you don't hear it so much as "see" it. Her productions are almost mystical in their ability to reach beyond the aural proscenium and pull the listener into an emotional tableau. So it's fitting that her current album *The Red Shoes* pays homage to another chillingly evocative talent, the late British filmmaker Michael Powell.

The Red Shoes, named after Powell's classic 1948 film about a doomed ballerina, was recorded and mixed by Bush's longtime engineer Del Palmer in her "home" studio: a state-of-the-art facility housed in two adjacent barns on her parent's farm in Kent County, near London.

The studio is equipped with an SSL 4048E console (with a G-series computer), a Fairlight, and AMS, Eventide, and Quantec signal processors. Six months after the project began, Bush purchased two Sony 3324A 24-track digital recorders from Abbey Road studios, making *The Red Shoes* her first 48-track digital production.

"We used to be dyed-in-the-wool analog lovers," admits Palmer. "But after day one of going digital, we were totally convinced that it was the best thing since sliced bread. Everything sounded so great direct from the microphones, that I barely touched the EQ during recording. And the absence of tape hiss is a boon for Kate's music, where arrangements sometimes break down to literally nothing."

The Red Shoes took three years to complete and includes guest artists such as Eric Clapton, Prince, Jeff Beck, and the Trio Bulgarka. Bush developed keyboard and vocal ideas over simple, 4-bar drum loops programmed by Palmer on the Fairlight. When a song was adequately fleshed out, drummer Stuart Elliott was called in to replace the Fairlight loop.

"All the drum sounds on the record are Akai S1000 samples played by Stuart on Simmons pads," says Palmer. "The only live sounds are the cymbals. If you solo the overhead tracks you can hear the clack-clack of the drumsticks hitting the pads. We used samples because our studio is relatively small, and if we miked acoustic drums we'd always get the same room sound, which is not very exciting."

Bush's lush vocal orchestrations were recorded on a Neumann U87, usually by herself. "She didn't want to bore me while she worked things out," explains Palmer. "So I'd set up a vocal sound, hand her the remote [control for the multitrack], and leave. When she felt she had enough good performances on tape, we'd select the best complete performance [for each song], and fix little things by punching in lines from other tracks."

According to Palmer, the album practically mixed itself. The sounds on tape were good, so he just added reverb and made sure each instrument had enough space. As a result, *The Red Shoes* is one of Bush's most organic productions.

"Kate really doesn't like to use samples or sequences," reveals Palmer. "Everything on the record—except a few drum loops—is played real-time. We definitely wanted a band feel, so we didn't get obsessed with technology. I just twisted knobs until things sounded good." ●

Kate Bush

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CREATIVE!

SPACE

The legendary Al Kooper "reKooperates" in his home MIDI studio.

The smirk personified everything that was hip and dangerous about rock 'n' roll in the 1960s. Organist Al Kooper was masquerading as Lady Liberty on the cover of his first solo album, *I Stand Alone*. But the cover art didn't portray a man in Halloween drag, like some kitschy layout in a fashion magazine. Kooper's face was superimposed on an actual photo of the Statue of Liberty, his tight lips and piercing eyes frozen into a mask of smug arrogance.

Of course, the image was more than just youthful irreverence toward The Establishment. The sensation of freedom was everywhere, and musical visionaries such as Jimi Hendrix were blissfully redefining the voices of their instruments. What better symbol for this age of sonic wackiness than the personification of liberty itself?

Luckily, it was no blasphemy for Kooper to wrap himself in the robes of this new freedom. He was a major figure in rock's cultural—and aural—break out. Kooper's organ fills ebbed and flowed under Bob Dylan's sneering vocal on "Like A Rolling Stone" and energized the Blues Project. Along with the likes of Steve Winwood, Felix Cavaliere, Brian Auger, and Keith Emerson (who often stuck knives in the organ keys to sustain notes while he played piano riffs), Kooper defined the rock organ sound of the 1960s. He was also one of the pioneers of jazz rock, conceptualizing the band Blood, Sweat & Tears, but leaving before the group hit its commercial stride.

However, Kooper is far from a walking museum piece. He is in constant demand as a producer, composer, and session musician. In the mid-1980s, he took a turn as a record executive and composed the gritty and evocative score for the acclaimed TV series *Crime Story*. Recent projects include a collaboration with author Stephen King on the soundtrack for his TV miniseries *The Stand* and an instrumental solo album, *Rekooperation* (MusicMasters/BMG), that showcases his Hammond B-3 chops and bizarre musical arrangments.

PHOTOS BY JIM HERRINGTON

By Michael Molenda

CREATIVE SPACE

"I demoed the entire *Rekooperation* album at my home in Nashville," says Kooper. "I have an enormous 2,500-pound rack of MIDI gear in my guest bedroom that's just terrifying and a small songwriting system in the living room. When I did *Crime Story* in 1985, I built a MIDI-based recording studio with my collaborator Charles Calello, who I hired because I wasn't computer savvy at the time. Now I'm a complete Mac head. I even designed the album cover on a Mac IIci with Adobe *Photoshop*. Anyway, we'd lease equipment and pay it off with our weekly checks from the show. When the series ended, we split up the gear. Charles got the mixer and multitrack recorder and I got the MIDI gear. I still don't have a multitrack deck in my home."

As modular digital multitracks (MDMs) now allow professional-quality masters to be recorded in home studios, it seems sacreligious for working musicians and producers *not* to own a multitrack. However, Kooper is remarkably casual about upgrading his studio. There are no current plans to consolidate the two workstations or purchase an MDM.

"My system is primarily a songwriting tool," says Kooper. "I don't like the studio in the house thing because you can't go *home*. It's nice to do your live tracking and mixing in a different place. Then, at the end of the day, you can turn off the lights, set the alarm, and get out of there."

However, the "songwriting tool" produced a track that made it on the *Rekooperation* album, exactly as it was recorded in Kooper's home. Although the other songs on the album were recut in a pro studio with live musicians, Kooper's faithful arrangement of Robert Palmer's "Looking For Clues" is 100 percent MIDI. (Surprisingly, Kooper doesn't own a Hammond B-3, so a Korg 01/W organ patch "stood in" for the B-3 on the song.)

"One of the benefits of MIDI systems is that you can sequence all the instruments and have a 'record' when you finish writing a song," explains Kooper. "That's very rewarding for a songwriter. And it's also inspiring to have drums and bass kicking while you're searching for ideas. Sometimes, a MIDI system's ability to deliver big production sound yields some surprises; this is what happened on 'Looking For Clues.' After hearing the demo, I simply decided that I couldn't cut it any better with humans. Also, I did a solo on the demo that was so good it intimidated me to think about doing it again."

In his home studio, a Korg 01/W organ patch often substitutes for Kooper's classic B-3 sound.

Kooper's songwriting system also produced the basic tracks for the song he co-wrote for *The Stand*. One of the characters in the book is a rock star with a hit song entitled "Can You Dig Your Man?" Kooper was commissioned to write music for the lyrics quoted in the novel and to turn the mythical hit into a bonafide song. ("I asked Stephen if I could change the lyrics," Kooper says, "and he said 'absolutely not!'")

"Some people may freak at this," reveals Kooper, "but I transferred the basic tracks I cut at home to the final 24-track master from a cassette! The cassette deck happened to be patched in when I did the stereo mix of my MIDI rhythm tracks. I brought the cassette to a pro studio, laid the basic track onto a 24-track machine, and added vocals and guitars. The completed song was mixed to DAT and sent to the film people. No one who sees the movie will care that the rhythm tracks were off a cassette; the song sounds great. I love it when you can take a low-tech approach to things."

Kooper's do-it-yourself methodology also applies to the final mix. Unlike the current trend in pop music, where superstar specialists or engineers mix the records, Kooper insists on moving the faders himself. ("I'm embarassed that I'm one of the few producers around that actually work this way," he laments.)The reason for this personal touch is not just to maintain control over his work. Kooper still works on song arrangements *during* the mixing process.

"I over-record like crazy," he says. "My productions always have millions of horn, string, and guitar tracks, so I

PARTNERS IN CRIME

The MIDI gear assembled for the *Crime Story* soundtrack awaits future integration with Kooper's songwriting system. It may be a long wait. "I suppose I should combine the two workstations into a proper studio someday," he says. During the *Crime Story* sessions, Kooper discovered his favorite bass sound in a Yamaha sound library for the TX7. (The TX7 has since been moved to the songwriting system.) "It's called Clean Bass and I use it on just about everything because it works with everything," says Kooper. "I just add a little boost at 100 Hz. The other patches and sounds are auditioned to match the needs of the song."

The Gear Line-Up. Akai S900 (2), Art Audio monitors, dbx 163 compressor/limiter, Garfield Masterbeat, Hill PS1 16-channel mixer, JL-Cooper MSB-1620, Korg DRV3000, Korg DSS-1, Korg EX8000 (3), Korg M1, Korg SG-1D, Korg T3, Kurzweil 1000HX, Kurzweil 1000SX, Linn 9000 drum module, Mac Plus running MOTU Performer, Mitsubishi video monitor, Rane SM-26 submixer (5), Rockman Sustainor (chorus and delay processor), Roland MKS-20, and Yamaha TX816.

build the song arrangement as I mix. I listen carefully to all the rough mixes until I know exactly what I want. After living with a bunch of roughs for awhile, it's easy to develop ideas about what works and what doesn't. Once I decide that something should go, I erase it. You see, I don't like using automation. If I had to program all those mutes I'd be puking. It's better to just erase the track. Bang, it's gone! Luckily, I very rarely second guess myself."

But Kooper's musical search-and-destroy missions don't stop at the mixing session. For *Rekooperation*, he was still editing songs in the mastering suite.

"I save a lot of things for last," admits Kooper. "I typically cut five minutes out of a record during mastering. I'll get into the mastering room and start thinking that something develops too slowly or that a phrase is boring. So I start cutting everything that still seems extraneous: double choruses, long fades, verses, and so on. I used Sonic Solutions's Sonic Station for the first time while mastering *Rekooperation*. Initially, I just sat there with my mouth open. The things you can do are incredible! I can't wait to start messing with future projects."

Kooper's mixing and mastering methods are almost like continuing performances of the work, rather than the final stages for processing tweaks. Many musicians are extremely uncomfortable leaving so many elements

AL'S SONGWRITING STATION

"My current system is geared toward orchestral sounds," says Kooper. "I use a lot of Korg stuff, and I have a M1 library with more than 1,500 sounds. A lot of what I do revolves around stock patches, so I always carry a M1 card in my wallet that's loaded with my favorite sounds. For example, I've got a killer acoustic guitar patch that I use to emulate pedal-steel sounds by manipulating the M1's pitch wheel. I love playing clubs in Nashville and doing pedal-steel licks on a keyboard; it's the ultimate goof on country music.

"As far as sequencers go," continues Kooper, "I was born and raised on [Mark of the Unicorn's] *Performer*. I think it's really difficult—unless you're a born cliphead—to change sequencers. For me, once I've 'gone steady' with a sequencer, it's probably a permanent relationship."

Tools Of Inspiration. AIWA F-770 cassette deck, Akai U41 integrated amplifier, Alesis D4, Alesis Midiverb, Art Audio monitors, Casio DAR-100 DAT, Korg A4, Korg DRV-3000, Korg M1R, Korg 01/W, Kurzweil 1000PX, Mac Classic II running MOTU *Performer* 4.2, Mackie CR-1604 mixer, Opcode MIDI Translator, SansAmp Rackmount, Sonus MT-70, and Yamaha TX7.

unresolved so late in the production schedule. However, Kooper maintains that a little audio anarchy during the mixing process can keep things vital and interesting.

"You've got to be open to new ideas," he stresses. "For example, my ideal drum sound is based on playing old 45 rpm records at 33 rpm. Admittedly, it's a marijuana thing, but it helped me discover a unique sound. I hope no one considers this racist, but I've always dug the fact that black musicians do things with instruments that white musicians would never think of, like putting a wah-wah pedal on a clavinet. Product developers should keep their eyes open for those musicians who use instruments in bizarre ways. These are the people who open new frontiers."

PRINCIPLES OF PROCRASTINATION

There are two main schools of thought in the mythical University of Music Production. The first, honed by decades of live performance tradition (and costly big studio rates), stresses defining and rehearsing all aspects of a musical arrangement *before* walking into the recording studio. This method saves time and money because creativity moves smoothly down a charted course.

The other method, symbolized by the Beatles's *Sgt. Pepper's Lonely Hearts Club Band* album, integrates the tools of the recording studio into the creative process. Pre-production is de-emphasized (although certainly not abandoned) in favor of "discovering" arrangement ideas during tracking and mixing.

Al Kooper's production of his *Rekooperation* album is a fine example of deferring arrangement decisions to the muse. Kooper "over-recorded" his musical ideas and waited until the mixing and editing phases to finalize song arrangements. Like Kooper, home recordists can enjoy the wonders of creative procrastination.

However, making sane and sensible use of myriad musical options requires discipline. Here are some tips for surviving a wealth of creative choices.

Take notes. Without documentation, you're dead (especially if you piggyback a bunch of instruments on one track). My track sheets have huge boxes for writing in the instrument, recording method, and so on.

Tune up. If you mix and match tracks during the mix, an off-pitch vocal or out-of-tune guitar can ruin your day.

Process shared tracks. If you share tracks, you'll go nuts trying to individually process each instrument during the mix. Record everything on these tracks the way you want them to sound later.

Record vocals flat. It's nearly impossible to combine separate vocal performances, if you EQ or process them differently during recording.— *MM.*

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STUDIO ELECTRONICS

By Scott Wilkinson

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On a crystal blue, California spring day in 1975, I sat at the kitchenette counter in my apartment near the famous Santa Cruz Beach Boardwalk, poring over my research thesis. This was my last assignment as a physics undergrad, and it was almost finished. My topic was the acoustics of woodwind instruments. I was into making bamboo flutes and shakuhachis and had decided to kill two birds with one stone: finish my degree and improve my flute-making with a little acoustical theory. The math was hairy, but after a while, it began resonating in my head, just like the instruments it described.

During that same year, I was also studying electronic music with Gordon Mumma, who had worked with John Cage and Merce Cunningham. The electronic-music lab at UCSC was equipped with an old, monophonic Moog suitcase synth. It made some great sounds, but it was hardly capable of what I had in mind. I dreamed of using the mathematics in my thesis to electronically simulate the sound of acoustic instruments.

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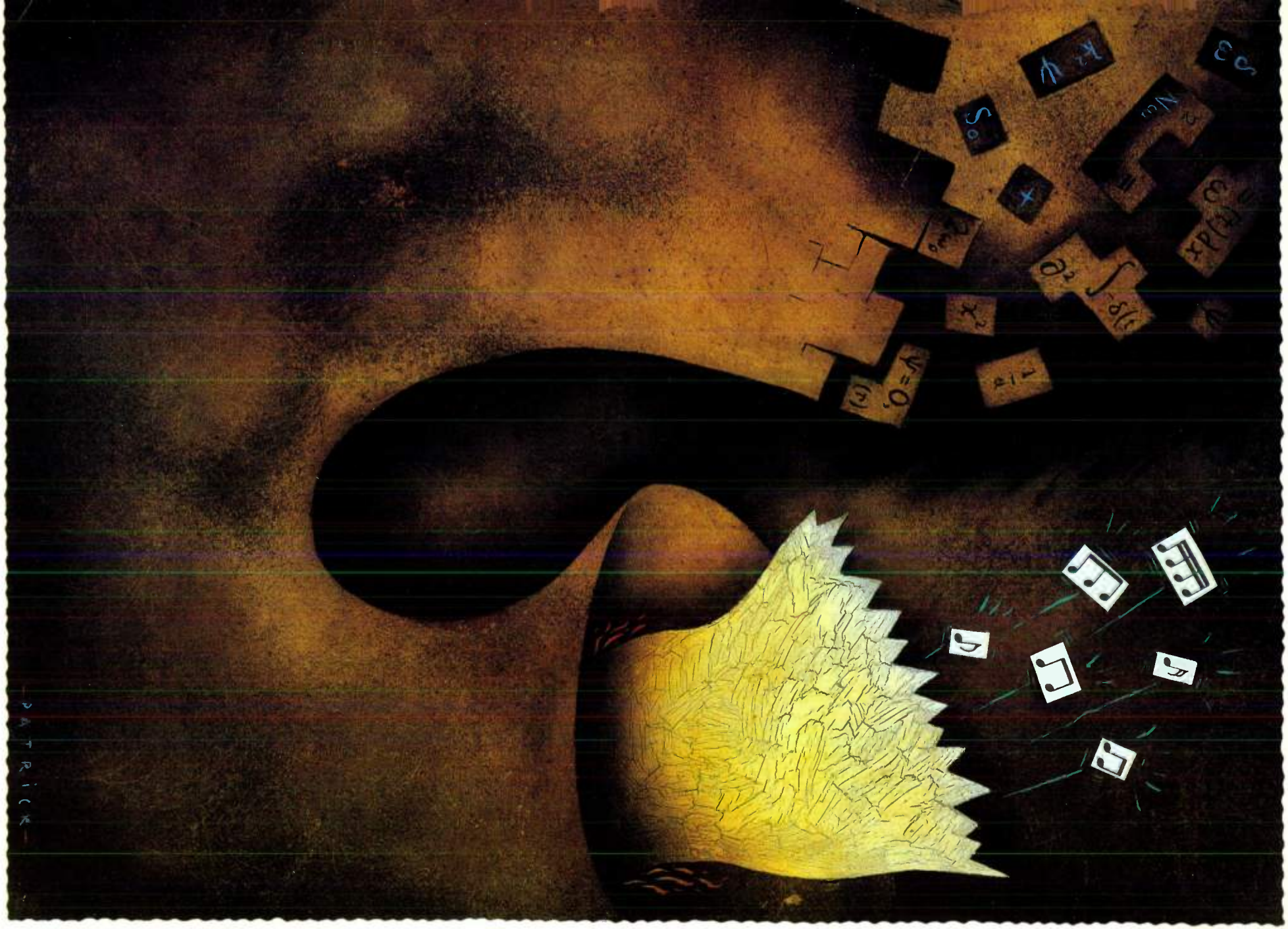

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Nearly nineteen years later, my dream has finally become reality. The mathematical descriptions, or *models*, of musical-instrument acoustics are being used to generate and control reasonable facsimiles of instrumental sounds in real time. This form of virtual reality, called *physical modeling*, requires immense computational horsepower, which has been unavailable in commercial products—until now.

RESONANCE REVIEW

To understand physical modeling, you must understand how acoustic instruments work. If you are unfamiliar with the basic concepts of sound, see "From The Top: Making Waves" in the January 1992 **EM**.

Anything that vibrates exhibits *resonance*, which is the tendency to vibrate at particular frequencies called *modes*. All musical instruments exhibit resonance modes that depend on several factors. For example, each string on a violin, guitar, or piano vibrates at several specific frequencies, which are determined by length, thickness, and tension. A wind instrument consists of a tube enclosing a column of air that vibrates at frequencies determined by the length and cross-sectional shape of the tube, as well as the type of mouthpiece: single reed (clarinet, saxophone, etc.), double reed (oboe, bassoon, etc.), lip reed (all brasses), or air jet (flute, recorder, etc.). The resonance modes of percussion instruments depend on the material and shape of each vibrating surface, as well as where the surfaces are fixed to its frame.

To produce a sound with a musical instrument, you must start the appropriate part vibrating by applying energy to the system. A momentary impulse, such as striking a piano string, plucking a guitar string, or hitting a drum, starts the vibration, which may include several resonant modes simultaneously. This vibration then diminishes to silence if no further energy is applied.

To maintain a constant vibration, you must continue to pump energy into the system by blowing into a wind instrument, bowing a string, and so on. Amazingly, the steady flow of breath or movement of a bow is converted into a pulsed air stream or vibrating string. This is too complicated to explain in detail here (see "Tech Page: Nonlinear Modeling"); suffice it to say that the mouthpiece or bow interacts with the resonant modes of the air column or string to produce a standing wave. (A standing wave occurs when sound waves are reflected back and forth along the same path, interacting with each other to create stationary zones of high and low amplitude.) This standing wave normally includes several partials arising from the resonant modes, which is an important part of the instrument's timbre.

Wind instruments of a fixed length, such as a bugle, can normally play only the notes in the harmonic series. To play a chromatic scale, there must be some way to make the length of the instrument shorter or longer, which shifts the resonant modes up or down, respectively. Woodwind instruments do this with tone holes, which effectively change the length of the instrument as they are opened and closed. Brass instruments physically add lengths of tubing as different combinations of valves are depressed. The trombone changes its length directly by moving the slide. String instruments shift their resonant modes by changing the vibrating length of the string with a finger or the tension of the string with a tuning peg.

Although most wind and string instruments can shift their resonant modes by changing the effective length of the vibrating part, there are certain resonant frequencies that remain fixed no matter what else is going on. These frequencies, called *formants*, are mainly determined by the overall shape of the instrument, which doesn't change as different notes are played. As we'll see in a moment, formants are among the most distinguishing characteristics of physical modeling.

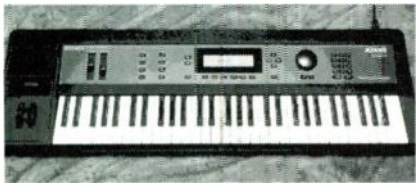
The behavior of a musical instrument is extremely complex, but it does succumb to analysis. Physical properties (reed stiffness, bore shape, string tension, etc.) and the way different parts of the instrument interact to produce sound can be described mathematically. The resulting equations are daunting, but they provide invaluable insight into the nature of musical sound. With the recent improvement in computer processing power and speed, these equations can now be used to simulate the instruments they represent in real time.

MODELING CLAY

Unlike most forms of music synthesis, physical modeling does not use oscillators, filters, amplifiers, envelope generators, or LFOs, at least not as primary sound sources and modifiers. Instead, the mathematical description of an instrument's acoustic behavior is programmed into a digital signal processor (DSP). The DSP then churns out numbers based on this description and sends them to a digital-to-analog converter (DAC). Notes are typically triggered with MIDI Note On/Off messages and modulated with MIDI Control Change and other continuous messages.

One of the primary reasons that real-time physical modeling has been unavailable until now is the limitations of DSP hardware. Historically, DSPs have been unable perform the required calculations fast enough. At best, you could feed the appropriate data into a

FIG. 1: The Yamaha VL1 is the first product to use the company's Virtual Acoustic Synthesis modeling technology. It is intended to play lead lines and solos with a maximum polyphony of two notes.



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computer and go to lunch while it crunched the numbers, after which you could play the sound. If you wanted to make any tweaks to the sound, you had to wait through yet another round of compilation.

In addition, general-purpose DSPs, such as the Motorola DSP56000 series, are not optimized for the required operations. As a result, several companies have developed custom DSPs optimized for physical modeling. Others are using the latest generation of generic DSPs, which have achieved much higher speeds in the last couple of years.

Physical modeling exhibits several distinguishing characteristics. For one thing, modeling systems tend to offer much more expressive capability with MIDI continuous control than most forms of synthesis, particularly sample-based synthesis. For example, blowing harder into a breath controller can cause a wind-instrument model to jump resonant modes, just like its acoustic counterpart. In addition, different articulations, such as legato and slurring, are much easier to achieve with a modeled sound. The model responds like an acoustic instrument, whereas a sample plays exactly the same way every time. (It is possible to coax some expression out of sample-based synths; see "From The Top: Electronic Expression" on p. 84.)

However, models are often not as accurate as samples in their re-creation of acoustic sounds. As complex as it may seem, the math is usually a simplified approximation; the actual behavior of an acoustic instrument is more subtle and individual than the math can generally describe. In addition, the computational requirements are still too intense to construct completely accurate models in real time with current commercial hardware. As a result, there is a tradeoff between samples and models. Samples are recordings of acoustic sounds, so each note is a more accurate representation than the corresponding modeled note. But samples are less accurate than modeled sounds when played in phrases, because the behavior of a model is closer to that of an acoustic instrument.

One of the best ways to suggest the behavior of acoustic instruments is to model formants. With samples, the recorded formants are transposed along with the rest of the sound as you play different notes. With physical models, however, the formants can remain fixed as you play different notes.

Another important difference is that mathematical descriptions generally take up less memory than digital-audio recordings, so modeling systems usually require less memory than sample-based synths. In addition, "macro" parameters are relatively easy to design. As you change one aspect of the model—say, the material out of which the virtual instrument is made—a whole host of low-level parameters automatically change as a result.

Finally, physical modeling lets you create hybrid sounds by combining the characteristics of two or more acoustic instruments, which can lead to entirely new and useful sounds. However, many combinations of physical elements, such as reeds and bores, do not result in a desirable sound, and some do not

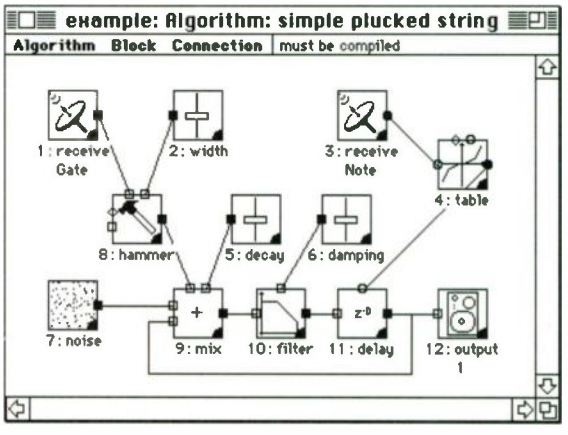

FIG. 2: This simple *SynthKit* algorithm simulates a plucked string. Each block includes one or more inputs (open squares on the left of the block), outputs (solid squares on the right), and control inputs (open squares on the top). Each block can also be named; the number preceding the name indicates the order of operation in the compiled code.

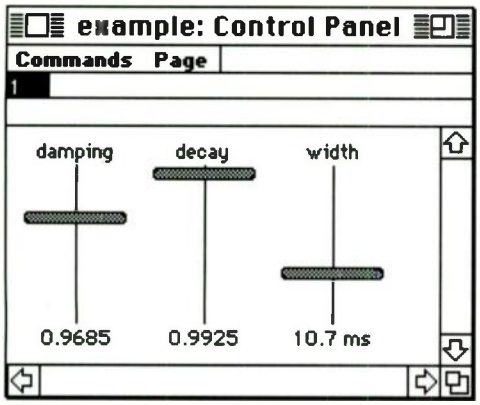

FIG. 3: Any control sliders that are placed in a *SynthKit* algorithm can appear in the control panel. These sliders can be moved as notes are played to voice the algorithm.

make any sound at all. Acoustician Arthur Benade calls these silent instruments "tacet horns."

YAMAHA VL1

The first company to introduce a commercial product based on physical modeling is Yamaha. The VL1 (see **Fig. 1**) is the first product to use the company's Virtual Acoustic Synthesis (VAS) technology, which has been under development since 1986. One result of this effort is a custom VLSI DSP chip optimized for physical modeling. The VL1 is designed around a woodwind model, the specifics of which are encoded in ROM.

The VL1 is intended to play lead lines and solos (VL stands for "Virtual Lead"). As a result, it has a maximum polyphony of two notes. Of course, this design is also a result of limited processing power. According to Charles Feilding, manager of Yamaha's sound-design office, "There is a tradeoff, certainly. If you put a lot of processing power into a single note, you can encompass a lot of sonic detail. If you want polyphony, you sacrifice detail. The more specific a model is, the more it can sound like a real instrument, but the less you can make it sound like anything else."

Like most modeling systems, the VL1 offers a high degree of expressive capability. Many of its parameters—such as embouchure, tonguing, scream, breath noise, and growl—can be controlled with any continuous message. Most of the factory sounds are designed to respond to Breath Controller messages in ways similar to acoustic wind instruments. For example, if you blow very softly while playing a sax note, you hear the air noise with no pitch. As you blow harder, the model begins oscillating. If you continue to blow harder, the model jumps to the next resonant mode.

In order to avoid tacet horns, the VL1 provides integrated, preset models that represent various combinations of reeds, bodies, and bells. These are called *Elements*. Each program, or *Voice*, consists of one or two Elements. Most of the factory Voices use only one Element; a few use the other Element for things such as dual-instrument sounds or additional sound components, such as breath noise and saxophone-key noise.

The Element models also include several guitars, basses, and bowed strings. "It's not an official part of the model," says Feilding, "but we did get some pretty good bowing-type sounds out it. Plucked instruments are pretty easy to do. For example, if you smack your hand on a brass mouthpiece, you hear a good decaying pop." However, it's somewhat counterintuitive to apply parameters such as breath noise, growl, and tonguing to these models. "It's

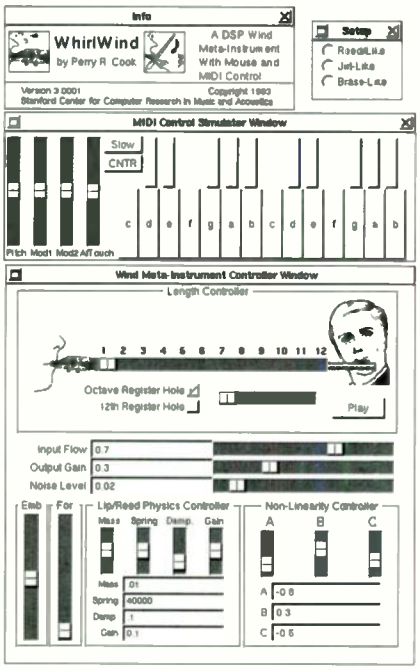

FIG. 4: In Perry Cook's *WhirlWind* for the NeXT computer, any wind instrument can be modeled, including brass, reed, air-jet, and any hybrid in between. The onscreen controls let you "construct" the instrument by specifying the relevant parameters.

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strange to adjust the embouchure on a guitar," he laughs.

KORG SYNTHKIT

Korg is another company hard at work developing physical modeling technology. Their efforts center on a Macintosh program called *SynthKit,* written by senior engineer Steve O'Connell for the purpose of internal research and development. This software is a synthesis construction kit, similar to Digidesign's *Turbosynth* but with a lot more real-time control capabilities.

Like other construction-kit programs, you start by creating an algorithm consisting of functional blocks, which are connected in various ways (see **Fig. 2**). The blocks pertaining to physical modeling include hammer, reed, bow, bore, and glottal-pulse models. As you assemble the algorithm, you can construct a control panel to address only those parameters you select (see **Fig. 3**).

After the algorithm is complete, it is compiled into DSP code, which is downloaded into one of several DSPs, including the Motorola 56000, Texas Instruments 57000, or a custom chip. Part of the code, such as LFOs and activities that don't happen all the time, can be specified to run in the host Macintosh to reduce the processing demands on the DSP. You can then trigger and control notes via MIDI in real time as you modify the algorithm from the onscreen control panel.

At present, *SynthKit* is used mostly with Digidesign cards, such as Audiomedia II. The current system provides from one to eight voices of polyphony, depending on the complexity of the algorithm.

The flexibility of the program lets sound designers use the available DSP power in any way. "With *SynthKit,* you pay [computationally] just for the functionality you want," says O'Connell. "With a fixed architecture, you may have three LFOs, but if you don't use all of them, they're still running. For example, I'm a wind-controller player; I don't care about envelopes. I want to make sure my breath controller is really smooth, and the filter is just right. That's how I tweak my algorithms, but someone else might have a different set of priorities."

The program also includes functional blocks for oscillators, filters, and other synthesis elements. These elements can be combined with the modeling blocks in many ways to create hybrid algorithms. The power of this approach is obvious. According to Charlie Bright, director of product voicing for Korg R&D, "I think the whole field of physical modeling is very interesting, but it's not going to replace anything. It's not *the* next big thing, it's *a* next big thing. Each type of synthesis has its place. There are times you want the realism of a sample, and other times you want the expression of physical modeling. Even when the model is not accurate, it's an interesting sound in its

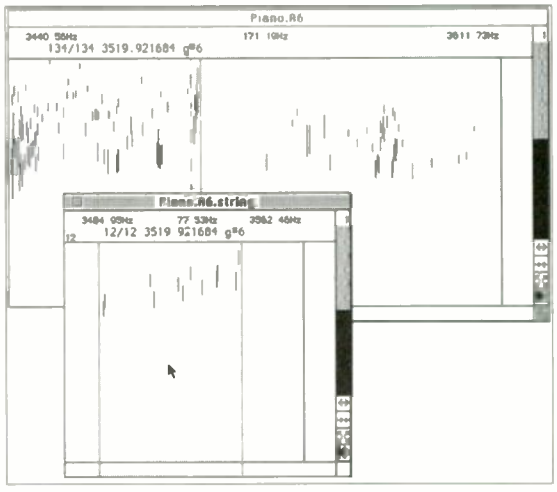

FIG. 5: Each vertical line in this screen from a custom resonance editor represents one resonance in a piano when G#6 is played. The horizontal axis is frequency, the vertical axis is amplitude, and the length of each line corresponds to the decay rate. The small region between the dotted cursor lines, which is magnified in the inset window, depicts the G#6 strings themselves. The low-frequency resonances to the left of the region represent the hammer thud, while the high-frequency resonances to the right represent the sympathetic vibrations of the higher strings.

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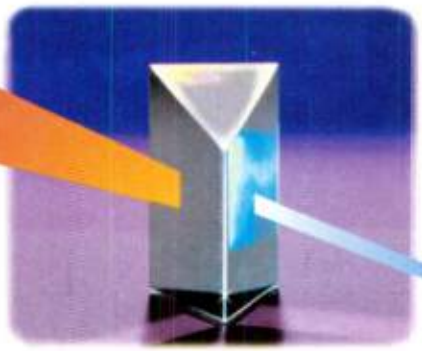

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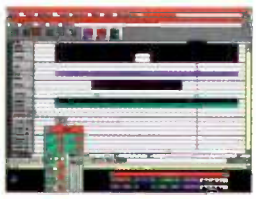

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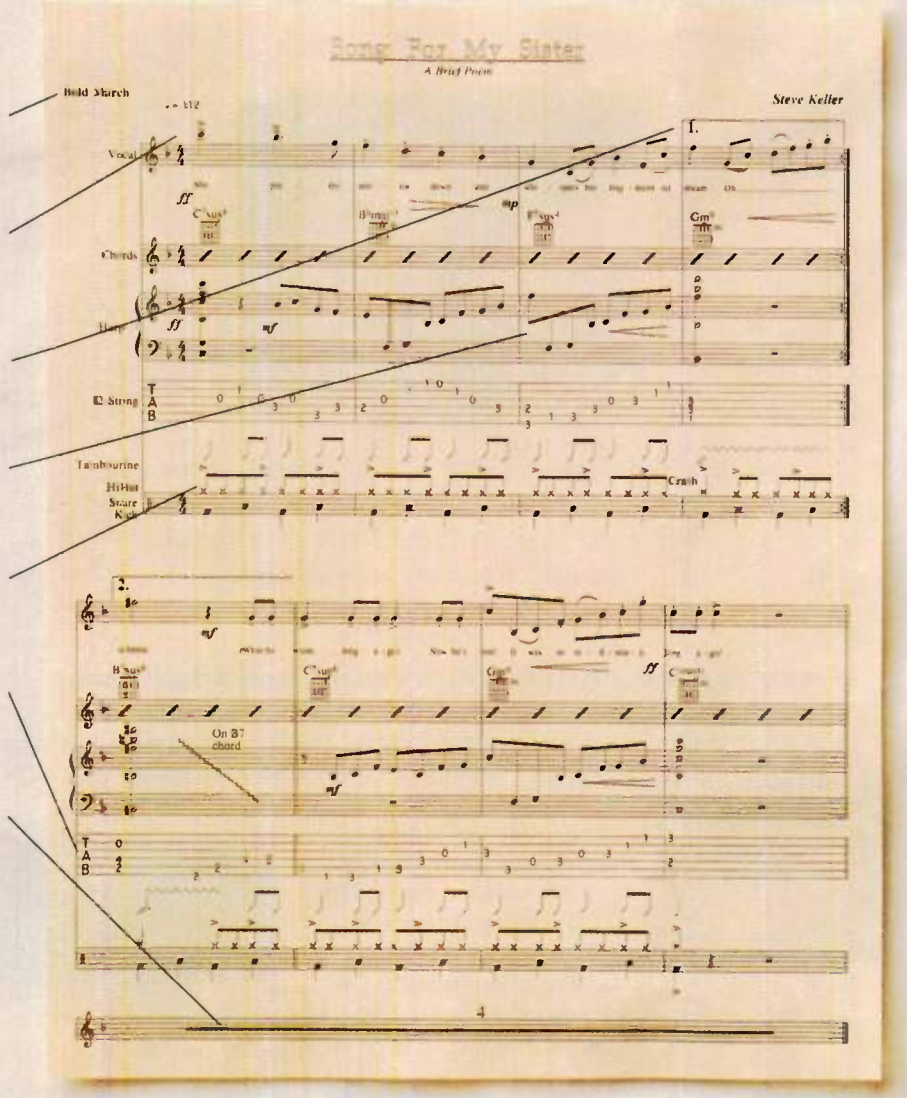

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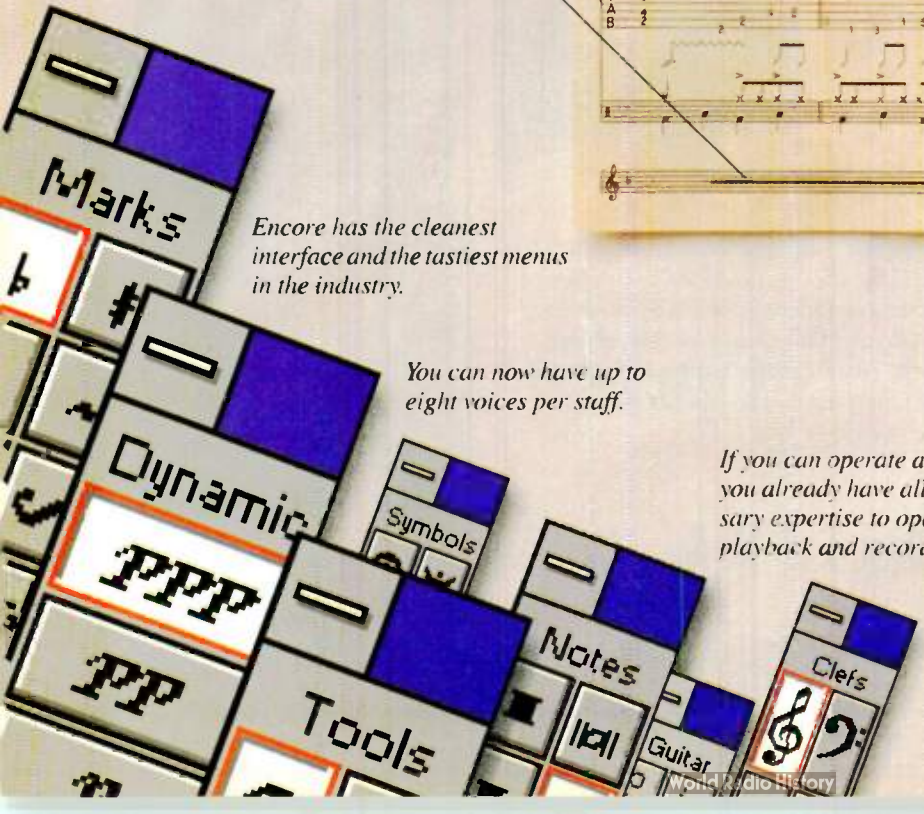

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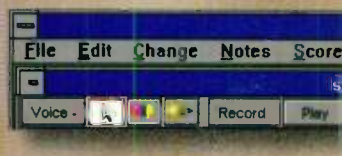

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own right, and it's useful musically." The algorithms developed with *SynthKit* are sure to appear in a Korg synth product before too long, so keep your ears open.

CCRMA WAVEGUIDE

At Stanford University's Center for Computer Research in Music and Acoustics (CCRMA, pronounced "karma"), associate professor Julius Smith has been working on a type of physical modeling called *waveguide* synthesis. This approach models a physical waveguide, or transmission line, which is any path along which a wave can travel undistorted. Examples include fiber-optic cables, microwave transmitters, and even certain aspects of room acoustics. The most important characteristic of a waveguide is its length, which must be significantly greater than its other dimensions.

Strings and air columns in musical instruments make great waveguides. They can be simulated by replacing the physical transmission lines with delay lines. As a wave travels from one end of an instrument to the other, it is delayed by the time it takes to traverse the distance. In wind instruments, it is reflected back and forth along the bore. As the effective length of a bore or string is changed to produce different notes, the instrument acts like a variable-length, bidirectional delay line.

Smith began his research by simulating a bowed string, which can be modeled as two waveguides, one on either side of the bow. He then moved on to the clarinet, when he was joined by graduate student Perry Cook. Cook continued the clarinet work and soon added trombone and vocal models to their repertoire. By that time, Smith was head of signal processing for NeXT, so they used a NeXT computer with its built-in 56000 for their simulations (see **Fig. 4**). Their models were typically 1- to 4-voice polyphonic.

After graduating, Cook began working for MediaVision, a multimedia sound-card company, consulting with them on waveguide synthesis and helping them build a custom DSP to implement it. Unlike some forms of physical modeling, a DSP performing waveguide synthesis requires direct access to large amounts of memory for many delay lines, which few off-the-shelf DSPs offer. Also, the MediaVision chip includes a lot of dedicated onboard hardware, such as hardware delays that require no calculations and a hardware interpolator that allows PCM processing and fractional delays. It also has four stereo codec (coder/decoder) ports, allowing you to directly connect up to eight audio channels.

MediaVision's first product to use the new chip will be a GM-compatible, multimedia sound card. Most of the voices will be waveguide-based, but a few will use other techniques, such as sampling for the sound effects. The company expects to offer a palette of synthesis techniques and hooks for multimedia composers to take advantage of waveguide synthesis. The new

Model Music

DSP chip will also be sold to third-party developers. Expect to see a product in the first half of 1994.

SILICON SOUND RESON8

Another approach to physical modeling was originally conceived at the Institut de Recherche et Coordination Acoustique/Musique (IRCAM), in Paris, about ten years ago. Called *resonant synthesis,* this technique models the resonant behavior of an instrument, rather than its physical behavior. Resonant synthesis begins by analyzing the sonic behavior of various musical instruments, then simulating this behavior without worrying about the physics.

Adrian Freed, now director of systems and software development at the University of California, Berkeley, Center for New Music and Audio Technologies (CNMAT, pronounced "senmat"), and Marie-Dominique Baudot, now president of Silicon Sound, built a box called the Reson8 and developed an editing environment to implement IRCAM's resonant models in real time. The Reson8 includes eight 56000s tied together on a high-speed bus. This box is still custom-made by Silicon Sound for researchers and well-heeled musicians. It connects to a Macintosh with a NuBus card and uses Opcode's *MAX* for its front end.

"The main goal was to generate as many resonances as possible with the Reson8," says Freed. "It can re-create between 400 and 800 resonances, depending on the sample rate. For a low note on a piano, you need something like 300 or 400 to make it sound convincing. You have all the resonances associated with the string, the thud of the key, and sympathetic resonances of other strings [see Fig. 5]. The important point is that you can simulate an instrument's complexity without knowing how it works internally."

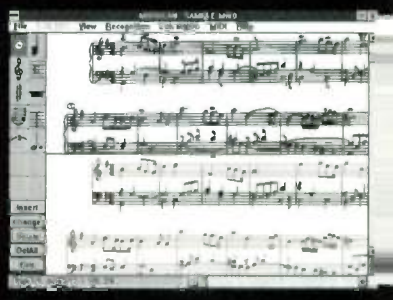
One advantage of this approach is the ease with which hybrid models can be constructed. According to Freed, "We analyzed a number of different instruments. Once you have all that information in the same form, as a set of resonance data, you can easily combine it in different ways. This is more difficult with models based on waveguides. The pieces in a waveguide model interact quite differently, so it's hard to build models in between. The resonance model forces everything into the same format. I have an environment that lets you cut-and-paste resonances from one instrument to another and smoothly interpolate between them."

Another advantage is data reduction. For example, it takes only three numbers to represent a resonance: amplitude, frequency, and decay rate. For a piano with 300 resonances, that's a mere 900 numbers.

Of course, there's no gain without pain. Freed points out the drawback to resonance synthesis in particular, and physical modeling in general. "Anyone working in physical modeling needs to build a large sound library to compete with samplers. Physicists describe the behavior of systems well, but they haven't had a simulation environment to hear how good their descriptions are. When you take the numbers from a textbook and apply them to a model, you often get the right character but not a nice example of the instrument. That's going to be the biggest challenge to anyone trying to commercialize this technology."

THE DREAMER WAKES

Almost twenty years have passed since that day in Santa Cruz, California, when I dreamed of using the mathematical models in my physics thesis to electronically emulate acoustic-instrument sounds. It seems that others had the same dream, which is finally a reality thanks to their dedication, ingenuity, and hard work. Physical modeling holds great promise for increasing the expressive potential of electronic music, answering one of the biggest complaints about the medium. It brings us one step closer to closing the gap between electronic and acoustic performance, so that both might be integrated into a seamless musical whole for all to enjoy.

EM *technical editor* **Scott Wilkinson** *rides the boundary between science and art as often as possible.*

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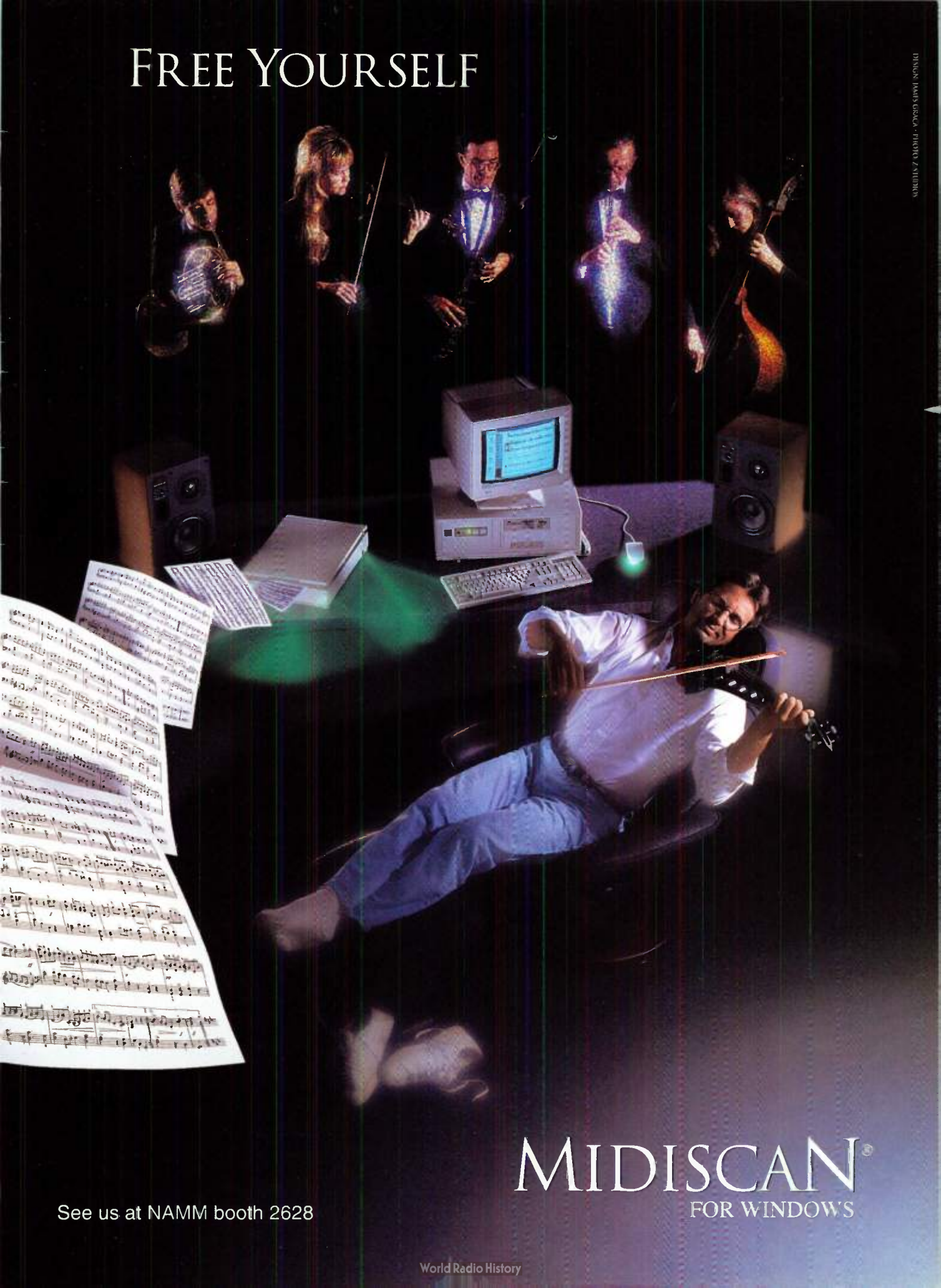

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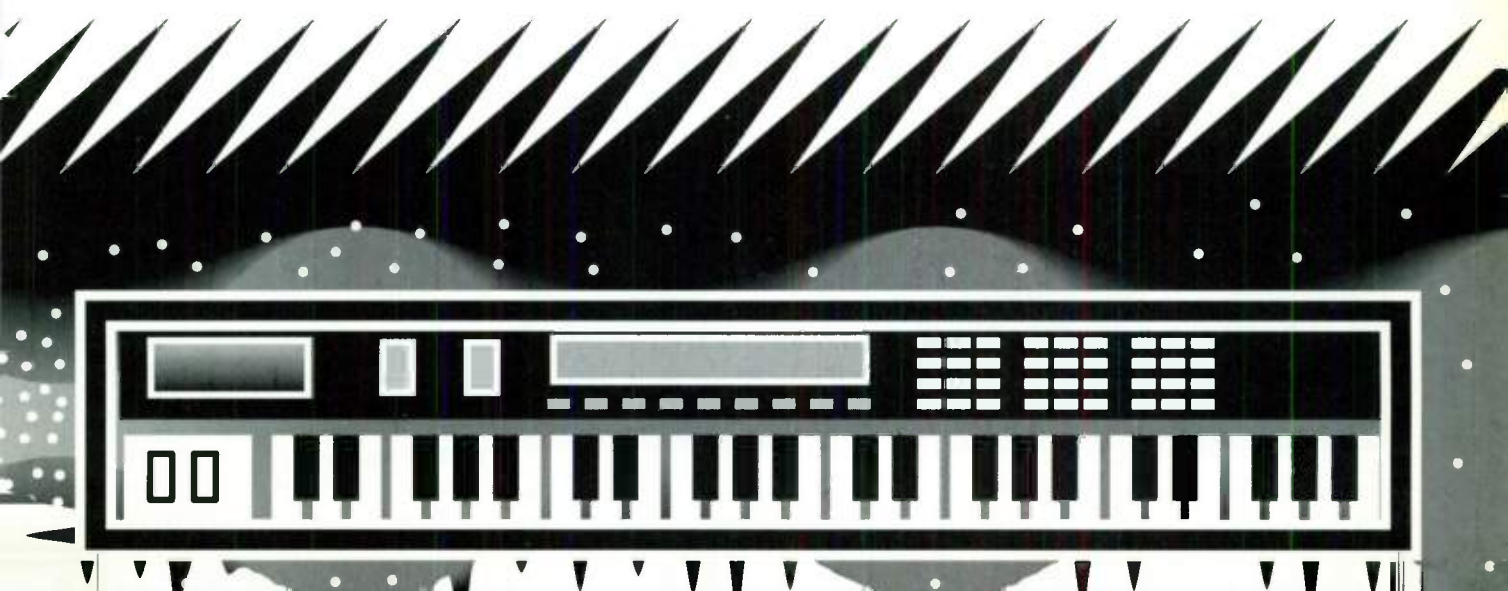
MAXIMUM FX

Don't let anybody tell you that things never change. There's a whole new generation of signal processors hitting hard and fast in the studio and on stage. And it's not just one or two companies vying for the brass ring, like Ford and Chevy did in the mid-1960s with the Mustang and Camaro. Today, it seems everybody is introducing some hot-rod sonic toy. We've seen the return of boxes that focus on a specific application, such as ►



the Sony DPS series (reviewed in the November 1992 and January 1994 **EM**) and Roland's new enhanced-soundfield SDE-330 delay and SRV-330 reverb. High-end wonderboxes, such as the TC Electronic M5000 and Eventide H4000, constantly push the performance envelope, while budget processors such as A.R.T.'s FXR Elite (reviewed on p. 154) stretch the bang-for-buck ratio. Further new ground has been broken by Lexicon with its powerful NuVerb, a high-quality effects processor on a Macintosh NuBus card.

But especially striking are the new midpriced, multi-effects boxes typified by the BOSS SE-70 (from Roland), DigiTech TSR-24, Yamaha SPX990, and Zoom 9050. These four sophisticated processors compete for overlapping markets and are offered at similar price points ($799 to $1,099), with Yamaha's device at the top peg.

What's so hot about these boxes? Well, they cram incredible amounts of processing power into an affordable package and can often be used as pro-quality, studio-effects *and* live-sound enhancers. In short, these multi-effects processors can do many things well. That counts for a lot when you're trying to stretch a dollar in revitalizing your studio or live rig.

Even so, no single effects box can master all applications. (Please stop me if I try to tell you otherwise.) However, some processors bridge the gaps better than others. So let's take a look at these new midpriced processing monsters and see which one may be just right for *your* needs. But before jumping into head-on comparisons, some brief introductions are in order. (For a quick look at each processor's features, see "Maximum FX Quick Reference," on p. 66.)

BOSS SE-70

The half-rack SE-70 (reviewed in the January 1994 **EM**) offers 35 individual effects, arranged into 45 different algorithms. These are stored in 45 ROM patches and 100 RAM patches. A happily schizophrenic box, the SE-70 can be optimized for either guitar or general-purpose applications by initializing a different set of factory patches into RAM. Up to sixteen effects can be used at once, and although the effects chains are not programmable, individual effects can be turned off within a chain.

In addition to true stereo processing, the BOSS SE-70 offers dual-mono in/dual-mono out, allowing the box to function as two discrete effects processors. The converters are 16-bit linear, with 64-times oversampled delta-sigma conversion on the ADCs and 8-times oversampling on the DACs. Some algorithms employ a 48 kHz sampling frequency for a 22 kHz bandwidth, while others use a 32 kHz rate that cuts the bandwidth to 15 kHz. All audio connections are ¼-inch phone jacks, and the input level is switchable between -20 dBV and +4 dBm. The unit has an external power supply.

DIGITECH TSR-24

The 1U rack-mount, DigiTech TSR-24 True Stereo Digital Multi-Effects System is the first of the company's new series of effects processors. DigiTech replaced the chip architecture of the DSP128 and DSP256 with a proprietary chip dubbed S-DISC. One advantage of the new architecture is that the unit's processing power can be doubled with an optional Parallel Processing Card (PPC-200; $295) that contains a second S-DISC chip and 256 KB of RAM. In addition, 18-bit ADCs and DACs and a 48 kHz sampling frequency give the unit great audio specs.

The TSR-24 produces approximately 50 different effects. The number of simultaneous effects is limited only by the available RAM and processing power, but six is about the limit for an unexpanded unit. The effects programs are organized into 105 ROM (factory) and 128 RAM (user) slots. But all this is just the foundation.

The TSR-24 gives you unprecedented control in programming its algorithms. You can chain any effects together (including redundant effects) in any order. In addition, the unit's two ¼-inch, balanced inputs can be configured as mono, true stereo, or dual mono. (The latter provides discrete processing of left and right input signals.) Its four completely independent outputs (also phone jacks) can deliver mono, dual mono, stereo, dual stereo, or quad out. Up to 32 user algorithms can be programmed and stored, and there are twenty factory algorithms in ROM. The TSR-24 has an internal power supply.

YAMAHA SPX990

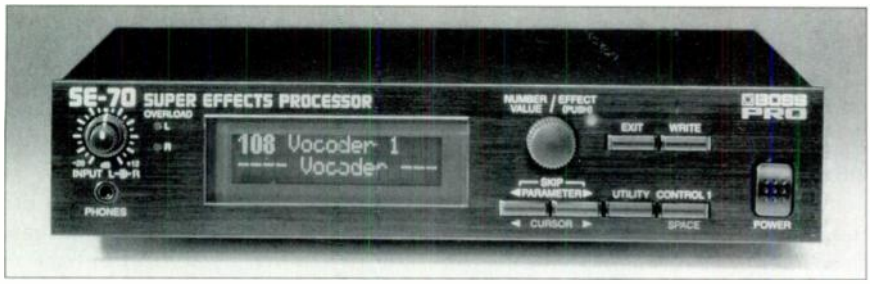
The 1U rack-mount Yamaha SPX990 Digital Multi-Effects Processor (reviewed in the January 1994 **EM**) offers 40 different effects, of which up to six can be used simultaneously. The SPX990's effects programs are stored in 80 factory ROM presets and 100 user RAM patches. A hundred additional RAM slots are available with the optional MCD32 memory card ($75).

Routing options include mono, dual-mono, and stereo in and out, and it can operate as two discrete effects processors. Its 20-bit A/D and D/A converters and 44.1 kHz sampling frequency account for the SPX990's pristine, full-bandwidth sound. The inputs and outputs use balanced phone jacks and XLRs and have independent -20 dBV/+4 dBm switches. The SPX990 has an internal power supply.

Zoom's 9050 is best on electric guitar. It offers a good variety of effects, considerable parameter control, and an easy user interface that simplifies onstage effects changes.

ZOOM 9050

The half-rack Zoom 9050 is dubbed an "Advanced Instrument Effects Proces-



Roland packed an amazing variety of effects into the BOSS SE-70. It's extremely versatile and is especially good on electric guitar.

sor," and its mono, high-impedance, front-panel input confirms its intended use. A low-impedance mono input is on the rear panel, along with stereo outs and send and return jacks for chaining external effects. All inputs and outputs are ¼-inch phone jacks. The unit has an external power supply.

The 9050 delivers 55 single effects, drawn from nine specialized groups, and up to eight effects can be used simultaneously. Guitarists and bassists can call up guitar- and bass-amp simulators for direct recording or "ampless" live-sound applications. Also noteworthy is an Auto mode in which the noise reduction tracks both the input-signal level and active patch to automatically diminish hiss and hum.

The Zoom machine's 198 RAM slots are divided into two banks of 99 effect patches. There are also 198 ROM patches, but these must be stored to RAM, one at a time. (Single ROM patches can also be auditioned via a Utility menu function.) Effects that are part of a multi-effects configuration can be individually turned off, but they remain chained in a predetermined order. The 9050's A/D and D/A converters are all 16-bit linear, and its frequency response tops out at 14 kHz.

REVERBERATIONS

Everybody uses reverb, and one test of a multi-effects processor is to determine the quality of its reverb programs. Some manufacturers design lush reverbs that stand up against recording studio scrutiny, while others desire starker ambiences that can cut through a dense stage mix or cluttered guitar timbre.

Vocal Processing. To retain a vocal track's clarity and impact in a mix, subtle ambience sometimes works better than an obvious or prolonged reverb tail. This is where exact tailoring of a reverb's early reflections (i.e., first-arriving, discrete echoes) becomes especially critical.

The SPX990's ER/Reverb multi-effects algorithm offers excellent parameter control over early reflections (ERs), in combination with diffuse reverb. You have to configure the inputs in stereo (e.g., take two aux sends from the mixer) to access both reverb and ERs on the same source.

The TSR-24 also provides outstanding control over the contour, levels, and spacing of early reflections. In addition, its ERs are warmer than those in the SPX990. One of the room algorithms included in the SE-70 offers excellent control and sounds especially musical. Zoom's 9050 is configured for instrument processing, so its ER programs don't offer enough parameter control for critical vocal applications.

Of course, diffuse reverb is equally important for vocal processing and the SPX990's lush, smooth reverbs win the prize here. The crystalline Vocal Reverb algorithm sounds especially wonderful. Particularly with medium to long decay times, the SPX990 reverbs and the BOSS SE-70's excellent halls and rooms offer superb clarity.

Although the TSR-24's reverbs are fairly smooth and warm, I found them slightly cloudy. Another drawback to the TSR-24 is that all of the normal (nongated) reverb algorithms have a sameness to them; separate algorithms for rooms, halls, plates, and chambers are not provided. That said, the TSR-24 can be programmed to produce some convincing room ambiences.

I found that the reverbs in the Zoom 9050 are its weakest programs. The reverbs exhibit a lot of unwanted artifacts which make them sound fluttery, ringy, or fizzy. These timbres may toughen up a raging guitar tone, but they certainly wouldn't be my first choice to treat vocals.

Percussion Enhancement. The plate reverbs on the SPX990 really knocked my socks off on drums. They're tight, clear, and smooth. And although the SPX gated reverbs are dense with tightly packed reflections, they are still sharp enough to cut through a mix.

The TSR-24's plate programs are not very convincing. However, the gated reverbs are wonderfully thick and beefy. The TSR-24's gate-time increments vary from 20 to 100 ms (compared to the SPX's 1 ms steps). Unlike the SPX, the TSR's release time is not programmable: The arbitrary slopes are flat, up, or down. However, the TSR-24 offers both accent level and delay, where the SPX does not.

The BOSS SE-70's room reverbs are realistic and clear, making them a good choice for drums. However, the plate reverbs are not very realistic or musical. Gated reverbs sound great if gate times are kept short. They're dense, but a tad fizzy.

The thin quality of the 9050's reverbs don't make for very convincing drum treatments. However, some of the reverb programs are excellent as "special effect" enhancements for ancilliary percussion such as wood blocks, tambourines, congas, and wind chimes.

MODULATIONS

All four boxes have really nice chorus effects. However, the SE-70's 16-voice chorus is the smoothest sounding of the bunch. It adds a lush richness to

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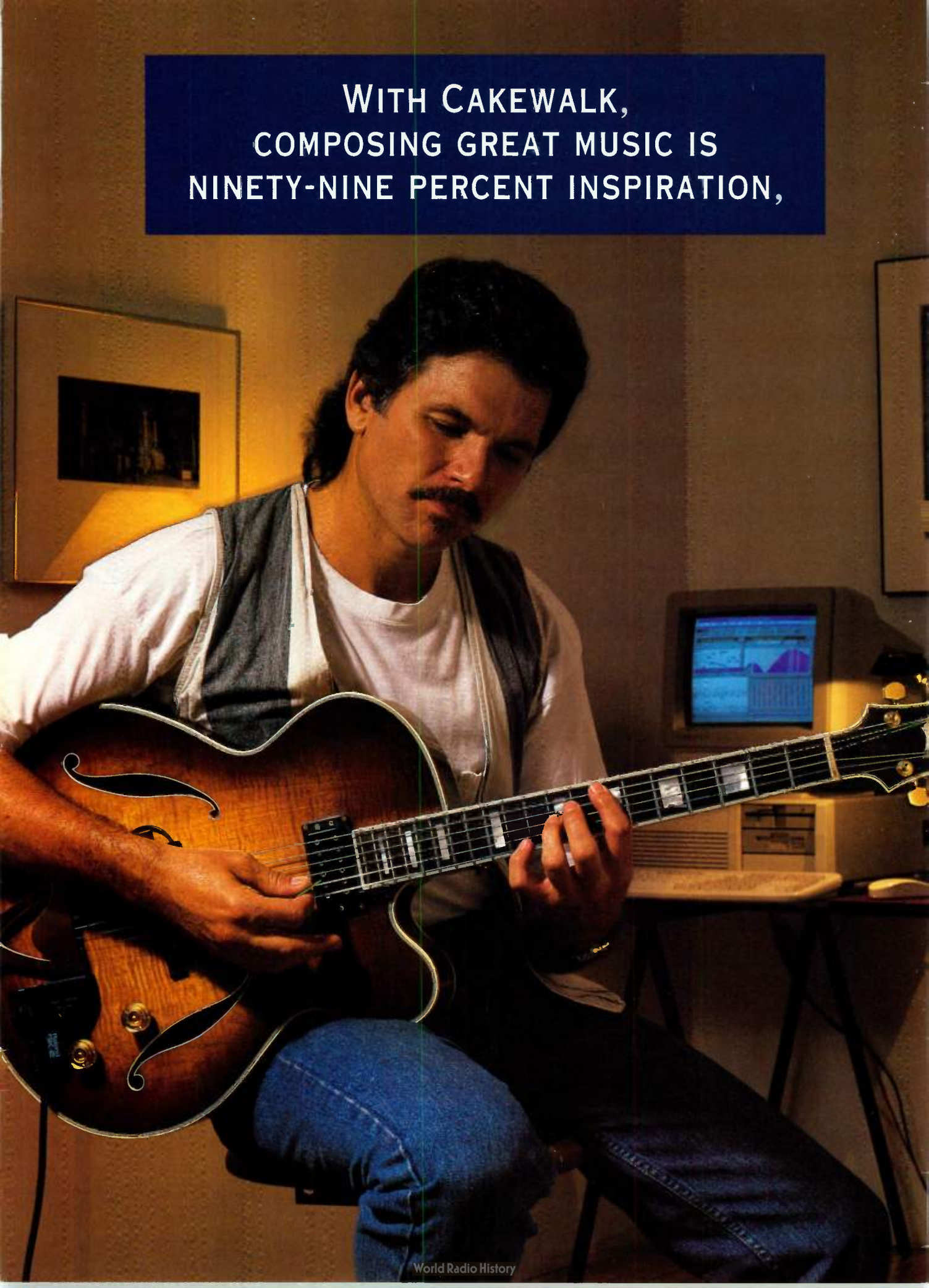

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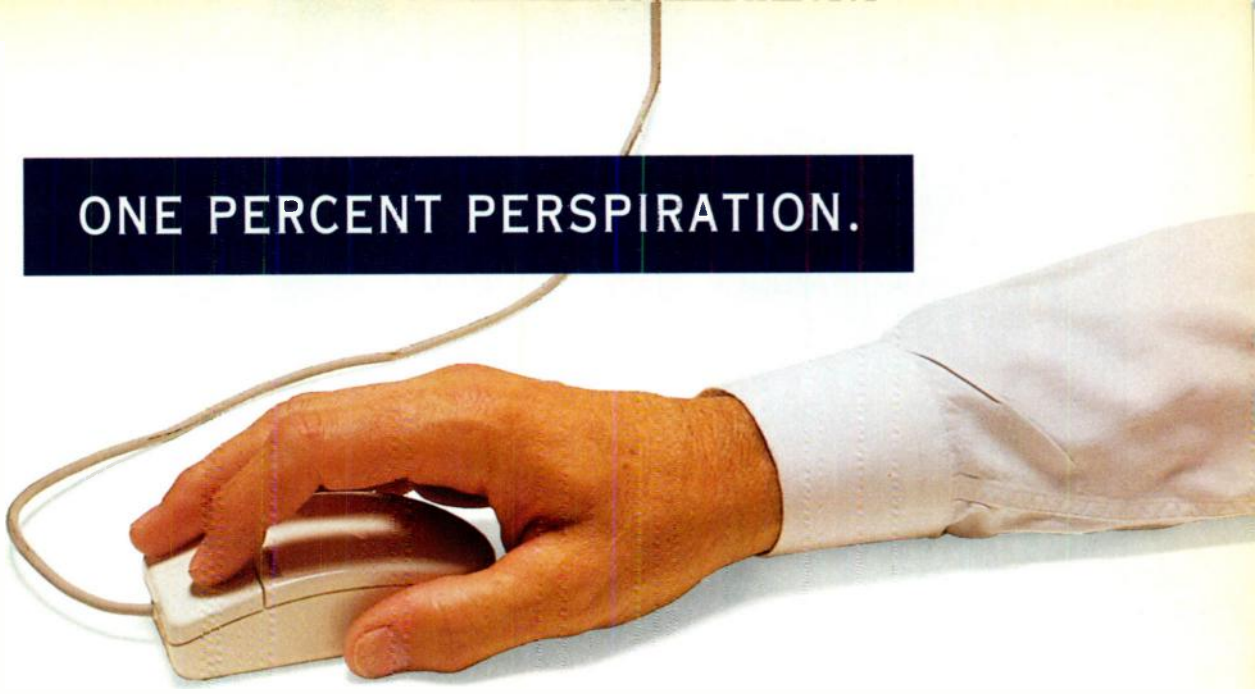

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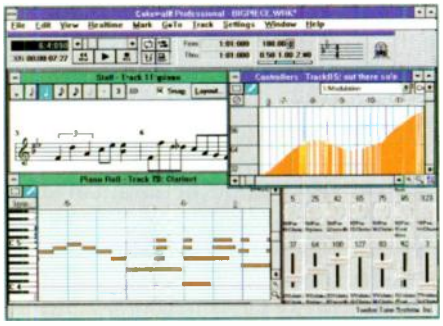

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System Requirements: IBM PC with 10 MHz 80286 or higher, 2 MB of RAM, mouse; Microsoft Windows 3.1. Supports any combination of up to 16 MIDI ports on devices with Multimedia Extensions drivers (including Roland MPU-401 compatibles and Music Quest MQX interfaces). Cakewalk Professional for Windows is a trademark of Twelve Tone Systems. Other products mentioned are trademarks of their respective owners.

instrumental tracks without sounding overprocessed. The TSR-24 offers as many as four voices for chorusing, which produces a sensual (if slightly glassy) timbre. The SPX990's choruses are inherently bright, although a lowpass filter can be adjusted to mellow the tone. You can also modulate the amplitude of chorused signals to evoke shimmering movement in the stereo field. The warmest choruses grace the 9050, but because they're mono, they're also the least wide.

The best phasers and flangers belong to the positively psychedelic SE-70, which can make even the most jaded effects jockey downright airsick. No phasers are offered on the TSR-24, but the flangers are extremely clear and present. The SPX990's flangers and phasers are as sparkly and bright as its chorus programs. Unfortunately, the SPX990 was the least successful at producing the classic swirling "jet flange." The Zoom's flanging and phasing programs sounded quite good, but I would have liked the ability to fine-tune a greater number of parameters.

The Yamaha SPX990 offers the most sophisticated pitch-shifting capabilities. Its pitch shifter is intelligent, automatically adding up to three diatonic harmonies within a user-specified scale. Custom scales are possible, and both tracking and pitch stability are excellent. It can produce detuning and arpeggiating, too. Although the Zoom 9050 also offers intelligent pitch shifting, its tracking is poor, and only one harmony can be added. Also, the 9050 sometimes gets confused and plays a major third where a minor third is the diatonic interval.

The BOSS SE-70 offers a nonintelligent pitch shifter with pitch, level, panning, and predelay. It lets you program up to twelve added voices; detuning and arpeggiation are provided. The DigiTech TSR-24 offers a nonintelligent dual-voice pitch shifter, a detuner, and an arpeggiator.

OTHER EFFECTS

All four boxes offer multitap delays. The SE-70 provides the most control here, with a mind-boggling twenty taps. Level, panning, and delay time (up to two seconds, in 1 ms increments) are independently programmable for each tap. The SPX990 provides a stereo, 6-tap algorithm, while the TSR-24 gives four taps in mono. The Zoom 9050 offers several taps, although I could not determine the exact number.

All the boxes, except the Zoom, offer some degree of sampling. However, the sampled sounds are volatile on power-down, making their use rather limited for repeat performances such as mix-downs (unless you never remix). The TSR-24 leads the pack, with up to five seconds of mono sampling, or 2.5 seconds in stereo. The SE-70, offers two seconds of mono sampling, while the SPX990 delivers 1.35 seconds in mono.

Both the TSR-24 and SPX990 can truncate sample start and end points in 1 ms increments, which is far more accurate than the SE-70's 20 ms resolution. In fact, only the sample endpoint can be truncated with the SE-70. The SE-70 and SPX990 offer looping and pitch transposition of samples via

Yamaha's SPX990 carries the highest price tag of the four processors, but it also has the best audio quality. Its lush, smooth reverbs and intelligent pitch shifter are top-notch.

MIDI note-number messages. The TSR-24 offers looping, but you have to loop the entire sample.

GUITAR INSANITY

Guitarists love effects. The number of musicians who can plug an axe directly into an amp—without so much as a chorus pedal for texture—can probably party on the head of a pin. Because the SE-70 and 9050 are designed for guitar (and the SPX990 offers distortion and compression programs), we put the boxes to the guitar torture test. We figure that any guitarist with a home studio—or any home recordist who plays electric guitar—won't pay the big bucks for these beauties without getting the most processing mileage. Here's how the boxes stacked up.

In The Studio. I plugged a 1962 Strat directly into each unit's inputs and patched the processors' outputs to my mixer. This is where the BOSS SE-70 really shines. We're talking *killer* analog distortion, very creamy and warm.

The Zoom 9050 rocks hard on electric guitar. It produces a wide range of timbres, from edgy, compressed tones to blazing stacks. I was disappointed in Yamaha's digital distortion, which is thin and buzzy. The TSR-24 doesn't offer distortion or compression.

The Zoom 9050's front-panel high-Z instrument input is a real convenience, but even the units with balanced inputs (SPX990 and TSR-24) handled instrument-level inputs without distortion or obvious gain problems. In fact, the unbalanced SE-70 provided the lowest output levels for nominal input. All four devices let you set the wet/dry mix, which is especially important when using them in-line as guitar processors.

On the bonus front, both the 9050 and SE-70 offer instrument tuners, although the BOSS's tuner is more boss. It offers separate presets for guitar and bass, with displays for string numbers and note names, plus utilities for non-traditional tunings. The Zoom 9050 offers a fairly hot headphone output with its own level control. The SE-70 also has a headphone output, but it doesn't get very loud (even when you clip the input), and it lacks a level control. Both units are workable as headphone

MANUFACTURERS

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fax (213) 722-0911

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8760 S. Sandy Pkwy.
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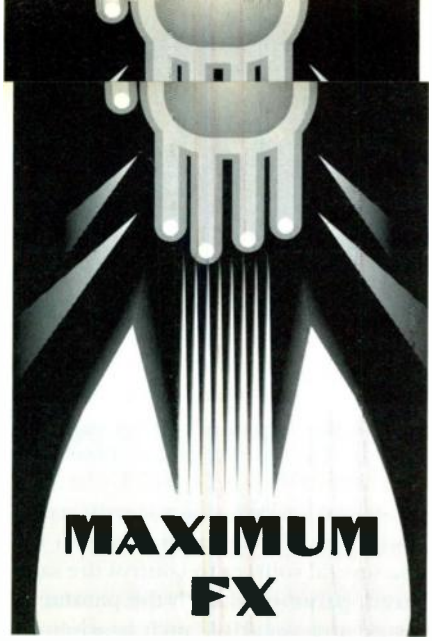
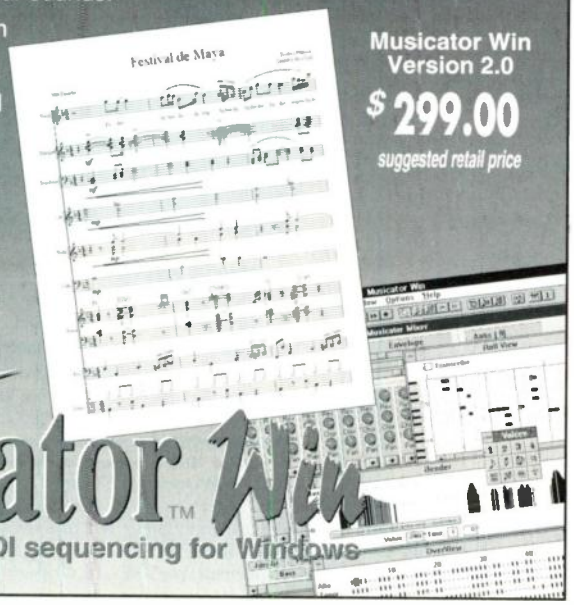
Yamaha Corporation
6600 Orangethorpe Ave.
Buena Park, CA 90620
tel. (714) 522-9011
fax (714) 739-2680

Zoom/Samson Technologies Corp.
(distributor)
485-19 S. Broadway
Hicksville, NY 11801
tel. (800) 328-2882
or (516) 932-3810
fax (516) 932-3815



two SPX990 parameters (within a specified range) per effects program, in real-time, via MIDI Continuous Controllers, Channel Pressure, or note number. You can also control delay times with a sequencer's MIDI Clock output, which is especially cool for songs with multiple tempo changes.

All four boxes implement bulk data dumps and Load for archiving and importing custom programs. The TSR-24 can "copy" individual programs to different program numbers on the receiving device.

USER INTERFACE

The SPX990 is the only unit that employs a downward hierarchy of menus, submenus, and parameters. The other three units lay out their parameters in a linear chain, which negates memorizing access protocols and submenu/parameter locations.

The SPX990 is highly programmable but ergonomically clumsy. You can't access more than one algorithm at a time from within any one preset, but must search for the desired algorithm through the unit's program directory before you begin to edit. The unit also offers no visual indication when a program has been edited and needs to be stored. Fortunately, nonstored edits are still intact after power-down. A data-entry dial is a nice touch, but its scroll rate is extremely unpredictable and variable. You'll also need a Masters degree in pidgin English to understand the owner's manual.

At the other end of the spectrum is the BOSS SE-70, which features the most intuitive operation of all four units. The number of tweakable parameters and the resolution of their increments are excellent. Unfortunately, unstored edits are lost when the unit is turned off.

The Zoom 9050's operation is also extremely intuitive. After a brief learning period, you'll find its operation is the fastest of all four units; a definite plus for live performance. The unit's hippest feature is a set of four data-entry knobs that allow instant and simultaneous editing (*sans* cursor) of the four parameters shown on each page of the display screen. Nine brightly colored indicators tell you at a glance which effects in a multi-effects setup are active and/or being currently edited. And even under the worst lighting conditions, you'd have to be blind to have trouble reading the fluorescent, bright blue display. The 9050 retains nonstored edits on power down.

The DigiTech TSR-24 provides a first in effects-processor programmability: You can actually program your own algorithms! The TSR-24 gives you complete control—within the confines of available RAM and processing power—over which effects you want, the order you want them, and all input/output routing between individual effects.

The TSR-24 provides no less than 34 buttons, seven status LEDs, four knobs,

continued on p. 158

BETA Bio

ROGER LINDSAY, *SOUND ENGINEER*

HOMETOWN:
Liverpool, England

CLIENTS:
Sade, Mark Cohn, Basia, B.B. King, David Gilmour, Frank Sinatra, Frank Zappa, Joe Jackson. et al.

ON GETTING STARTED:
"As a keen young roadie in Liverpool in 1967, my family thought I would do it until I was 21, then 'get a haircut and a proper job.' Thanks to my wife's patience, some talented artists and a little luck, the former is infrequent and the latter has evolved into a long and enjoyable career."

ON BETA MICROPHONES:
"Sade's voice is unique — very subtle, very difficult to capture. When the Beta 58 came out a few years ago, it established a new industry standard. We're currently using the new Beta 87 Wireless. Its response is amazing — studio quality in live performance."

OTHER SHURE FAVORITES:
SM98A ("Great for drums."), SM91A ("Outstanding for kick drums and piano."), VP88 Stereo ("I use it for cymbals and percussion racks, and it's great for house tapes."), Beta 57 ("Superb for snare, bongos and congas.").

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BETA Bio

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SHURE BETA

By Michael Molenda
Photograph by Robert Perry

The Acoustic Home Studio

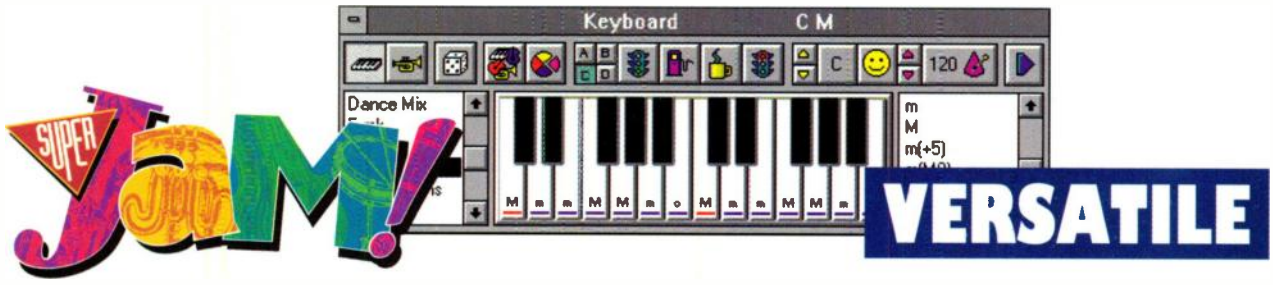
Surviving the exquisite terror of open mics in ambient abodes.

Technology is hurling recordists toward the desktop digital studio at warp speed. It's just a matter of time before our computers become completely integrated recording studios, offering unlimited digital-audio tracks, real-time effects and dynamics processing, *and* powerful mixing and editing capabilities. But even when the digital future is fully realized, one crotchety holdover from the analog era will continue to strike fear and frustration into the hearts of recordists. That tenacious old-timer is the microphone.

The reason for the mic's longevity is simple: There are no AES/EBU connections to a singer's larynx or to the millions of air molecules that cradle the sound of a saxophone or acoustic guitar. If you want to record acoustic sounds, MIDI sequencers, hard-disk recorders, and other cowabunga digital wizardry won't help you; you need a microphone.

Unfortunately, getting a good sound through a mic and onto tape (or disk) has never been easy, even in an ideal recording environment. And the typical home studio is far from an ideal audio environment. The electronic bleating of your child's Sega games, your neighbor's nightly tirades against Rush Limbaugh, and the gentle hum of

STOP, LOOK, LISTEN!



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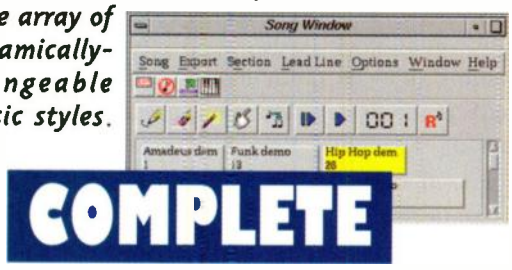

Each style contains several grooves and embellishments, like intros, fills, breaks and ends. Plus, you can modify any existing style or create your own with **SuperJAM!**'s extensive recording and editing tools.

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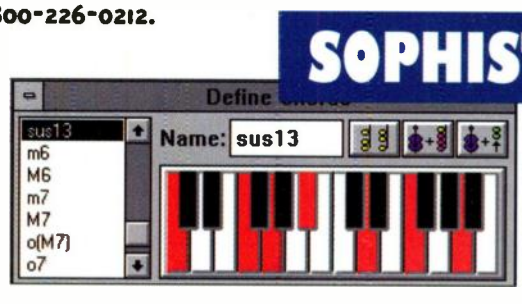

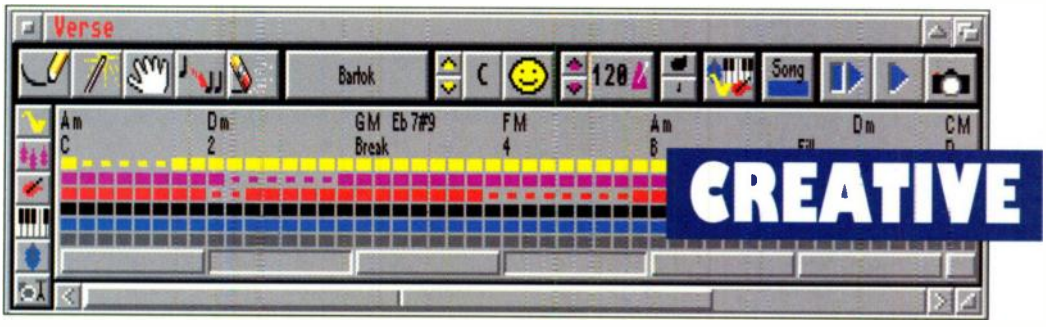

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The Acoustic Home Studio

nearby traffic conspire to make acoustic recording at home a constant nightmare. In short, if your creative endeavors extend beyond MIDI sequencing into the acoustic realm, you have a problem.

But transforming your home into a workable acoustic studio, where microphones can coexist with your recording environment, is not hopeless. You just need to know how to make your mics, instruments, walls, floors, and ceilings work together to produce beautiful sounds.

OPEN RELATIONSHIPS

Microphones can be mischievous little buggers. Left to their own devices, they seldom discriminate between "bad" sounds and "good" sounds; they just invite everybody to the party. For example, an open mic will gleefully document an amazing vocal performance along with the dulcet tones of your neighbor's power saw. This sonic candor is why large recording studios spend thousands of dollars isolating their rooms from the outside world.

The acoustic environment *within* a room can also compromise recordings. Once again, large studios usually have a number of ways to combat audio dysfunction. Walls and ceilings are angled and "decorated" with absorptive materials to prevent standing waves (caused when parallel reflecting surfaces bounce sound waves that reinforce specific frequencies) and bizarre echoes. Isolation booths allow instrumentalists and vocalists to be segregated from other musicians for maximum audio separation, and gobos (moveable sonic shields) can be positioned to further isolate the players or diminish unwanted sound reflections.

Even the size of large studios helps recording engineers deal with acoustic aberrations. You can do a lot more than simply position musicians far away from each other. Designers often take advantage of the square footage to construct different sound zones. Drums can be set up on a hardwood floor under a high ceiling to facilitate ambient miking, while a saxophone can be recorded "dry" (if desired) in an area with thick carpets and absorptive walls.

Unfortunately, the typical home recordist doesn't have a budget for acoustic studio design. Home studios are usually set up according to available space, rather than optimum acoustics. And often, most of *that* space is shared with beds, desks, and other artifacts of home life. MIDI musicians who produce MIDI basic tracks but then record vocals and other acoustic instruments in a commercial studio only need a small area optimized for monitoring. The rest of the recording space can be a sonic nightmare. But anyone who brings a microphone into their home must deal with the sum total of acoustic anomalies coexisting within the studio space.

SOUND TREATMENT

Luckily, you don't have to hire an expensive acoustic design firm to make your home more sonically hospitable. Peter Elsea, author of two excellent **EM** articles on acoustical treatment—"Sound Sanctuary" (June 1991) and "The Taming of the Room" (August 1991)—renovated his wife's home studio using common building and household materials (see **Fig. 1**). The total cost was less than $100. Fearless handypersons can also call Mix Bookshelf (tel. [800] 233-9604 or [510] 653-3307) and order a studio-design manual.

In addition, a number of commercial firms offer prefabricated "project studio" systems for sound isolation and absorption. Acoustic Sciences Corporation's Studio Towers (see **Fig. 2**) can be easily moved around to create a neutral, non-reflective recording space. The company also offers wall-mounted panels. A set of six towers costs $899, and a set of eight panels is $299. RPG Diffusor Systems has assembled AcousticTool kits that include the company's Skyline and Abflector wall diffusors and B.A.S.S. traps. A Demo Project Studio package of six Skylines, four Abflectors, and four traps is $1,017.

Probably the most well-known sound absorption/diffusion material is Sonex (see **Fig. 3**), manufactured by Illbruck, Inc. Sonex's polyester urethane and foam melamine wall panels are also television stars: The colored geometrical diffusers decorate the transporter rooms on *Star Trek: The Next Generation*. Most home studios use 2-inch-thick Sonex, which costs $2.50 per square foot. If you want high-tech gobos, Yamaha Corporation of America manufactures the Sound Screen, a portable sound-isolation shield. The freestanding, 4-panel unit is made of clear acrylic and costs $400 for a 24-inch-high model. (A 48-inch shield is available for $600.) These are just a few of the companies that can help optimize your acoustical environment. Any reputable pro audio dealer can provide more information on these and other products.

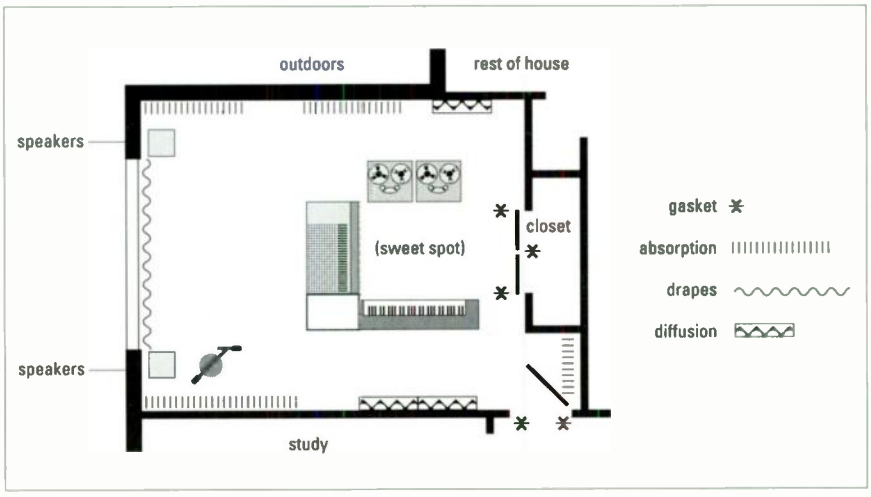


FIG. 1: Common materials, common sense, and a little acoustical empathy can turn your home studio into a "mic-safe" environment. EM contributor Peter Elsea used drapes, homemade absorptive panels, and bookcases (as diffusors) to tame the acoustics of his wife's project studio.

The Acoustic Home Studio

So what do you do with all this stuff? These materials and other common hardware and houseware goods can be used to transform your personal recording environment into an "acoustic friendly" zone. You must prevent unwanted sounds from sneaking into your microphones and compromising your recordings. There are two main weapons used to attack sound problems: isolation and control.

ISOLATION

The average recordist isn't going to build double walls or "float" floors to soundproof their home studio. Isolation is usually limited to getting the environment as quiet as possible, without new construction. Following are some quick tips for making the most of what you have.

Pick your spot. If possible, choose the quietest room in the house for your studio. Unless you live alone, avoid areas near the kitchen or living room. Obviously, it's sonic suicide to put an apartment studio near a window that overlooks a busy street. If a basement or garage is available, make sure that traffic and other outdoor sounds do not overwhelm the environment.

Floors. A good, thick, wall-to-wall carpet (and carpet pad) can help diminish sound from the apartment or room below you. Carpet also muffles the sound of people walking around live mics. If a wall-to-wall carpet is not feasible, at least try to cover a large section of the studio with a padded carpet remnant or decorative rug.

Doors. Most hardware stores carry floor thresholds with thick rubber gaskets. Use these to prevent sound from leaking under doors. The cracks around the door frame can be stopped up by gluing a ribbon of thick foam around the outside edges of the door itself *and* the inside surfaces of the door frame. As an added precaution, affix wide, flat, rubber strips along the perimeter of the door. These should extend at least two inches across the crack between the door and frame. If the door opens "in," be sure to place these gaskets on the outside frame (so you can open the door!); if the door opens "out," install the gaskets on the inside frame. It doesn't look pretty, but it works. Once the door is closed, and you're locked into your creative den, ultra-paranoid recordists can drape a thick curtain across the door to further discourage sound leakage.

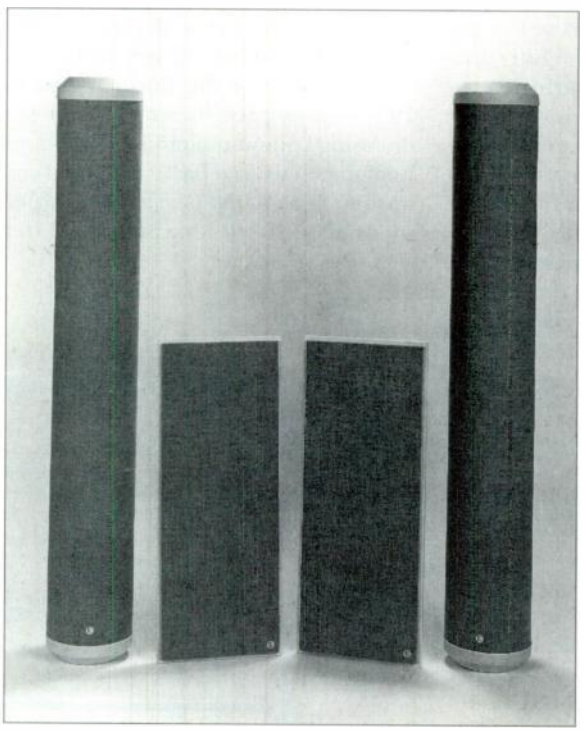


FIG. 2: Diffusors, such as Acoustic Sciences Corporation's Studio Towers (and panels), allow home recordists to "tune" their studio environments. Standing waves and other sonic anomalies can be controlled by positioning diffusors and absorptive materials to counteract sound reflections.

Windows. External windows are great for inspiring creative daydreams, but they're total drags when it comes to soundproofing. An inexpensive way to deal with this massive sound-leakage threat

Combination compressor/noise gate units, such as the dbx 266, allow recordists the ability to maximize signal levels and shut out the majority of annoying environmental noises.

is to cover the window and surrounding area with heavy drapes. Keep the drapes snug against the wall to minimize leakage. If the window has a deep frame, you can also jam thick blankets into the opening.

CONTROL

Once you've minimized the chance of surprises from the outside world, sonic anomalies inside your studio must be controlled and neutralized. Be vigilant about preventing standing waves, flutters, and other reflective sounds that can sabotage pristine recordings.

A simple test is to walk around the studio and clap your hands. Listen critically for "metal tank" slapback timbres and excessive "liveness." Don't forget to stand up *and* sit down during this test. My studio's prize-winning standing wave was most evident when sitting against the wall near the outside edge of the mixing console. Wherever you hear something weird, mark the spot with masking tape. Now it's time to unleash the diffusers and absorbers.

Diffusors are objects that reflect and redirect sound waves evenly throughout a room, while absorptive materials are employed to reduce echoes and standing waves, smooth out a room's frequency response, and lower noise levels.

Professional acoustic designers have all kinds of great test devices for tuning a room, but because most home recordists can't afford acousticians, we're going to control reflections via the old "listen and adapt" method. Stand on the spot where you marked the sound problem and have a friend hold up an absorptive panel (or move a diffusor) against a wall near the problem area. Clap your hands and direct the friend to move the panel until the echo, flutter, or standing wave tone is diminished. Then, *temporarily* mount the panel to the wall (or leave the diffusor in place). Fine-tuning the room may require more panels, so you don't want to finalize positions until all the diffusors and absorbers are in place, and the room sounds relatively flat (or dry).

If you have no clue where to start placing diffusors and absorptive materials, the commercial manufacturers of these products often publish helpful floor plans. For their project-studio system, Acoustic Sciences Corporation recommends placing a Studio Tower in each corner of a rectangular room and one Tower at the middle of the front and rear walls. Four Studio Panels are placed on the side walls near the mixing console to stop wall reflections.

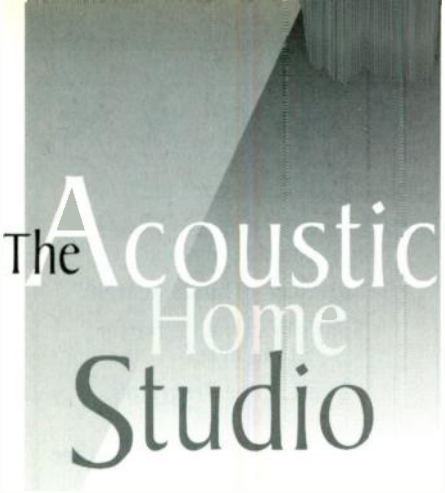
▼

Anyone who brings a microphone into their home must deal with acoustic anomalies.

RPG Diffusor Systems also offer recommended floor plans for each of their AcousticTool packages. Typically, manufacturers stress controlling reflections on the front and back walls and the side walls near the mixing (or recording) position.

I use Sonex in my studio, and I've found it's hard to *overuse* absorptive materials. I covered the entire back and front walls of the control room and the entire isolation booth. Unfortunately, Sonex is expensive to use so liberally. If you're on a tight budget, you can get reasonable results by buying 3-inch-thick foam mattresses from a bedding store. You can mount the mattress on the wall "as is" for maximum coverage, or cut the foam into separate panels.

When everything is almost in its final position, be especially critical of sound in the main recording and mixing areas. There should be no evidence of



flutter echoes, sharp slapback, or reverberation. To be honest, a little reverb or room tone won't kill your recordings, but use discretion when deciding how much is too much. If the room tone significantly changes the timbre of an instrument, you'll be chasing the "room," instead of the instrument tone, during recording.

FUN WITH MICS

Want to hear something unfair? All this work spent optimizing the acoustics of your home studio *still* doesn't guarantee you'll record a good sound. Now you have to deal with mic selection and placement.

Finding the right mic for the gig is critical. You don't need a collection of mics that rivals a pro studio, but you should have at least one good, large diaphragm condenser. These condenser mics are great for capturing the nuances of dynamic sounds, such as vocals, pianos, and acoustic guitars. They're not cheap, but affordable models in the $600 to $1,500 range—such as Neumann's recently released TLM 193, AKG's new C3000, and Audio Technica's AT4033—do exist.

For home recording, a mic with switchable polar patterns is ideal. If the model you like (or can afford) has a single pattern, make sure it's a cardioid or supercardioid type. These patterns are most sensitive to sounds directly in front of the mic, a real boon if you're fighting ambient noise and poor acoustics. Putting the mic close to the source sound diminishes the effects of the room environment. A multipurpose dynamic mic, such as the venerable Shure SM57, is also good to have around. The home recordist on a budget can do great work with just these two types of microphones. Now let's take at look at some common acoustic recording situations and see how to use these mics to their best advantage.

LEAD VOCALS

It's almost a rite of passage for recordists to use an ordinary bathroom as a vocal booth. Sound reflections from floor tiles, porcelain fixtures, and mirrors produce slap-back effects that can enhance the timbre of some voices. However, because these reflections are recorded along with the vocal, it's difficult to change the sound later on. You can add a longer reverb (or delay) during mixdown to diminish the slapback effect, but you'll never be completely rid of the midrange boost and sharp reverb decay.

If you absolutely adore your bathroom vocal treatment, then tonal commitment may be a good thing. Personally, I like options. Overdubs can sometimes change the sonic landscape of a track, making a particular vocal effect seem inappropriate. Obviously, if an unsatisfactory room treatment is permanently recorded onto something as critical as a lead vocal, you're sunk. I recommend tracking vocals dry, so that you can base your processing decisions on the finished track. Unfortunately, moving out of the bathroom will not prevent skirmishes with room acoustics. Recording dry vocals at home requires a good ear, common sense, and a little help from dynamics processing.

Large diaphragm condenser mics, such as beyerdynamic's MC 834, are great for reproducing the subtle timbres of acoustic instruments.

First, move your microphone around the room to find a spot that produces minimal reflections. Reduce possible noise leakage by staying away from windows and doors. If you engineer your own vocal sessions, move away from the mixer to avoid reflections from the board, table surfaces, computer, and equipment racks. If possible, use a remote control to set up a vocal station in your "dead zone."

To further minimize the chance of reflections and outside noises compromising your vocal track, position your mouth approximately six inches from the microphone. A foam windscreen or pop filter should be employed to diminish plosives such as "P's" and "B's." You can also practice moving your mouth ever so slightly off the microphone when singing words that produce these annoying pops.

Supercardioid dynamic mics, such the Shure Beta 57, are perfect as all-purpose workhorses for close-miking situations. These types of microphones are less sensitive to sounds emanating from the back and sides.

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The Acoustic Home Studio

(Take care not to move so much off the mic that your vocal tone changes noticeably.)

When recording vocals in the acoustic home studio, a compressor/gate is a good tool. The compressor helps you record consistent levels, while the gate can shut out ambient noise. It's a little risky to record with a gate in-line, because words can get clipped if the singer's dynamics slip below the gate's input threshold. I never use gates when recording vocals in a pro studio. (It's safer to apply them to the vocal track during the mixdown.) However, if you can't diminish environmental noises in your home studio, gating may be a necessary evil.

To avoid ruining a good take, however, determine a suitable threshold setting by doing a few run-throughs as you warm up your voice. You should be able to shut the input signal down between vocal phrases without clipping words. Be extremely careful of parts where you hold out a line. The gate shouldn't clamp down until the complete phrase fades out. Believe me, it will take some practice to get the settings right. But keep in mind that a clean, uncluttered vocal track is no small reward for your efforts. If you sweat through the process, the vocals recorded in your bedroom *can* sound as good as anything tracked at a big, expensive studio.

ACOUSTIC GUITARS

A jangling acoustic guitar can shower a studio with masses of ricocheting harmonics, so your recordings will thank you for limiting the reflective surfaces of your environment. Once again, a condenser mic is my favorite choice for documenting the brilliance of steel and nylon strings. On some guitars, a small diaphragm condenser actually sounds better than a large diaphragm. It pays to audition both types, if you can.

You shouldn't have any problem with environmental noise if you position a mic near the soundhole. Experiment with positions between six inches and one-and-a-half feet away to determine a good balance of room and instrument sound. Avoid pointing the mic directly into the hole, however, because the rush of air and sound can produce a muddy tone. I usually position the mic off-axis, pointing up toward the fretboard.

If you want to record a stereo perspective, place one mic towards the bottom edge of the soundhole (for bass frequencies) and another near the fifth fret (to increase the jangle factor). Obviously, when you use more mics, you increase the chance that room reflections and environmental noise may compromise the sound. This is especially true if you position a mic far enough from the source to increase

ambience. Listen very critically to ensure that your neighbor's lawn mower doesn't make a guest appearance on the guitar track.

Ambient mics also increase the possibility of low-frequency noises creeping onto the track. Usually, rolling off a few dB at 100 Hz (or lower) diminishes the rumbles without compromising the overall tone. If the environmental noise is unbearable (is *everybody* in the neighborhood mowing their lawns simultaneously?), consider breaking out the noise gate again. I've had good luck gating strumming performances, but gating soft, dynamic parts often produces unmusical results. Recording quiet classical passages should probably be deferred until the world slows down to a hush.

PIANOS

Producer Scott Mathews has a wonderful rock 'n' roll upright in his studio, and he never worries about sound leakage, environmental noise, or room tone. He just tosses two Shure SM57s inside the piano and shuts the lid. And

FIG. 3: Absorption can help your studio produce truer sound by diminishing sound reflections and combating frequency anomalies. Sonex (shown on the walls and ceiling near the above mixing station) is a commercially available absorptive material that can be used to completely cover reflective surfaces.

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For warmer tones, use two condenser mics positioned approximately one foot over the sound board. Increase definition by pointing one mic toward the bass strings and the other toward the treble strings. These positions work for either uprights or grand pianos. To minimize environmental sounds, take a thick blanket and hang it over the piano lid until the microphones are completely enclosed within the "sound tent." You'll need sturdy mic stands and judicious application of gaffer's tape to ensure that the weight of the blanket doesn't tip over the mics.

▼

Ambient mics increase the possibility of low-frequency noises creeping onto the track.

The most difficult piano miking to pull off in a home studio is the classical method, where the lid is fully opened (or removed), and the mics are positioned ten to fifteen feet above the sound board. The chance of environmental noise infiltration is extremely high, and small rooms usually aren't the best places for ambient piano recordings. You'll save yourself a lot of headaches if you stick with relatively close mic positions.

FADE OUT

There's no reason why acoustic recordists can't make masters that compete sonically with total MIDI productions. Especially now that modular digital multitracks offer home studios the benefits of pristine digital sound. And think of what sonic heights you can achieve if you combine MIDI tracks with beautifully recorded acoustic sounds.

When you master your microphones and gain control over room acoustics, you move closer to being a completely self-sufficient, creative entity. To me, the real benefit of the digital desktop studio is giving artists the power to retain creative control over every phase of the musical production process. Whether you're a sequencer jockey, or a classical cellist, the ability to record master-quality acoustic sounds in your home is truly revolutionary.

EM *editor* **Michael Molenda** *is co-producer of* The Infinite Summer of Love *(Taxim Records), a compilation of Bay Area bands reinterpreting the music of the Flower Power era.*

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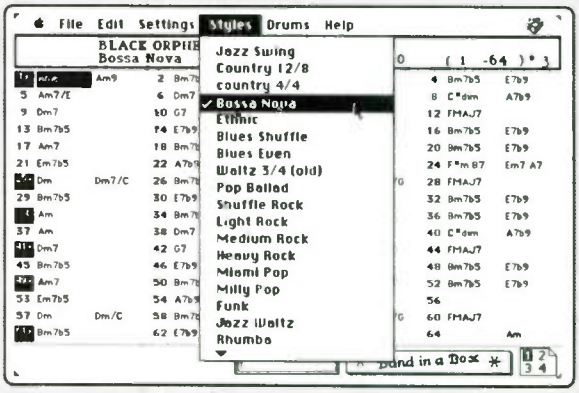

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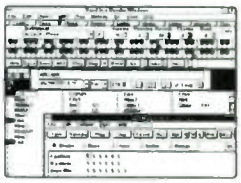

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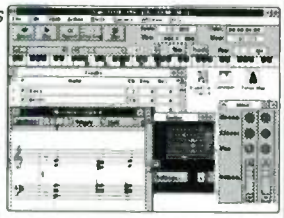

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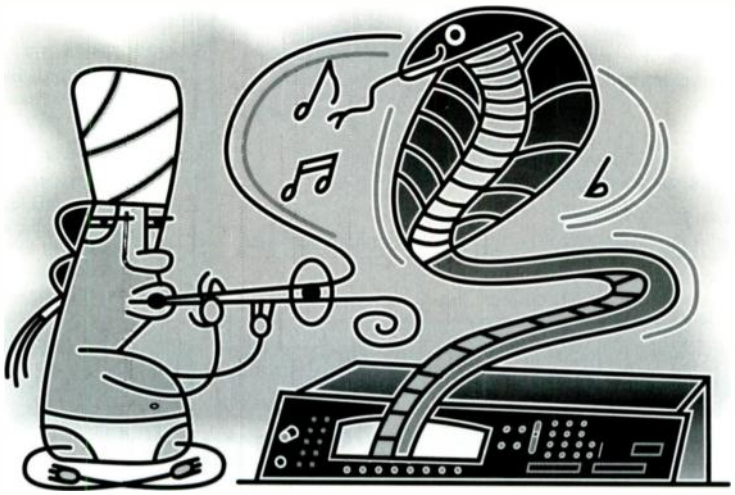
Electronic Expression

By Scott Wilkinson

Most people think synths are as expressive as banana slugs, but it ain't necessarily so.



One of the chief complaints about electronic music is its lack of "human feel." In the hands of a good player, most acoustic instruments display a wide range of expressive capability. The subtle nuances of timbre, dynamics, and phrasing are some of the most compelling aspects of the musical experience. Unfortunately, many people believe that synths and samplers are not capable of such expression.

In the early days of synthesis, this was entirely true. And even today, many players grumble about the lack of "connection" they feel with their synth. For example, every time you play a sampled note, it sounds essentially the same. On an acoustic instrument, however, the same note can sound quite different depending on how it is played.

But expression is not denied to the electronic musician. With a few tricks and tweaks, you can add many levels of expression to an electronic performance.

ELEMENTS OF EXPRESSION

In the search for electronic expression, it's important to understand which musical elements performers vary in real time to express an emotion or idea. For example, *pitch* can be varied over the course of a note to produce expressive qualities. Regular, periodic variation of pitch up and down at a rate of about four to seven times per second is called *vibrato.* The onset of vibrato often occurs after a note has started, and its speed might change from one note to another. In addition, the depth of vibrato—how far the pitch moves above and below its nominal value—can be varied. Except for opera singers, who use wide vibrato as a vocal embellishment, the depth usually is relatively shallow.

Dynamics are another important means of musical expression. Aside from playing different notes loud or soft, players often vary the volume of a single note (or series of notes) to perform crescendos or diminuendos. Periodic variation of loudness is called *tremolo.* As with vibrato, tremolo can be delayed from the start of the note and varied in speed and/or depth.

Acoustic-instrument players can also vary *timbre* from dark to bright over the course of a performance. (The tone of a note might get brighter as it gets louder in a crescendo.) Acoustic instruments also achieve different levels of expression by using *articulations.* These articulations include staccato, legato, tenuto, and various types of accents.

SIMULATED EXPRESSION

So guess what? Most synths and samplers already include ways to control certain parameters of musical expression. Pitch is determined by the instrument's *oscillators,* which produce waveforms at various frequencies, depending on which keys are pressed. The frequency of an oscillator can be controlled, or *modulated,* in a number of ways. Dynamics are controlled by *amplifiers,* and timbre is altered by *filters.* Like oscillators, the behavior of these amplifiers and filters can be modulated by various means (see **Fig. 1**).

Vibrato and tremolo are usually simulated in synths with a *low-frequency oscillator* (LFO). The LFO can be applied to the oscillator frequency, amplifier level, or filter cutoff frequency to produce a regular, periodic variation. The depth of this variation is determined by the amplitude of the LFO. Unfortunately, an LFO is preprogrammed to behave the same way every time, so it's

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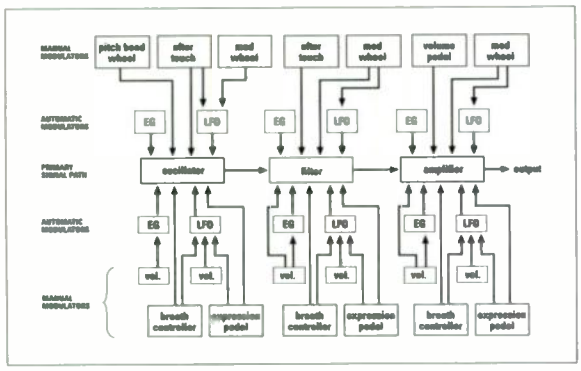

FIG. 1: The architecture of most synths includes a primary signal path from an oscillator through a filter and amplifier. All three of these components can be controlled with many different automatic and manual modulators, which in turn are under expressive control.

not very expressive. As we'll soon discover, however, there are several ways you can exert expressive control over the LFO.

The pitch, volume, and timbre of a synth can be also varied with *envelope generators* (EGs) that control the attack, decay, sustain, and release of each note. For example, a piano note rises to its highest volume quickly after a key is played and decays very slowly until the key is released (see **Fig. 2a**). Like LFOs, EGs can be applied to oscillator frequency, amplifier level, or filter cutoff frequency. The attack, decay, sustain, and release portions of each note are preprogrammed into the EGs to simulate the behavior of acoustic notes.

The EG's profile is most often specified with several *rates* and *levels*. After each note is started, the EG moves to the first level at one rate, then to the next level at another rate, and so on until the note is released when the EG moves to its final level (usually O) at the final rate (see **Fig. 2b**). All of this is programmable by the user (see "From The Top: Tweaking Synths, Parts 1 and 2" in the June and July 1992 **EM**). However, EGs must be controlled in real time to achieve any expression.

EXPRESSIVE MIDI

One of the coolest things about MIDI is the presence of messages designed to convey musical expression. Among the most fundamental of these is *Velocity*, which is actually part of the Note On and Note Off messages. Velocity represents how quickly a key travels as it's played; this information is normally used to determine the initial volume of the note.

However, Velocity can also be applied to a wide variety of expressive parameters in most modern synths. For example, it can be used to scale EG rates and levels. As the Velocity increases, the rate at which the EG moves through its preprogrammed profile speeds up, and the levels change. Velocity can also be applied to LFO depth and/or frequency. The higher the Velocity, the more pronounced and/or faster the vibrato or tremolo.

Another parameter that can be expressively controlled by Velocity is filter cutoff frequency. As the Velocity increases, the filter frequency is changed, altering the timbre of the sound. To simulate various articulations, Velocity can

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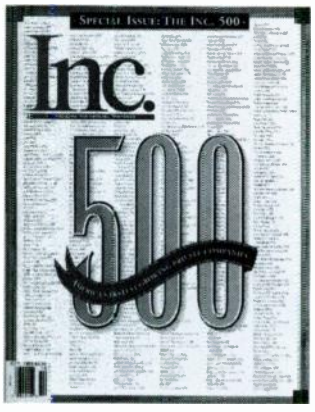

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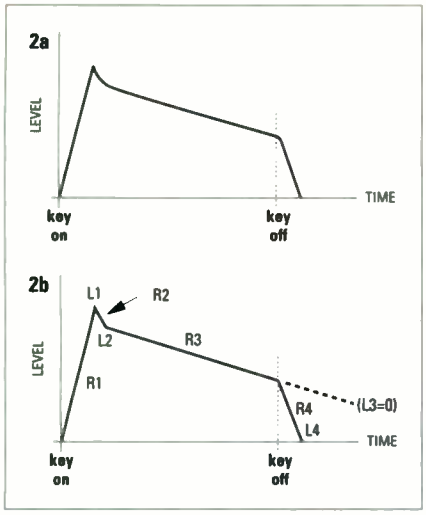

FIG. 2: The amplitude envelope of a piano (2a). A piano amplitude envelope can be simulated with an envelope generator (2b). If you hold the key down, the note slowly dies away; it will eventually drop to silence (L3 = 0) unless you release the key, after which the sound quickly falls to silence (L4 = 0).

be used to *crossfade* or *switch* between two or more different samples. Low Velocities might trigger a soft-attack sample, while high Velocities might trigger a hard-attack sample of the same note.

Most synths include several *Velocity curves*, which determine how the synth responds to your particular playing style. If you are a heavy-handed player, you might want to select a Velocity curve such as the one depicted in **Fig. 3a**. If you've got a light touch, the curve

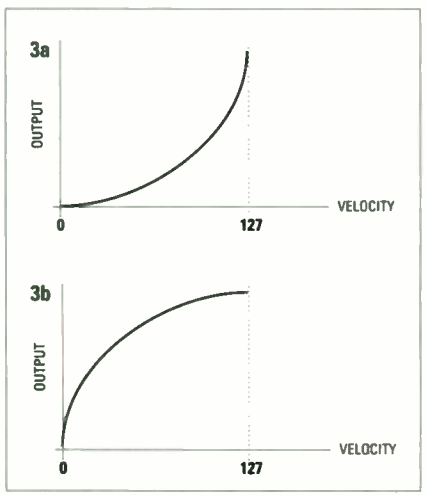

FIG. 3: A Velocity curve that is more sensitive in its upper half (3a) allows heavy-handed players a full range of Velocity control. A curve that is more sensitive in the lower half of the velocity range (3b) is usually preferable for players with a light touch.

in **Fig. 3b** might be more appropriate. Velocity curves let you adjust the response of the synth to maximize its expressive potential under your fingers.

As you hold down a key on the keyboard, you can still affect that note expressively by varying the pressure you apply to the key. Technically, this is called *Pressure,* although it is also known as *Aftertouch.* Aftertouch can be a very expressive tool, because as you apply different amounts of physical pressure to a key, you can affect parameters such as filter cutoff frequency, volume, pitch, and LFO depth and frequency without removing your fingers from the keyboard.

There are two kinds of Aftertouch: *Channel Pressure* and *Poly Pressure.* With Channel Pressure, the relevant parameters of all sounding notes are equally affected, which is determined by the key with the most pressure being applied. With Poly Pressure, each note is affected independently. Poly Pressure offers much more expressive capability, but is more expensive for manufacturers to implement. Many MIDI sound modules respond to Poly Pressure, but only a few keyboards send this message.

Virtually all keyboards have two control wheels to the left of the keyboard. The left wheel is called the *pitch-bend* wheel. Moving this wheel up or down from its center-detented position alters the pitch of any sounding notes. The pitch-bend wheel also sends MIDI Pitch Bend messages to external sound modules.

The other control wheel on most synths is called the *modulation wheel.* Moving this wheel from its minimum position sends a stream of *Modulation* messages, which are often used to control the LFO depth in real time. However, Modulation messages can also be used to control a wide variety of expressive parameters, such as filter cutoff frequency, volume, and LFO frequency.

Modulation is one example of a *Control Change* message. This group of messages provides most of MIDI's expressive capabilities. There are more than 100 Control Change messages, each designed for a specific purpose. For example, *Volume* controls the overall volume of a synth. The *Expression* message is usually activated with a continuous footpedal (similar to a volume pedal) and applied to various expressive parameters.

One of the most important but underused expressive Control Change messages is *Breath Controller.* This message was first implemented by Yamaha for their breath controller device, which consists of a small mouthpiece connected with a cable to a sound module. As you play the keyboard, you also blow into the breath controller with various wind-instrument articulations (ta-ta-ta, da-da-da, la-la-la, etc.). The articulations and changing breath pressure are translated into continuous MIDI messages and applied to various parameters in the synth. Breath Controller messages allow wind-instrument expression, such as crescendo/diminuendo, sforzando, vibrato, and tremolo.

FUTURE EXPRESSION

One of the most promising developments in electronic expression is *physical modeling* synthesis. In this process, the physical behavior of acoustic instruments is modeled mathematically and reproduced electronically. For example, you can blow with increasing pressure into a breath controller while playing a note and hear the synthesizer "jump" overtones just like an acoustic woodwind instrument. This is not possible with any previous synthesis technology. Yamaha is the first company to introduce a synthesizer based on physical modeling with its VL1. This technology promises a quantum leap in the expressive capability of electronic instruments (see "Model Music" on p. 42).

▼

You can add expression to an electronic performance in more ways than you might think.

In the meantime, there is a great deal of expressive potential in past and present synthsesizers. All you need to do is understand how synths realize this potential, tweak some patches, and use the various controllers to their best advantage. You'll be well rewarded with a level of expression that belies the critics' complaints. ●

Hiring an Engineer

By Michael Molenda

If your masters don't shine, don't whine, call in the professionals.

Sometimes lucky engineers get hired by their heroes. The author (center) shown with legendary guitarist Harvey Mandel (left) and co-engineer Neal Brighton.

To paraphrase the visionary poet William Blake: Some musicians CALL themselves recording engineers. Blake's crotchety rebuke meant that there's a difference between CALLING yourself something and BEING it.

So what's my point? Well, it seems that everyone who owns a cassette ministudio, MIDI system, or modular digital multitrack considers him - or herself a recording genius. Given this abundance of audio Einsteins, I'm puzzled why I *still* hear hundreds of distorted, hiss-infested, and reverb-drowned demo tapes. I can only assume the sheer brilliance of these sonic dysfunctions eludes my non-Mensa comprehension.

Seriously, however, a poorly recorded or mixed tape devalues your work. If you're not a great mixer, or if you have difficulty recording vocals and other acoustic instruments, don't settle for mediocre masters. Get help! You can hire a professional recording engineer to spice up your home recordings.

AUDIO ADORATION

Most recording engineers are fanatics. If given carte blanche to schedule sessions, they'd devour an entire month auditioning microphones and mic placement for each instrument. Then, they'd spend the rest of the year refining gain stages, tweaking EQ, and programming signal processors. A deadline is often the only reason a project gets completed at all. And during those rare moments when an engineer isn't in the studio, he or she is usually studying new records for interesting sounds, checking out the latest audio gear, or reading trade magazines.

But devotion to excellence isn't the only reason engineers are so driven. Survival is paramount. If a pro engineer *doesn't* get great sounds, he or she doesn't work. Period. Now, when was the last time the sonic CIA confiscated your home ministudio because you erased your best solo?

I don't mean that pro engineers are the only people capable of recording great tracks. I've heard some amazing home demos that absolutely shamed tracks recorded in big, expensive studios. But if you're looking for consistently high-quality tracks, the law of averages is on the side of those who make their living honing their skills. And anyway, artists are usually more interested in documenting ideas and performances than sweating over the timbral nuances of a vocal track or other sound source.

It comes down to this: As the audio industry continues to produce affordable, master-quality tools for the home recordist, how well those tools are used becomes critical. Some artists have the engineering chops to release commercial products from their bedrooms, while others may need a little help. The trick to maximizing the sonic potential of your equipment is knowing when to call in a pro engineer.

ENGINEERING HELP

Although there are unfortunate exceptions (more on this later), a good engineer can step into any recording environment and deliver the goods. This talent is a boon to home recordists, who should consider hiring a professional engineer whenever a critical phase of a project lies beyond their expertise or competence. For example, most artists can deal with MIDI tracks just fine, but recording a clean vocal

PHOTO BY MARK DAVIS

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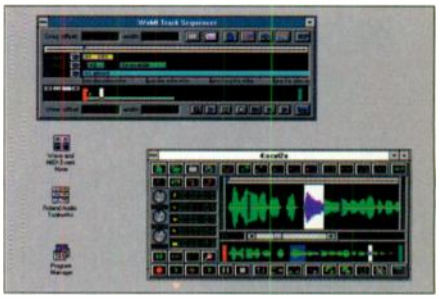

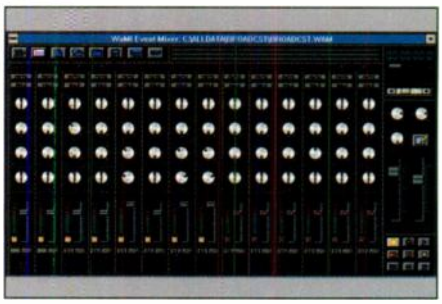

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is often a hit-or-miss proposition. Poor vocal recordings can be caused by inexperience and sometimes by lack of proper microphones. Because most independent engineers own a collection of good mics, the home recordist can take advantage of the pro's chops *and* equipment.

Mixing is another area were many artists fall down. The tracks may have been well recorded, but the "final assembly" ends up muddy, over-processed, and/or noisy. Engineers specializing in mixdowns are legion, and you owe it to yourself to ensure that your final product sounds as good as possible.

In addition, as the modular digital multitrack (MDM) age blurs the line between pro and home studios, hybrid projects offer artists the best of both worlds. For instance, you could flesh out a song on a home MIDI system, mix a stereo reference track (and time code, if necessary) to a MDM, and take the tape to a pro studio to record live drums. Back at home, you can agonize over vocals, then hire a mixing specialist to come over and mix your masterpiece.

Finding an engineer is easy. Give a call to some local recording studios and inquire if their staff engineers are available for outside work. If not, many studio managers have lists of reputable independent (freelance) engineers. Local bands that have recently completed recording projects are also good sources for referrals. Ask them if they liked working with a certain engineer and get his or her telephone number. Usually the local musician's grapevine is filled with information on hot engineers.

Finally, commercial listings are available for just about every metropolitan area. *Mix* magazine is launching its *MixPlus* regional directories in June 1994(with editions following in August and October). *MixPlus* covers the east, west, and central U.S. with listings on engineers, studios, tape and CD duplication firms, and other data of value to musicians.

Most engineers charge an hourly rate for their services, although project fees (one lump sum for the life of the project) are sometimes negotiable. In the San Francisco Bay Area, rates for indepedent engineers vary between $10 per hour (for unsung heroes and heroines) and $50 per hour (for acknowledged industry heavies).

Happily, rates are usually negotiable.

My "outside" rate—as a well-known, but hardly heavyweight, gun-for-hire—is typically $25 per hour, but I've done favors for friends and bands I've liked for as low as $5 per hour. On the other extreme, remix engineers with successful track records don't bargain very much. Some charge (and get) $1,000 for a single mix.

THE AUDITION

An empathetic working relationship is essential to musician/engineer collaborations, as the engineer must translate your ideas into sound. To ensure harmony throughout a project—and a final master that meets, or hopefully exceeds, your expectations—a face-to-face meeting is critical.

Play some examples of your work, detail your influences, and discuss how you envision the project's sound. Bring examples of CDs that you like. If the engineer turns white, giggles, or sneers as you play your favorite recording, he or she probably isn't right for your project. If you plan to hire the engineer to work in your home studio, make sure that you trust them. Don't be afraid to ask for project credits, and be sure to contact everyone the engineer cites as a reference.

It's extremely helpful to provide an independent engineer with a complete list of your equipment. During the session, they may be able to optimize your setup with a personal processing rack or better mics. Be sure to ask if they charge extra for providing their own equipment. In addition, apprise the engineer of any outside noise problems (crying babies in the next apartment, etc.), time limitations, and equipment quirks (the mute on channel seven is intermitant, and so on). Providing such information is more than just common courtesy, it ensures the engineer can do the best job possible.

Independent engineers such as Bob Hodas (above) often work on everything from major projects to demos. For example, Hodas recently remixed the *Aladdin* soundtrack for Walt Disney's World on Ice *and* tracked several home studio projects.

BAD SEEDS

If you're past the age of five, you've probably figured out that life is seldom fair. This discovery triggers countless moral dilemmas throughout one's life, but the one we're concerned with here is why bad engineers get gigs. Unfortunately, I don't know why.

Too often, I'm hired to repair tracks butchered by supposedly competent engineers. In fact, my recording studio has made a profitable sideline out of remixing poorly recorded master tapes. I've experienced savagely distorted signals, vocal tracks with consonants (or entire words) missing, and tracks so noisy (hiss, ground loop hums, etc.) that I couldn't figure out what instrument was on the track. Once, I even got a tape in which the drums were submixed onto the lead vocal track!

Some of my favorite—albeit depressing—war stories involve a local engineer who was notorious for falling asleep during sessions. On one occasion, a friend finished an impassioned vocal performance and heard snoring in his headphones. Puzzled, he walked out of the vocal booth to find the engineer face down on the mixing board. Unfortunately, sleeping beauty had landed on the talkback mic and slate buttons. As a result, the snoring was recorded to tape along with the vocal. Scratch one brilliant vocal track. The really depressing punch line is that this individual was able to run a successful studio for years.

But who keeps these bad seeds working? We do! If you have a terrible experience with an engineer be sure to spread the word. Do not recommend engineers who do bad work, have bad habits, or are otherwise unprofessional. Don't be sheepish! If you feel your tracks have been poorly recorded, get a second opinion from a reputable recording studio. Some studio managers will put up your tape and check it out at no charge, as long as it's during studio downtime or a session break. Professionals hate to have shoddy engineers waltzing around, taking hard-earned money, and churning out crap. Bad seeds soil the reputations of every hard-working engineer and recording studio.

Unfortunately, it's practically impossible to get your money back from an unprofessional independent engineer. Because they're freelance, they answer to nobody. (Recording studios, like most reputable businesses, usually make good on their mistakes.) A butchered master tape is often one of those painful "live and learn" experiences. The only solution is to find a *reputable* engineer and retrack or remix the project as needed.

END OF SESSION

Making music is extremely personal, and home recordists—by virtue of their comfortable isolation—are perhaps the most guarded at inviting outsiders into their creative spaces. But if the goal of all your creative efforts is producing a brilliant master tape, judicious use of outside professionals makes perfect sense. If your music is important to you, you owe it to yourself to make the best tape possible. Don't let fear or egotism brand your beautiful song with a distorted vocal track or muddy mix. ●

Every once in awhile, an engineer's obsessive commitment to sonic excellence pays off. In the above photo, engineer David Reitzas (left, with producer David Foster) shows off the 3M Visionary award he won for his work on the multiplatinum *Bodyguard* soundtrack.

Using Windows MIDI Software

By Warren Sirota

The wild world of MIDI as viewed through Windows.

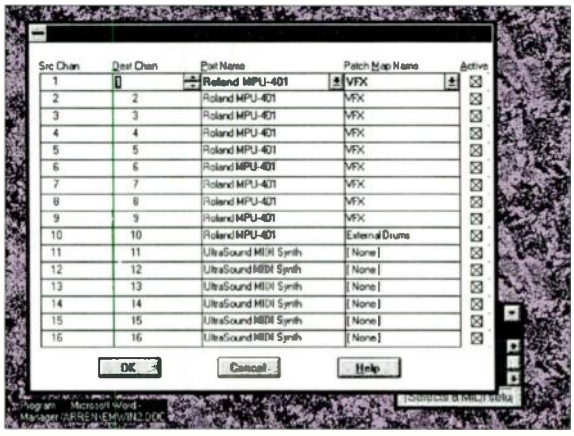


FIG. 1: The *Windows* MIDI Mapper.

Windows 3.1 has become an important environment for musicians. The computers on which it runs are inexpensive, and the quality of the MIDI software created for it is quite high. Yet, configuring MIDI applications to run correctly with *Windows* requires at least a basic familiarity with mysterious and intimidating concepts such as Control Panel drivers, interrupts, hardware addresses, running DOS applications in a window, 80386 Enhanced Mode, and perhaps even the poorly documented and cantankerous MIDI Mapper.

Why is configuring *Windows* so complicated? Most PCs are based on the ancient ISA bus that was first seen on the 80286-based PC/AT. This bus lets the computer control peripherals but provides little information to the computer about what cards are plugged in or their status. The CPU is flying blind, or at least in a deep haze, and it's up to you to navigate.

DRIVING MISS INTERFACE

It's tempting to call *Windows* 3.1 an operating system, but it's not. It's a phenomenally complicated application that runs under DOS, pretending it's an operating system. Other programs run under its control, sending Application Program Interface (API) calls to *Windows*, which reinterprets them and either passes them to DOS, or executes them directly.

One of the purposes of *Windows* is hardware independence. Under DOS, each program requires a separate software driver for each peripheral that might be used with the software, which is particularly problematic with printers. The situation is greatly simplified under *Windows*, which requires only one driver for each device, regardless of the program. This has led to a greater variety of MIDI interfaces that needn't be compatible with the venerable Roland MPU-401. Each interface needs only one software driver to work with any *Windows* MIDI application.

The Setup program for a new sound card or MIDI interface typically installs the appropriate drivers on your hard disk automatically. In some cases, the manual includes instructions for installing drivers. These drivers are configured in the Control Panel. *Windows* 3.1 comes with a number of drivers preinstalled, including one for the Roland MPU-401 and compatibles.

INTERRUPTS AND ADDRESSES

The CPU communicates with installed cards via interrupts (also known as IRQs for Interrupt Requests) and bus address mapping. (The bus is the physical communications path between the CPU and the cards; the card slots are hard-wired to the bus.) The CPU is too busy to spend all its time asking the ports if they have anything new to say (a process called *polling*). Instead, each card uses a preset interrupt and bus address, which can be changed only by moving jumpers, or setting a DIP switch on the card, if it can be changed at all.

When a MIDI message comes in, the hardware on the card changes certain voltages on the bus, which taps the CPU on the shoulder and says, "Hey, I'm the board with IRQ 7, and I have something for you." The CPU looks at the interrupt table and gets the address of the interrupt driver to run. The driver uses the bus address to get the data from the card and passes it on to the *Windows* multimedia subsystem, which hands it off to the application program that is using the driver, if there is one. Outgoing communications follow the

same process in reverse.

Armed with this information, it's time to take a tour through the Control Panel drivers. Double-click on the Control Panel icon in the Program Manager main window, then double-click on the Drivers icon. A list of drivers for MIDI, sound, and other devices appears. As you highlight each driver name, the Setup button is either enabled or dimmed, depending on whether user-adjustable parameters are available.

Go through all your drivers, checking on the Setup parameters whenever they're available. As you do this, it will probably save you some future headaches if you make note of the bus addresses and interrupts that you encounter, either on a sheet of paper, or in a spreadsheet or word processor in another window. That way, when you install additional devices in the future, you'll know which choices are available. (Drivers cannot share bus addresses or interrupts.)

As you go through the Control Panel drivers, it looks as if you can change the interrupts and addresses used by the hardware. However, you're really configuring the driver software. You must set the appropriate parameters with DIP switches or jumpers on the cards to ensure proper operation with software sequencers and other programs.

You might wonder why the manufacturers don't hard-code the interrupt and bus address of the hardware into the driver. There are several reasons. First of all, parallel- and serial-port MIDI interfaces attach to cards that are already in your system. The interrupts and addresses are determined by the card in this case, not the interface. Secondly, as mentioned earlier, many cards have jumpers or DIP switches that let you alter these settings. This is necessary if you have several devices sharing the same address or interrupt, which always results in a system crash.

If you ever alter the settings in a driver, you must restart *Windows*. The drivers load themselves into memory and put their addresses into the interrupt table during *Windows* startup. This explains why you normally can't run a DOS MIDI application in a window; the *Windows* drivers have grabbed those interrupts and won't let go. (You *can* run MIDI programs in a DOS window if you have a VXD MIDI driver for the relevant devices. Microsoft ships VXD drivers for the Sound Blaster and AdLib sound cards with *Windows* 3.1.)

PERFORMANCE PENALTY

Most people run *Windows* in '386 Enhanced Mode, whether they're using an 80386 or a faster machine. The main advantages of this mode are virtual memory and the ability to multitask DOS applications in a window alongside *Windows* applications. Virtual memory gives your computer the ability to use spare hard-disk space as a temporary extension of RAM, letting you run more programs simultaneously.

Unfortunately, hard disks are a lot slower than RAM, and extensive use of virtual memory can slow down your computer so much that it interferes with a MIDI datastream. This is especially important for serial-port MIDI interfaces, because they send out each bit individually. Parallel-port and other interfaces send out a byte or more at a

time, so they require only about twelve percent of the interrupt processing overhead required by a serial-port interface. As a result, they usually work fine in Enhanced Mode.

If you have any timing glitches during recording or playback (especially with a serial-port interface), close all windows except the sequencer and the Program Manager. If that doesn't solve the problem, restart *Windows* using the "WIN/S" command. This starts *Windows* in Standard Mode. You won't lose anything except the ability to run as many programs at once, and you'll gain significant communications speed.

MIXING AND MAPPING

You can have multiple interface drivers installed at once, as long as they don't conflict with each other. Most applications have a MIDI Setup menu choice or, even better, pop-up menus for individual tracks or instruments that let you choose which driver they use. This lets you use several drivers simultaneously. For instance, if you have a Sound Blaster board with MIDI and an MPU-401, you can send out sixteen channels of MIDI data from each interface, for a total of 32 channels in a single song. If you have a multiport device, such as the Key Electronics MP-128, you can send sixteen independent channels through each of eight separate drivers, one for each output port.

Some drivers can only be used by one application at a time, which is an inconvenience when you are trying to use a patch editor in one window and a sequencer in another. You must disconnect the MIDI output of one application in order to use the other. If you have this problem and use an MPU-401 or compatible interface, you can fix it with the inexpensive *Multi MPU* driver from PG Music. Plans for the next release of this driver, due in January 1994, include a Multi Echo feature that routes the output of one program to the input of another. This is useful for recording SysEx datastreams from patch editors into a sequencer, or synchronizing sequencers with drum-pattern generators or other programs.

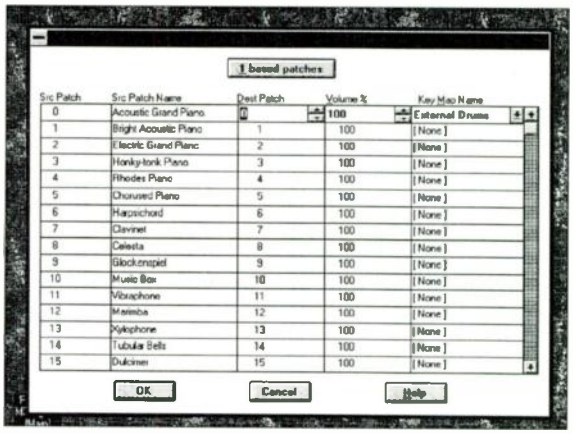


FIG. 2: The External Drums patch map invokes the External Drums key map, which maps GM drums to the set the author generally uses on his GR-50 guitar synth.

Another alternative for choosing drivers is the MIDI Mapper. This driver is supplied by Microsoft as part of *Windows*, and it has its own Control Panel icon. The MIDI Mapper is useful for creating drum and patch maps that emulate General MIDI on non-GM synthesizers. It sits between your application and the interface driver, translating Program Change and Note On/Off messages on the drum channel to numbers that work with your synthesizer. For instance, a Program Change 1 to call up a GM Acoustic Piano sound might be changed to a Program Change 27 to call up a piano on your non-GM synth. You must create the map, of course, and the task is not made any easier by the nonstandard behavior of the MIDI Mapper and poor documentation.

My main MIDI Mapper Setup is depicted in **Fig. 1**. The first nine channels go through the VFX patch map and then out the MPU-401, while the upper channels trigger the General MIDI sounds in a sound card. Channel 10 goes through the External Drums patch map and out the MPU-401. The VFX patch map includes a bunch of patch-number substitutions for much of the GM set. Creating the map is slow and cumbersome, so I started by mapping all the sounds to a whistle sound. Whenever some GM sequence triggers a whistle, I know it's trying to call up a patch I haven't mapped yet, and I have work to do.

The External Drums patch map doesn't perform patch remapping (see

Fig. 2). In fact, only the first line of the patch map is significant. It invokes the External Drums key map, which maps GM drums to the set I generally use on my GR-50 synth.

There are two keys to using the MIDI Mapper successfully. First, you must realize that it's lying when it says it's saving data. If you make changes to a patch map or key map, you are asked if you want to save them. Of course, the answer is "Yes" if you want to save them, but be cautious. Responding affirmatively only sets a flag in the Mapper to save your work when you exit the program. If you happen to quit from the Program Manager and end your *Windows* session without explicitly closing the MIDI Mapper, you'll lose your changes without even knowing it. I close the Mapper and the Control Panel after every significant block of work and then reopen them.

The second key to using the MIDI Mapper is understanding how the maps are activated. In the absence of any clear directions, you might think that simply selecting a patch map will activate it. However, the Setup that is selected when you leave the MIDI Manager is the master control here. Whatever patch maps called by the Setup become active, as do whatever key maps called by the active patch maps. Remember this, and you'll be able to use the MIDI Mapper to great advantage.

TECH SUPPORT

Don't hesitate to contact the technical support people at the manufacturer if you have trouble setting up an interface. You paid for it, and you're entitled to a few minutes of phone support, especially if it saves you hours of frustration. Before you call, write a concise statement of the problem and the exact text of any error messages you encounter.

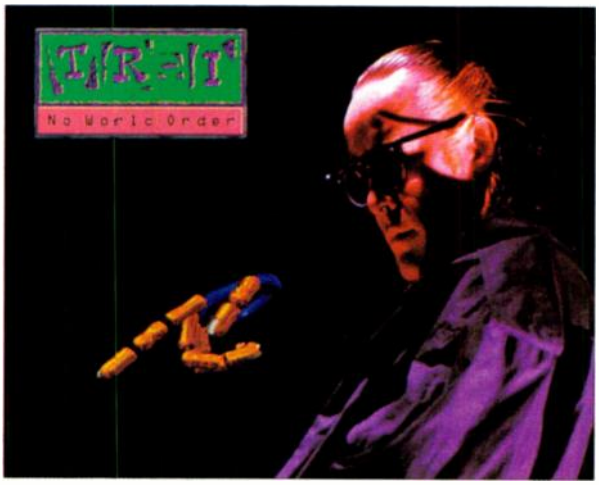
To get the most out of tech support, adopt a humble and attentive attitude. Don't take your frustrations out on the staff, and don't try to prove how much you know. Most phone support people really do know what they're doing, and they are genuinely concerned with satisfying the customer. Let them do their job, and they'll make yours easier.

Guitarist and composer **Warren Sirota** *writes the "Audio" column for* Multimedia World *and is currently creating new categories of software for musicians in the* Windows *environment.*

The Interactive Todd Rundgren

By Camran Afsari with Michael Molenda

TR-i goes CD-i with No World Order.



In almost every phase of his long career as an artist and producer, Todd Rundgren has expressed his pop sensibilities with a special accent on technology. Today, Rundgren's interest in cutting-edge media has prompted him and partner David Levine to conceptualize, design, and release an interactive version of his *No World Order* album for the Philips CD-i platform. Rundgren's enthusiasm for the emerging medium is so complete that he has adopted the name TR-i to signify his reincarnation as an interactive artist.

"This is the future," says Rundgren. "Ultimately, the only way people will get music is through software duplication. Instead of buying an artist's CD at a record store, consumers will download a record through an interactive television. I could update a version of a previous release, and three hours later, someone could download it and listen to it."

MEDIA AND MESSAGE

No World Order is available as a standard audio CD (on Forward Records) and as a CD-i from Philips Interactive Media of America. Going interactive requires a special CD-i player that also plays standard audio CDs and Kodak Photo CDs. The Philips CD-i player ($499; a Magnavox version is $399) plugs into your television and includes a joystick for selecting menus and playback functions.

There's a joke about it taking twenty musicians to screw in a light bulb: One musician does the deed, and the remaining nineteen claim they could do it better. With a CD-i player, musicians and similarly opinionated types finally have the opportunity to back up their boasting. For example, the *No World Order* CD-i ($24.98) allows almost total control over the listening environment. Although you can't rewrite Rundgren's tunes, you can manipulate how the elements of his music are constructed and played.

The user can determine a certain mood and maintain it throughout a listening cycle. You can make a song faster or slower, or even change the density of the mix. All of these options can be preprogrammed, or made on the fly while the music is playing.

To offer this level of control, more than 1,000 4- to 8-second musical events, or *scripts*, are stored in the CD-i database. The user can arrange these scripts to perform conventional songs, instrumental pieces that resemble dance tracks, or sound collages that would delight a post-production engineer. In addition, Rundgren invited heavyweight producers Don Was, Bob Clearmountain, Hal Wilner, and Jerry Harrison to do guest mixes of his scripts. The user can select the efforts of one of these producers instead of Rundgren's mixes.

CONTROL FREAKING

The main editing screen of the *No World Order* CD-i is arranged into Flavors and Spices. Flavors are the basic playback attributes that can be controlled by the listener, such as Mood, Tempo, and Mix, while Spices are the choices available for each Flavor. A user-selectable Slack parameter interprets how precisely the CD-i program interprets Spice selections. For example, selecting "tight" Slack means the CD-i will only play the choice in the center of the Spice list. Conversely, "loose" Slack empowers the system to choose any Spice on the list. To clarify these choices, let's briefly review some playback options for *No World Order*.

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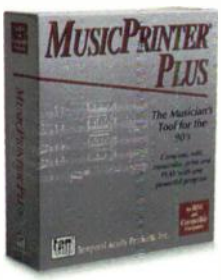

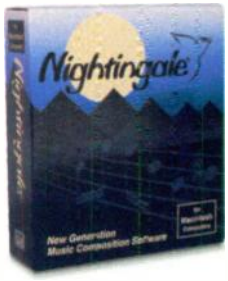

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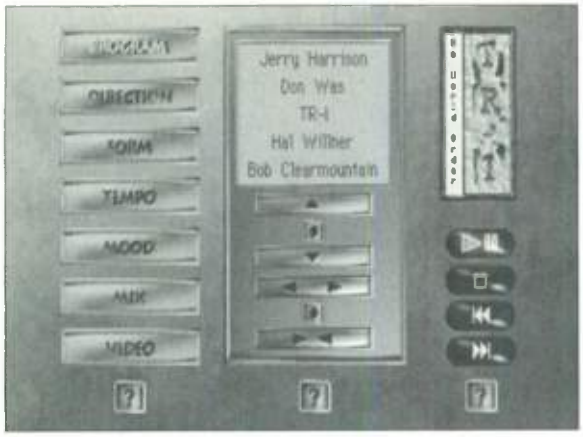


The main editing screen of *No World Order* offers several options for customizing your listening experience.

Direction. Once you select a playback program, you can choose to travel backward or forward through the musical event. You can also run through the program at speeds so fast that the selections appear to degenerate into randomness.

Form. Creative, Standard, and Conservative are the three Spices available when selecting the form of your listening experience. If you choose Conservative, the system maintains thematic continuity: It won't play a fast song immediately after a slow or sad song and vice-versa. If Creative is selected, the CD-i varies the theme in terms of fast songs, slow songs, happy songs, sad songs, and so on. If no Spices are chosen, Standard mode is enacted and the CD-i plays the same unaltered sequence as the non-interactive CD.

Tempo. The playback tempo of selected scripts can be adjusted between 86 and 132 beats-per-minute.

Mood. How are you feeling today? You can match a listening experience to your temperament by instructing the CD-i to play scripts that convey dark, light, mellow, or other moods.

Mix. The user can play remix engineer by selecting varying degrees of sonic density. Sparse or thick mixes can be selected, as well as karaoke versions that filter out the vocals.

Video. To keep the system memory dedicated to finding and playing the selected scripts without frustrating pauses, memory-eating video options are limited. However, the user can choose one of two video "feedback" screens for viewing.

Help. Assistance through the plethora of choices is provided in a unique and futuristic fashion. When Help is initiated, instead of dull online text, a sultry female voice explains the current selection.

INTERACTIVE DESIGN

Many of the songs on *No World Order* feature Rundgren's own strain of rap, structured using hip-hop's typical declarative style. After recording the music on analog multitrack, Digidesign's Sound Tools was used to cut each verse and chorus into individual musical events.

"The most difficult stage of the project was programming the CD-i player to read audio from the hard disk so that it plays the various musical events seemlessly," says Rundgren.

All the 4- and 8-bar musical events on the CD-i are tagged with their respective interactive "identities," such as tempo, key, and mood. The finite amount of RAM in the CD-i player (1 MB) is the primary reason the program is not more graphically oriented. Much of this precious RAM was allocated to a buffer that stores the tail-end of the current musical event, so the audio keeps playing, even as the read-head zooms off to find the next musical selection. The split-second audio interruptions that plague some systems are nonexistent on *No World Order;* the segues are smooth with no pops or clicks.

SELECT: END

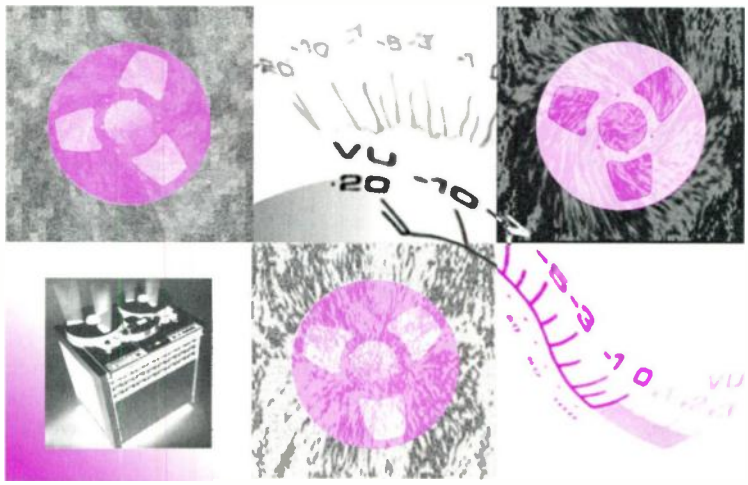
Rundgren's CD-i endeavor embodies his philosphy of music. He doesn't want his music to be the usual linear experience of write, record, and distribute. He comments hopefully on the future of CD-i, "I imagine the day when artists have total control over the way their work is distributed." Given the technology currently at our disposal, Rundgren's musical utopia looks more like a reality than a dream.

Camran Afsari *is a San Francisco-based independent engineer and music journalist.*

High-Output Tape and dbx

By Michael Gore

Using hotter tapes is no advantage if your dbx system reads the wrong levels.



By now, everyone should know about the new generation of high-output recording tapes developed by Ampex and 3M. The improved tape formulations of Ampex 499 and 3M 996 produce less noise and deliver a higher maximum output before hitting severe distortion. Recordings made with these tapes can approach pristine digital noise specs while retaining the "fatness" of analog.

However, optimizing the benefits of 499 and 996 requires that you adjust the operating level of your tape deck. But don't call your service tech yet. If you use dbx noise reduction, messing with operating levels can produce migraines instead of music.

OPERATING LEVEL

A tape recorder's operating level is the level of magnetization *on tape* that is set to read as 0 VU on the deck's meters. Professional multitrack recorders have internal playback and record level controls that can adjust the deck's operating level up or down as needed. In the early days of tape recording, a standard operating level known as "0 level" was established. Techs recognize this standard as 185 nWb/m, which means that one meter of tape at 0 VU holds 185 nanoWebbers of magnetic strength (a very tiny amount of magnetism).

Inevitably, tape manufacturers improved their products until the 0-level standard no longer exploited the noise performance and higher signal levels that could be recorded onto the newer tape formulations. Someone soon discovered that raising the operating level of the *recorder* allowed more magnetic strength onto the tape at the 0 VU mark. To take advantage of this, a new standard operating level of +3 dB (250 nWb/m) was gradually adopted (see **Fig. 1**). At a +3 level, you can still record your tracks exactly as before, but because the machine is now set up so that 0 VU equals a +3 level on tape, a hotter signal is automatically recorded. The result is an improved signal-to-noise ratio and cleaner, better-sounding recordings.

Note that the output of the recorder is always the same at 0 VU: -10 dBV for semi-pro decks and +4 dBm for pro machines. When a deck's operating level is increased, the playback level is decreased by the same amount, so that recording and playback levels match. In short, the recorder operates exactly as it did before.

The superb performance of Ampex 499 and 3M 996 allows recordists to increase a deck's operating level all the way up to +9 dB (520 nWb/m). Want to talk about pristine analog masters? The noise floor is practically blasted off the tape at this signal level! However, if you realign your deck to +9 dB, any tapes recorded at the +3 dB operating level will now play back 6 dB lower. The diminished signal strength is not necessarily a problem—the output level from the recorder is just lower—*unless* you use dbx.

THE DBX DILEMMA

First, a little background. An analog tape recorder usually has a 70 dB dynamic range between unacceptable (tape) noise and severe distortion. Compare this spec with a DAT recorder, which typically delivers a dynamic range of 96 dB, and it's obvious

DMITRY PANICH

that analog tape is much noisier than digital systems. The "hiss factor" of analog tape is why many recording engineers use noise reduction such as dbx, Dolby S (for the semi-pro), and Dolby SR (for the pro).

A dbx system compresses signals as they're recorded to tape and decompresses them during playback (see **Fig. 2**), allowing more than a 120 dB dynamic range from your analog tape recorder. This figure beats many digital noise specs, while giving the user all the wonderful warmth and fatness of analog tape.

The reference level for dbx is 0 VU. Any signals recorded at 0 VU are not processed by the noise-reduction system. However, signals above 0 VU are compressed by 2:1, and signals below 0 VU are expanded by 1:2. For example, if you send a tone that is +2 dB above the 0 VU level into your dbx system, the signal it sends to the tape is only +1 dB VU. The exact reverse occurs during playback. When you play this signal from tape, the dbx unit doubles the signal level back to the original +2 dB level. The result? A normal-sounding signal with extremely low noise.

All of this is well and good *until* you change your recorder's operating level to take advantage of the extra headroom of high-output tapes. With a dbx system, any change in output level changes the way dbx behaves. For example, a tape recorded on a deck with a +3 dB operating level plays back 6 dB *lower* on a recorder set up for +9 dB. In this situation, the dbx unit says, "Hey, I must have worked on that signal when I recorded it [as it is no longer playing back at 0 VU], so I should restore it by expanding it downward."

Therefore, a signal that read 0 VU at +3 dB is reduced to *-12 dB* after being processed through dbx on a +9 dB system. Big problem! Nothing on the +3 dB tape sounds like it should.

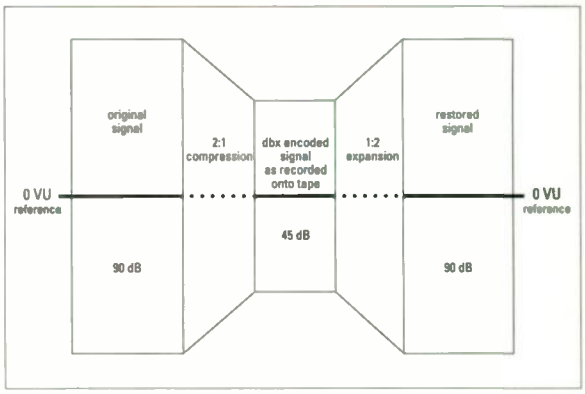


FIG. 2: A dbx noise-reduction system compresses the input signal at a 2:1 ratio, and outputs the signal at an expansion ratio of 1:2. The system's reference level is 0 VU, so only signals above or below that threshold are processed. When you change your recorder's operating level, you change the 0 VU relationship, which can cause the dbx unit to "misread" recorded signals.

RATIONAL REALIGNMENT

It's important to stress that nothing is wrong with the dbx unit: You've changed the levels at which your recorder plays your old tapes. So, if you use dbx, you'll need to adjust the recorder or the dbx system every time you play a tape with a different operating level. Unfortunately, changing operating levels back and forth is seldom fun and often creates more problems than it solves.

Because of this, I often try to talk dbx users out of changing their operating levels (unless they're certain they will *never* remix or overdub old projects). With the improved formulations of 996 and 499, you get reduced tape noise and the ability to slam your meters, even at the standard +3 dB level. It's not necessary to change your operating level to make better sounding recordings with high-output tapes (although you should adjust your deck's bias and EQ settings to match whichever tape you use).

If you insist on changing operating levels and still need to play old tapes, have a qualified technician align your machine for the high-output tape and operating the level you choose. Then, ask the tech to make you a setup tape with 1 kHz tones at your old 0 VU level and your new 0 VU level. Next, politely ask for a tape level-alignment lesson.

It's not difficult to align your own recorder, but you must follow very specific instructions. Once you have copies of your old and new operating tones, changing back and forth is a relatively easy procedure.

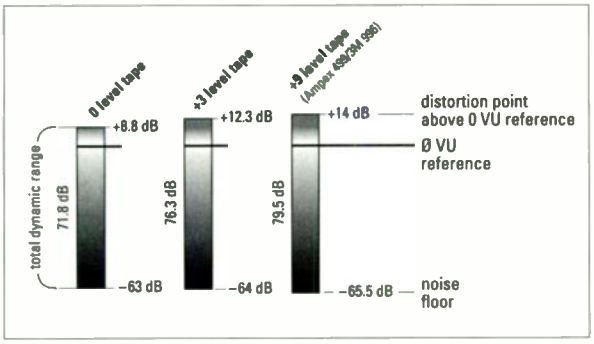


FIG. 1: Changing your recorder's operating level helps exploit the benefits of high-output tapes such as Ampex 499 and 3M 996. Using the old 0-level tapes, your signal-to-noise ratio is 71.8 dB. Then, a +3 level (and using better tape) improves the signal-to-noise ratio to 76.3 dB. Finally, a +9 dB level with 499 or 996 posts a signal-to-noise ratio of 79.5 dB.

LEVELED OUT

There's a well-known story about a famous band recording at a major studio where, after weeks of work, an overenthusiastic maintenance technician realigned the recorders and noise-reduction systems. The project never sounded the same again, and the studio had to cough up a ton of free recording time to compensate for their tech's gaffe.

So what's the moral of this tale? *Never* change the alignment of your deck when you're in the middle of an important project.

If the tracks sound good, and nothing is noticeably wrong, wait until you've finished the project and your clients are toasting your wonderful ears and mixing talent. But once everything is done, properly setting up your machine for the new tapes is the smartest thing you can do. I can't imagine not opting to reduce tape noise.

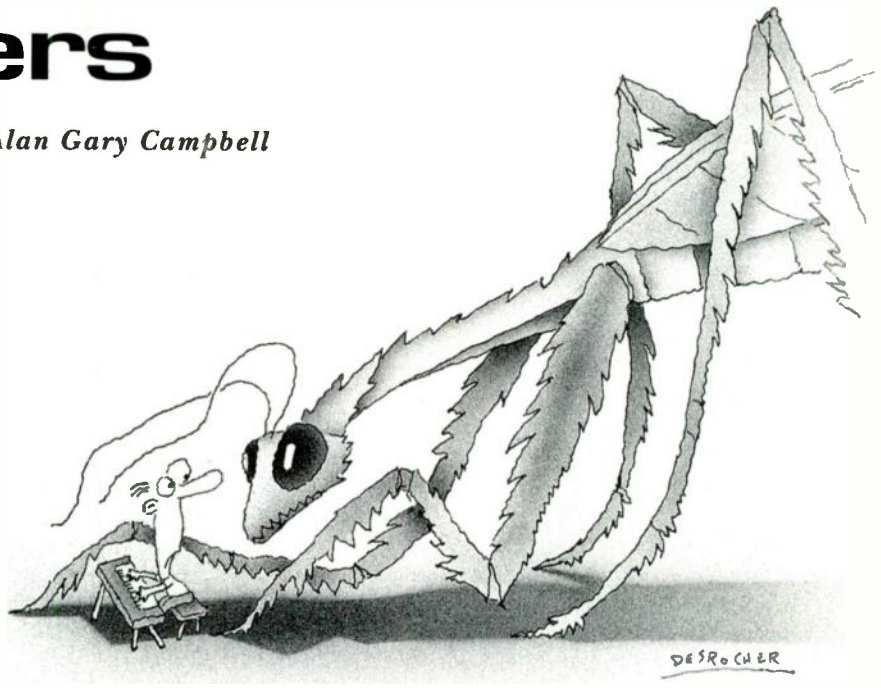
And by the way, don't think that anyone buys CDs just because the recordings are quiet. They buy them because the music is good! People will be recording hit records on analog tape recorders well into the 21st century, and I'm sure I'll still be repairing them.

Michael Gore *is owner and chief technician of Bay Area Studio Engineering in San Francisco.*

Questions & Answers

By Alan Gary Campbell

The parts-house poet expounds on "de-bugging" synths and dissects derelict dinosaurs.



Q. Parts are getting scarce for some older gear, such as my Prophet-5 and Minimoog. Is it practical to buy a non-working instrument—a derelict—to raid for parts?

A. Some parts for vintage synths are becoming rare and sought-after, and obtaining a nonworking unit can provide viable replacements. Nonetheless, evaluation by an experienced technician is called for. If, for example, the instrument has suffered power-supply damage or liquid contamination, or has undergone extensive repair or modification (all are common), its value as a parts source is questionable. Even clean-cased instruments are not necessarily pristine on the inside. Conversely, rough cosmetics are not always indicative of deteriorated electronics.

Further, components that are not socketed, but soldered, must be removed carefully to avoid damage. This is not a job for the inexperienced; even in the service environment, proper desoldering equipment and skills are by no means commonplace. Moreover, mechanical components on synths in average or lesser condition are often not salvageable.

Therefore, approach nonworking gear with caution. Fortunately, many of the electronics parts in the Prophet-5 and Minimoog are standard components that are still available, and both instruments are robust. Note that common problems with these instruments have been addressed in "Service Clinic" at various times; refer to the topical indexes in the January 1989, 1991, and 1993 issues.

Q. When the mod wheel on my Minimoog is all the way back, some modulation still bleeds through. I've tried reorienting the pot, to no avail. Is there an adjustment or fix for this?

A. The Minimoog mod wheel works as a variable bleeder resistor that shunts the modulation signal to ground, thus controlling the level, an odd design. As the mod-wheel pot becomes worn, it can develop excess end resistance that creates an undesirable voltage drop and residual modulation signal, even with the pot all the way back. This is a common problem and is often the first thing a player will notice when evaluating a used Mini. A special replacement pot (also used in the Micromoog and Multimoog) was once available; it incorporated a silvered "hop off" at the end of the pot element to ensure near-zero end resistance over an extended service life. To my knowledge, there is no present source for these pots and no internal adjustment to compensate for the effect.

Fortunately, considerable improvement is often obtained by replacing the worn pot with a standard, good-quality (Allen Bradley or similar), heavy-duty, 50 kΩ, 2W, audio-taper pot. Next, rewire the control circuit as a voltage divider. The existing leads connect, as before, to the pot's wiper and counterclockwise end-terminal. A jumper should be added from the (previously unused) clockwise end-terminal to pin 2 of the 12-pin Cinch-Jones connector in the left-hand controller section, and the existing jumper between pins 1 and 2 of the connector should be cut.

As an emergency measure, this modification may afford some improvement, even with the old pot. Do not substitute a lightweight, open-frame, Radio-Shack type pot, except as a stopgap.

Q. Why are the heat sinks on amps and synths black? They often get really hot.

JACK DESROCHER

Wouldn't it be better if they were chrome, or some other color that reflected more heat? Would it help to spray them with a heat-reflective coating of some kind?

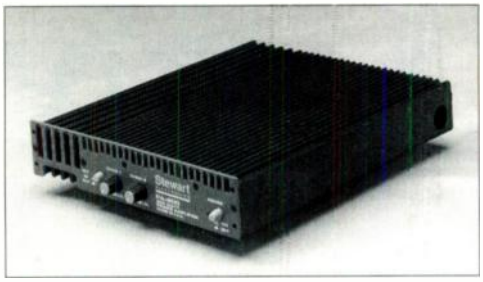


FIG. 1: This small, but powerful, power amp looks like one big heat sink. Heat sinks are the first line of defense against thermal damage, drawing heat away from electronic components and radiating it into the air.

A. A lighter color would reflect more heat energy, but a heat sink (see **Fig. 1**) must radiate, not reflect, the greatest possible amount of heat. A black surface approximates a maximum-efficiency radiator/absorber. This relates to the "blackbody," a theoretical, perfect radiator/absorber encountered in physics and thermodynamics. With equipment operating under normal conditions, the heat-sink temperature is always significantly higher than the ambient temperature; therefore, energy is radiated, not absorbed.

Spraying anything on a heat sink is likely to reduce its radiative efficiency by forming a nontransmissive barrier. (Heat sinks, by the way, are made black via an anodizing process; they are not painted.) When heat sinks are viewed as energy radiators, it's easy to see why they should be kept clean and not operated at high ambient temperatures or near heating vents, lights, direct sunlight, or other heat sources.

Q. One key on my Korg 01/W became intermittent, and when I removed the bottom panel, I discovered the remains of a dead bug clogging the key contact. I cleaned it with non-residue cleaner, but should I use some sort of lubricant, as well? Should the contacts be cleaned and lubricated periodically? Is there any way to keep bugs out? Also, the rear screws that hold the bottom panel seem almost stripped, even though I was careful when I removed them. Should they be replaced?

A. The now-familiar metal-leaf switches used in the Yamaha DX7, DX7II, and KX76/88 and the Korg SDP-1 and M-, T-, and O-series instruments are among the most reliable types available. They incorporate rugged, long-lived, self-wiping contacts that generally require no lubrication or other maintenance. Periodic lubrication might increase the contact life slightly, but under normal-use conditions it is unnecessary. This should be considered, however, for instruments used in coastal areas or other harsh climates. A simple, low-abrasive electronic contact cleaner/lubricant is sufficient. Note, though, that disassembly of the instrument may void the warranty.

It is impossible to keep insects out of keyboards entirely, because there is no practical way to block the numerous entry points at the keyboard action, performance controls, etc. (Some of these gaps are needed for ventilation, as well, to aid in cooling the instrument.) Fortunately, squashed bugs in key contacts are not all that common.

The rear bottom-panel screws on some 01/Ws are prone to stripping, even with careful removal. If they are badly stripped, they should be replaced. Locally obtained tapping screws of equivalent size can be used; the existing screws have captive lockwashers, but separate lockwashers are equally effective. But in terms of warranty coverage, this is a nebulous area. Opening the unit at all could be a problem, not to mention replacing the screws with nonfactory parts. It pays to have a good relationship with your local service center.

CALLING ALL PARTS

I have received numerous inquiries lately regarding sources for vintage-synth parts. The most frequently requested components are the Tel Labs Q81 tempco resistors; the Curtis Electromusic Specialties 3300-series ICs (especially the 3340 VCO and 3360 dual VCA ICs); Clairex CLM-series photocouplers; and the Reticon SAD 1024 delay lines.

Readers are requested to forward any information regarding sources for these and other vintage parts to "Service Clinic," c/o **EM**, 6400 Hollis St. #12, Emeryville, CA 94608.

EM *contributing editor* **Alan Gary Campbell** *is owner of Musitech.*

Reviews

Emagic Notator Logic Audio 1.7 (Mac)

By Peter Freeman

Digital audio, sequencing, and notation join in a stunning tour-de-force.

As musicians build upon those who came before them, so music-software developers create and enhance their products in an attempt to go beyond their predecessors. Opcode forged ahead by integrating MIDI sequencing and digital-audio recording in *Studio Vision*. Later, sequencer veterans Mark of the Unicorn and Steinberg jumped in with *Digital Performer* and *Cubase Audio*, respectively.

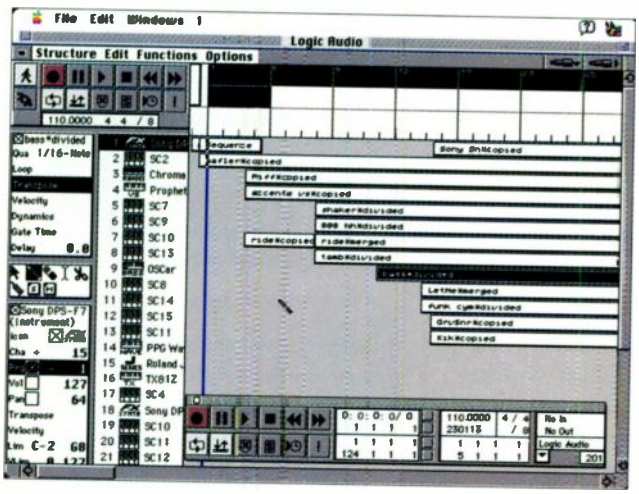


FIG. 1: In *Notator Logic Audio*'s Arrange window, each track is assigned a user-defined Instrument, with its own icon (left of center). Each Track contains Sequences, represented as rectangular bars. Note the Parameter boxes and Toolbox at left. The Transport display (bottom) can be resized and customized.

Meanwhile, Emagic was rising from the ashes of C-Lab, a respected German developer best known for its ground-breaking, Atari-based, integrated sequencer/notation program, *Notator* (reviewed in the January 1989 **EM**). Resolving to extend its influence into new markets, Emagic released *Notator Logic* for the Macintosh early in 1993. Although vestiges of its Atari predecessor have been retained, *Notator Logic* was not a simple port of *Notator*, but a new, extremely high-level, Macintosh program.

The next step was obvious: Like *Vision*, *Performer*, and *Cubase*, *Notator Logic* 1.6 was enhanced with digital-audio recording, playback, and editing features, emerging as *Notator Logic Audio* 1.7. Emagic pushed ahead with an innovative user interface and the superior music-notation features one expects from a descendent of *Notator*.

RECOMMENDED SYSTEM

Emagic's pride and joy requires a Macintosh 68030 or better, 8 MB of RAM, System 7.0 or higher, and any Digidesign audio-recording NuBus card. Without a Digidesign card, you can still use *Logic*'s MIDI section, which can run on a Mac Plus or better with 4 MB of RAM and System 6.0.4 or later. (The program is also available for the Atari ST, TT, and Falcon030.)

Logic Audio is a memory monster because it employs Digidesign's new Digital Audio Engine (DAE) driver to address the audio card. The *MIDI Manager*-compatible program requires a minimum of 2 MB, but the DAE needs 2.5 MB, while System 7 easily uses 2 MB. I used a IIci with 20 MB of RAM, and the program worked fine.

As with all disk-based digital-audio recorders, you need a large, fast hard drive. A 600 MB or larger drive with an 18 ms access time is recommended. For four tracks on a single drive, an access time of 8 to 10 ms is recommended. The program is happiest on a 16-inch to 21-inch monitor, where its linear design and window-handling capabilities shine.

Logic Audio supports Digidesign's entire range of audio hardware, from the original Sound Accelerator to Session 8, Audiomedia 1 and 2, Sound Tools II, and Pro Tools (up to sixteen channels). With the Sound Accelerator, Audiomedia 1 and 2, and Sound Tools II cards, four simultaneous playback tracks are available. The tracks are internally mixed to two outputs on Sound Accelerator and Audiomedia 1 and 2.

The program is copy-protected using two ADB hardware keys. One key enables the main program, and the other activates the audio portion. I only experienced one problem with the keys: *Logic Audio*'s keys could not reliably co-

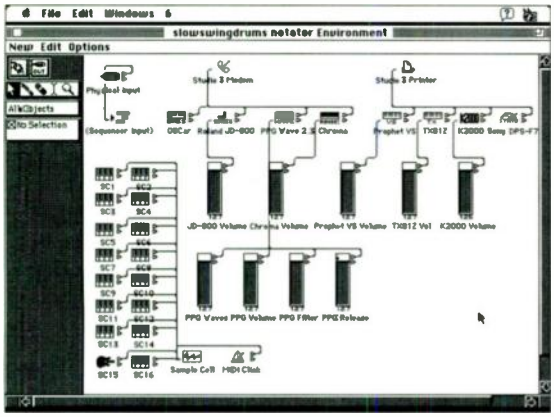


FIG. 2: The Environment window offers a graphic representation of your MIDI system and provides real-time MIDI-processing tools, such as faders, buttons, and data splitters. The flow of MIDI data from your MIDI interface is set with the Physical Input (upper left), while the Sequencer Input lets you route the outputs of the window's processors into the sequencer.

exist on the same Macintosh with the keys used by Steinberg's *Cubase Audio* and *Time Bandit.*

SEQUENCER ARCHITECTURE

Logic Audio supports an unlimited number of MIDI tracks at a timing resolution of 960 ppqn. The program primarily displays music in a linear (as opposed to pattern-oriented) fashion. However, you can achieve pattern-based recording using Folders (more in a moment). Most of the initial action takes place in the Arrange window (see **Fig. 1**), with its endless track list. Each Track is assigned an Instrument, which is a user-defined device, with its own icon, that occupies a MIDI channel and output port (if you have a multiport MIDI interface).

Within each Track are Sequences, *Logic Audio*'s musical building blocks. A Sequence appears as a rectangular beam whose displayed length corresponds to the length of the recorded passage. Any number of Sequences can be recorded on each track, manipulated with the Toolbox, copied, and moved within or between tracks. This method is an intuitive way of representing and working with musical information. Unlimited hierarchical levels can be created through the use of Folders, which let you group and manipulate any number of Sequences (including audio Sequences) as a single entity. For the most part, Folders are treated just like Sequences; any process applied to a Folder is applied to all of its contents.

The Toolbox is a small pop-up window that "floats" on top of all others. It contains a small, but effective, arsenal of tools for manipulating Sequences in the Arrange window. The Scissors cut at any point in a Sequence; the Glue tool joins Sequences; the Pencil defines Sequence length; and there are self-explanatory Eraser, Text, Solo, and Mute tools.

CUSTOMIZED INTERFACE

Logic Audio's user interface provides extremely flexible, customized access to information. Emagic opted not to cram all the menu options into the program's main menu bar. Instead, the program relies on local submenus; windows have their own menu bars containing relevant functions. This method is effective, because you are only presented with the menus you need.

The Arrange window and all editing windows include a Parameters display, a vertical box along the left edge of the active window that provides information on the selected object. For example, the Arrange window Parameters include transposition, delay, playback quantization, Program Change, and Volume messages. If the parameters are "normalized," events corresponding to the current Parameter settings are written into the selected Sequences or Folders, as opposed to being applied only during playback. This is a helpful option for experimenting with attributes of a Sequence (or an entire Folder) on the fly.

Any number of copies of every type of window can be opened simultaneously, with memory being the only restriction. The implementation of this feature is so simple and intelligent, I wonder why it's not part of System 7: The program allows up to 90 Screen Sets, which are arrangements of onscreen window positions. You can set up your favorite, most commonly used arrangements of editing windows and recall them with one or two keystrokes.

Once I learned to work with *Logic*'s windows, I was spoiled. *Notator Logic Audio* stands above its competition in this regard. You can set up many multidimensional views of any musical element, from a single event to an entire song, and switch between them quickly and easily. I've even seen this work with three monitors, which is a huge help in a program this complex.

You also can create as many resizable Transport bars as needed. In addition to including the main "tape-transport" controls (Play, Stop, Record, etc.), the Transport bar has Cycle (loop), Autodrop (auto punch-in/out), and Replace mode on/off buttons. It also shows the current tempo, time signature, and Display Format. The Transport bar can even be converted to a giant SMPTE display (very useful!) with one command.

My favorite time-saver in the program is the Key Commands window, where most of the program's commands (I counted 221) can be assigned user-defined key equivalents. The window even has zoom controls.

CYBER-ENVIRONMENTALISM

A central facet of *Logic Audio* is the Environment window, where you create a graphic representation of your MIDI

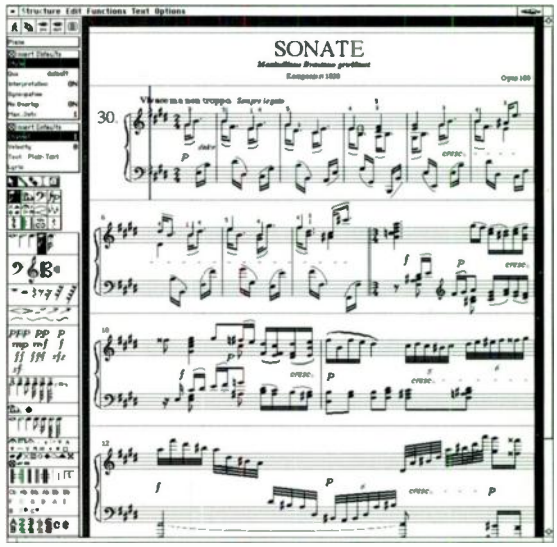


FIG. 3: The Score Editor offers the deepest notation features of any Mac sequencer, including a generous selection of notation symbols.

system using icons and virtual patch cords (see **Fig. 2**). This tells the program the names of your MIDI instruments, their interface ports and channels, and how they are connected. It's similar to Opcode's *OMS*, which is not yet supported. (Full *OMS* support should be implemented by January 1994. The program will automatically make an Environment layer directly from your current *OMS* studio setup document, if desired.) The Environment window also provides a multitude of real-time MIDI-processing tools, including faders, buttons, data filters, arpeggiators, delay lines, chord memorizers, on-screen keyboards, and data splitters.

The Environment window even lets you determine the flow of MIDI data from your MIDI interface to destinations within the program, using two objects. The Physical Input object represents your MIDI interface hardware; objects you connect to it have incoming MIDI routed directly to them. The Sequencer Input represents the recording "front end" of *Notator Logic Audio;* you can route the outputs of any or all processing objects in the program's Environment into the program's MIDI input, allowing you to record modified/processed data without having to apply the modifications afterwards. Although the basic concepts used in the Environment window are straightforward, the reality can be complex, confusing, and intimidating.

The smooth responsiveness of the real-time objects in the program's Environment is a delight. Faders, buttons, and knobs all work well as soon as they're created, regardless of whether the program is in Play or Record, with audio playback or without.

RECORDING

Logic Audio can record MIDI and digital audio in several ways, including manually (with the Record button), or with Autodrop automatic punch-in and punch-out. In the Arrange window, you can set Song Position, Cycle (loop), and Autodrop zones independently. Cycle and Autodrop can be set simply by dragging the mouse inside the desired region of bars, while the current Song Position can be changed by clicking the mouse at the desired point.

Surprisingly, if you record audio while Cycling through part of the song, only the audio between the Cycle Locators (which define the loop start and end points) is recorded. *Logic Audio* drops out of Record immediately on the second iteration of the loop. This is strange, as the program could easily have created a new Audio File for each successive iteration of the loop, allowing you to sort through multiple "takes."

THE EDITORS

Notator Logic Audio's primary power lies in its customizable editing displays. Although some of these displays are based on time-tested designs, many employ advanced concepts that make them more sophisticated than those of other programs.

The Event List displays MIDI data in list format, but its Display Format lets you represent time information in a distinctive way. For example, if you view a Sequence in the Event List, with the Display Format set to eighth notes, the start time and duration of each note is shown in bars, beats, eighth notes, and ticks. So "2 2 1 3" means second bar, second beat, first eighth note, third tick. I found this approach quite confusing at first, but I eventually I got used to it.

As with all the editors, a control area lets you filter what is shown in the list. This area also contains the Catch and Link buttons. Catch simply determines whether the editing window will "chase" the current Song Position. The Link button, however, is unique, letting you determine which level of your musical hierarchy is visible in each editor. Link mode consists of two flavors: Show Same Level and Show Contents. For example, with Show Same Level, if you select a Folder in the Arrange window and view it with an Event List editor, you'll see a list of the Sequences in the Folder, with their start times and durations. However, if you choose Show Contents, you'll see the MIDI data contained within the Sequences, which is the bottom of the hierarchy.

Selecting the same Link mode in multiple windows establishes a link between them; any changes you make in one will be reflected in all the others instantly. Link modes can get confusing—for instance, one wouldn't expect to see anything other than MIDI events in an Event List—but their potential is great.

The Matrix editor is *Logic Audio*'s graphic editor for note events. Notes are displayed, in piano-roll style, as rec-

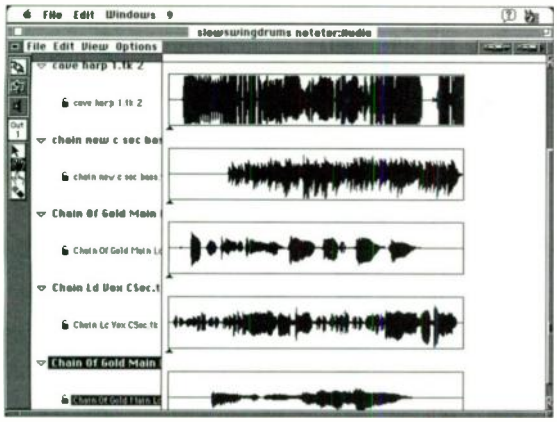


FIG. 4: The Audio window displays the Audio files used in the current song. The graphic waveforms show the portion of the file used in a Region.

tangular bars on a gray background. The Matrix editor includes a novel method of displaying Velocity, too: Each note contains a thin, horizontal line that runs from the center of its left boundary to the right. The higher the value, the further the line extends toward the right boundary, making it easy to gauge Velocity at a glance.

The Hyper Edit window displays MIDI data as vertical beams arranged along a horizontal time axis. This outstanding feature is primarily useful for displaying MIDI controller and Velocity data. Multiple types of controller, note, and Pitch Bend data, called "Hyperdefinitions," can be displayed simultaneously, one beneath the other. A collection of Hyperdefinitions is a "Hyperset." The program allows unlimited Hypersets to be created for different situations (sixteen channels of MIDI Volume, an entire kit's worth of drum notes, etc.), which can be instantly recalled from a list in the left of the Hyper Edit window. Among other things, a Hyperset can act as a drum editor, with different quantization and delay settings. The feature works flawlessly.

As in all *Logic Audio*'s editors, Hyper Edit data can be displayed in real time, on input. In the Hyper Edit window's control area, there is also a box called Auto Define. When this is checked, selecting an event in another editor automatically creates a Hyperdefinition tailored to that event's type. This feature is very cool, as it both simplifies and speeds up the process of creating Hyperdefinitions.

Nearly all of *Logic Audio*'s functions can be performed in real time, while playing or recording. I experienced no major difficulty with edits "on-the-fly," although I did come across an occasional minor anomaly now and again. A few times, after using the Glue tool to merge consecutive Sequences while playing, the newly merged Sequence stopped playing, requiring a slight "jog" of the Fast Forward or Rewind controls to reactivate it. Nothing serious, just irritating.

All the editors have important features that are essential for quickly getting around. For example, zoom is available in many areas of the program, including some you wouldn't expect. The Select Next/Previous Event commands (assignable to any Mac key) plays a selected event, with its proper duration, at

the current song tempo. If no event is selected, choosing Select Next or Select Previous selects the first or last event, respectively, in the displayed Sequence. You can also select multiple adjacent events in the editors with the user-definable Toggle Next/Previous Event keys.

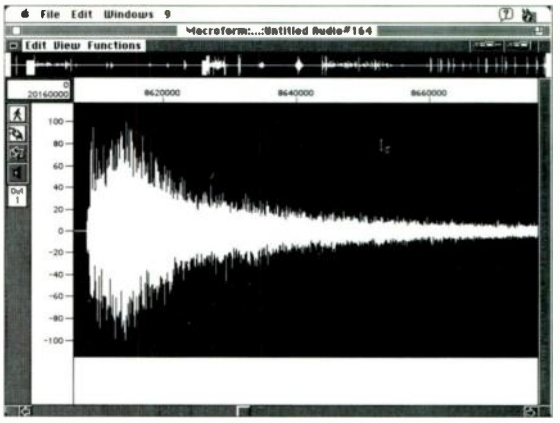


FIG. 5: In the Sample Editor window, any section of a Region can be looped independently of the song playback. The overview at the top makes it easy to navigate around the entire Audio file.

SCORE EDIT

An impressive aspect of the program, the Score Edit window (see **Fig. 3**) displays the contents of selected Sequences and Folders in standard musical notation, with unlimited staves and polyphony. It provides control over the way in which music is both interpreted and displayed by the program, with an excellent array of notation symbols for manually modifying and inserting music. *Logic*'s myriad desktop-publishing functions include a Page Editor, resizeable staves, support for Adobe's Sonata PostScript font, and PostScript file exporting.

To accommodate various types of material, the Score Editor provides a Score Style window, which is analogous to Style sheets in word processors. Among other parameters, the Styles determine how the selected Sequence is displayed, for example, as piano notation (grand staff, bass and treble clef), as a single staff with polyphonic voicing, or as a single-line percussion staff. *Logic* comes with over a dozen Styles, but you can add an unlimited number. This reflects the same Emagic philosophy exhibited elsewhere in the program: Give the user maximum control.

Although its musical-interpretation algorithms are excellent, there are a few omissions in the Score Editor. You can name chords by typing in text, but the program doesn't recognize them, so chords entered in this way won't transpose if you transpose the Sequence. In addition, the Score display doesn't support guitar fretboard symbols or tablature. But these limitations pale compared to *Notator Logic*'s scoring abilities.

I found the Score Editor to be immediately useful and highly accurate. Scoring is secondary to my work, so I didn't examine the Score Editor in great detail, as I did with the rest of the program. But I saw enough to believe that this is the best and deepest scoring section of any Mac sequencer.

QUANTIZATION

Notator Logic's real-time quantization options are phenomenal. Certainly, the program has all the parameters other professional sequencers possess. Among these are Strength, for determining how far quantized notes will be pulled into line; Range, for determining how far from the nearest quantization value a note can be before it is quantized; and Q-Flam, which creates flams of a specified amount of ticks.

Logic Audio also comes with a large assortment of preset Groove templates, which are setups of rhythmic relationships that can be applied freely to any Sequence. (You can't quantize Folders.) Among these are the standard ¼-note through 1/96-note settings, twelve different degrees of swing, and various tuplets.

You can create your own Groove templates, either by graphically setting up rhythmic relationships in the editors, or by direct extrapolation from a selected Sequence. For instance, this lets you capture the rhythmic "feel" of an unquantized performance. The new template can be applied to any or all Sequences in your Song. Groove templates can even be applied by a percentage, rather than simply on or off, allowing a Groove to be used subtly.

If, after quantizing a number of Sequences with a particular Groove template, you decide to alter the template, any Sequences you've quantized with that template are automatically updated (unless you disable the function).

This is so useful, you'll wonder how you managed without it.

SYNCHRONIZATION

Logic Audio synchronizes to (and can generate) MIDI Clock and MIDI Time Code, supporting 25, 29.97, 29.97 drop-frame, 30, and 30 drop-frame SMPTE formats. The program can automatically detect a SMPTE format other than the one selected and asks if you wish to use it. *Logic Audio* locked up quickly and flawlessly to MTC generated by a JLCooper DataSync box, which converts Alesis ADAT clock signals to MTC.

Of course, tightly synchronizing sequenced digital audio to a tape deck is not always possible. Digital-audio sequencers, such as *Logic Audio,* are concerned only with the start time of the audio, which plays "wild" (not resynched) after the initial trigger point. In this circumstance, short audio segments play back fine, but longer ones can drift noticeably. It is unrealistic to expect *Logic Audio* to perfectly synchronize long segments of digital audio to tape without continuous, sample-accurate synchronization (commonly called "word clock"). Fortunately, *Logic* supports the Digidesign's SMPTE Slave Driver, which supplies word clock.

I came across a bug (squashed, I hope, by the time you read this) while synching with the Reclock function. This is designed to let you record a piece of music freely (without click, or regard for the program's tempo setting or bar lines), adding bar lines later with the use of a Guide Sequence. The Guide Sequence is created by tapping along with your original music at a specified rhythmic interval. Unfortunately, when I played a piece of music in a compound meter—6/8 time—with constant tempo variations, the program couldn't accurately place the bar lines at the positions I tapped in.

AUDIO

Logic Audio has one of the most impressive implementations of integrated digital audio within a sequencing environment I've seen. Audio can be recorded, played back, and edited *in real time,* on as many channels as your Digidesign hardware allows. The Sample Editor window offers various *Sound Designer*-like DSP functions not normally found in programs of this type, such as Reverse, Normalize, Fade In/Fade Out, Invert, Change Gain, and

• NOTATOR LOGIC AUDIO

Trim. Many DSP functions, such as Volume and Parametric EQ, can be controlled with sliders and automated, which you can't even do in *Sound Designer*. Recorded audio appears in the Arrange window as Sequences, just like MIDI data, and can be manipulated in most of the same ways.

Not surprisingly, audio is mainly handled in the Audio window (see **Fig. 3**) and edited in the Sample Editor (see **Fig. 4**). When you record, you create an Audio file that contains all audio recorded in a continuous pass. Any portion of the Audio file can be defined and manipulated independently. These portions are called Regions and become Audio Sequences when dragged into the Arrange window. All audio operations are non-destructive; when you leave the Sample Editor, you are asked to confirm any permanent changes, such as Fade In or Out, which are then written to disk.

Audio Sequences behave almost identically to MIDI Sequences, with two noteworthy exceptions: They cannot be transposed or quantized using the Playback Parameters (although the positions of Audio Sequences are quantized if they are contained inside a Folder), and they cannot be glued together with the Glue tool. I was a bit surprised and disappointed by this last point; I would expect it to be easy to glue Audio Sequences together, as they

Product Summary

PRODUCT:
Notator Logic Audio 1.7
PRICE:
$699
SYSTEM REQUIREMENTS:
Mac IIx or better with 8 MB RAM and System 7.0; Digidesign audio-recording card; hard drive; MIDI interface
MANUFACTURER:
Emagic
PO Box 750
Nevada City, CA 95959-0750
tel. (916) 477-1051
fax (916) 477-1052

EM METERS	RATING PRODUCTS FROM 1 TO 5
FEATURES	● ● ● ● ◖
EASE OF USE	● ● ●
DOCUMENTATION	● ● ◖
VALUE	● ● ● ● ●

are only pointers to audio data, not the data itself.

When manipulating Regions, some of *Logic Audio*'s more unique and practical aspects become apparent. The Audio window lists the files used in the current song. A graphic waveform display of each Audio file shows the portion used in a Region; the area of the file not used (i.e., outside the Region's boundaries) is displayed, but grayed out. You can move the boundaries of each Region by clicking and dragging. Regions also contain Anchors, which are movable reference points that let you precisely position the entire Region in the Arrange window.

Some of *Logic Audio*'s most impressive features are found in its real-time handling of audio. In the Sample Editor window, any section of a Region can be selected and looped independently of the song playback. Looping continues audibly while the loop points are changed, which makes isolating a specific section of audio rapid and intuitive. Amplitude can be displayed either as percentages, or sample values. At the top of the Sample Editor is an overview area similar to that found in Digidesign's *Sound Designer,* which makes it easy to get around an Audio file.

The Sample Editor's Strip Silence feature (see **Fig. 5**) is important for conserving hard-disk space and helping clean up recorded audio. Implemented similarly to other programs of this kind, Strip Silence lets you specify a level threshold, minimum time to accept as silence, preattack time, and post-release time. Based on these settings, the program removes all areas of the selected audio that it interprets as silence. This acts a bit like an audio gate, albeit a destructive one. *Logic Audio*'s unique implementation shows what the "stripped" waveform will look like, based on your current settings, and varies this display immediately as you alter the parameters. This is far better than the usual "trial-and-error" methods required by most programs.

CONCLUSIONS

Notator Logic Audio is an incredibly feature-packed program. I was knocked out by its combination of innovative digital-audio features and phenomenal real-time editing and quantization options, coupled with an outstanding user interface. In addition, its timing stability and rhythmic resolution are the best of any sequencer I've used. If your music involves groove and timing subtleties, you'll love this program. The scoring section is impressive, too, especially for a sequencer; you would need a high-end notation program to top it.

The program almost never crashes, even after lots of strenuous, real-time digital audio and MIDI tasks. During the review period, *Logic Audio* crashed twice. A crash produces a standard Macintosh "Save As" dialog box, with the words "Try To Save Your Song" entered in the name field. Enter a name for the current version of your song, and *Notator Logic Audio* will attempt to save it to disk, then quit to the Finder. This worked perfectly—no work was lost—and I was able to relaunch *Logic Audio* immediately. I was amazed.

Of course, the program isn't perfect. I offered several gripes earlier, and I have one more: There is no way to control the program's tempo other than the Tempo indicator in the Transport bar. This is inexcusable in a professional sequencer. But on the balance,

it's hard to knock the program's features.

Plainly, this program can do an amazing amount of stuff, and it displays the data in almost any way you wish. Its depth and flexibility means a steep learning curve, though. Many important concepts are not fully and clearly explained in the manual, which makes it harder to grasp the program as a whole. The Audio manual is decidedly better than the main manual, and revised documentation will come with *Notator Logic* 2.0, due early in 1994.

Once you get the picture, the learning curve flattens quickly, and you can produce your best work in minimal time. Then you'll understand why *Notator Logic Audio* deserves the attention of any serious computer musician.

Peter Freeman *is a freelance bassist/synthesist and composer living in New York City. He has worked with such artists as John Cale, Jon Hassell, Chris Spedding, L. Shankar, Sussan Deihim, and Richard Horowitz.*

Circle #437 on Reader Service Card

Big Noise Software MIDI MaxPak (PC)

By Robert Kendall

A new contender joins the ranks of the heavyweight Windows sequencers.

Big Noise Software's *MIDI MaxPak* began life as a modestly priced, but well-rounded, package of MIDI sequencing and remote-control applications. With version 2.0, this *Windows* program takes off its glasses, dons a new set of pro-level features, muscles up to a new $299.95 price tag, and prepares to take on the big guys.

As its name implies, *MIDI MaxPak* is a package of several separate programs that work together. The leader of the pack is a 64-track sequencer, *SeqMax*. Important supporting parts are played by the *MixMax* MIDI automation module, *LibMax* patch librarian, *JukeMax* playlist-based sequence player, and *TapeMax*, which lets you operate tape

You've got a musical idea you want to get down in a hurry without losing the feel. So you turn to the instrument you're playing for ideas that'll help you finish the composition quickly and easily.

Sound impossible? Not with the new *i*3 from Korg, the next step in music workstations. The *i*3 is the first interactive music workstation that works with you as a creative partner to speed the music-making process.

interactive

At first glance, the *i*3 is a full-blown music workstation with all the things Korg is famous for: hundreds of huge sounds with 32-voice polyphony, a powerful 40,000-event, 16-track sequencer, dynamic digital multi-effects, a 3.5 inch disk drive and a card slot. But that's where the similarities end.

Unlike other workstations, the *i*3 is capable of producing musical "ideas" of its own – phrases and patterns called *Styles* that can be modified, looped and combined to block out songs in minutes.

interactive

The interactive *i*3 extrapolates or produces chords and patterns from the notes you play. And with Korg's unique *Full Range Scanning* feature, your chords won't be forced into the simplistic, default versions found on other instruments. The *i*3 also includes a unique new Backing Sequence mode, enabling you to record Arrangement performances and eight regular sequence tracks on top on the backing tracks.

In addition to being the perfect interactive compositional tool, the *i*3 also shines in live performance. When you need sounds in a hurry, the *i*3's 256 programs cover all the basses, and then some. And Korg's dynamic digital multi-effects processors enhance every mode with real time control. If you want even more range, the *i*2 has an expanded 76-note keyboard, plus an additional acoustic piano.

interactive

Even if you're not a keyboard or sequencing virtuoso, the *i*-Series gives you the power to write music you could never write before. And if you are, it takes you to a new level of creative musical composition so quickly you won't believe it.

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decks remotely with MIDI Machine Control. The modules are tied together by *MIDI Director*, which allows multiple Big Noise programs to run simultaneously, in synchronization. This lets you set up elaborate systems to control everything that responds to MIDI from within a customizable, user-friendly sequencing environment.

If you want to work with more than 64 tracks, the *MIDI Director* lets you run several copies of *SeqMax*, load a different sequence into each one, and lock them together during playback. If you have different sequences loaded into multiple copies of *SeqMax*, a Disable Playback feature lets you play them one at a time. This would be a great way to work with alternative versions of a song. Unfortunately, a bug in the review copy made this function inoperable.

SEQMAX

In power and sophistication, *SeqMax* has overtaken Big Noise's former flagship product, *Cadenza*, to go head-to-head with Twelve Tone Systems's reigning PC heavyweight champ, *Cakewalk Professional for Windows*. Like *Cakewalk Pro*, *SeqMax* offers printable staff notation to supplement powerful editing options, flexible recording and quantizing, and support for MIDI Time Code. Some of the slickest available graphic-editing screens facilitate working with every kind of MIDI data.

The program also lets you work with pattern-based sequences, which can be a great labor-saver for repetitive music. Along with some other unique features, this makes it one of the best sequencers on the market for handling percussion parts. The recording resolution is 480 ppqn.

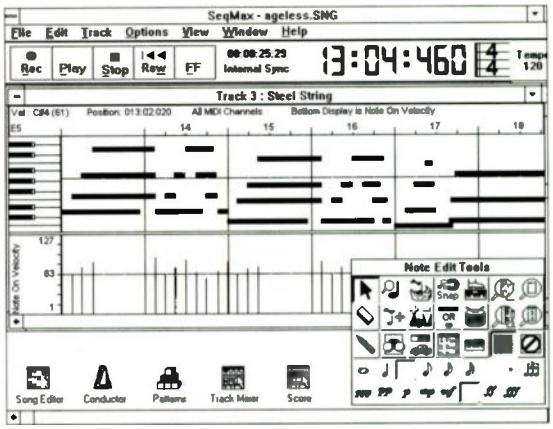

FIG. 1: *SeqMax*'s Graphical Editor displays notes in its top pane and either controllers or Velocities in its bottom pane. The right mouse button pops up the toolkit.

SLICK GRAPHIC EDITING

SeqMax provides a wealth of ways to work with your MIDI data, yet it's always easy to find your way around the different views. For example, right-clicking on a track in the main Track Sheet window calls up either an event list or a graphic event editor for that track. Double-clicking on a bar in the Song window (which displays each bar as a box) opens the graphic event-editor at that bar.

One of *SeqMax*'s strongest features is this admirably streamlined graphic

event-editor, which resembles the one in *Cakewalk Pro*. It combines a piano-roll Note Editor and an editor for controllers and Velocity into a single window, which is split into two "panes." The notes appear in the top pane, with their Velocities or controller values depicted in the lower pane as vertical bars on a grid (see **Fig. 1**). This means you don't have to worry about juggling and aligning several windows if you want to see notes and controllers simultaneously.

Editing speed and efficiency is the name of the game here. Right-clicking on either graphic-editing pane calls up a palette of toolkit icons. In the Note Editor, these provide the usual editing modes for inserting and deleting notes and changing their position or duration by dragging. Other icons let you zoom in and out, turn snap-to-grid on or off, or invert a melody. Double-clicking on any note opens a dialog box for fine-tuning duration and other parameters.

In the controller pane, you can drag the mouse to create a graduated series of controller values, or adjust Velocities. The density of controller messages you enter this way is determined by how fast you drag the mouse. Its toolkit makes this graphic editor easier to work with than similar editors in other sequencers, which rely more on menus.

Toolkit icons let you thin out controller messages, remove duplicates, compress their range, invert values, or scale values by a percentage or fixed amount. It's hard to draw straight lines and smooth curves with the mouse to create, say, a graceful *crescendo*, so *SeqMax* helps out: Click between two controller values on the grid, and the program fills in the intervening values. Select a group of values, and it fills in between each pair for a smoother effect. The downside is that you can't specify an amount by which to thin out controllers, or fill them in. In addition, there's no way to edit controllers on several tracks at once.

The toolkit functions proved one of the most unstable parts of the package. The Controller Fill tool sometimes wouldn't work with descending values, and other tools sometimes behaved erratically until the program was restarted. I'm told all of this will be fixed by the time you read this.

It's easy to switch from one track to

another in the Graphic Editor window. You can also open several Editor windows at once to compare different tracks or see different controllers on the same track, and they scroll together during playback.

WEALTH OF WINDOWS

An alternative to the graphic editor is a sensibly designed event-list editor. Different event types appear in different colors. You can filter out the types of events you don't want to view, and you can cut-and-paste blocks. You can even enter Windows Media Control Interface (MCI) commands as events, which let you play digital-audio files and control other multimedia elements.

Another way to work with controllers is from the Mixer window (see **Fig. 2**). This graphic emulation of a mixer console presents several controls for each of sixteen tracks. A fader governs MIDI Volume (Controller 7), there's a rotary pan control, and two additional virtual knobs can be set to govern the controllers of your choice. Mute and solo buttons perform the appropriate tasks. The controls move during playback in response to controllers in the sequence. Conversely, moving the knobs with the mouse during playback affects the sequence, and you can record controllers using this method.

SeqMax's Tempo Map window boasts many of the same tools that make editing controllers so easy; just call up the toolkit with the right mouse button. A Tap Tempo feature lets you tap out the correct beat on your MIDI keyboard while a rubato section is playing and automatically adjusts tempos to correctly align the bar lines.

Although the program supports nearly any unusual time signature, it won't correctly play compound meters. Songs in 6/8 or 12/8 end up with six or twelve beats (metronome ticks) per bar, respectively, instead of the traditional two or four. I'd prefer to choose how the beat is defined, as in Passport's *Master Tracks Pro.*

WHAT'S THE SCORE?

SeqMax's Staff Notation window isn't meant to replace a notation program, but it gives you another option for viewing and editing your music. Working with a Score view can give you a much better grasp of musical structure, especially because you can view multiple tracks simultaneously on different staves (see **Fig. 3**).

Like *Cakewalk Professional for Windows, SeqMax* can quantize the display of the music and eliminate small gaps between notes to avoid cluttering the score with confusing rests and tied values. This affects only the display, making it easier to read; the original rhythmic inflections are preserved during playback.

Unfortunately, *SeqMax*'s Score window is much less usable than *Cakewalk Pro*'s. To begin with, you can't enter or display triplets, which is a real drag. In addition, *SeqMax* lacks an important feature found in nearly every notation package on the market: the ability to snap notes to the nearest beat or subdivision of the beat when you place them on the staff with the mouse. When placing notes off the beat in *SeqMax,* you must try to judge where they should fall in relation to grid lines that delineate the beats. I found it impossible to position notes where I wanted them on the first try. For example, I often ended up with eighth notes on the fourth sixteenth-note of the beat, instead of the third.

The best way around this problem is to change the quantization setting of the screen display to match the value of each note you add, which forces it to the correct position, but this is a cumbersome approach. You can drag notes horizontally or vertically on the staff with

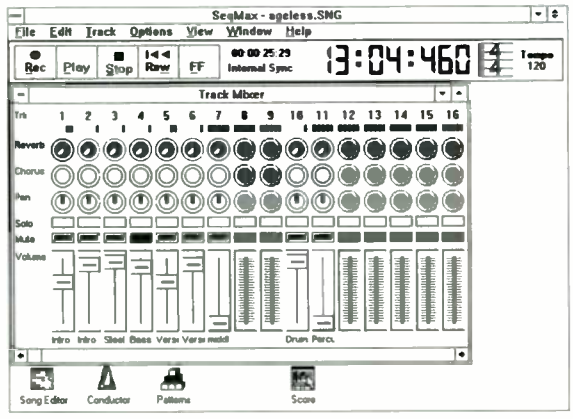

FIG. 2: *SeqMax*'s Mixer window provides a graphic emulation of a mixer console. Moving the controls with the mouse sends MIDI Volume, Pan, and two selectable Control Changes.

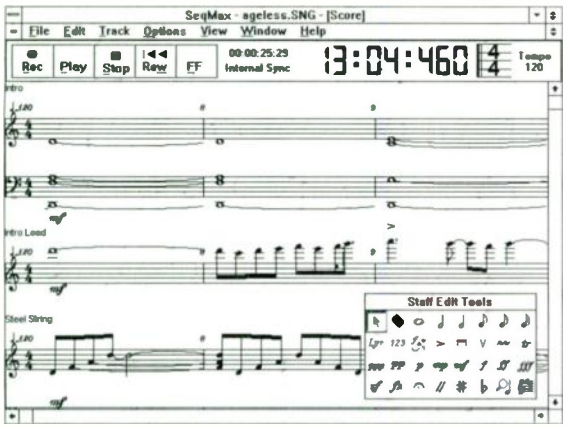

FIG. 3: The Score window shows your sequence as staff notation. Dynamic and expression markings don't affect playback.

the mouse, but I often found it difficult to grab notes with the cursor, compounding the Score window's general awkwardness.

On the positive side, the program lets you add a variety of dynamic and expression markings to your score, although these don't affect playback. You can also add lyrics.

The program gives you a quick-and-dirty printout of a score or parts, suitable mostly for study purposes. You have minimal control over layout, and the fonts are less than elegant, although the font and type size are user-selectable. When I tested it on an HP LaserJet 4, the program wouldn't print properly unless I reconfigured the *Windows* Print Setup to print TrueType fonts as graphics, which slows down printing considerably. It turns out that *SeqMax* and the LaserJet *Windows* printer driver aren't fully compatible yet.

THE BIG PICTURE

The Track Sheet window lets you set initial track parameters, such as panning and volume, but not Velocity offset. You can select patch names from a list that can be configured for General MIDI, Roland GS, E-mu's Proteus/1, the Korg M1, and several Roland keyboards. If your synthesizer isn't included, you can create a custom patch list. Unlike most sequencers, it lets you include a Bank number, as well as a Program number. You can even save different track-sheet settings to reuse in new sequences.

The instrument list shows patch names in alphabetical, rather than numerical order. This can be an advantage in some cases, but for systems such as General MIDI, which groups instruments together by family, it can be confusing.

For global editing, *SeqMax* provides a Song Editor that shows several tracks at once, depicting each bar as a box. You can select blocks across noncontiguous tracks and shift the music forward or back, change note durations or start times, and transpose chromatically. (There's also a diatonic transposition option, but it doesn't always work correctly.) You can remap controllers from one type to another, and there are flexible quantization, swing, and humanize options. An unusual Harmonize function doubles all selected notes at a specified interval.

All global editing functions can use a

powerful event filter, which lets you perform tasks such as transposing only those notes within a certain pitch and Velocity range. Unfortunately, there are no options to globally edit Velocities or continuous controllers. You must use the graphic editor to work on them one track at a time.

MUSIC BY PATTERN

For some users, one of *SeqMax*'s biggest selling points is its flexible, easy-to-use pattern capability. This lets you put together a song by creating musical sections—Patterns—of any length and adding the Pattern names to a playlist. If you want to edit a chorus, for example, you just have to change it once, rather than four or five times.

The Pattern feature is never confining; you can make some tracks (such as rhythm instruments) Pattern-based and others (such as leads) linear. The Pattern Editor is a sequencer within a sequencer and has most of the same recording and editing features as the main program. To assemble a Pattern track, you simply select Pattern names from the list you created with the Pattern Editor. You can also save Patterns in a library to use in other songs.

Patterns don't completely eliminate repetitive editing, though. Multitrack Patterns aren't allowed, so you must create a separate list for each Pattern-based track. Both the Pattern editor and main sequencer have access to the graphic event-editor.

The Pattern feature is superb for creating drum tracks, but *SeqMax*'s percussion prowess doesn't stop there. The piano-roll Note Editor's toolkit has a Drum View icon that changes the display to show notes as dots, without duration, and displays drum-kit names, rather than the usual piano keyboard, to the left of the grid (see **Fig. 4**). The program provides General MIDI drum-kit names and offers keymaps that can convert key assignments to those of several non-General MIDI synths. You can also create your own keymaps and key-name lists and assign different ones to each track.

In the Note Editor, you can hold down the left mouse button and drag to enter repeated notes of a selected duration. You can transpose all notes of the same pitch in a track by dragging to the left of the grid. Registered users can also get a free library of 300 drum patterns.

OPTIONS AND LIMITATIONS

There are quite a few recording options, but several limitations. For example, there's no support for multitrack recording, although you can often work around this by using the Track Split feature to divide the data into two tracks after recording. A useful touch is a special Setup track, which can store SysEx and other MIDI data representing the state of your system, loading it before the sequence plays. *SeqMax* also can record SysEx data into regular tracks.

A Record Input dialog box lets you filter out MIDI channels and specific types of MIDI data, but you can't exclude individual controllers. It's either all or none. On the other hand, the step-recording interface is excellent.

The program was able to accurately import and export a variety of Standard MIDI Files, adding the initial Program Change numbers for each track to the track sheet. If the MIDI file contains Instrument Name metaevents, the names are placed in the track's Instrument column. As a multimedia author, I'd like to see the program automatically attach GM instrument names to tracks on request.

MIXMAX

Among the modules that *MIDI MaxPak* provides to complement *SeqMax* is *MixMax*, which is a mixer-like sequencer dedicated to MIDI automation. It is a well-endowed sequencer, at that, with real-time and step-time entry, event-list and graphic editing, and embedded Program Changes.

MixMax closely resembles *SeqMax*'s Mixer window in appearance. Each control on the *MixMax* console can send assorted MIDI events up to 120 bytes in length. You can even add new controls and create custom control surfaces, which is very useful, especially when performing with a sequence. If you run *SeqMax* and multiple copies of *MixMax* together under *MIDI Director*, for example, you could simultaneously control MIDI-automated mixers (e.g., Fostex DC100, Mackie OTTO-1604, and MOTU MIDI Mixer 7s), customized MIDI lighting systems, stage effects, and audio effects, all synchronized with the sequenced music tracks.

If you have a sequence loaded in *SeqMax*, you can play it back from within *MixMax* and hear the changes as you

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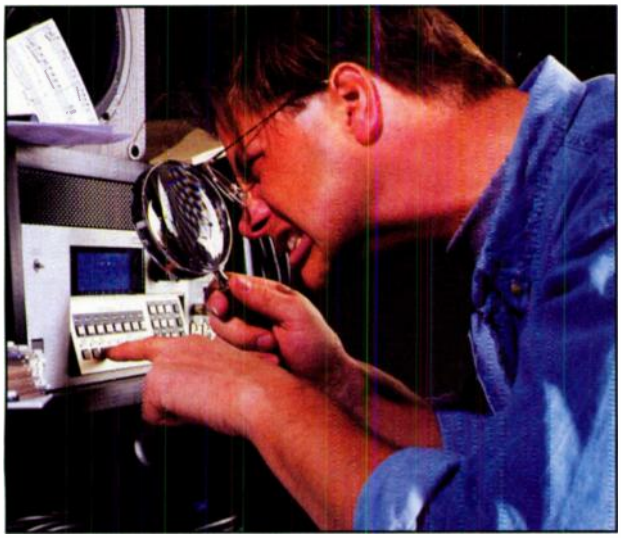

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It's true. The first machine designed specifically for low cost digital multitrack production is now available. And it comes to you from the world multitrack leader, TASCAM. It's simply the most advanced, well thought out and heavy duty digital 8-track deck you can buy. The best part is, it's incredibly affordable.

The DA-88 is built for production. The integrity of TASCAM's design is evident in every facet of the deck. From its look and feel — to its exceptional sound, unsurpassed features and expansion capability.

Goes Faster, Lasts Longer And Takes A Beating

While we admit that it's an elegant looking machine, it's tough to see its finest asset. The tape transport. Designed and manufactured by TASCAM specifically for the DA-88, it's fast, accurate and solid. And that's what counts in production — in personal studios, project studios or in those demanding high-end facilities.

You'll notice it uses superior Hi 8mm tape, giving you a full 108 minutes of record time. What's more, the transport is lightning fast and yet so quiet you'll barely hear it blaze through a tape.

We didn't stop there. Because production environments are notorious for constant, if not abusive, shuttling, punching, 24-hour operation — you get the idea — the transport was designed and built to take a beating.

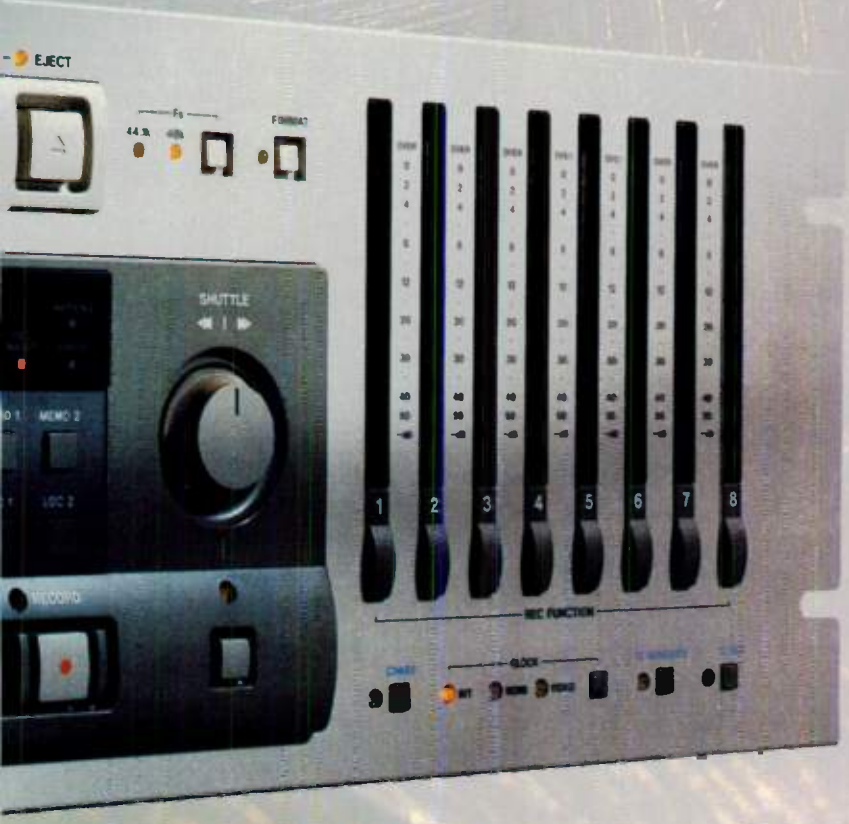
Even more impressive is the transport's responsiveness. Take a look at the front panel. Notice the shuttle wheel? Turn it just a bit and the tape moves at one fourth the normal play speed. Turn it all the way and it flies at 8 times faster. Do it all night if you want. It's quick, smooth and it's precise. Need to get to a location quickly? Accurately? Shuttle a bit and you're there. The location is easily viewed on the DA-88's 8-digit absolute time display — in hours, minutes, seconds and frames. With the optional SY-88 sync card it displays timecode and offset, too.

Adding the optional SY-88 synchronizer card is as easy as changing a Nintendo® cartridge. With it you're SMPTE and MIDI compatible. And no matter how many DA-88s you have locked up, you need only one sync card. Other optional accessories include AES/EBU and SDIF2 digital interfaces allowing the digital audio signal to be converted for direct-digital interfacing with digital consoles, signal processors and recording equipment.

You Already Know How To Operate It

Unlike other digital multitrack decks, the DA-88 works logically and is simple to operate. Like your analog deck. All functions are familiar and easily operated from the front of the deck.

s Machine



Take punching-in and out, for example. You have three easy ways to do it. You can punch-in and out of single tracks on the fly. Just hit the track button at the punch-in point. Hit it again to punch-out. You can use the optional foot switch, if you like.

Or, for multiple tracks, simply select the track numbers you want to punch, push play, and when you're ready, hit record to punch-in, play to punch-out.

Finally, for those frame accurate punch-ins, you've got auto punch-in and out. In this mode you can rehearse your part prior to committing it to tape.

No matter which way you choose, your punch-in and out is seamless and glitch free due to TASCAM's sophisticated variable digital crossfade technology.

That's not all, you also can set your pitch (± 6%), sample rates (44.1 or 48K), as well as crossfade and track delay times. All from the front of the DA-88.

Complete Synchronicity

There's more. Add the optional SY-88 synchronizer card to just one of your DA-88s and you've got full SMPTE/EBU chase synchronization. The best part is, you can record time-code without sacrificing one of your audio tracks. You also get video sync input, an RS-422 port to allow control of the DA-88 from a video editor, and MIDI ports for MIDI machine control.

A Digital Recording System That Grows With You

The DA-88 is truly part of a digital recording system. Start with 8 tracks today — add more tomorrow.

Adding tracks is as simple as adding machines — up to16 for a total of 128 tracks. They interconnect with one simple cable, and no matter how many DA-88s you have, they'll all lock up in less than 2 seconds.

Controlling multiple machines is made simple with the optional RC-848 remote. With it you can auto locate and catch 99 cue points on the fly. It comes complete with shuttle wheel, jog dial, RS-422 and parallel ports, and it controls other digital and analog machines, too.

Listen To The Rest

Of course, the sound quality is stunning. With a flat frequency response from 20Hz to 20kHz and dynamic range greater than 92dB, it delivers the performance you expect in digital recording.

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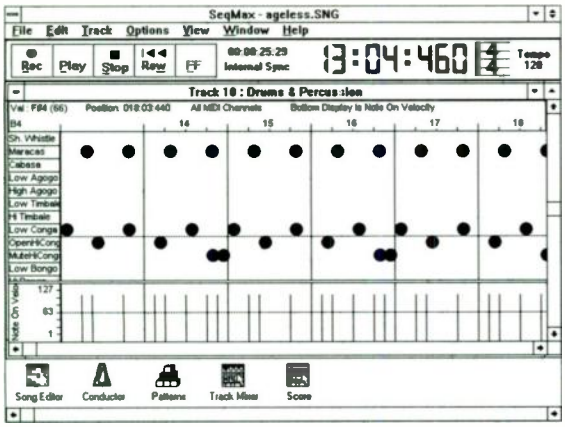


FIG. 4: *SeqMax*'s piano-roll Note Editor offers a Drum View that displays drum-kit names to the left of the grid and shows each note as a dot without duration.

move the *MixMax* controls with the mouse. If you're in Record mode, *MixMax* saves all your onscreen control moves (or controller messages sent from an external device), but in a separate Mixer Session file, rather than in the sequence. If you prefer, you can export the Mixer Session as an SMF and merge it into a *SeqMax* track, keeping the whole song in one file. Otherwise, the controllers are sent when you run *MixMax* and play the sequence back with a Mixer Session loaded.

OTHER MODULES

TapeMax provides remote control of any audio or video tape deck that responds to MIDI Machine Control messages. It displays graphic tape-transport buttons that function like those on a tape recorder and allows you to record-enable up to 32 audio tape tracks and a video machine. There are seven user-definable autolocate points. Taken with the *MixMax* and *SeqMax* modules, this feature could make *MIDI MaxPak* a good choice for some post-production gigs.

LibMax is a full-featured patch librarian, with preconfigured setups for a variety of popular synthesizers and options for customized setups. It automatically downloads and uploads individual patches or patch banks and allows you to cut-and-paste patches in a bank. *LibMax* can create instrument database files, with patch names and Program Change numbers, for use in *SeqMax*, and it can also export patches and banks as SMFs for merging SysEx into *SeqMax* tracks.

Rounding out the collection of modules is *JukeMax*, a jukebox program for playing MIDI files in succession from a playlist. *JukeMax* uses a special file format for faster loading, but you can also import Standard MIDI Files. Oddly, the module won't import regular *SeqMax* files; you are expected to export *JukeMax* songs from the sequencer, presumably to take advantage of their loading speed. You can transpose each song and set options to pause between songs or segue to the next song. The program even scrolls through any lyrics embedded in the sequence.

CONCLUSIONS

MIDI MaxPak is a marvelous package that's loaded with unique and attractive features. It boasts one of the best-designed and most consistent interfaces on the IBM-compatible sequencer market. You get a lot of trimmings, too: For example, *MaxPak* is one of a handful of software packages to provide real MMC support.

There is room for improvement, of course. For instance, *SeqMax* is not going to compete as a scoring program. Admittedly, that isn't the program's main purpose, but even so, its Score window is too poorly implemented to

Product Summary

PRODUCT:
MIDI MaxPak 2.0
PRICE:
$299.95
SYSTEM REQUIREMENTS:
80286 or better PC; *Windows* 3.0 or higher; 2 MB of RAM (4 MB recommended); hard disk with 4 MB free space; mouse; MIDI interface
MANUFACTURER:
Big Noise Software, Inc.
PO Box 23740
Jacksonville, FL 32241
tel. (904) 730-0754
fax (904) 730-0748

EM METERS	RATING PRODUCTS FROM 1 TO 5
FEATURES	● ● ● ●
EASE OF USE	● ● ● ●
DOCUMENTATION	● ● ●
VALUE	● ● ● ●

be as useful as it should be. *SeqMax*'s limit of 64 tracks per sequence is not a big problem if you run two *SeqMax* modules together. However, I wish you could perform more types of controller editing on all tracks at once. But for the most part, and especially for the price, these are minor issues. In addition, version 2.1 (shipping at press time) adds automated backup, new *LibMax* profiles, and the ability to save window layouts with each song.

A more serious problem is the instability of the program in the version I tested: Bugs and system crashes were all too common. I think it's reasonable to expect a cleaner program in version 2.0. [*According to Big Noise Software, the bugs reported in this review had been fixed by press time.—Ed.*]

Running custom-configured, multiple copies of the various modules is extremely attractive for music production, some kinds of post-production, and live performance. *MixMax*, in particular, offers hidden power I barely touched. Once it's debugged, *MIDI MaxPak* will be one the top music packages of the *Windows* world.

Robert Kendall *is a composer, multimedia artist, and freelance writer. His multimedia installations, which combine music, interactive literature, and video art, have been exhibited widely.*

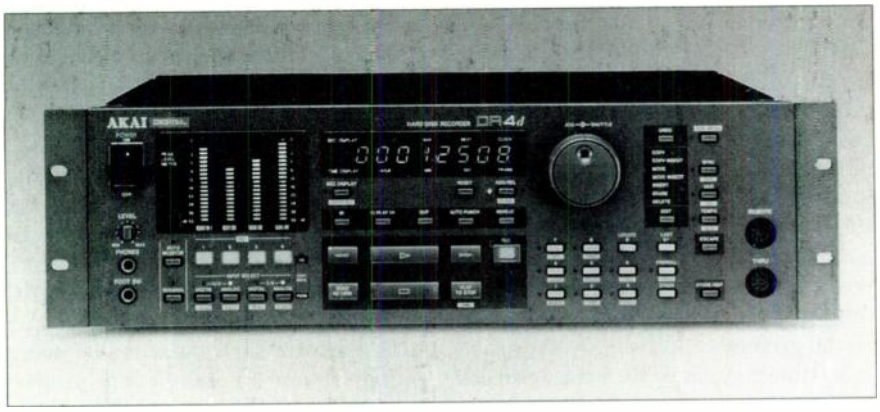
Circle #438 on Reader Service Card

Akai DR4d Hard-Disk Recorder

By Geary Yelton

Who says hard-disk recording requires a computer?

Back in the 1970s, I bought a 4-track, reel-to-reel tape deck that changed my life. I learned the basics of studio recording on it, and although it wasn't meant to be portable, I lugged it around whenever I felt the need. I recorded live demos and basement tapes for local bands, produced backing tracks for vocal groups on the road, and captured musician friends playing my songs in my



The Akai DR4d offers four tracks of hard-disk recording without requiring a computer. Its editing features are excellent compared to a tape recorder, but pale compared to a computer-based DAW.

living room or theirs. If I wanted to record more than four passes, I had to bounce two or more tracks down to a single track. That meant gritting my teeth, shrugging my shoulders, and putting up with the noise inherent in multiple-generation, analog tape recording.

These days, things are different. Hard-disk recorders offer the speed of random access, clean digital sound, and editing features that no tape recorder—analog or digital—can match. It seems the only disadvantage of these systems is the need for a computer to operate them—that is, unless you're talking about the Akai DR4d.

OVERVIEW

The DR4d hard-disk recorder is a free-standing, 21-pound, 3U rack-mount module that requires no computer. It isn't the only such hard-disk recorder—the Roland DM-80 can be used with or without a computer—but it is the least expensive of the genre.

The DR4d offers four tracks, and as many as four units can be linked together for sixteen tracks. An optional, internal, 213-megabyte hard disk is available ($500), which provides just over ten minutes of 4-track recording at 44.1 kHz. As many as seven SCSI hard disks can be chained for additional recording time.

The DR4d's exceptional sound is due to 16-bit, 64× oversampling A/D and 18-bit, 8× oversampling D/A converters, which is the same as the Alesis ADAT format. In addition to the usual sampling rates of 44.1 and 48 kHz, a rate of 32 kHz is also available. This yields a bandwidth similar to FM radio, making it appropriate for broadcast applications.

There are four ¼-inch analog inputs and four analog outputs, which are switchable between -10 dBV and +4 dBu operation. A pair of digital I/O ports allow 2-track recording from a digital source and backup to a DAT recorder.

A second pair is available on a plug-in card ($299). The digital ports include both XLR and RCA jacks, with AES/EBU or S/PDIF formats selected from the front panel. You can switch either or both pairs of inputs from analog to digital before recording begins; LEDs indicate which are selected. Because there are no input or output attenuators, all levels (except headphone output) must be controlled with an external mixer.

Anything you can do with a 4-track tape recorder, you can do with the DR4d, and then some. Although it has no signal-processing features, such as equalization, track reverse, or time compression, it provides sequencer-style cut, copy, and paste editing. Unlike most hard-disk recorders, it doesn't provide playlist editing. In addition, edits are destructive; you can undo your last edit or recording if there's sufficient disk space, but edits change the file recorded on disk.

THE FRONT PANEL

The dark-gray front panel makes for an impressive-looking piece of studio gear, crammed full of buttons, displays, and one of those big, infinitely rotating knobs with an indentation for your fingertip. Once you've learned your way around, the buttons give you instant access to nearly every function. Until then, finding the right button can be tedious. The only front-panel illustration in the manual is on p. 3, which isn't as helpful as it might be when it comes to finding a particular button.

Some buttons, such as the track record-enable keys (called simply REC keys, not to be confused with the REC key in the transport section), light up to indicate their status. Others have small, red LEDs to show they're active. A Sub-Menu key serves as a shift key, bestowing alternate identities on certain buttons.

The big knob is the Jog wheel, which works just like the one on a pro video deck. Turn it to manually find a location as you listen to a recording. The wheel is smooth and precise and proves especially useful for finding punch-in and punch-out points. Concentric to the Jog wheel is a spring-loaded, center-detented Shuttle wheel, which is used to play forwards or backwards at one-quarter, half, twice, or four times normal speed.

The 8-digit, alphanumeric display in the center is primarily for indicating location. Unfortunately, 7-segment LEDs are less than ideal for text; I've never seen a word in this display that I recognized immediately. It took a moment to realize that something resembling "nnl dl" was supposed to say "MIDI." Numbers are okay, though. In Time Display mode, it shows hours, minutes, seconds, and frames. In BBC mode, it shows bar, beat, and clock.

To perform such tasks as specifying punch-in/out points, locating to particular points, and so on, time values are entered directly into the time display using the numeric keypad. My gripe about the time display concerns the four dots that indicate whether something is recorded on each of the four tracks. At first glance, they appear to be decimal points to the right of each of the last four digits, which is highly confusing. You almost have to count the number of digits from the edge to tell which pair indicates what. If these dots were placed at the top of the display, or better yet, somewhere else altogether, this problem could be avoided.

To the left of the main display, four 20-segment LEDs display playback and source levels for each track. Conveniently, they hold peak levels, updated every second.

RECORDING AND PLAYBACK

If you know how to operate a multitrack tape recorder, you pretty much know how to operate the DR4d, except for its special features. Transport controls include Play, Record, Stop, Fast Forward, Rewind, Play to Out, and

Product Summary

PRODUCT:
DR4d
PRICE:
$1,995 (w/o hard drive)
MANUFACTURER:
Akai Professional
PO Box 2344
Ft. Worth, TX 76113
tel. (800) 433-5627
or (817) 336-5114
fax (817) 870-1271

EM METERS	RATING PRODUCTS FROM 1 TO 5
FEATURES	● ● ◖
EASE OF USE	● ● ●
SOUND QUALITY	● ● ● ◖
VALUE	● ● ● ◖

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Does the world of electronic musical instruments seem like it's stuck in an endless rut? New bells. New whistles. Same old sound...

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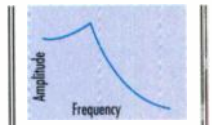
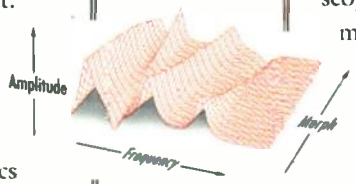
Imagine sending a saxophone through the body of a violin and then smoothly morphing it into a distortion guitar. Or send a piano through the resonances of the human vocal tract pronouncing a variety of vowels. Or sweep a synth pad with 32 polyphonic flangers. Or use a mod wheel to control the subtle timbral changes that result from picking an acoustic guitar at different distances from the bridge. These are just hints of what Morpheus is all about.



Traditional Synthesis

Single, 4-pole lowpass filter with resonance.



Z-Plane Synthesis

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Zero Return. When you press the Play to Out key, it looks at the current location, rewinds a specified number of seconds, then plays forward to the same location. For example, let's say you're playing back a freshly recorded track, and you think you hear a chair squeak. Press Stop, then Play to Out; if it's a problem, you can mark it for later editing, or fix it on the spot.

Zero Return instantly locates to the beginning, or the point you designate as zero by pressing the Reset key. Because it has the random-access advantages of a hard disk, think of Zero Return as instant Rewind. The Rewind key, on the other hand, rewinds at a comfortable rate of about twenty seconds of recorded time per second of real time. Fast Forward advances at the same rate.

A REC button beneath each track's level meter enables the track for recording. You can record on any or all tracks at once. If you cross into the red portion of the meter, you get a taste of that harsh digital distortion we've all come to know and hate.

If you prefer the previous take to something just recorded, press the Undo key (space permitting, as noted earlier) to go back to the last version. You can even undo the last recording after you've powered down and turned the DR4d back on. To compare two takes, repeatedly press Undo.

Punching in and out is a breeze. Once you punch out, though, you can't punch in again without stopping first. The punch points are memorized by the auto-punch function, just in case you like where you recorded, but don't like what you recorded. A front-panel jack accepts a footswitch for remote punch-in/out. The DR4d also lets you automate punches with a rehearsal function, so you can practice before committing to disk.

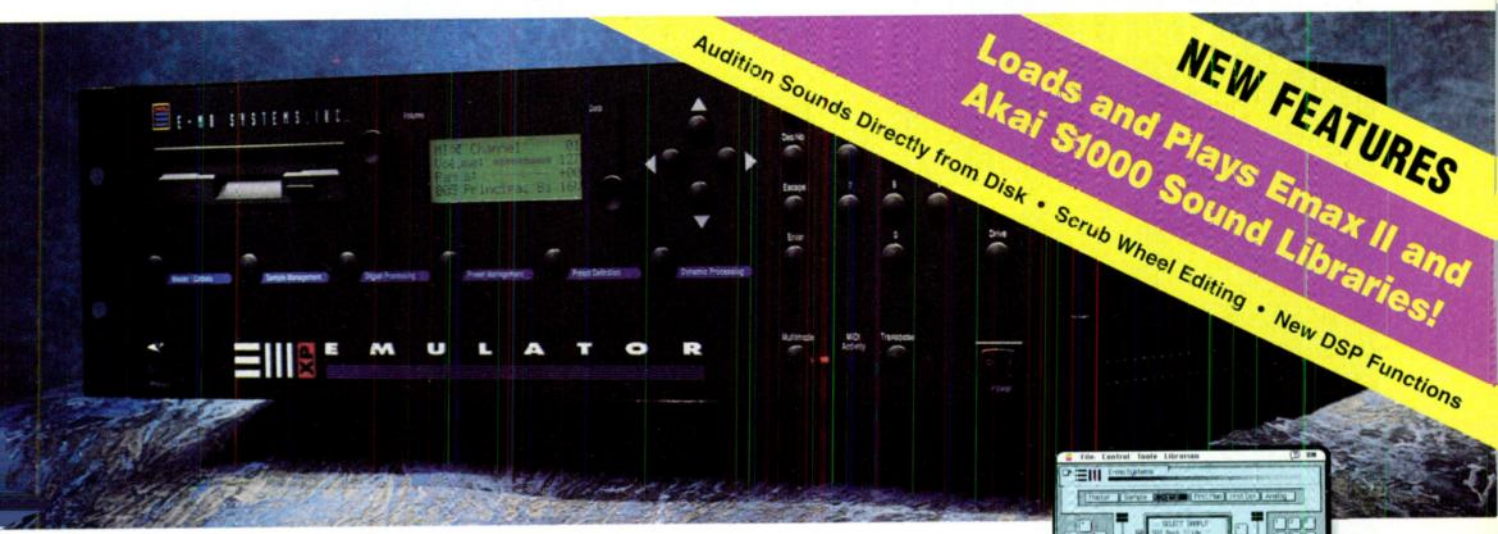
An Auto Monitor button lets you listen to your recording when playing back a track that's armed to record. When stopped, or actually recording, you monitor that channel's input. This is ideal under most circumstances; you can monitor your source through headphones as you record, then immediately listen to what you've recorded without additional button-pushing. With a track armed and Auto Monitor turned off, you constantly monitor the source rather than the track. Oddly, Auto Monitor is off by default.

Another playback option is a digital version of Varipitch, which actually varies the playback sample rate. The amount by which you can vary the pitch depends on the original sampling rate. The pitch variation is measured in Steps, but they have nothing to do with musical steps, cents, or any other traditional measure of pitch. For example, with a Varipitch setting of -53, playback occurs four whole steps lower than originally recorded. If the sampling rate is 48 kHz, the pitch can only be lowered. At 44.1 kHz, it can be raised or lowered, and at 32 kHz, it can only be raised.

Any studio multitrack machine should offer autolocate functions, and the DR4d is no slouch in this department: Up to 108 locate points can be stored and recalled. If you like, you can specify a certain number of seconds of preroll before any locate point. Eight locate points can be recalled with single numeric keys. Another hundred, called Stack Locate points, can be recalled with 2-digit numbers.

The only problem with having so

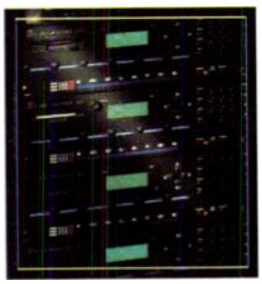
The Emulator IIIx Series of Professional Digital Samplers.



Its Power Is Only Surpassed By Its Simplicity.

Whether you're a professional musician or a sound designer for film or video post production, you don't have a minute to waste. You're on a continuous search for that perfect audio tool that will maximize your productivity. Well, look no further. Introducing audio tools from E-mu that combine high-end functionality with down-to-earth, time-saving ease of use—the EIIIx series of professional digital samplers.

As you would expect from the company that pioneered digital sampling, the EIIIx series features true 16-bit resolution for the purest audio quality possible. Proprietary DSP technology gives you pitch transposition capabilities over an incredible 10 octave range without aliasing, imaging or clock noise.



But incredible sound is only half of the story. The EIIIx series offers an impressive complement of features beginning with 32-voice polyphony, 32 digital resonant lowpass filters and 8 MB of RAM standard (expandable to 32 MB). And with AES/EBU digital I/O and eight balanced polyphonic outputs, the EIIIx series is ready for any mix environment. Dual SCSI connectors make it easy to link multiple EIIIx modules and to access a variety of mass storage devices. Add a long list of sample processing functions and you've got both power and versatility at your fingertips—all accessible through the industry's clearest user interface.

Optional Remote Controller/Librarian software allows you to control all EIIIx functions from the screen of your Macintosh and easily catalog, search and retrieve sounds from your entire library in seconds. You can even configure and load custom sound banks into your EIIIx with a simple click of your mouse.

All EIIIx series samplers are compatible with the ever-expanding EIII sound library. Over 16 gigabytes in size, the EIII library includes virtually every instrument on earth as well as an enormous selection of sound effects—all brought to you by E-mu and the industry's leading third-party sound developers.

EIIIx series samplers are available in a variety of configurations. For sampling live, or from analog source material, the EIIIxs features two channels of 64x oversampling sigma/delta analog-to-digital conversion. Remove analog sampling and you've got the EIIIxp—ideal for sampling within the digital domain or as a voice and memory expander when linked to other EIIIx units. Both models are available as Turbo versions featuring 32 MB of RAM and an internal 120 MB hard drive.

But with all these features, the most impressive one may be price. EIIIx models start at $3,995. Visit your nearest E-mu dealer for a demo and consider your search for the perfect audio tool over.

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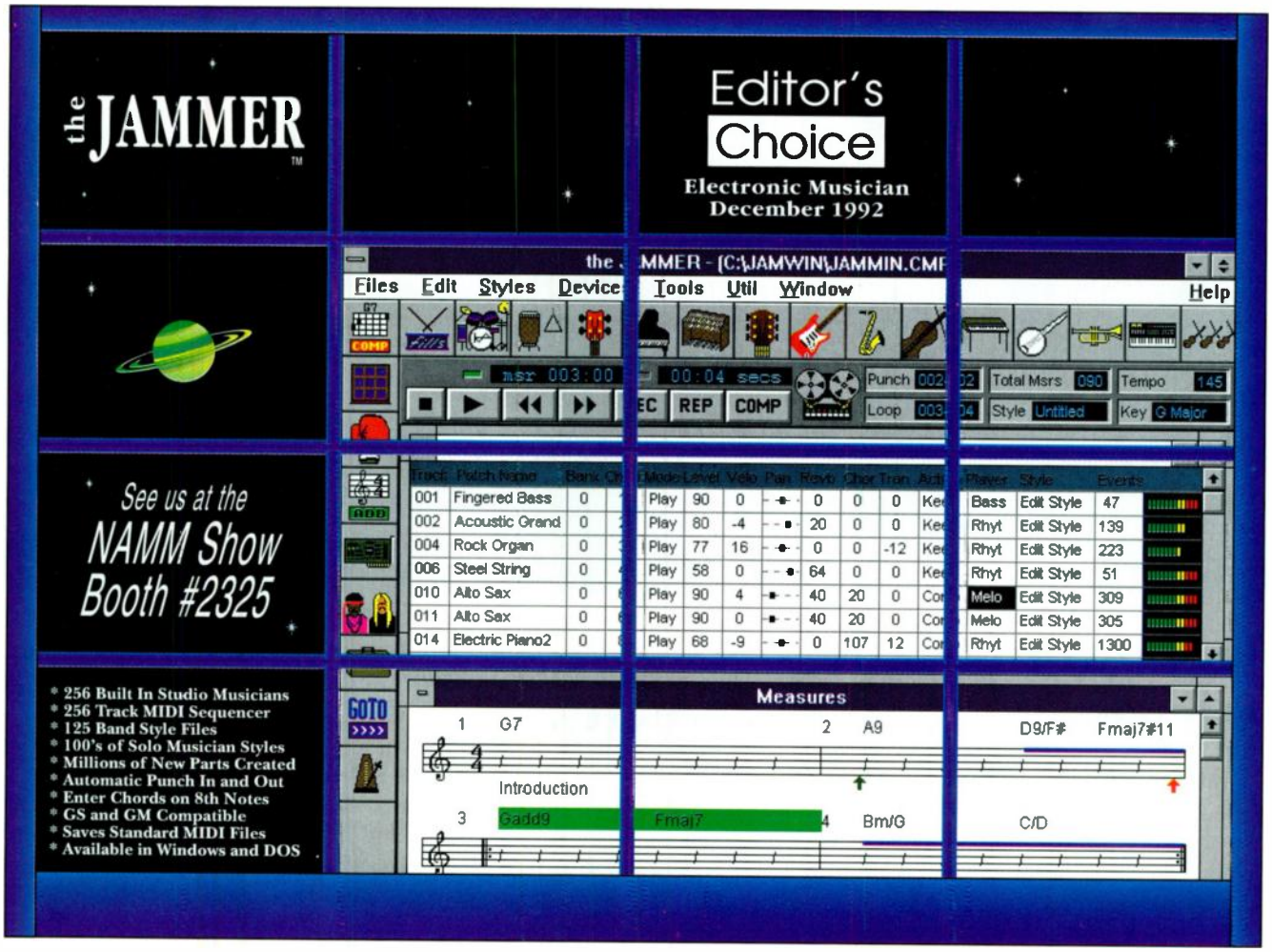

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many locate points is remembering all those numbers, so keep a pad and pen handy. I'd love to be able to sequence these locate points via MIDI or some other sort of computer control, but it's not possible. A Last Memory function remembers the last two places you pressed Stop. This is used to go back and forth between the current location and the last stop.

EDITING

There are seven types of audio editing. You can Copy a section to another location, overwriting any audio data that's already there. When you choose Copy+Insert, existing data is pushed forward to make room for the copied material. You can also Move data from one location to another, replacing what's there, or Move+Insert, effectively splicing it in.

When you Erase, the specified section is replaced with silence, as with tape. (Because silent recorded passages use up disk space, you should always erase them to maximize your recording time.) On the other hand, Delete erases a section and moves subsequent data backward to fill in the gap. Finally, you can Insert a blank section, sliding data forward to make room. All edits can be compared to the previous version with the Undo key. Unfortunately, there is no facility to merge tracks; you must go through an external mixer to bounce, which a drag.

These editing functions are infinitely more convenient than splicing tape. If you do a lot of tape splicing, the editing capabilities alone may make the DR4d worth the price of admission. In addition, Akai is working on Macintosh software that will provide graphic waveform editing and many DSP functions. The DR4d doesn't have onboard DSP to perform these functions, so presumably you would have to load the audio file into the Mac's RAM and use some sort of NuBus hardware, e.g., one of Digidesign's Motorola 56000-based cards, or Spectral Innovations' AT&T 3210-based NuMedia card.

VARIATIONS ON A THEME

The primary SCSI port can only be used for recording audio on an external hard drive; there is no utility for backing up from that port. If you install the optional second SCSI port ($199), you can back up your data to an external hard disk, magneto-opti-

cal drive, or data DAT. Without the second SCSI port, you must back up to an audio DAT recorder with digital inputs and outputs.

All my backups went without a hitch. Backing up the entire hard disk is painlessly simple, as is loading from DAT. Backing up selected material is easy, but you must specify in and out points beforehand. I was also able to seamlessly transfer data back and forth between the DR4d and Pro Tools.

Up to four recorders can be connected with cables attached to multipin DIN ports. I don't understand why these ports are on the front panel, though, as it's highly unlikely you'll change their configuration often enough to warrant front-panel convenience. One unit serves as the master transport control for the others, but unfortunately, it's not possible to transfer audio data between machines when they're synchronized.

The optional DL4d remote control ($849) duplicates all the front-panel controls, except for the level meters and headphone-level control. However, they're arranged in a slightly different configuration, so if you've grown accustomed to bopping around on the front panel, you must reorient yourself to the DL4d's layout. For example, the Sub-Menu key is below the display, rather than in the upper right corner. An extra button lets you switch among four recorders.

With the optional MIDI interface card installed ($159), the DR4d can be used as a MIDI master clock to synchronize a MIDI sequencer. Unfortunately, the DR4d can't slave to MIDI Clock, MIDI Time Code, or MIDI Machine Control. If it did, you could control the DR4d from your computer-based sequencer, as with other hard-disk recorders. (Support for MIDI Machine Control is promised, along with dedicated Macintosh software to control it.)

Even with the DR4d as the master, the MIDI implementation is relatively primitive, sending MIDI Clock, Start, Stop, Continue, and Song Position Pointer, but not MIDI Time Code. In addition, synchronization is anything but easy. First, you create a Beat Map, indicating the time signature and any time-signature changes. Then you enter a Tempo Map, specifying the initial tempo in beats per minute (including tenths of a beat), then the bar location

and tempo of any subsequent changes. Tempo changes can only occur at the beginning of a measure, which precludes nuances such as fermatas. Programming MIDI sync on the DR4d reminded me of the Roland SBX-80, circa 1987, which was actually better. It sure would make life at lot easier if the DR4d could respond to external MIDI synchronization.

There's also an optional SMPTE interface card ($199). It reads time code without difficulty, but as of this review, its output jack doesn't do anything other than pass incoming time code. Again, if you need to use the DR4d with other recording equipment, it's a necessary add-on.

APPLICATIONS AND OPINIONS

I found the DR4d to be most useful for situations in which I would have used my 4-track reel-to-reel over a decade ago, especially remote recording. You can take it, along with mics and a small mixer, into a performer's environment, instead of convincing the artist to come to you. It's fine for producing song demos with tracks that hope to survive their way onto the final product. There's no compromise in audio quality, as there is with even the best multitrack cassette decks.

Unlike most multitrack cassettes, though, an external mixer is absolutely essential. If you have a home or project studio, already own a mixing console, want to dip into hard-disk recording, but can't afford a computer-based setup, the DR4d may be just what you've been waiting for. With enough hard-disk space, it's also an excellent, economical medium for mastering CDs from DAT, ADAT, or any other audio tapes. Remember, when you use it as a 2-track recorder, you get twice the recording time.

If you're a broadcast engineer who spends a lot of time at the splicing block, the DR4d may seem like one of the greatest inventions in the history of audio. As a random-access alternative to a cart machine in the broadcast booth, all those autolocate points could come in mighty handy.

With the optional SMPTE card, the DR4d shines in a post-production environment. It offers much more recording time than most samplers, at a reasonable cost. I know of several post facilities with a DR4d in each room.

As a 4-track addition to a sequencer-based studio, the DR4d is lacking. It must perform seamlessly with a sequencer, and at present, it's just too much work. I understand why MIDI is an option; users who don't need it shouldn't have to pay for it. But for those who need them, the MIDI features need improvement. With some software re-engineering, the DR4d has the potential to provide those four digital audio tracks every synthesist knows he or she needs. But, I'm sad to say, it's not there yet.

One DR4d is relatively cost-effective: $2,500 for 40 track-minutes of self-contained, random-access, digital recording, with no need for a computer. Moving beyond four tracks is less so. There are several alternatives to this approach. Digidesign's Session 8 lists for $4,000 plus a computer (around

$1,000). The Alesis ADAT has little self-contained editing capability, but the low cost of media makes its $4,000 list price more attractive. A complete 16-track Digidesign Pro Tools system lists for more than twice the price of a comparable DR4d system, but its capabilities are light-years beyond the DR4d.

Ultimately, you must decide if the DR4d will suit your needs. In some applications, the unit offers good value, especially with some of the options installed. In other situations, it falls short. Fortunately, Akai seems dedicated to improving this product with software upgrades. If you want random-access digital audio at a reasonable price, without requiring a computer, and you don't expect to need more than four tracks, the DR4d is worth considering.

Geary Yelton *has joined the ranks of "creative professionals" at Ernst & Young in Atlanta. After over a year's dry spell, he has found the inspiration to begin composing original music again.*

Circle #439 on Reader Service Card

Mackie 8•Bus Mixer

By Neal Brighton

A monster mixer finally hits the streets.

They're here! The long-awaited Mackie 8•Bus mixers are actually shipping. These in-line consoles offer outstanding equalization, generous aux sends, and insane signal-routing options. The prices are unbelievable, too: The 24 × 8 × 2 model I reviewed retails for $3,995, the 16 × 8 × 2 costs $3,195, and the 32 × 8 × 2 lists for $4,995.

The hype about these boards always seemed too good to be true, which is why many musicians considered the 8•Bus series "wishful vaporware." Now, Mackie has delivered the goods; let's see if they deliver as promised.

FIRST IMPRESSIONS

When I pulled the board out of the box, the first word that came to mind was "clean." The 8•Bus is an ergonomic dream. Everything is well laid-out into four main sections: Channel I/O, Channel strips, Master I/O, and Master section. The power supply is a beefy unit that can be rack-mounted (2U), and a generously long multipin cable allows the unit to be set up far from the mixing position. But the cooling fan inside the power supply was so quiet, I didn't feel that distance was warranted; I simply left the unit on the floor, under the console.

I must admit that one of my favorite tasks when reviewing a product is taking it apart. Getting inside the 8•Bus is not easy, though, as the board is built like a tank, with an interlocking, bull-nosed, aluminum protrusion at the front of the mixer that rock-solidly secures the 1-piece top panel. Two plastic side covers hide most of the assembly screws, and you need to remove a lot of screws to get inside. I pity the techs that service these boards.

Once inside, I found PC-mounted pots similar to those used on Mackie's CR-1604 mixers. (For $3,995, you can't expect P&G faders and custom pots.) Everything is well secured, and given a hardy road case, the 8•Bus should do fine as a location-recording or live-sound console.

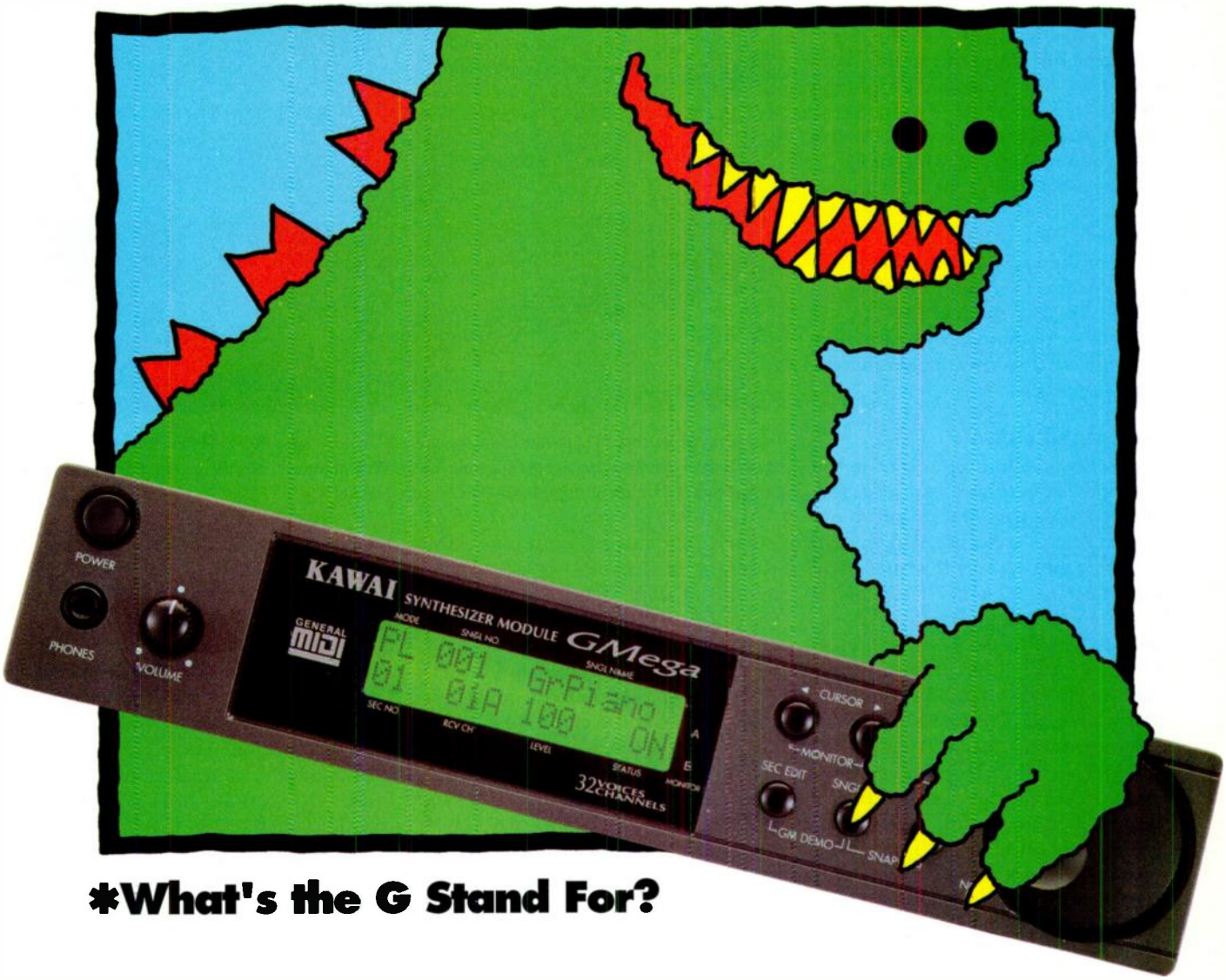
For spec nuts, the manual claims a general frequency response of 20 Hz to 60 kHz (±1 dB) and 0.009% THD at 1 kHz (20 Hz to 20 kHz bandwidth). At a +4 dBu operating level, the master section has a 90 dB signal-to-noise ratio. Channel-to-channel crosstalk is rated at -85 dB. I didn't pull out any heavy testing artillery to confirm or refute these claims; I can only say that the 8•Bus sounds incredibly quiet. Crosstalk and signal-to-noise was certainly comparable to my Trident Model 65 console, which cost a ton more than the Mackie.

CHANNEL I/O

Mackie's 8•Bus series offers powerful signal-processing options. Some features are found on practically every mixer in existence, while others are adapted from bigger, more expensive models.

All channel inputs and outputs are mounted on the top panel for easy accessibility. The mic inputs are standard, 3-pin XLR connectors and the mic gains have 48V phantom power that

G MEGA*



*What's the G Stand For?

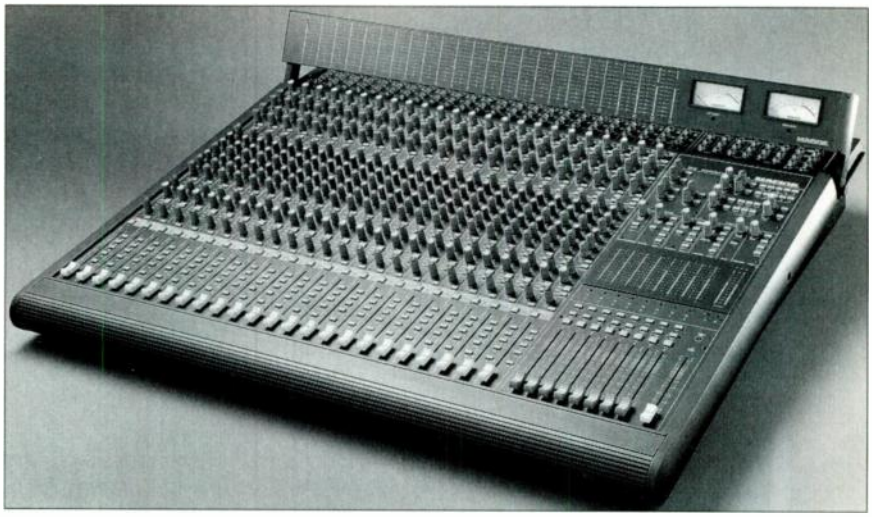
Try **G**argantuan, or **G**igundo, or any other word that describes the incredible number of sound programs (384 total) inside the diminuitive but amazingly powerful Kawai **G** Mega. Or maybe it's for the totally new Digital Multi Spectrum Tone **G**eneration system (16-Bit PCM and 16-Bit DC at a 44.1 kHz Sampling Rate), or the **G**obs of Sample Memory (48 Megabit), the **G**lorious 32-Voice Polyphony, the **G**igantic Wavetable of 256 Tuned Instruments plus 256 Percussion instruments, or the **G**enerous Selection of Drum Kits– 7 Kits for each Tone Bank (128 Sounds Each) all through 32 channels of MIDI. Maybe it's for the General MIDI implementation which allows you to get right to making music faster than ever before, or how about the fact that it's **G**loriously Easy to Program **G**azillions of your own sound creations into the 128 User Programs. Or how about the **G**RRRRREAT Panel Layout featuring an easy to read **G**reen Back-lit display. But then again, maybe it's for the **G**alactically Huge Sounds, or the basic fact that you've never **G**otten so much sound out of one (reasonably priced) module before. Convinced? Okay, mabe the **G** Mega is really named after a **G**iant **G**reen-skinned **G**oliath who likes to **G**rind cities underfoot. But please don't tell him. His head's big enough.

KAWAI

Digital Magic.

can be switched on or off in banks of eight. Below each channel's XLR input are three ¼-inch jacks: The top jack is a balanced-line input, the middle is an unbalanced direct out, and the bottom is a TRS channel insert.

Given the obvious care taken with the ergonomics of the 8•Bus mixer, it was surprising to find the mic/line selection switches mounted *behind* the line-input jack, where they are obscured by the patch cords and optional meter bridge (16-channel $695; 24-channel $795; 32-channel $895). Aside from this somewhat annoying arrangement, the controls are configured neatly and intuitively.



The Mackie 8•Bus series of in-line consoles offers 4-band EQ and a Mix-B section that allows each channel strip to return two signals simultaneously. With group and effects returns, this means you can get approximately 60 signals into the 24 x 8 x 2 model.

REAR-PANEL I/O

Because connections to and from the multitrack deck are seldom disengaged, it makes sense that Mackie put these I/O jacks on the rear panel. Although the tape returns and submaster/tape outputs are not as easily accessible as the channel-strip connections, the rear-panel jacks allow the connecting cables to be neatly (and safely) hidden behind a table or mounting console.

All tape-return jacks and submaster/tape outputs (arranged in groups of eight) are ¼-inch, balanced connections that can be switched for +4 dBu or -10 dBV operating levels. Main L/R balanced outputs are also provided via XLR connections. The power-supply jack and a port for a future 24-channel Expander Console option (for the 24- and 32-channel boards) complete the rear connections.

CHANNEL STRIPS

Like most boards, the channel strips begin with a mic/line gain knob. However, Mackie adds a twist by providing a switch that flips the signal between the tape return and mic/line input. It's a great idea; with a simple button push, you can be ready to mix (or track), without repatching. The switch also routes signals to the Mix-B/Monitor section (more on this later).

You get six aux sends on four knobs: Aux 1 and 2 are always 1 and 2, but aux 3 and 4 can be switched to aux 5 and 6. All aux sends can be selected pre-fader or post-fader, in pairs. However, when pre-fader is selected, the signal is still post-EQ. A Source switch allows aux sends 3/4 (or 5/6) to be dedicated to the main channel strip, or the Mix-B section.

One of the mixer's most impressive features is the channel EQ section. The amount of tonal control is awesome. The full 4-band EQ can be used to process signals routed to the channel strip, or the fixed high (12 kHz) and low (80 Hz) bands can be sent to the Mix-B section. These bands offer ±15 dB of equalization, as does the low-mid band, which is variable between 45 Hz and 3 kHz. The high-mid band is a monster, providing three levels of control: a variable center frequency from 500 Hz to 18 kHz, a variable bandwidth from 3 octaves to 1/12 octave, and 15 dB of boost or cut. And finally, each channel has an EQ in/out switch and a 75 Hz low-cut filter. Whew!

At the bottom of the channel strip are the pan pot, mute switch, solo switch, and fader. The mutes and solos have status LEDs. Soloing (post-fader/post-mute) is true solo-in-place, which maintains the stereo placement of soloed signals. The channel strips have a red LED that warns against overloading, and a green LED alerts you when a signal is active, a nice touch for helping confused engineers trace a signal path or confirm an input.

The 100 mm Panasonic faders have a smooth audio taper, although they feel a bit light. Subgroup assignments are selected with the typical odd/even pan-pot routing: Panning left sends signals to groups 1, 3, 5, and 7, while panning right services groups 2, 4, 6, and 8. (Panning center routes signals to groups 1 and 2, 3 and 4, and so on.) A L/R mix switch assigns the pan pot to the stereo bus during mixdown.

THE MIX-B SECTION

Below the equalization section on the channel strip is the Mix-B section. This is more than just an in-line monitor section. Of course, you *can* use Mix-B to monitor signals on the channel strip during recording, but you can also use it as an additional track return at mixdown. The section can be switched to monitor tape tracks or line inputs. This means you can return 24 tape tracks *and* 24 line inputs (such as virtual tracks from your MIDI instruments) simultaneously.

Each channel of the Mix-B section has its own level and pan controls, but you can also assign the main channel strip's high and low EQ controls *and* two of its aux sends to the Mix-B signal for added processing. But that's not all; Mix-B can use the main channel signal (pre-fader) as its source. By assigning Mix-B signals through a separate L/R output for alternate stereo mixes, you can run two separate and distinct stereo mixes from the L/R mix and Mix-B outputs.

For audio post-production applications, you can produce a conventional stereo mix, a mono dialog mix, and a mono sound effects mix at the same time, on the same mixer. Sound-reinforcement mixers can run a hassle-free subwoofer mix through Mix-B and save their aux sends for more effects processing. The uses for the separate Mix-B outputs are only limited by one's imagination.

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• 8•BUS

MASTER I/O

The master I/O section, like the channel I/O, is top-mounted for easy access. All connections are ¼-inch TRS, balanced or unbalanced, depending on the application. You get L/R main inserts for processing the stereo bus (some of my clients like to compress their entire mix to emulate "mastered" CDs); submaster inserts; aux send and aux return jacks; and stereo control room, studio, main mix, two headphones, and Mix-B outputs.

L/R inputs for a 2-track mastering deck and an "external" deck (a compact disc player, cassette deck, and so on) allow handy monitoring of both playback sources. I find this feature essential when referencing my final mixes to commercial CDs.

MASTER SECTION

The master section of the board is straightforward. The six aux sends each have a level control and solo switch. However, the six stereo aux returns have different "personalities" for varied routing options during recording and mixing. Returns 1 and 2 each have a level control, pan pot, solo switch, and assignment buttons for the eight subgroups and L/R mix. Returns 3 and 4 have just a level control, solo switch, and assignment buttons for the two headphone mixes and the L/R mix. Returns 5 and 6 have a level control and solo switch and are dedicated to the L/R mix.

Below the aux send/return section

Product Summary

PRODUCT:
8•Bus Mixing Console
PRICE:
16 × 8 × 2: $3,195
24 × 8 × 2: $3,995
32 × 8 × 2: $4,995
MANUFACTURER:
Mackie Designs
20205 144th Ave. NE
Woodinville, WA 98072
tel. (800) 258-6883
or (206) 487-4333
fax (206) 487-4337

EM METERS	RATING PRODUCTS FROM 1 TO 5
FEATURES	● ● ● ● ◖
EASE OF USE	● ● ●
AUDIO QUALITY	● ● ● ● ◖
VALUE	● ● ● ● ●

are clearly marked "boxes" for various monitoring functions: Monitor or Mix-B level; headphone 1 and 2 levels; control room, studio, and talkback volume; and solo level. The solo-level box includes a nifty Rude Solo Lite that flashes on and off whenever a solo button is pressed. LED meters handle level readings for the eight subgroups and L/R main mix. The main mix LEDs also function as solo-level meters when a solo button is depressed.

Finally, you have the eight subgroup faders (each with individual solo switches) and the single L/R mix fader. Rather than a pan pot to designate stereo assignments, the subgroups have L-Mix, R-Mix, and Mono L+R switches. I'm sure you can guess what pushing the L-Mix and R-Mix buttons does; enabling the Mono switch routes a signal to both sides of the left and right mix buses.

CONCLUSIONS

In the words of one of our staff producers, Jerry Stucker: "This board sure makes things easy!" The myriad routing options make it child's play to do near-psychedelic signal processing (blending effects in and out, assigning tracks to individual or grouped processors, etc.) and integrate sequenced MIDI tracks with tape tracks during mixdown. On the 24 × 8 × 2 console, there are approximately 60 ways to return signals to the board.

I used the 8•Bus in sessions with an Alesis ADAT and was never disappointed with the sound quality. Unlike some mid-priced mixers, the clean, quiet, smooth Mackie EQ let me get virtually every sound I wanted. Even when the EQ is split between the channel strip and the Mix-B, enough tonal control is available to adequately process signals on both sections. In fact, the EQ is so comprehensive that I was able to get decent tones from poorly recorded tracks without using outboard graphic equalizers.

Beyond the obvious technical quality of the 8•Bus series, I'm impressed with Mackie's sense of professional practicality. The board's price may put its primary market in the personal studio and small project studio, but it's crammed with truly professional features. Home recordists can stay with the Mackie 8•Bus as they upgrade from semiprofessional to professional gear, thanks to the board's ability to

run either +4 dBu or -10 dBV operating levels.

The nonmodular design is a bummer for me, because I enjoy doing my own maintenance, but the majority of 8•Bus owners won't want to get inside their mixer. (Isn't that what service techs are for?) Besides, I can twist an ungodly number of screws in exchange for getting this much board for under $4,000.

The owner's manual is a kick in the pants. The text is written in that irreverent but fun Mackie lingo and still manages to explain everything clearly and comprehensively. There are enough informational graphics to please the pro and calm the beginner. I especially liked the track sheets and board diagrams, which can be photocopied and used to document session settings.

Everyone (and I mean everyone) who saw the 8•Bus wanted one, and the desire was intensified if they stuck around to *hear* it. Mackie's 8•Bus series seems destined to be a big winner, and the success is well deserved.

Neal Brighton *is an independent producer/engineer and co-owner of Sound & Vision studios in San Francisco.*

Super Sample Editors (PC)

By Dennis Miller

Sonic Foundry's Sound Forge 2.0 takes on Turtle Beach's Wave for Windows 2.0.

PC-based digital-audio fanatics don't have to take the taunts of Mac users anymore. No, I'm not going to launch into an impassioned argument about the benefits of one platform over another. But after a period of stagnation, digital-audio editing software for *Windows* has made a long-awaited leap forward.

The movement started at the low end, with an assortment of limited, but inexpensive, programs (see "Audio Editing Software For Multimedia PCs" review in the June 1993 EM). These ap-

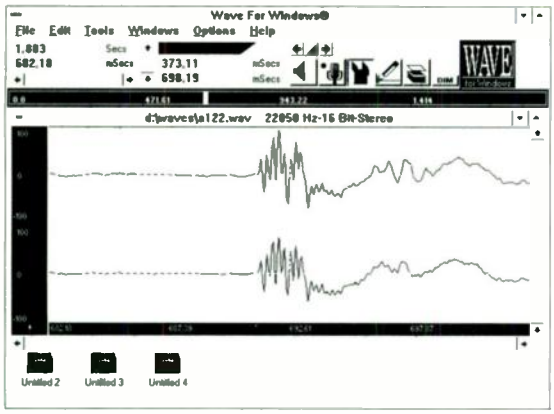

FIG. 1: *Wave for Windows*'s clean, uncluttered main screen. Turtle Beach Systems's program uses relatively few onscreen icons, but don't be fooled: It has impressive audio-processing capabilities.

plications are mostly intended for simple, stereo recording with sound cards and often come bundled with the hardware. But for complex, creative music or sophisticated multimedia applications, the primary choice for *Windows*-based PCs has been Turtle Beach Systems's long-established, but aging, *Wave for Windows* 1.0.

All that has changed because two of the most important PC digital-audio editors in years have made the scene. Not surprisingly, one of them is version 2.0 of Turtle Beach Systems's *Wave for Windows*. The other is an entirely new program, *Sound Forge*, from Sonic Foundry. Both are *Windows* Wave (.WAV) file-editing programs that support all *Windows* 3.1-compatible sound cards, provide features far beyond those in the various bundled programs, and do so for a much lower price than the Macintosh stalwarts.

These two audio editors don't provide multitrack digital-audio editing, which usually requires hardware that outperforms the average multimedia-oriented sound card. But both programs have enough cut-and-paste editing and audio-processing features to create, alter, and play complex stereo productions. And by using a *Windows* sequencer that supports MCI commands (a standardized way to play various types of multimedia files, including Wave files, video, animation, MIDI, and CD-ROM audio), you can incorporate your sound files into MIDI sequences with relative ease, greatly enhancing your desktop projects.

Even low-resolution Wave files demand far faster transfer rates to and from disk than MIDI files, so you'll be happiest using a system that meets at least the minimum requirements of the Multimedia PC Level II standard: an 80486SX PC, 4 MB of RAM, a 16-bit sound card (although 8-bit will work), a mouse, and a 160 MB or larger hard drive. Fast graphics are important, too, as screen redraws can be time-consuming, especially with large files. If you're doing serious music-production, you should acquire a tape-backup device for backing up individual files, as well as the finished production.

ENTER THE INTERFACE

Wave and *Sound Forge* offer clean, uncluttered working areas. Across the top of their main screens (see **Figs. 1** and **2**), you'll find the familiar menu bar, which provides access to most of the basic commands. A second control bar contains icon buttons for other program functions. *Sound Forge* follows the common *Windows* convention of displaying a text message that indicates the buttons' functions when you click on them. Because *Wave* displays only a few icons on screen, the fact that it lacks this feature is not much of an issue.

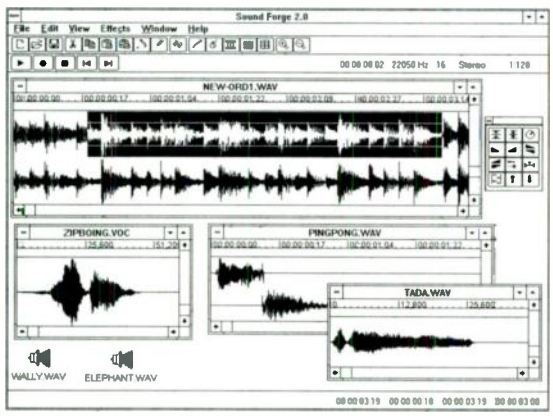

FIG. 2: *Sound Forge*'s main screen. Sonic Foundry's program can simultaneously handle a wide variety of audio file formats, including WAV and VOC files.

• WAVE/SOUND FORGE

Sound Forge provides numerous ways to optimize performance, such as setting the size of the Undo buffer, changing the resolution of the onscreen image, and specifying how much of a file is displayed when it's first loaded. This last option is particularly important if you work with large files, as it can take quite a while to display a file in its entirety, especially on a slow computer.

Wave gives you similar options, and it has a Soundfile Overview window, positioned just above the main file-display area, that helps you move quickly around a file, even if only a small amount of the file is displayed in the active Soundfile window. *Wave* uses scroll bars to change the horizontal and vertical view resolutions, making it easy to change zoom levels. A Previous View feature moves backward through the last eight views used in a session.

RECORDING

Because so many desktop multimedia projects include digitized sound, it's important that a program offer easy-to-use, efficient recording capabilities. Both *Wave* and *Sound Forge* let you record into an existing sound file or create a new one. With *Sound Forge*, you can, in theory, create a new file using any sample rate between 5 and 48 kHz. You can also convert sample rates of existing files between 2 kHz and 60 kHz. *Wave* will record only at 11.025, 22.05, and 44.1 kHz, although you can convert a file you've already recorded to many other rates. With both programs, however, the actual available sample rates are limited by your sound card; few if any cards support more than three or four rates.

Each program provides a Record Setup screen in which you specify the sample rate and bit resolution for a new file and monitor the incoming signal before recording. With *Wave* (but, unfortunately, not *Sound Forge*), you can also monitor during recording. *Wave*'s recording controls look like those found on a standard tape console, including a button that pauses and resumes recording. Although it is simple to operate, *Sound Forge* requires that you use an Okay button to begin recording, which I found annoying. Both programs have clip indicators and calculate the available record time remaining on disk, based on the selected sample rate and resolution.

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PROCESSING

The programs really shine when it comes to processing sound files. You'll find many of the standard effects used in hardware multi-effects units, but keep in mind that the software relies exclusively on your computer's CPU to crunch the numbers, and some of the routines can take a long time to compute. For example, expanding a 1-second, 16-bit, 44.1 kHz file to twice its length (yes, there were audible artifacts, but I didn't care) on a 66 MHz, 80486 machine took between one and seven minutes in *Wave*, depending on which of the three accuracy levels I selected. *Sound Forge* doesn't offer a time-expansion feature, but in general, many of its effects seem to run quicker than *Wave*'s. It's difficult to make direct comparisons; in most cases, the programs use different parameters to control their effects.

Many of the same effects are found in both programs, such as reverse, flange, delay, and distortion, but *Wave* adds numerous other processes, including reverb and a fancy 4-band equalizer (see **Fig. 4**). With this EQ, you can easily change the bandwidth and cutoff frequencies for each band and adjust the gain of the bands individually or globally. Settings are not saved with a file, but they can be stored on disk and reused. *Wave* comes with dozens of presets for many of the effects and provides an Advanced option that lets you create and save your own settings.

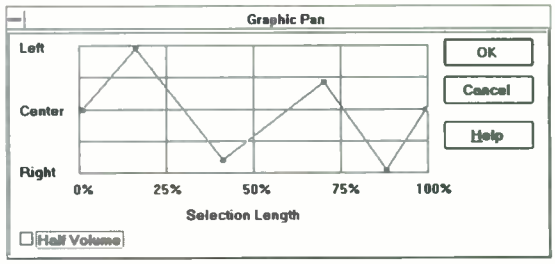

FIG. 5: *Sound Forge*'s Panning option displays a 2-dimensional graph representing stereo position over time.

Sound Forge's toolbox is not as extensive as *Wave*'s, and many of its effects have only a few parameters. Flange, for example, provides just Light, Medium, and Heavy options. Some of the other effects, such as Panning, are more flexible: You highlight a range, choose the Pan option, select the Graphic option, and the program displays a 2-dimensional graph representing stereo position over time (see **Fig. 5**). Move the line segment to any start and end point, and your file pans accordingly. Although this is useful, it would be even nicer if you could pan each channel individually. On the other hand, *Forge* lets you apply most other types of processing to one channel of a stereo file, which *Wave* does not.

In *Sound Forge*, if you use the same effects repeatedly, the program can automatically reapply the parameters from the previous operation, without requiring you to specify them again. It's a minor detail, but it turned out to be a time-saver on several occasions.

PLATFORM-TO-PLATFORM

At least once a week, I'm asked how to

move audio files between a Mac and a PC. With *Sound Forge*, this is a simple proposition, as it reads and writes Macintosh AIFF and SND, NeXT, Sun, Amiga SVX, and Atari *Sound Designer* sound files. Sonic Foundry provides a batch-file conversion program to registered users at no charge. *Forge* can also import Turtle Beach's *SampleVision*, Covox VB, and Dialogic VOX files, and it supports Microsoft ADPCM and Dialogic VOX ADPCM 4:1 compression formats.

Wave can import files in several formats including Turtle Beach's own *SampleVision* (SMP) and *SoundStage* (SFI), while both programs support Creative Labs VOC format, used by the ever-popular Sound Blaster card. *Wave* also supports Microsoft ADPCM compression. Both programs can save stereo files as mono and 16-bit files in 8-bit resolution.

SUMMARY

Both programs have much to offer and should serve you well when creating projects. There are a few things I would like to see added or enhanced, though. My wish list includes integrated, real-time mixers to adjust playback levels; easier editing and processing of multiple files simultaneously; and support for SMDI to allow Wave files to be transferred directly from the PC to a sampler. All of these capabilities are

Product Summary

PRODUCT:
Sound Forge 2.0

PRICE:
$179

SYSTEM REQUIREMENTS:
80386 or better PC-compatible; 2 MB of RAM (4 MB recommended); *Windows* 3.1; *Windows* 3.1-compatible sound card; hard drive

MANUFACTURER:
Sonic Foundry
100 South Baldwin, Suite 204
Madison, WI 53703
tel. (608) 256 3133
fax (608) 256 7300

EM METERS	RATING PRODUCTS FROM 1 TO 5
FEATURES	● ● ● ●
EASE OF USE	● ● ● ● ◖
DOCUMENTATION	● ● ● ◖
VALUE	● ● ● ●

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508	527	546	565	584	603	623	642
509	528	547	566	585	604	624	643
510	529	548	567	586	605	625	644
511	530	549	568	587	607	626	645
512	531	550	569	588	608	627	646
513	532	551	570	589	609	628	647
514	533	552	571	590	610	629	648
515	534	553	572	591	611	630	649
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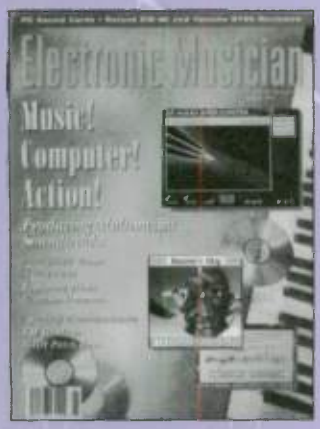

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technically possible and would help make *Wave* and *Sound Forge* even more useful to the professional musician.

When making your decision about which program to buy, here are a few things to consider. If moving files among computer platforms (for example, between a PC and Macintosh) is important, or your work often involves combining segments from many different files, *Sound Forge* is the right choice. Its clean interface and "smart" icon buttons make it easy to use and quick to learn. And if you're dumping your files to audio tape, perhaps using MCI commands from within a MIDI sequencer, you probably won't mind having fewer effects in the program, as you can always add them externally.

On the other hand, if you like the idea of having a software-based "effects unit" in your computer, with a large number of processing tools, *Wave* is the best choice. Although it's not quite as friendly as *Sound Forge*, it's a solid, reliable program. It's an especially good choice if your music will stay on the PC, perhaps as part of a multimedia presentation. For basic cut-and-paste editing, though, either program is fine. Pick the one that looks best for you and have some fun in the waves!

Dennis Miller *is on the music faculty of Northeastern University in Boston. He spends much of his time saying "no" to projects that would keep him from writing music.*

Circle #441 on Reader Service Card

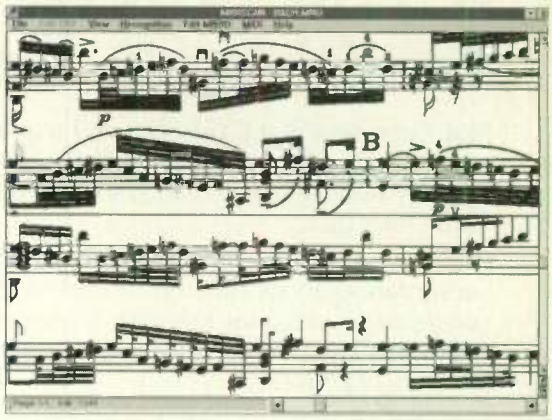
Musitek MIDISCAN

By Bob Lindstrom

Optical music recognition is finally a reality.

When music-notation programs first became available, electronic musicians took a one-way trip to heaven. Suddenly, we were able to turn our instrumental chops into professional-looking music manuscripts. However, electronic musicians never seem to be satisfied; now we want to turn sheet music into MIDI files.

Although optical character recognition (converting the written word into computer text files) was a thorny problem, optical music recognition seemed a virtual impossibility. With so many symbols and variants in standard Western musical notation, a computer must possess artificial intelligence of the highest order to evaluate the printed page and convert it into MIDI data.



MIDISCAN **failed to recognize durations accurately in this unedited MNOD file of a Bach violin sonata, but it did a good job of recognizing pitches. In the first measure, a confused *MIDISCAN* fabricated a whole-note chord in the MNOD file (lower window).**

Musitek is the first company to take up the challenge. *MIDISCAN* attempts to realize the impossible dream of gleaning MIDI files from scanned, TIFF images of manuscripts. The program runs on 80386-based PC-compatibles or better under *Windows* 3.1 or higher. It requires at least 4 MB of RAM, a *Windows*-compatible video card, a mouse, and a full-page scanner with controller and software. I used an 80386, 33 MHz system with 12 MB of RAM and a *Windows* accelerator.

Is *MIDISCAN* a miracle? The answer is a definite "sometimes." For the first product in a new product category, *MIDISCAN* does some extraordinary things. It performs well when converting piano reductions and clean original source material. With less-conventional challenges, its performance can be uneven. Still, with some experience optimizing scan contrast and resolution, removing spurious notational elements before converting to MIDI, and using high-quality source material, *MIDISCAN* can often streamline the sometimes tedious process of entering notes from the printed page into a MIDI file.

HOW DOES IT DO THAT?

The *MIDISCAN* miracle starts with an uncompressed TIFF (Tagged Image File Format) image of each musical page. You start by telling the program if the page is a single instrumental part or a multipart score. In the File Selection screen, you identify the appropriate TIFF files in the order they should be converted and merged. (Multiple pages must be in the same format, e.g., pages from the same single part or score, to combine them in this way.) During the batch-conversion process, *MIDISCAN* examines the TIFF representation of each page and corrects for a skewed or crooked scan. The program can correct for skew angles up to ±8 degrees.

Next, *MIDISCAN* identifies staves, key and time signatures, note pitches, accidentals, note and rest durations, ties, and bar lines. At present, the program ignores chord symbols, slurs, guitar tablature, fingerings, articulations, lyrics, and dynamics. Musitek hopes to add slur and articulation recognition in a future version.

Musitek claims that the recognition

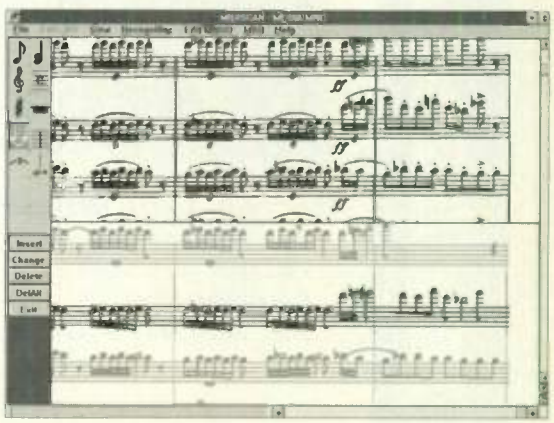


FIG. 1: MNOD editing tools are located in an icon tree (left) and help fine-tune files before conversion to MIDI. The music in this example is the TIFF file included with the program.

process should take from two to five minutes per page. However, with some of the denser manuscript pages I tried, the program frequently pushed that to as much as ten minutes.

After the recognition process, *MIDISCAN* creates a single file in its own MNOD (Music Notation Object Description) format, which includes all the selected TIFF files. After the MNOD file is saved, the program displays it beneath a graphics window containing the original TIFF scan. The user can compare the TIFF file to the MNOD interpretation in these windows. With the MNOD editing tools, you can insert, delete, and adjust musical elements to bring the MNOD file into closer agreement with the TIFF original.

The dual-window comparative display, combined with a solid array of editing tools, makes fine tuning MNOD files one of the best aspects of *MIDISCAN*. The interface and features work brilliantly to make this process easy.

After saving the edited MNOD file, you convert it to a Standard MIDI File (SMF), assigning separate MIDI channels to each staff of a score. *MIDISCAN* is limited to sixteen staves per system, the number of available MIDI channels. In systems exceeding that limit, *MIDISCAN* allows you to choose which staves to exclude from the 16-

Product Summary

PRODUCT:
MIDISCAN
PRICE:
$379
SYSTEM REQUIREMENTS:
80386-based PC-compatible or better, *Windows* 3.1 or higher, 4 MB RAM, *Windows*-compatible video card and mouse, scanner with controller and software.
MANUFACTURER:
Musitek
410 Bryant Circle, Suite K
Ojai, CA 93023
tel. (805) 646-8051
fax (805) 646-8099

EM METERS	RATING PRODUCTS FROM 1 TO 5
FEATURES	● ● ●
EASE OF USE	● ●
DOCUMENTATION	● ● ● ◖
VALUE	● ● ●

channel MIDI transcription.

You then load the SMF into a sequencer. Additional editing is necessary from within the sequencer to add dynamics, note velocity, and other expressive nuances not included as part of the recognition process.

A QUICK SCAN

I started using *MIDISCAN* by loading the sample TIFF file included with the program and following the brief tutorial in the well-written, 74-page, spiral-bound manual. This simple minuet responded effectively to recognition.

The resulting MNOD file was surprisingly faithful to the original TIFF file (see **Fig. 1**). In some places, dynamic markings were mistaken for notes. Yet, on the whole, it was an excellent representation of the manuscript. Similarly acceptable results were obtained with some piano reductions of Steely Dan and Donald Fagan songs. *MIDISCAN* skillfully interpreted these pages with relatively few errors.

The MNOD editing tools provide an efficient way to correct errors in the MNOD file. After editing the sample score, the MIDI conversion produced a file that loaded without problem into Twelve Tone Systems's *Cakewalk 2.0 for Windows*. The audible results were accurate, but expressively cold due to the lack of dynamics and phrasings.

Although the MNOD tools let you correct errors in the MIDI translation, Musitek suggests that optimizing the scanning and MNOD conversion processes can help ensure the best possible interpretation. For example, scanning at 350 dpi increases the quality of the TIFF image, thereby improving the reliability of *MIDISCAN*'s performance. Adjusting the image to achieve strong contrast also helps the program operate at the top of its form. In addition, the program's TIFF editor lets you eliminate notational elements, such as guitar tablature and slurs, that *MIDISCAN* doesn't recognize. Doing this before translating to MNOD format significantly improves recognition.

Generally, I was encouraged by my test outing with *MIDISCAN*. Fleet-fingered musicians may be able to input short pieces into a sequencer or notation program in no more time than it takes with *MIDISCAN* (particularly if you include the time required to enter

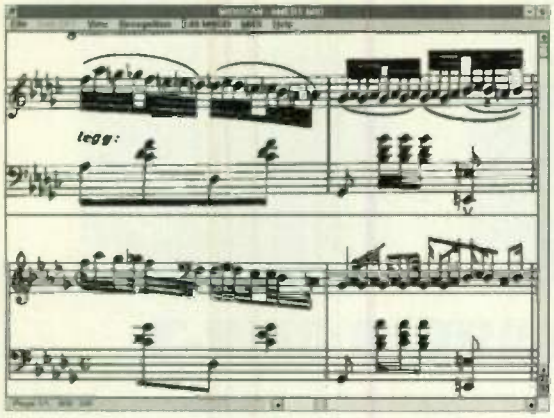


FIG. 2: In this unedited TIFF scan of a 19th century American piano piece, *MIDISCAN* identified pitches and rhythms incorrectly in the MNOD file (lower window). In part, this is due to the murky reproduction of beams in the original TIFF file. Note that the program has identified the key signature incorrectly.

expressive elements, such as dynamics). But for the average keyboard jockey, or those with lengthy compositions to enter, *MIDISCAN* can really cut down on the drudgery.

SCANNING FOR CLINKERS

After verifying that *MIDISCAN* worked effectively with the factory-authorized, sample TIFF file and several "standard" piano reductions, it was time for a few torture tests. These tests represented challenges that some musicians are likely to place before *MIDISCAN* and were intended to find the outer limits of the program's performance.

MIDISCAN was fooled while locating the beginnings and ends of staves in an orchestral score. Occasionally, it identified the instrument names at the front of each staff as the beginning of the staff. Fortunately, it was simple to enter Correction mode and relocate the faulty placement. After that, *MIDISCAN* did remarkably well with the recognition, providing a fairly accurate interpretation of a complex orchestral passage.

While converting the orchestral page to MNOD format, *MIDISCAN* crashed twice for lack of memory (on a 12 MB system). The third time, I carefully set up sixteen of the page's eighteen staves for recognition; *MIDISCAN* was then able to complete the MNOD conversion.

Finally, I resorted to downright dirty tricks by scanning an American concert piano composition printed with a music font that had been popular in the 19th century but is seldom seen today, except in a historical context. In addition to being nonstandard by contemporary criteria, the page included cascades of grace notes. As I had anticipated, *MIDISCAN* hardly knew what to do with this mass of notes and stems (see Fig. 2).

DO I RECOGNIZE YOU?

With additional experience creating TIFF files and carefully touching up the scans before subjecting them to *MIDISCAN*, it is possible to increase the accuracy of recognition. But the question remains: How much work is it worth? By the time you've edited the TIFF file, converted to MNOD, edited the MNOD file, completed the MIDI conversion, and refined the MIDI data to include the missing phrasing and dynamics, I suspect that some musicians will be better off entering the notes by hand, especially for short jobs.

Nevertheless, *MIDISCAN* embodies a wonderful concept. Considering the difficulty of what it's trying to do, it's a marvelous and admirable programming achievement. Much has been achieved in version 1.0, but much remains to be done.

Musitek is really onto something here. With ongoing and major improvements in its music-recognition prowess, *MIDISCAN* could become a staple application in every MIDI studio. At present, it will serve the most common optical music recognition needs of many musicians and ease the pain of getting print to MIDI.

Bob Lindstrom *is a freelance writer, composer, and conductor who owns one of just about every major type of computer available.*

Circle #442 on Reader Service Card

A.R.T. FXR Elite Stereo Processor

By Richard Chycki

True stereo, 16-bit effects at a rock-bottom price.

With its versatile line of multi-effects processors, A.R.T. has made a healthy business out of bringing smiles to the faces of guitarists and home recordists. But it was still a shock that one of the first devices bearing the company's new ASIC chip is a super bargain.

For $299, the FXR Elite boasts true stereo algorithms, simultaneous multi-effects capabilities, and limited MIDI control. The cost may have been slashed by allowing the unit's 255 presets only one or two parameter adjustments, but nothing about this box can be called "cheap."

STATING THE CASE

Extending a mere 4¼ inches deep, the FXR Elite's single-rackspace, steel casing is extremely solid. A conservative redesign of the often gaudy A.R.T. front-panel graphics symbolizes that the FXR Elite is a tough, no-nonsense machine. The sparse rear panel holds the MIDI In and Out ports and sports ¼-inch connectors for the stereo inputs, stereo outputs, and bypass switch. (The left input and output connectors sum both channels for mono applications.)

A.R.T.'s FXR Elite offers only basic programming functions, but it has a true stereo signal path and delivers good flange, chorus, delay, and reverb effects at a bargain price.

Power is provided by an external AC adapter.

The front-panel layout is clean and logical. Switches are available to bypass (which activates a flashing LED indicator), save preset alterations, enter Utility/MIDI modes, kill the dry signal (also LED indicated), and scroll presets. The preset number is indicated by an LED panel, while an angular row of seven LEDs identify which two parameters are adjustable within the selected preset. Adjustments are entered with a pair of rotary encoders. Input and output level controls and input signal (and clip) indicators are also provided.

The FXR Elite accommodates line-level signals of up to +14 dBV. Instruments can also plug directly into the unit; its 500 kΩ input impedance will not load down most passive instrument pickups.

PREDESTINATION

If you're looking to select your own effects and develop custom configurations, forget it. The secret to successful FXR Elite use is to find a preset that is closest to your requirements and tweak it. The Elite's 255 user presets are divided into sixteen banks of sixteen presets (except Bank 8, which has fifteen presets). Basic parameters, such as delay time, regeneration, and modulation sweep, can be modified. The status of the dry kill (which eliminates the dry signal, leaving a 100 percent wet output) and wet/dry mix knobs can also be saved in each preset.

Moving any of the three encoders

Product Summary

PRODUCT:
FXR Elite Stereo Effects Processor

PRICE:
$299

MANUFACTURER:
Applied Research and Technology
215 Tremont St.
Rochester, NY 14608
tel. (716) 436-2720
fax (716) 436-3942

EM METERS	RATING PRODUCTS FROM 1 TO 5
FEATURES	● ● ◖
EASE OF USE	● ● ● ● ◖
AUDIO QUALITY	● ● ●
VALUE	● ● ● ●

causes the LED numerical display to indicate the respective controller's value (0 to 99); the indicator remains visible for about two seconds before returning to the preset-number display. Changes to the preset are volatile until they are saved, which requires a simple button-press.

THE LINE-UP

The first 48 presets are true stereo reverbs of varying lengths and brightness: rooms, chambers, halls, plates, and a healthy portion of gated and reverse reverbs. Only level and EQ contour can be adjusted. Several banks are dedicated to dual mono and stereo delay; flanger, chorus, and pan; and reverb patches.

Other dual-mono algorithms include (L/R channels): regular and gated reverb/delay, delay-flanger/chorus, delay-reverb/flanger-chorus, and gated reverb/flanger-chorus. With these dual-mono effects, if you have selected, say, a reverb/delay preset, you get mono reverb at one output and mono delay at the other output. Several more complex multi-effects algorithms offer various combinations of delay, reverb, flanger, and chorus.

▼ The nominal amount of noise would be masked in all but the most revealing situations.

In MIDI/Utility mode, you can assign up to two simultaneous MIDI controllers (CC 0 to 99) to the programmable functions. Utilitarian MIDI channel selection, Program Change mapping, and SysEx dumps are handy. A bypass footswitch can be programmed to accept normally open momentary, normally closed momentary, or push-on/off footswitches.

The manual decodes any controller abbreviations you may find in the FXR's menu. Overall, the manual is concise and logical, clearly advising the user of recommended connection op-

tions and listing a plethora of effects and parameters.

SOUND QUALITY

The FXR Elite uses 16-bit A/D and D/A converters, at a sampling rate of 48 kHz, for a bandwidth of 20 Hz to 20 kHz. The internal ASIC performs its computations in digital 24-bit words. In use, listening to the wet signal exposed a nominal amount of noise that would be masked in all but the most revealing situations. As with previous A.R.T. processors, changing presets causes the unit to mute momentarily and emit a soft "thump," which could be audible under certain conditions.

All the reverbs are useful, and having true stereo effects at this price is brilliant. Of particular note, the hard-attack plate algorithms have interesting early-reflection characteristics. The small room, gated, and reverse reverbs are somewhat metallic and brash. This isn't necessarily a disadvantage, however, as the sharp timbres can cut through a thick mix. The dual-mono reverbs offer two distinct acoustic environments, which is useful for independent processing of two mono sound sources, such as separate keyboards in a live rig.

There's no problem finding a delay algorithm for any situation. The FXR Elite offers a wide variety of rhythmic options. The flanging and chorus algorithms, although somewhat restricted because of the limited programmability, provide basic modulation effects to add motion to static sounds.

FINAL WORDS

Aimed specifically at home studios, the FXR Elite is a no-frills, multi-effects unit that packs a hefty punch for the dollar. Its selective programmability and broad effects possibilities make it an ideal processor for any quick-and-dirty audio situation. Whether you're a bedroom studio aficionado shopping for your first reverb unit, or a professional technoid in need of one more ambient slap echo, the FXR Elite delivers the goods.

Richard Chycki *is a producer/engineer/guitarist in Toronto, Canada, who has worked with Skid Row's Sebastian Bach, James LaBrie of Dream Theater, and Jeff Healey.*

Circle #443 on Reader Service Card

(continued from p.68)

two screens, and a data wheel (all clearly labeled) on the front panel. The downside to all this power and flexibility is that some initial study of algorithm routing is necessary for proper operation. This is not a "plug in and go" unit, but the manual is excellent. On a down note, the TSR-24 is the only unit of the four that gives you the number, but not the program title, of the RAM slot you're thinking of overwriting to store a new program.

DISCOVERIES

The most expensive box, the Yamaha SPX990, is also the best-sounding for most studio applications. The clarity and realism of its reverbs can't be beat, although some may prefer the warmth of the DigiTech TSR-24's reverbs.

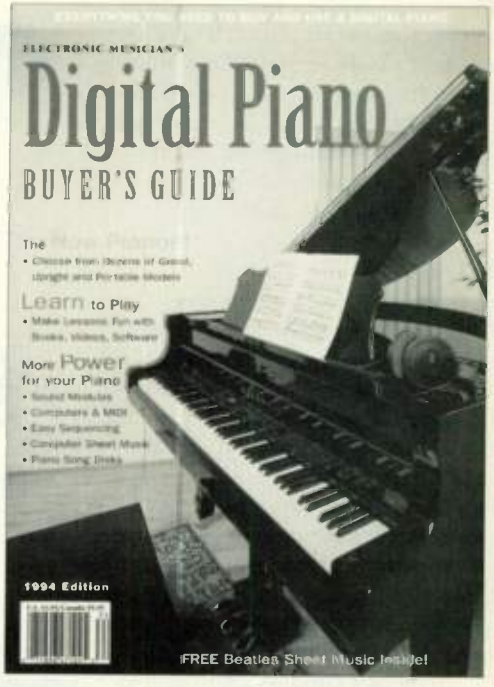
The two obvious choices for live guitar use are the BOSS SE-70 and Zoom 9050. However, the SE-70 is the better sounding (and more expensive) box. In particular, the SE-70's distortion, flange, and phaser effects are unmatched by the other three boxes combined. Simply put, the SE-70 *kills* on electric guitar.

The SE-70 and the 9050 are also the easiest boxes to operate. On the other hand, the TSR-24, with its impressive utilities for programming effects algorithms and routing configurations, offers live and studio applications the other three boxes can't touch. For example, the quad output configurations can be used for 4-speaker, dual-stereo live applications, where different parameter values are chosen for front and rear speakers. Move over, Pink Floyd!

All four units offer powerful footswitch, foot controller, and/or MIDI control of Program Changes and parameters. The DigiTech TSR-24 gives you total control over the order in which programs are sequenced and uses a generic footswitch. Both the SE-70 and the 9050 offer MIDI-free, real-time modulation of effects parameters via expression pedals.

In the potpourri category, the SPX990 offers the highest quality pitch shifter, the TSR-24 the most useful sampler, and the 9050 and SE-70 the widest palette of weird special effects (ring modulators, vocoder, etc.).

All you need to do is determine what functions and effects are most important to your work. We've picked apart the products for you, now pick the one that's best for you.

Michael Cooper *is owner and chief recording engineer of Michael Cooper Recording in Eugene, Oregon. He writes frequently for several music-industry publications.*

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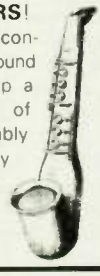

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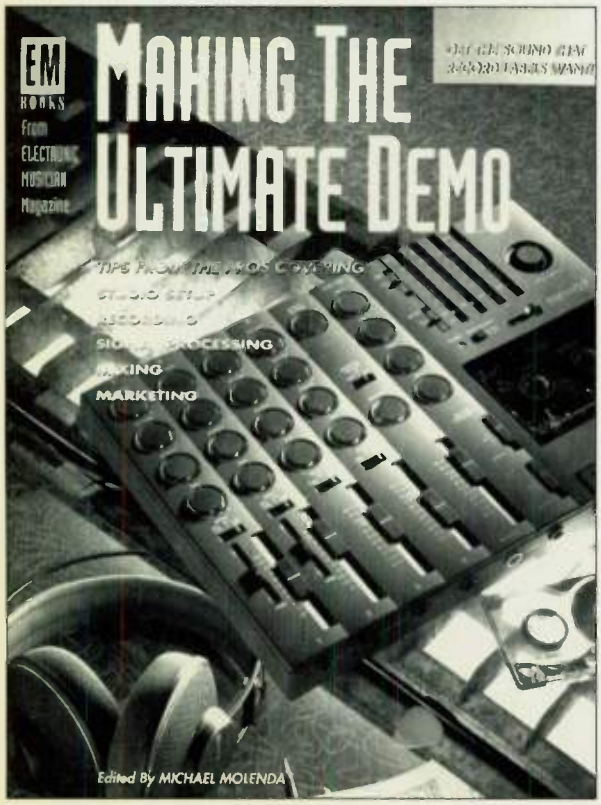

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TECH PAGE

Nonlinear Modeling

Nonlinear behavior is crucial to physical modeling.

By Scott Wilkinson

One of the most complex, but critical, concepts in musical-instrument acoustics is called *nonlinearity*. In the simplest sense, if you graph action versus reaction in a linear system, the result is a straight line. For example, the more you stretch a rubber band, the more restoring force it will exert; if you stretch it twice as far, it will exert twice the restoring force. Of course, this is true only up to a point. If you stretch it far enough, it becomes almost infinitely resistive (see **Fig. 1**). If you apply even more stretching force, it becomes permanently deformed or breaks altogether. In this case, the rubber band is said to be nonlinear.

Sustaining instruments convert steady energy—blowing into a wind instrument or bowing a string—into oscillation (see "Model Music," p. 42). This process is nonlinear in nature. For example, a brass player's lips are similar to a rubber band in that they are somewhat elastic. However, their elastic properties change in a nonlinear way as they are deformed, which causes them to oscillate in a brass mouthpiece.

Single and double reeds behave in a linear manner most of the time. As they are bent from their rest position by the fluctuating pressures within the mouthpiece and player's mouth, they exert a linear restoring force (that is, until they are bent as far as they will go in either direction). At that moment, they become nonlinear, changing their direction of motion. This nonlinearity results in a vibrating reed.

The interaction between bows and strings is also nonlinear. As the bow first makes contact with the string and begins to move, it sticks to the string, pulling the string away from its rest position. When the string can't be pulled any farther, it begins slipping against the bow and springs back beyond its rest position as far as it can go. It then sticks to the bow, and the cycle is repeated. This is called *nonlinearity with memory*, because it depends on where the bow and string were, with respect to each other, a moment before.

These nonlinear oscillators are attached to a resonant system, such as a string or wind-instrument bore, which presents the oscillator with certain favorable frequencies known as *resonant modes*. For example, it's much easier to buzz your lips into a trumpet, rather than into free air, which has no resonant modes. When the oscillator is initially stimulated to vibrate, it couples with the nearest mode and vibrates at that frequency.

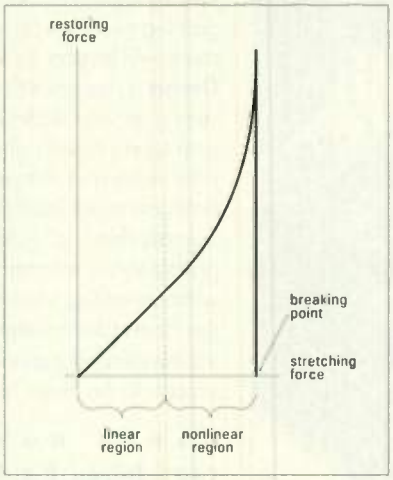

FIG. 1: If you stretch a rubber band from its rest position, it exerts a linear restoring force. If you stretch it beyond a certain point, however, the restoring force becomes nonlinear.

Physical modeling strives to emulate these nonlinear systems. The better the model of the nonlinear oscillator, the more completely you are able to capture the essence of the instrument. Of course, this is easier said than done; the mathematics of nonlinear systems are not trivial, to say the least. Nevertheless, this is the core of physical-modeling synthesis.

At the Center for New Music and Audio Technologies (CNMAT) at the University of California, Berkeley, researcher Xavier Rodet is working with a special, nonlinear-oscillator circuit to implement physical models. The circuit was developed by Leon Chua, a professor of electrical engineering at the university.

According to CNMAT research director David Wessel, "The Chua circuit displays many of the behaviors of physical systems, such as clarinets and saxophones. It can produce a great variety of sounds. It also goes berserk pretty easily, so you want to be careful. But it captures many features of many different classes of nonlinear systems. It's a potent distillation of nonlinear dynamics into a simple representation."

This and other work with nonlinear circuits heralds a new era in physical-modeling synthesis. It's an exciting time to be an electronic musician, so fasten your seat belt for the musical ride of your life.

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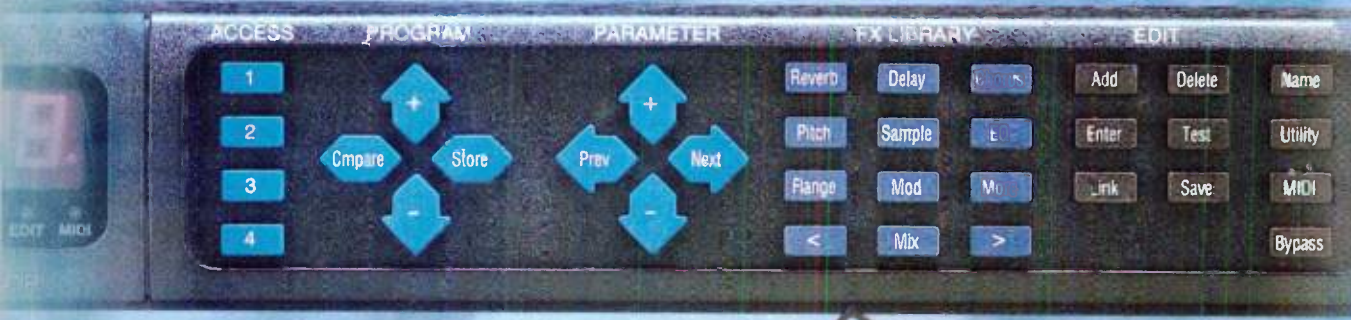

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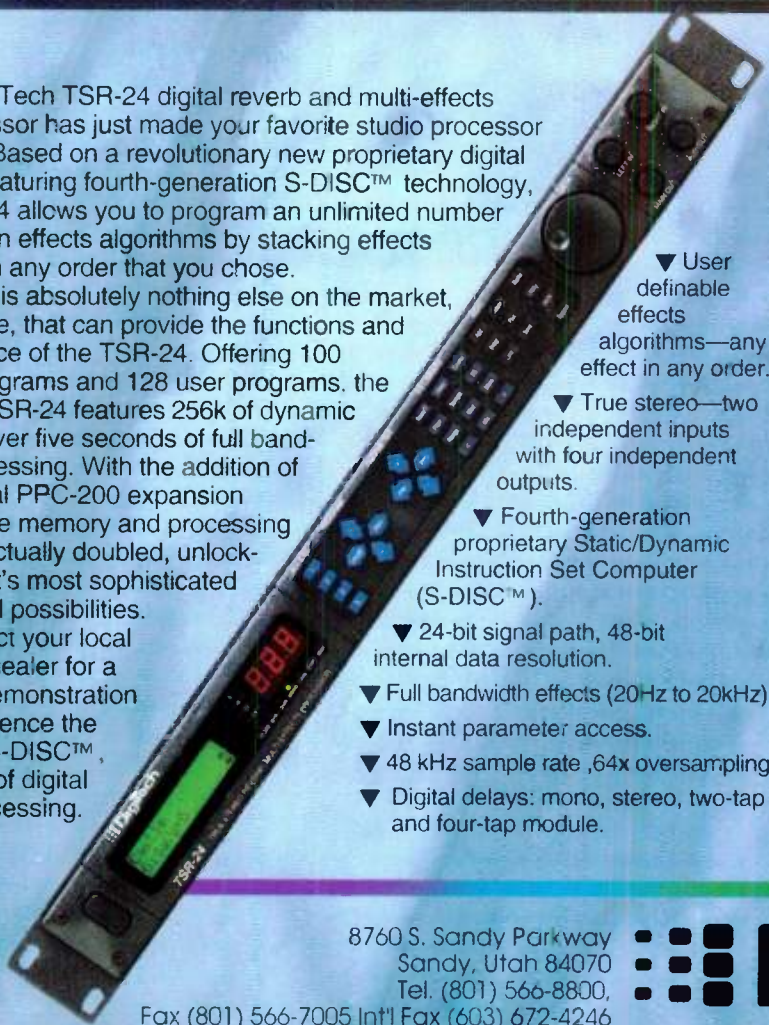

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