NEW! VINTAGE PAGE • Boss BR-8, M Audio Delta 1010, Røde Classic II, and 8 more reviews

Electronic Musician®

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August 2000

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1604-VLZ™ PRO

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1402-VLZ™ PRO

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1202-VLZ™ PRO

VLZ PROs have also won more industry awards

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VLZ™ PRO Series with XDR™ mic preamps. Precise creative tools for serious artists.

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Our VLZ™ PRO Series has become the industry standard for compact mic/line mixers. They're used day-in and day-out by more professionals to create more albums, demos, movie and broadcast sound tracks, commercials and web casts than any other brand.

They mix and submix in most of the world's top recording studios (we know of one 1202-VLZ™ PRO that's actually *built into* the control surface of a $1,000,000 digital console). And VLZ™ PRO mixers are in more basement, garage and back-bedroom home studios than you can shake a patchcord at.

XDR™. The finest microphone preamplifier design ever built into a compact mixer.

Because the preamps in mixers have long been considered a poor second to $1000 to $2000-per-channel outboard preamps, Greg and our Analog Engineering Department spent two years of meticulous experimentation creating a sonically comparable mic preamp circuit.

According to numerous cynical recording engineers, magazine reviewers and a lot of satisfied owners, we succeeded.

One reason is the advanced 2068 op-amps that are a foundation of the XDR design. They blow away our competitors' 4580 op-amps in terms of noise and distortion. Consider these real, measurable XDR™ (Extended Dynamic Range) microphone preamp specs:

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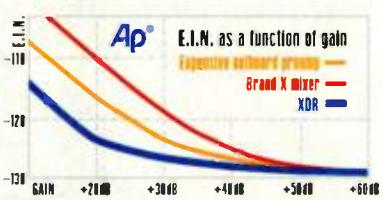
- **0.0008% Intermodulation Distortion**
- **130dB total dynamic range to handle hot digital sources**
- **3Hz to 192kHz bandwidth**
- **Ultra-low mic E.I.N. at practical real-world gain levels**

By "practical" gain levels, we mean the +20 to +30dB normal operating range. The chart below compares E.I.N. for XDR™ ■, an Awesomely Expensive Outboard mic preamp ■ and a compact mixer ■ whose specs *claim* –129dBm E.I.N....but only at +60dB gain.



While XDR™ sonically rivals esoteric designs, it's no creampuff. We also built in protection against damage from shorts and "hot patching"...and the best RFI rejection of any compact mixer.

But don't just take our word for it...

Here are a few comments we gleaned from just *one week* of incoming VLZ™ PRO Series owner registration cards:

"Love the XDR mic preamps...clean and sweet!" C.H., Tampa FL

"A quality replacement for a far more expensive mixer brand." J.C., Arlington TX

"I was contemplating a couple of '-----' outboard mic preamps ($2000+). The new XDR preamps let me make my next purchase a CD burner or an outboard processor instead." M.M., Miami FL

"Great product. XDR's are a great innovation and the value's unbeatable." J.K. Boise ID

"I hooked up my brand spankin' new AKG 3000 and all I can say is 'cool'." T.D., Waukesha WI

"I've been though numerous small consoles that were noisy. This one isn't, so it's a keeper!" J.F., Boca Raton FL

"Gorgeous preamps. Nice job, guys." J.C., Provo UT

"Nothing comes close to the quality/price." P.K., Spokane WA

"Excellent frequency response... excellent mic preamp. Worthy of our Neumann mics." C.M., Atascadero CA

"Killer mic preamps!" R.A., New York NY

The VLZ™ PRO Compact Mixer Series:

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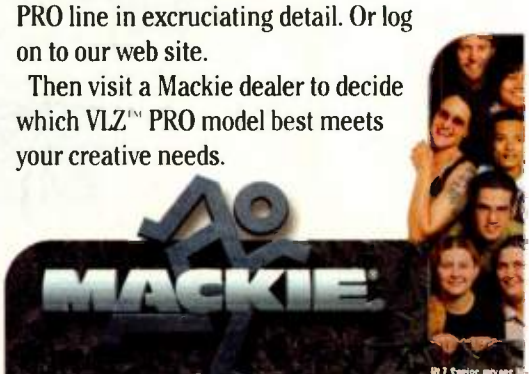
than any other competitive mixer line. These are just the awards we remembered to take photos of.



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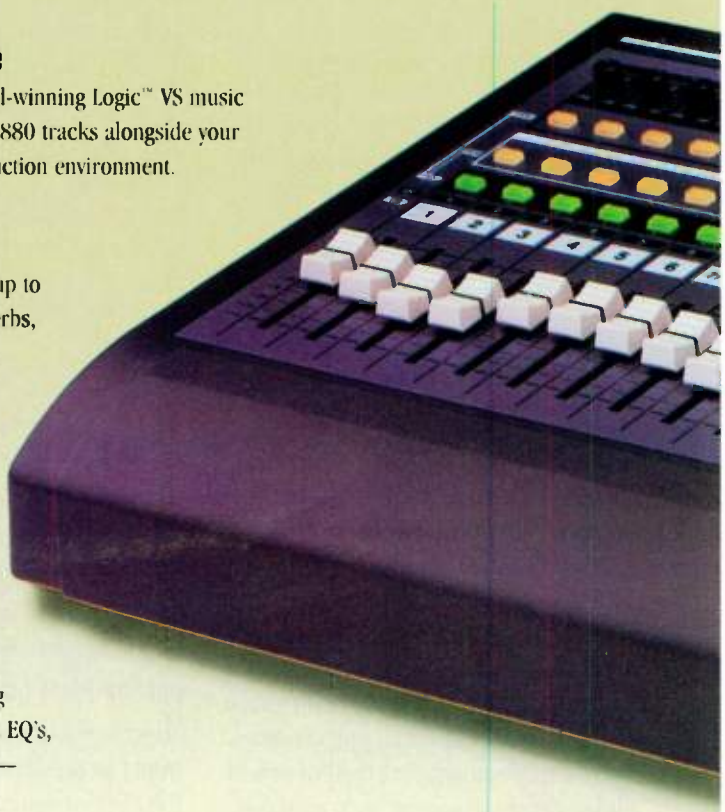
Every VS-1880 includes a FREE copy of Emagic's® award-winning Logic™ VS music production software, so you can edit and mix your VS-1880 tracks alongside your MIDI sequences in an integrated computer-based production environment.



Unrivaled Effects

By installing optional VS8F-2 Effect Expansion Boards*, you get up to 4 stereo/8 mono effects processors including studio-caliber reverbs, delays and chorusing, vintage effects simulations, and innovative COSM Guitar Amp, Microphone and Speaker Modeling.

Automated Digital Mixing

Perfect your mixes with the VS-1880's built-in 28-channel digital mixer, which includes time-saving dynamic automation capabilities and routing options galore.

Mastering Tools

The Mastering Tool Kit* gives you professional CD mastering tools including split-frequency compression, full parametric EQ's, extensive dynamics control and preset mastering templates—cleanly integrated into the V-Studio recording environment.

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Answers to any operational questions you may have—from day one through day one million—are never far away, thanks to Roland's extensive product support team.

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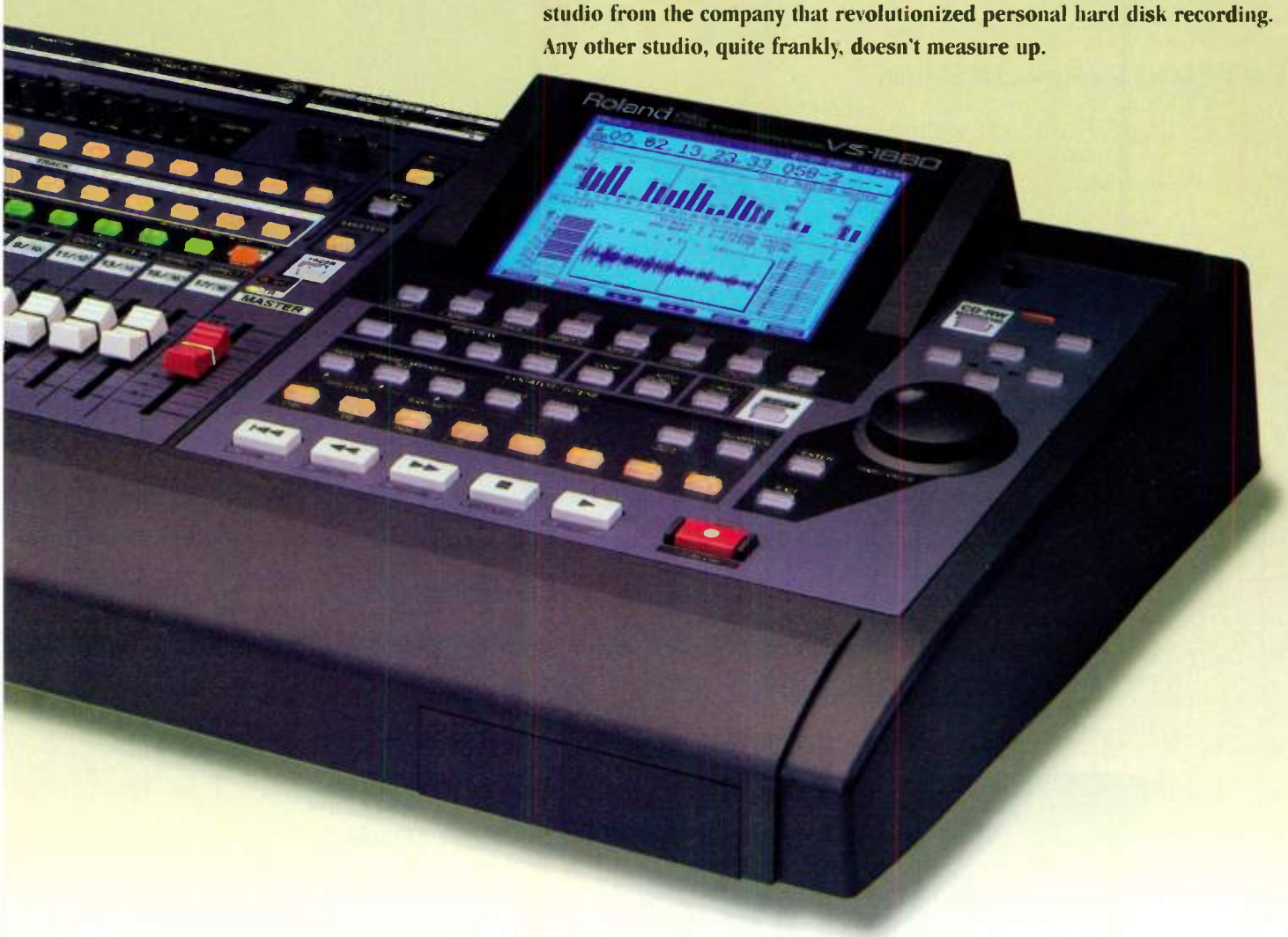
When it comes down to it, you can never have enough tracks... or effects... or convenience... or power. That's the thinking behind the new Roland VS-1880 Digital Studio Workstation. It's the ultimate integrated recording studio from the company that revolutionized personal hard disk recording. Any other studio, quite frankly, doesn't measure up.



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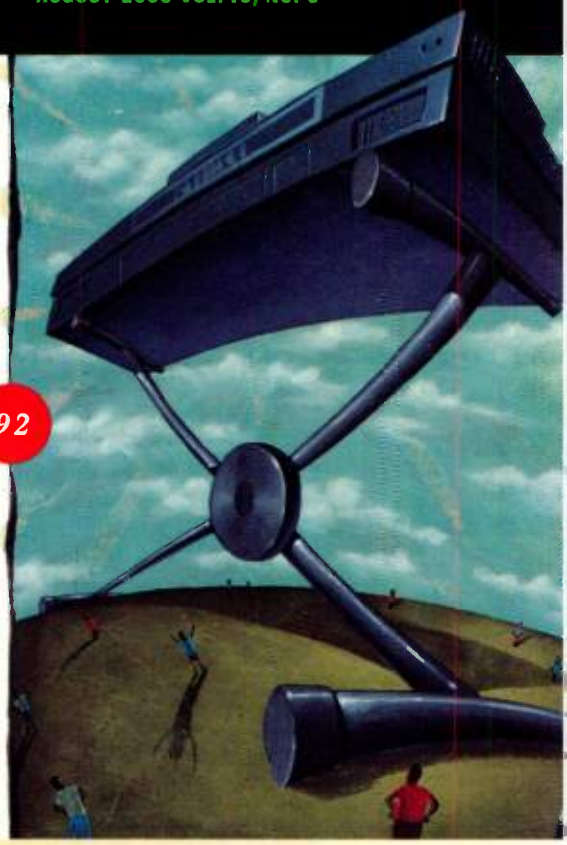
I N S I

FEATURES

DEPARTMENTS

Electronic Musician® (ISSN 0884-4720) is published monthly by Intertec Publishing, (ABC) 6400 Hollis St., #12, Emeryville, CA 94608. ©2000. This is Volume 16, Number 8, August 2000. One-year (12 issues) subscription is $36; outside the U.S. is $55. Periodical postage paid at Oakland, CA, and additional mailing offices.

Electronic Musician®
AUGUST 2000 VOL. 16, NO. 8



COLUMNS

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REVIEWS

Electronic Musician

From the Exotic to the Mundane


ANTHONY PIDGEON

Something about the versatility of MIDI encourages me to dream up unusual things I can do with it. Of course, you can accomplish strange and wonderful things with a MIDI keyboard and a sequencer, but if you want to do something completely different, alternative controllers are a big help. Fortunately, **EM** associate editor Gino Robair and assistant editor Marty Cutler also are outspoken about their love for things alternative, so when I asked them to write an overview of the current alternative controller scene (see "The Outer Limits" on p. 48), they jumped at the chance.

To keep the project manageable, we concentrated on devices that are played like instruments, rather than MIDI processors and control surfaces. We also had to define what the heck *alternative* meant in this context. For instance, Marty's beloved MIDI banjo is not the sort of thing you see every day, but it's mainstream compared with Laetitia Sonami's Lady's Glove.

Ultimately, we chose to focus on the sci-fi world of controllers that are not simply MIDIfied traditional instruments. Finding some of these designers and controllers was a major challenge; you can't simply round up the usual suspects. So we asked well-known musician, instrument designer, and author Bean Blaine for help. Inspired, Bean turned in three times as much copy as we asked for—all good stuff. In short, we went over the top.

Longtime contributor Paul Lehrman also has a bent for over-the-top, creative musical solutions. In "Rediscovering the *Ballet Mécanique*" (p. 74), he describes the daunting challenges he faced in producing a modern performance of George Antheil's brilliant work. The original 1924 score called for 16 player pianos performing in sync, an impossibility in Antheil's day. Lehrman met the challenge by writing a huge, complex sequence to control Yamaha Disklaviers and digital pianos. I attended Lehrman's performance of *Ballet mécanique* with the San Francisco Symphony and was blown away. Bravo, Paul!

On the other end of the spectrum from unique controllers and Disklaviers are products we commonly take for granted, such as the humble keyboard stand. I hate to think about the money I've wasted on keyboard stands I later came to dislike because they lacked pedal space, were unstable, and so on. I wish I could have read "Stand and Deliver" (p. 92) long ago. And who better to write it than longtime touring and studio keyboardist Julian Colbeck?

But we didn't let Julian just piddle about with keyboard stands all month. So this month, we're introducing a new column, "Vintage Page" (p. 30). Each month, Julian will list the ten most popular vintage keyboards and synth modules, ranked according to the latest used-instrument sales and rental figures. He'll briefly explain which attributes make the instruments popular today, with an in-depth discussion of that month's hottest instrument. Starting next month, we will show both the current and the previous month's rankings so you can see what has remained hot over time.

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Intertec Publishing Corporation
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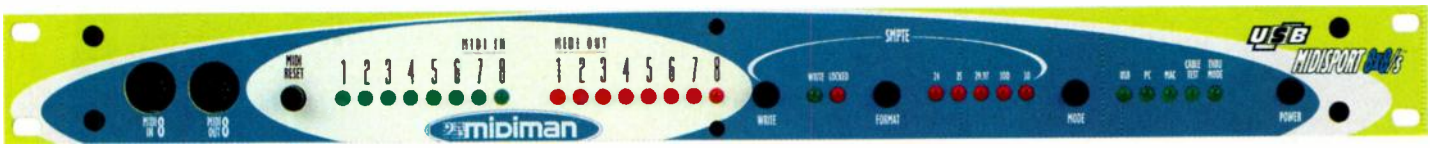

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¡OLE!

David Rubin deserves praise for his thoroughly researched article about flamenco music [see "Desktop Flamenco" in the June 2000 issue of **EM**]. It taught me, among other things, that *malagueña*—as in Ernesto Lecuona's "Malagueña"—is a song form associated with the Andalusian city of Málaga. Throughout the article Rubin shows a true understanding and love of flamenco.

David Baker
via e-mail

Your great and informative story on flamenco really caught my attention. The article certainly gave me some interesting facts and history. I am planning several Spanish productions and want to purchase two of the sampler CDs you reviewed. Where did you find Zero-G's *Flamenco Sounds*? I have searched everywhere on the Internet but cannot locate it. I did find Discovery Firm's *Flamenco—Made in Spain*, and I am purchasing it. Thanks.

R. Barry Knox
via e-mail

Barry—I'm glad you enjoyed my article. All of the flamenco sampling CDs that I reviewed in "Desktop Flamenco" are available from one of two large distributors: East West (www.soundsonline.com) and Big Fish Audio (www.bigfishaudio.com). You'll find the Zero-G disc at East West.—David Rubin

SCHOOL DAYS

I'm applying to college, and I am interested in electronic music and computer applications in music. Can you recommend any midsize or large colleges known for their electronic-music labs? I am already considering U.C. Berkeley, UCLA, the University of Maryland, and the University of Illinois at Urbana-Champaign. I'm pretty sure I won't be able to get into MIT. I appreciate any help you can offer.

Jeff Vogt
via e-mail

Jeff—Funny you should ask, because yours truly is codirector of the Music Technology program at Northeastern University in Boston! Our focus is composition for electronic instruments and the computer, and the program runs both as a stand-alone five-year major and as part of a dual major in Multimedia Studies. You can read about it at www.casdn.neu.edu/~music/DegreePrograms/MusicTech/index.html.

On the West Coast, the University of Oregon in Eugene has an excellent undergraduate program (http://darkwing.uoregon.edu/~fmo/about.html); on the East Coast, New York University also runs a great program (www.nyu.edu/education/music/mtech). And of course, there's the Berklee College of Music in Boston (www.berklee.edu).

Also check out the Music School Search Web site at www.musicschoolsearch.com, where you can plug in all the conditions you want your school to meet and let the site search for schools for you. You'll be amazed at how many programs are available these days.

Good luck with your search, and hope to see you in class!—Dennis Miller

WHERE CREDIT IS DUE

I'm glad you took the time to mention the creative, hard work of Nick Carr on *SpongeBob SquarePants* [see "Cartoon Cutups: Music Editing for TV Animation" in the June 2000 issue of **EM**], but you might want to do a follow-up out of respect for the composers who crank out *new* music for Nickelodeon episodes every week. Some of us don't even need music editors—we write to picture. Wow, what a crazy, novel idea!

To mention a few: Dave Eccles *(Nickelodeon Rocket Power)*, Denis M. Hannigan (*CatDog* and early *Rugrats* episodes with Mark Mothersbaugh), Jim Lang *(Hey Arnold!)*, Charlie Brissette *(The Angry Beavers)*, and Mark and Bob Mothersbaugh (*Rugrats*, the titles for *Rocket Power*). I write for *The Wild Thornberrys*, *Aaahh!!! Real Monsters*, and *Aeon Flux*.

No, none of us are famous composers (except Mark and Bob, who had a life before cartoons), but we work hard. Nickelodeon does hire people to write original music; MTV Networks has always let us try new, experimental, and interesting ways to score cartoons. They aren't all library shows, and your readers should know that. Give the composers a nod for the hard work they do.

Drew Neumann
via e-mail

ELECTRONIC ENTREPRENEUR

I've recorded background music for various video projects. Recently I was asked to record some original music for radio spots and television commercials. I don't know what fee I should charge for such services. I'm considering starting my own music-production library, and I don't know how much to charge for that service, either. Please steer me in the right direction.

Lee Fisher
via e-mail

Lee—Fees for commercial music vary a great deal. Generally the ad agency pays

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the composer-producer a creative fee *for writing and producing a custom music track. This fee is negotiable and ranges from about $1,000 for a local commercial to $10,000 or more for a big-time national spot. A lot depends on where the commercial will run (local TV, local radio, cable, network TV, and so on) and your reputation and track record. The more "in demand" you are, the more you can charge. Often you can get an additional payment to cover production costs.*

If your spot is aired, you may also make money in the form of performance royalties from ASCAP or BMI. The payments vary greatly depending on whether the commercial is local or national and how often it runs.

Possibly you'll earn money for playing the tracks. If you're a member of the American Federation of Musicians and you file a union contract for the recording, you and any musicians you hire will get session payments from the client (the company that hired the ad agency), and you'll be eligible for residuals if the spot runs for more than 13 weeks. Unfortunately, many commercials (especially those produced outside of major cities such as New York, Los Angeles, and Chicago) are nonunion buyouts, *for which clients purchase the music outright, and they can use it as much as they want without any further talent payments.*

As for your question regarding production music (also known as stock music *or* library music*), again, a great many variables exist. Because it's not written to order, a client will pay less for production music than for a custom-composed track. In addition, the client is only licensing its use, not buying it outright. (The advantage for the library is that it can license the same piece of music to an infinite number of clients.) Often a large client, such as a post-production facility, will purchase a* blanket license *from a music library; the license grants unlimited use of the library's music for a specified period of time (usually a year). Production music is also licensed on a* needledrop *basis—that is, one track at a time for a single specific use.*

John Kiehl of the Aircraft Music Library (a prominent music library) suggested that the best route for someone starting out might be to put roughly an hour of music on CD and sell the discs outright on a nonexclusive buyout *basis—the clients can use the music as much as they want but don't get exclusive rights to it. He advises pricing the CDs at about $100 and marketing them over the Internet. Kiehl also mentioned Web sites that—in exchange for a percentage of the sales—will post your music, offer downloadable samples, and handle all the e-commerce aspects. All you have to do is provide the music. One such site is Digital River (www.digitalriver.com).*

A good library-music reference is the Web site of the Production Music Association (www.pmamusic.com), an industry trade group.—Mike Levine

COPY RIGHT

Is there a program that enables you to burn CDs on multiple CD recorders at once? Could I turn my Mac into a duplicating center? I know stand-alone duplicators are available, but a couple of recorders could do the same job for a fraction of the cost.

Willie Harris
Orlando, FL

Willie—Currently I know of no Mac applications that allow you to burn CDs simultaneously on multiple drives. As an alternative, you might think about getting one of the newer 12× CD-R drives. They burn CDs considerably faster than the older, slower drives. In fact, burning one CD at a time on a single 12× drive could actually be faster than burning two CDs at a time on inexpensive slower drives.

If you still want to turn your Mac into a minireplicator, however, there may be hope. According to an Adaptec spokesperson, the company is currently developing multidrive capabilities for a future version of its software. The new features will most likely appear first in Toast *and then in* Jam*, but Adaptec hasn't determined a release date.*

PC users, on the other hand, have more options. Microboards Technology (www.microboards.com) offers a multidrive solution. For $2,055, you can get the company's MultiWriter *software bundled with a SCSI card and a small tower housing two 8× CD-R drives. Larger, more expensive towers with up to eight drives are also available. Prassi Europe (www.prassieurope.com) offers another solution. Its* PrimoCD Plus *software ($79) lets you burn two CDs at once, and its high-end* PrimoCD Pro 8 *($499) supports up to eight drives.—David Rubin*

THE LAST WORD

Check out Les Barker. Go get 'em, **EM**. Nothing like a little controversy to keep things interesting. I'd hate to see your volume of mail on this one [see "Letters: Manly Words" in the June 2000 issue of **EM**].

I recently went shopping. When I told the salesperson I was looking for a birthday present for a nine-year-old, he asked, "Boy or girl?" "What possible difference could it make?" I shot back. It was a science store. Was he going to get me a pink telescope instead of a black one? It could just as well have been a music store, no? Maybe the salesperson would have shown us a lovely flute instead of a bass guitar.

"Pop music, which is often an expression of sexual themes, relies on technicians who passionately articulate their craft in similar terms." Les, what are you talking about? I thought clients hired me as an engineer because of my knowledge and willingness to care about their project being the best it can be.

"Would feminists deny audio craftsmen their parlance in retribution for nature's disparity?" Hold on, let me get my dictionary. Well, *parlance* is a good word choice here, but *disparity* will raise some eyebrows. I'm a bit sick of political correctness, but the first word in my dictionary's definition of disparity is *inequality*. Stating that nature created females unequal to men takes some balls. (Oh no, I just described Les using sexual language! Am I proving him right?)

"Little girls, unlike little boys, naturally prefer toy dolls to toy trucks." Well, Nature versus Nurture can be debated all day, and I doubt it will be resolved here in the editorial pages of **EM**. I do at least ask people not to prevent their children from playing with certain toys because of preconceived notions of what's appropriate.

As far as **EM**'s freedom of advertising goes, I don't care either way. People who buy gear based on an ad's sexual (or sexist) content get what they deserve. If a reader is of an impressionable age, hopefully someone will explain what the ad is trying to accomplish and the need to look beyond the marketing technique.

Michael Nickolas
via e-mail

WE WELCOME YOUR FEEDBACK.
Address correspondence and e-mail to "Letters," Electronic Musician, *6400 Hollis Street, Suite 12, Emeryville, CA 94608 or to emeditorial@intertec.com. Published letters may be edited for space and clarity.*

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"Thank you for your extremely informative inSync Newsletter and other valuable time and cost saving references. Your services...provide a bridge to help professionals in the industry to up-date and keep abreast on a weekly basis." *Chris Mar*

"You guys are 'the' pro's (and I live in 'Music City')." *Denny Elliott*

"You guys never cease to amaze me, your staff is so knowledgeable and helpful and it's always a pleasure dealing with you folks. Thanks!" *Craig DelCasino*

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WHAT'S NEW

By Marty Cutler

▲ EMAGIC MT4 MIDI INTERFACE

Emagic's MT4 ($199) is a cross-platform USB MIDI interface with two MIDI inputs and four MIDI outputs. Each input and output is addressable as a discrete group of 16 MIDI channels, allowing input of 32 MIDI channels and output of 64 MIDI channels. The ability to create patch configurations lets you use the MT4 as a MIDI patch bay. Up to 32 patch configurations can be stored and switched with MIDI Program Change messages. Emagic includes software for editing and storing custom configurations.

Front-panel LEDs indicate MIDI I/O and USB activity, and whether the MT4 is being used as a MIDI patch bay. The unit works directly with Emagic's *Logic Audio*. With other applications, the MT4 requires OMS on the Mac and USB MME drivers on the PC. Emagic USA; tel. (530) 477-1051; fax (530) 477-1052; e-mail emagic@emagicusa.com; Web www.emagic.de.

▼ BUCHLA AND ASSOCIATES MARIMBA LUMINA 2.5

The Marimba Lumina 2.5 ($1,995), from Buchla and Associates, is not a software upgrade for the original Marimba Lumina; rather, it's a new 2½-octave version of the instrument. Despite its smaller size (44 inches long) and lighter weight (15 pounds), the Marimba Lumina 2.5 retains the feature set of its larger sibling (see this month's feature "The Outer Limits") while introducing several new capabilities.

For example, the Marimba Lumina 2.5 includes a set of 12 pentagonal sensors in its upper left corner—two more than the original Marimba Lumina. The additional sensors allow you to extend the range of the instrument by an octave in either direction. There is also a dedicated transposition key that can shift notes up or down by one octave.

The Marimba Lumina 2.5 has a built-in DB51XG synthesizer sound card and full-size, location-sensitive bars. In addition to two mallets, the unit includes four pucks—small shuffleboard-style disks that can send notes or controller information as they are moved around the bars. An optional solar panel ($275) can be used as a power source. Buchla and Associates; e-mail mlumina@buchla.com; Web www.buchla.com.

▼ NATIVE INSTRUMENTS B4 TONEWHEEL ORGAN

Native Instruments' *B4 Tonewheel Organ* ($199) is a new VST instrument aimed at capturing the classic sound of a Hammond B-3 combined with a rotating speaker. To capture characteristic instrument phenomena such as harmonic foldback, drawbar crosstalk, and loudness robbing, Native Instruments analyzed the electromechanical sound-generation process and tube circuitry of several choice combinations of organs and speaker cabinets. The results are animated and realistic organ sounds, rather than the static patches typically heard from sampled organs.

The *B4* features 91 tonewheels with nine drawbars for each of the two manuals, as well as a pedal keyboard. You can add percussion to any harmonic, and the key click is adjustable. Scanner Vibrato and chorus can be switched on and off. You can also add and adjust the amount of distortion. In addition, you can customize *B4 Tonewheel Organ* for different applications and musical styles by varying parameters on the virtual rear panel of the instrument.

No Hammond B-3 aficionado would be content without rotating speakers. Accordingly, *B4 Tonewheel Organ* has a virtual knob on its left side for real-time control over speed. Minimum system requirements for the PC are a Pentium II/266 MHz with 32 MB of RAM running Windows 95. Mac users need at least a Power Mac 604e/250 MHz with 64 MB of RAM running Mac OS 8.0. Native Instruments USA; tel. (800) 665-0030; fax (408) 266-6591; e-mail infoUSA@ native-instruments.com; Web www.native-instruments.com.

PSP STEREOPACK PLUG-INS

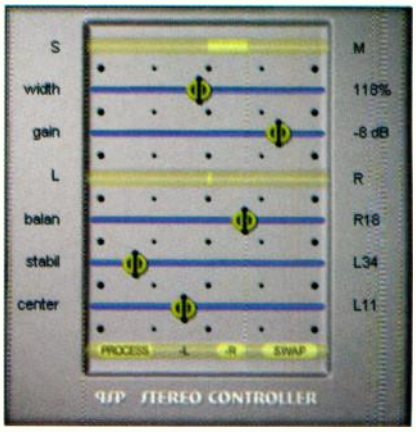
PSP's *StereoPack* ($24) contains four VST-based stereo processing plug-ins for Windows PCs. (A Macintosh version is anticipated in the fall.) Considering that PSP is the first company to design a game that can be played as a VST plug-in, it isn't surprising that several of its plug-ins bear an astonishing resemblance to tabletop hockey games.

The *Pseudo Stereo* plug-in adds depth to monaural tracks using pseudostereo encoding techniques. By adjusting the amount of processing, *Pseudo Stereo* can create a variety of effects as you record, mix, or remaster mono tracks. It comes with a library of presets to get you started.

The *Stereo Enhancer* plug-in improves spatial relationships in stereo tracks. *Stereo Controller* is a real-time and file-based solution for correcting anomalies that are common in stereo recording, such as phase incoherence. The plug-in also lets you make subtle changes to the stereo image, allowing independent control of signal levels of each channel.

In addition, the bundle includes *Stereo Analyser*, a tool for visually measuring and inspecting the stereo signal. You can use it to analyze properties of a stereo signal while recording, mixing, or mastering. The plug-in features a stereo oscilloscope with a hold option and adjustable operating levels. Monitoring can be performed with mean-peak or peak-hold displays.

Minimum requirements are a Pentium II/200 MHz processor with 32 MB of RAM, and an SVGA 16-bit display with 1024 × 768 resolution. PSP; tel. and fax 48-60-196-3173; e-mail contact@pspaudioware.com; Web www.pspaudioware.com.

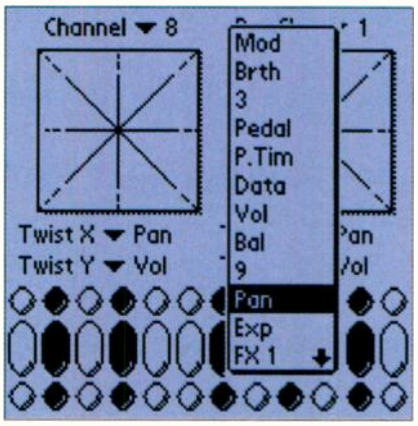


RUBICON CONTROL PAK 1

The Rubicon MIDI Control System Control Pak 1 ($82.95), by Rubicon Systems, puts a real-time MIDI controller into a Palm device by bundling a Rubicon MIDI interface with controller software. Besides its clever implementation of the Palm's stylus-based interface, the system offers a wide variety of assignable MIDI control options.

The Rubicon MIDI interface, which is compatible with most Palm OS–based MIDI applications, connects to the Palm device via a serial cradle or PC connector. The Rubicon interface includes a single MIDI Out but no MIDI In; MIDI data can be imported or exported with the supplied Mac and PC synchronization software.

The Realtime Controller includes faders that allow access to 16 freely assignable MIDI controllers, arranged in two banks of eight faders each. Separate areas enable switching of MIDI Program Changes and Channels. A Scene Selector lets you store, recall, and change up to 16 setups.



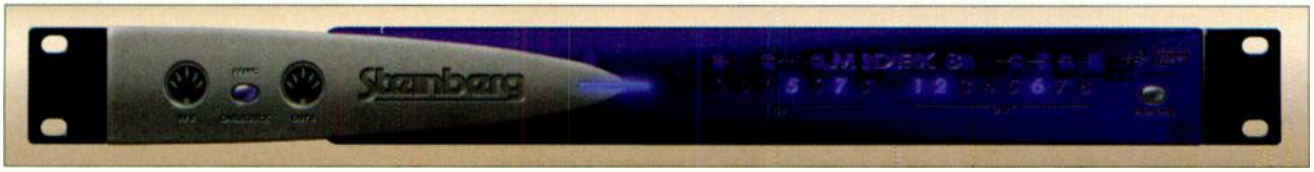
After you have assigned controller data to positions on an *x-y* axis for the Twist Pad control surfaces or the Scratch Pad, you can use the Palm stylus to send the data. Whereas the Twist Pad sends either Note On or controller information, the Scratch Pad sends a Note On message in addition to the controller data—allowing you to, for example, achieve theremin-like effects. The Control Pak 1 also includes a 4-octave Trigger Board for sending Note On messages.

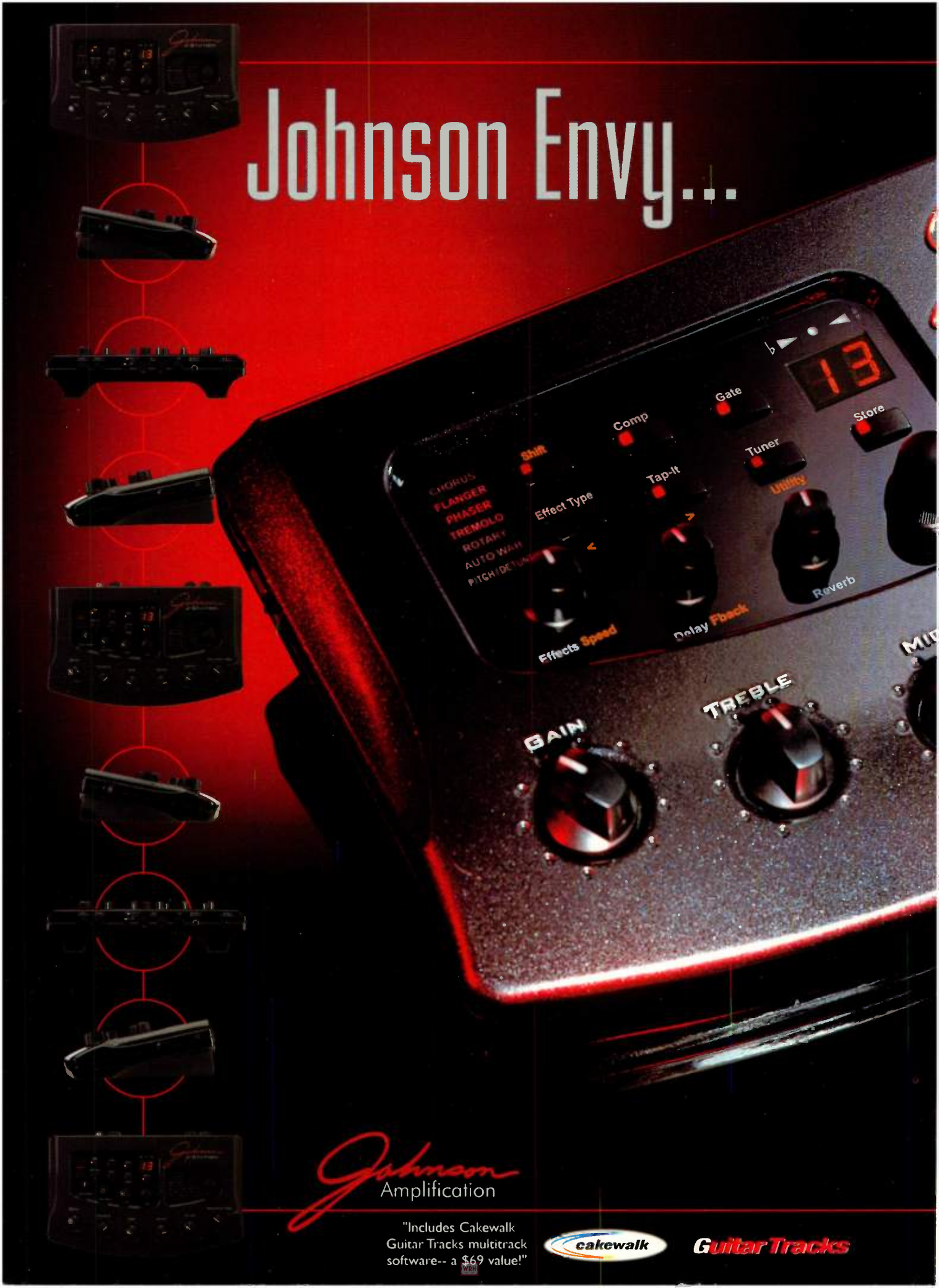
The Mixer integrates the first bank of the Realtime Controller section with a 16 MIDI–channel Volume mixer for controlling digital mixers and external MIDI gear. The Scene Selector is also applicable to the mixer. The Control Pak 1 requires Palm OS 2 or later and 2 MB of memory. Rubicon Systems (U.K.); tel. 44-113-276-2168; fax 44-113-276-2169; e-mail enquiries@rubiconsystems.co.uk; Web www.rubiconsystems.co.uk.

STEINBERG MIDEX 8

Steinberg North America's Midex 8 ($449) is a cross-platform USB MIDI interface that offers eight discrete MIDI inputs and outputs, for a total of 128 channels of MIDI I/O. Steinberg promises a timing accuracy of 3 ms when the Midex 8 is used with the company's new Linear Time Base technology and *Cubase VST* 5.0.

Midex 8 is built into a unique 19-inch housing that can be used on the desktop or rack-mounted with the supplied rack ears. The interface draws its power from the USB connection, so you don't need an external power supply. The Midex 8 includes drivers for Macintosh and Windows operating systems. Steinberg North America; tel. (818) 678-5100; fax (818) 678-5199; e-mail info@steinberg-na.com; Web www.us.steinberg.net; www.cubase.net.

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SOUND ADVICE ▲▲▲▲

▲ EAST WEST

Collections of sampled brass instruments rarely work with all musical styles. What might sound perfect for big band would be overkill for a mariachi group or for a small jazz ensemble. In the interest of providing more authentic-sounding brass sections for a variety of musical applications, East West presents *Quantum Leap Brass* ($695).

This collection on CD-ROM appropriately groups brass instruments for several different styles, including orchestral, pop, big band, mariachi, rock, Latin, R&B, and hip-hop. The instruments were recorded in stereo, in half-step intervals, using RCA 44 ribbon mics and Neumann M 49 condenser mics. The majority of the samples are not looped, but a bonus set of looped samples is included for samplers that have less available RAM.

Quantum Leap Brass contains multisamples of individual instruments, as well as instrument sections with a number of different articulations, such as varied attacks and swells. *Quantum Leap Brass* is available for Akai S5000, Akai S6000, and GigaSampler formats as a five-disc set, and for the Akai S1000 and compatible samplers as a six-disc set. East West; tel. (800) 833-8339 or (212) 541-7221; fax (212) 541-7015; e-mail sales@eastwestsounds.com; Web www.soundsonline.com.

KID NEPRO

If you think that dance tracks are your Korg Triton's strongest suit, Kid Nepro's *Studio/Session Mix* ($25) just might sway your opinion in another direction. One glance at some of this collection's patch titles—Beck's Wurly, Santana's Organ, and Page's Guitar are a few examples—will provide clues about the Kid's intention.

Studio/Session Mix features 128 individual Programs and 128 Combis, consisting of new keyboards, strings, brass, guitars, and lead sounds geared toward pop sessions and live performances. Sounds are available on floppy disk in PCG (Korg-talk for Programs, Combis, and Global) format for loading directly from the Triton's floppy drive. Kid Nepro; tel. (718) 642-7802; fax (718) 642-8385; e-mail kidnepro@aol.com; Web www.kidnepro.com.

▲ POCKET FUEL

Defying the convention of hip-hop loops and low-fidelity grooves created from sampled drum machines and scratchy records, Pocket Fuel has released a new collection in its Rhythmic Architectural Design Systems (RADS) series.

RADS Volume 4, for Sonic Foundry's *Acid,* is a drum-loop collection that was created using acoustic kits played by real drummers. The grooves were inspired by popular hip-hop artists such as Busta Rhymes, Limp Bizkit, Babyface, and TLC. To balance out the collection, Pocket Fuel also recorded a number of intros, outros, and fills for the collection.

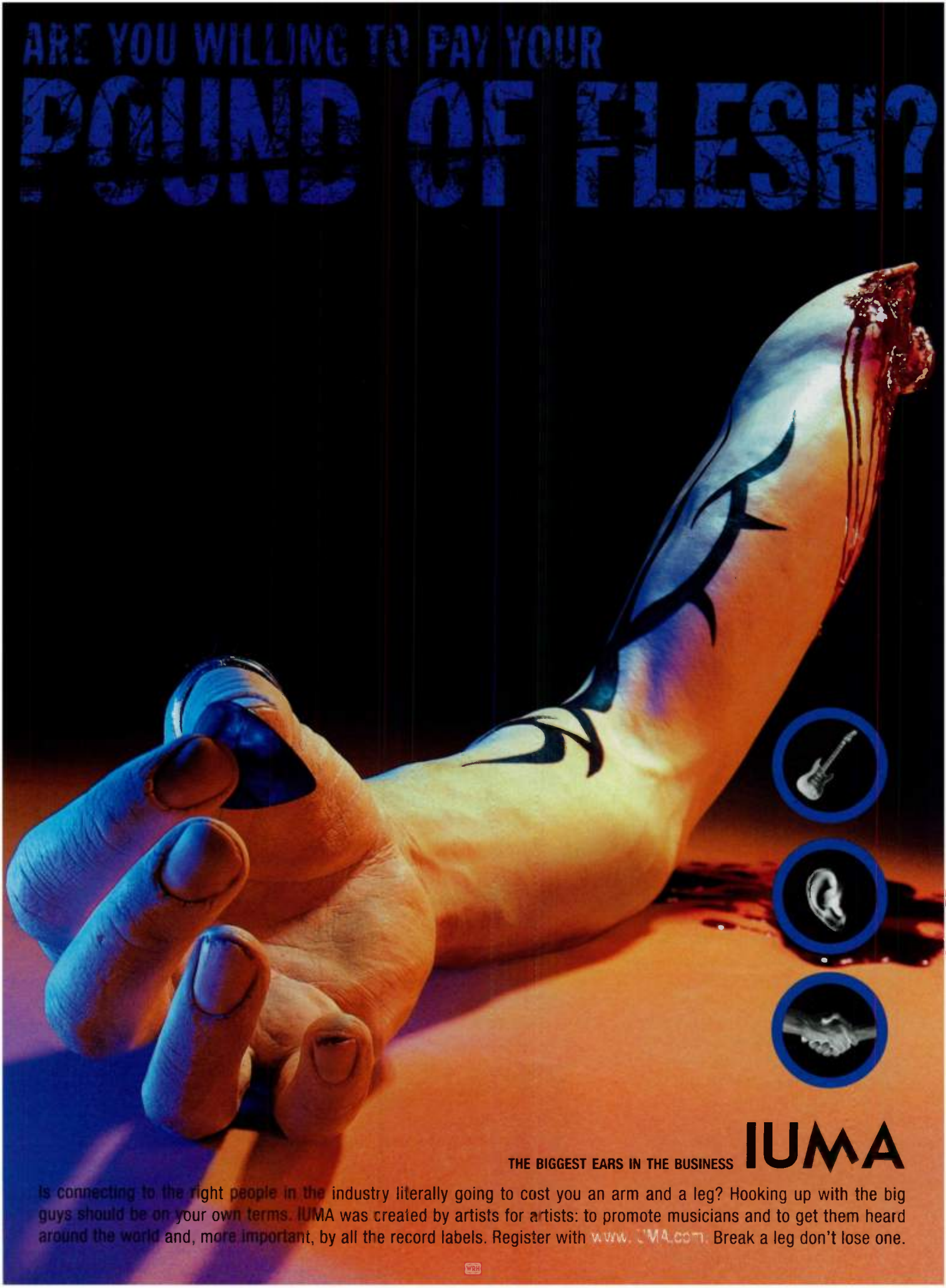
To get the right sound for hip-hop styles, Pocket Fuel selected the drums individually; the kit is a mixture of vintage Ludwig and GMS drums. A vintage API console fronting a Pro Tools system with an Apogee AD8000 A/D/A converter captured the grooves. Pocket Fuel; tel. (888) 643-8263 or (212) 726-1341; fax (718) 403-0913; e-mail radsinfo@pocketfuel.com; Web www.pocketfuel.com.

▼ DS SOUNDWARE

The instruments recorded for DS Soundware's *The Ultimate Orchestral Percussion Sample Library* ($299) for the *GigaSampler* were set up on a stage and miked from the vantage point of a conductor. In this way, the instruments retain their position and balance when played together.

Each instrument in this library is sampled with a variety of articulations, including left- and right-hand snare hits, tambourines (both bronze and German silver) with crescendos and left- and right-hand strikes, and various mallet strokes. All samples are set up for velocity switches, allowing more realistic changes in dynamics.

Other samples include a thunder sheet, almglocken, a ratchet, ceramic chimes, Chinese bells, and anvils. DS Soundware; e-mail donnie@dssoundware.com; Web www.dssoundware.com.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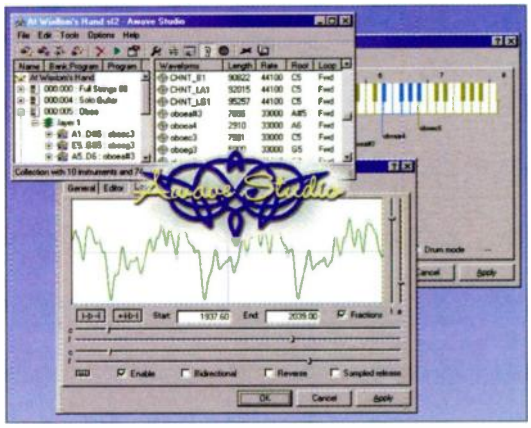
Is connecting to the right people in the industry literally going to cost you an arm and a leg? Hooking up with the big guys should be on your own terms. IUMA was created by artists for artists: to promote musicians and to get them heard around the world and, more important, by all the record labels. Register with www.IUMA.com. Break a leg don't lose one.

KEY CHANGES

Tactex has announced that its touch-sensitive smart-fabric control surface has been licensed for use on **Big Briar**'s forthcoming Performance Synth. The padded surface will give players gestural control over a variety of Performance Synth parameters . . . **Emagic** has announced the availability of Windows 98 USB drivers for its Unitor8 MkII, AMT8, and MT4 MIDI interfaces. The drivers can be downloaded for free at www.emagic.de . . . **MBHO** microphones are now being distributed in the United States by **MTC** . . . The *ObjektSynth* software synthesizer has now been released for BeOS 5 . . . **USB Audio** is now shipping USB ASIO drivers for the Macintosh . . . The **Drum Machine Museum** is the U.S. distributor for **Software Technology**'s *VAZ+* and *VAZ Modular* software synthesizers . . . **E-mu/Ensoniq** has resumed production of the Ensoniq Paris system, the ASR-X sampler, and the ZR-76 keyboard. Additionally, software updates for the ASR-X and the Paris DAW are now available . . . **Line 6** has released version 2.0 of its software for the company's Pod guitar processor. You can now transfer sounds between Pod, Pod Pro, and Flextone II amplifiers . . . **N-Track** *Studio* 2.1.4 has added support for VST Instruments as well as for VST 2.0 plug-ins . . . **PG Music** has released four new Styles for *Band-in-a-Box*. New discs include *Southern Gospel* and *'60s British Invasion* . . . The Editor/Librarian of **Sound Quest**'s *MIDI Quest* 8.0 can be used as a plug-in for *Cakewalk*, *Cakewalk Guitar Studio*, and *Cubase VST*. *MIDI Quest* can also be called up in Sound Quest's *Infinity*. System Exclusive editing, auditioning, and storage can now be performed within the sequencing environment.

FMJ SOFTWARE AWAVE STUDIO 7.0

FMJ Software's *Awave Studio* 7.0 ($89.95) is a utility for managing the integrated desktop studio where MIDI synthesizers, wavetable-based sound-card synths, and MIDI and audio tracks share the same real estate. *Awave Studio* lets you edit digital audio and synth patches, convert file formats, play back MIDI/digital audio sequences, and render WAV files from MIDI sequences. In addition, the application can use third-party DirectX plug-ins.



The software's Batch Conversion Wizard works with more than 150 audio file formats and supports simultaneous effects processing. The Audio Processing Wizard includes basic editing tools that let you resample and combine waveforms. The Audio Player sports a real-time oscilloscope and frequency analyzer. The Recording Wizard allows you to record your own samples from scratch. *Awave Studio* supports SMIDI and SDS, enabling you to transfer audio files to and from samplers.

The *Awave Studio* wavetable soundcard editor supports DLS Level 1 and 2, SoundFont 2, and other formats, many of which can be played and auditioned from the sound card. You can save sequences, customized sounds, and samples in a bundle, and the bundles can be recalled, played back from within the program, and rendered as WAV files. Minimum requirements are a Pentium-based PC running Windows 95, 98, 2000, or NT, with at least 32 MB of RAM. FMJ Software; e-mail fmj@fmjsoft.com; Web www.fmjsoft.com.

BIG BRIAR CP-251 CONTROL PROCESSOR

With Big Briar's CP-251 Control Processor ($299), you can add complex dynamic control of all your Moogerfooger stompboxes, as well as other voltage-controlled gear. The CP-251 provides the essential components of a modular synthesizer for processing audio and voltage signals.

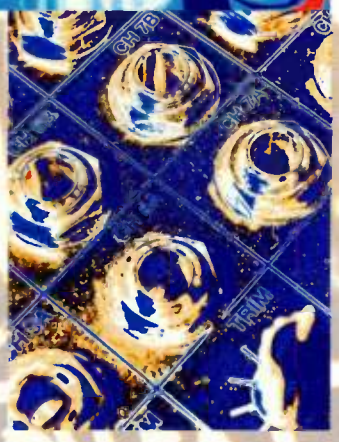
A 4-input mixer allows you combine control voltages. Two of the four inputs will accept expression pedals and other external control signals. Front-panel controls include two input attenuators, a master gain, and an offset-level knob. The mixer provides both normal and inverted signals.

The Lag Processor gives you independent control over Rise and Fall times, which are variable from 1V/second to 1V/ms.

The CP-251's Voltage-Controlled LFO can produce triangle and square waves with frequencies ranging from 0.2 to 50 Hz. The frequency can be controlled by the Rate control or from the pedal input.

The CP-251 comes with a white-noise generator for modulating audio or control signals, a sample-and-hold circuit, and a trigger input. In the absence of external control and trigger signals, the sample-and-hold's out 1 produces a series of random voltage steps that change at the rate of the LFO. Out 2 is a smoothed version of out 1, for generating continuously varying control signals over a wide range of rates. Big Briar; tel. (800) 948-1990 or (828) 251-0090; fax (828) 254-6233; e-mail info@bigbriar.com; Web www.bigbriar.com. ●

When a Tune Hits...



...you need to respond *fast*—before the magic moment is lost forever. So when inspiration strikes, which would you rather do: bust open your computer, wrestle with IRQ conflicts, and troubleshoot a couple of failed driver installations, or hot-plug a full-blown 24-bit audio recorder/processor/controller/mixer into your computer's (or laptop's) external port and get busy making music?

(Now *that's* a tough question.)

We made a pretty good name for ourselves defining the state-of-the-art in professional recording gear. But that's yesterday's news (and we're not about to rest on our laurels). Today's musicians demand—and deserve—capabilities far beyond those offered by the current crop of run-of-the-mill audio interfaces. Capabilities that put a host of powerful, easy to use studio tools at your creative fingertips:

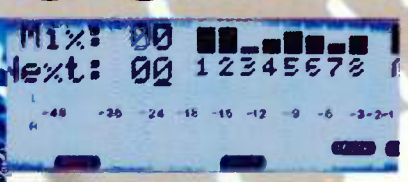
24/96 precision mic/instrument/line inputs. Comprehensive digital mixing with sophisticated EQ and a compressor/gate/expander on every channel. Remarkably flexible—but amazingly simple—signal routing. Fully configurable hardware control of your audio software. Total parameter recall. Plus more analog and digital ins and outs than you ever dreamed of. Oh, yes, and a user interface that makes a manual about as necessary as snow tires in the Sahara.

Sound interesting? Just wait 'til you hear it. Better yet, wait 'til you use it—either with your computer, or live at the gig. (By the way, it's priced lower than most single-purpose digital audio interfaces.)

EZbus

Computer Audio Recording Interface
Software Control Surface
Stand-Alone Digital Mixer

The EZbus is coming—get on it.



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Web Page

By Roger Maycock

DOTDOTDOT.COM

The **MIDI Manufacturers Association** (MMA) (www.midi.org) is working on the next generation of the MIDI specification, known as XMF, which is expected to provide MIDI control from within a Web page. The MMA's goal is to create an open standard file format for assembling all media assets (and/or links to external media assets) into a single file. This file would render a MIDI note–based piece in a computer-based player with consistent audio playback across all players and platforms. XMF is intended to address interactive playback (which is not supported by Standard MIDI Files), content protection, Meta-data, and the Internet. The MMA anticipates that XMF will be "extensible," thus facilitating support for future media types . . . **Java 2, Standard Edition (J2SE)**, version 1.3 for Windows (http://java.sun.com), was released May 8. New features include the Java Sound API (application programming interface), which provides low-level support for audio operations such as audio mixing, audio capture, MIDI sequencing, and MIDI synthesis. This extensible API allows developers to capture and play popular audio formats—including WAV, AIFF, AU, MIDI, and RMF—in Java applets and applications. Powering the API is the Beatnik Audio Engine, which provides MIDI synthesis; sampled-audio playback; and 64-voice stereo 16-bit mixing in one tightly coded package. Once implemented by programmers, J2SE will render Beatnik plug-ins unnecessary . . . **AccurateSound.Net** (www.accuratesound.net) has released *Pristine Sounds 2000* (Pro, $199; Lite, $99), a new digital audio editor for Windows 95, 98, and NT. The application cleans up and adds effects to prerecorded music and sound in WAV, AU, SND, PCM, RAW, MPG, and MP2 formats. It also supports DirectX plug-ins; provides noise reduction, spectragraphic editing, and 3-D graphical EQ; and offers a customizable interface.

WEB SITE OF THE MONTH

Billed as a resource guide to MIDI, synthesizers, and electronic music production, Synth Zone (www.synthzone.com) comprehensively covers many issues confronting the electronic musician. With links to hundreds of manufacturer and software-developer sites as well as sites providing shareware and freeware applications, classified ads, discussion groups, and various Web rings, Synth Zone contains something for just about everyone.

Descriptions of each link expedite your search, informing you of the goods and services the listed sites offer. The categories include Electronic Keyboards & Effects, Music & Audio Software, Synth Related Resources, Musicians Services, and Music & Audio Links. The Synth Zone Feature Link highlights a particular product or service that the site's administrators deem particularly noteworthy.

Synth Zone is especially useful for fans of vintage and somewhat obscure instruments. My quick tour through Synth Zone revealed links to the Moog Taurus Pedal Appreciation Society, the Crumar Mailing List, and a site featuring Oberheim SEM chassis designs by James Husted. There's a lot to investigate within Synth Zone, so plan on staying awhile!

DOWNLOAD OF THE MONTH

Internet TapeDeck from recordLab (www.recordlab.com) is a comprehensive multitrack recording application available as a free download. Designed for Windows 9.x operating systems, *Internet TapeDeck* is an 8-track system with support for multiple sound cards—including those with multichannel capability.

The main screen is laid out like a portable cassette multitrack recorder, with the mixer to the left and the stereo bus and effects sends/returns to the right. At the top of the screen are the File icons (New, Open, and Save), the transport keys, and a position display with indicators for punching in and out.

Collapsible mixer sections conserve onscreen real estate. The position and transport controls are movable and dockable.

You can name each of the mixer's channel strips, which include a trim pot, pan pot, fader, and 3-band EQ as well as two postfader effects sends that are capable of accommodating multiple effects chains. The channel strips also have Mute, Solo, and Arm buttons and a peak-level meter that changes color according to the track's status.

The Master section contains two effects returns, each with return enable/disable, volume, pan, and solo. The FX window lets you keep track of your effects assignments. As you might expect, you get a master stereo-bus gain fader with an associated VU meter. Output formats include WAV and Windows Media audio.

In addition to the 3-band EQ, *Internet TapeDeck* ships with a basic reverb developed by 3Com, recordLab's partner. Forthcoming effects include a multiband EQ, a flanger, a chorus, and an enhanced reverb. The application also accepts DirectX plug-ins.

WEBCAST

If classical, jazz, and related styles appeal to your musical taste, Global Music Network's GMN.com (www.gmn.com) is well worth investigating. GMN.com stands out among the crowd of Internet music sites with its exceptionally wide variety of offerings, which include musical performances, narrated program notes, video interviews, lectures, information on composers and performing artists, and music-related products.

Recent Webcasts have included live audio and video performances from Andrea Bocelli, Steve Lacy, Robin Eubanks, and the Dave Brubeck Quartet.

GMN.com also presents weekly features, such as free downloadable tracks. You can get a variety of Web-music players directly from the download area.

GMN.com's Quick Music Search allows you to search the site by artist, venue, or event. When you find an item you like, you can purchase the CD immediately. And if you're feeling lucky, you can enter one of GMN.com's contests for a chance to win prizes such as T-shirts, CDs, and even a stand-alone CD-R recorder. Another bonus is the site's minimal amount of commercial advertising. All in all, GMN.com is a refreshing and culturally rich destination.

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WEB APP

Know Your Web Audio Rights

For struggling recording artists, the Internet has become the medium of choice. A band can reach more fans online than on tour—at far less expense. But although efforts (such as the Secure Digital Music Initiative) are being made to protect the intellectual property of those who create, produce, market, or distribute music online, it's still easy to copy and transport digital files. Court cases such as those involving Napster and My.MP3.com are stinging examples of how easily your work can be copied and distributed without earning you a penny.

And now anyone can be a broadcaster without an FCC license. With Live365.com's do-it-yourself Web radio system, all you need to become an online DJ is a computer, an Internet connection, and a passion for music. Granted, Live365.com is ironing out royalty agreements with ASCAP, BMI, and other groups, and the company does abide by the Digital Millennium Copyright Act (DMCA) of 1998. But the act's complicated rules confound artists and listeners alike. (You can get a PDF file of the DMCA at www.loc.gov/copyright/legislation/dmca.pdf.)

The DMCA details the various rights, obligations, and liabilities of copyright holders and intellectual-property distributors. It amends the Copyright Act, extending the protection of U.S. law to new forms of creative work. DMCA laws attempt to restrict the public's ability to copy material by prohibiting Internet broadcasters from playing four songs by the same artist within three hours, four songs from a boxed set within three hours, or more than two songs in a row by the same artist. Furthermore, it is illegal to publish playlists in advance and take requests.

The DMCA includes some exceptions to ensure that Internet service providers (ISPs) can conduct business efficiently. For example, an ISP is permitted to copy and update material and to track the number of hits a work receives. In the event an unauthorized work is distributed from its servers, the provider is exempt from monetary liability if, after receiving proper notification from the copyright holder, it promptly removes or blocks access to the data.

Any person injured by a violation of the DMCA laws may bring a civil action in federal court. Section 1203 of the DMCA gives courts the power to grant a range of equitable and monetary remedies similar to those available under the Copyright Act. Special protection is given to nonprofit organizations. This law has resulted in more than 100 colleges and universities banning Napster without any further legal ramifications.

BAND ON THE WEB

Abney Park

The Internet's ability to eliminate the middleman is forcing the music industry to rethink its approach to music marketing and distribution. Web sites such as RollingStone.com, MP3.com, and Riffage.com provide unprecedented exposure for artists. Seattle-based gothic/industrial band Abney Park is one group using the Internet to its advantage.

With its complex yet subtle sound, Abney Park hasn't fallen into the trap of using repetitive rhythmic and lyrical devices—an all-too-common failing in the world of electronica. The band's strangely organic sound is quite irresistible to its growing legion of fans.

Abney Park credits a large part of its exposure and success to wide Internet distribution of its songs through its award-winning MP3.com Web page (www.mp3.com/abneypark)—the band counts more than 100,000 downloads of its music. Several Abney Park songs have hit number one on the MP3.com site. "The Only One," for example, recently enjoyed a two-week stretch as the top Pop/Rock song, beating out songs by well-known artists Ricky Martin, Alanis Morissette, and the Mighty Mighty Bosstones. "The Wake" spent more than two months in the number one slot on the Gothic music chart. Abney Park also reached number one with "The Change Cage" (Industrial Rock), "Black Day," (Darkwave), and "No Life" (Black Metal).

Abney Park founder and songwriter/composer Robert Brown points out the opportunities the Internet offers artists. "Many of the best artists in the world haven't been heard by anyone," says Brown. "Undiscovered artists' creative freedom becomes limitless when they can suddenly reach any audience."

Bassist Suzanne Sweeney agrees. "It's encouraging to see the broad range of music currently available through the Internet. Every genre, style, and taste is represented. Artists are now realizing that they hold the tools to produce their own vision." Brown adds, "With the Internet, anyone can be heard; the opportunities are growing exponentially."


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VINTAGE PAGE

By Julian Colbeck

Each month, "Vintage Page" will rank classic electric and electronic keyboard instruments according to their current popularity, based primarily on sales and rentals in the used-instrument market. This is the first edition of the column; future editions will parenthetically note the previous month's rankings for keyboards that remain hot items, enabling you to follow the changes in the market. Our estimated street prices are categorized according to the instrument's condition.

In the Spotlight:

Sequential Circuits Prophet-5

Produced: 1978–1984
Made in: USA
Designed by: Dave Smith, John Bowen
Number produced: 7,500
Synthesis system: analog, subtractive synthesis
Price new: $4,595
Today's prices: A=$2,000; B=$1,300; C=$400

The Prophet-5 was a groundbreaking instrument, the first to exploit the use of microprocessors, and thus the first truly programmable polyphonic synthesizer. Everything about it is quality, from its look to its range of lush and complex sounds, beloved by such artists as Phil Collins (still) and Peter Gabriel. However, like a vintage sports car, the Prophet-5 needs care and attention to maintain its performance.

Produced in three revisions, Rev 1 and Rev 2 units are unstable and problematic. Always go for a Rev 3 model; indeed, Wine Country Productions, the company that took on the Sequential mantle after the original company ceased trading, deals with nothing else.

Five-voice polyphonic (just to be different), it has 2 variable waveform oscillators per voice; gutsy, 24 dB/octave, resonant filtering; and an extensive "poly-mod" modulation section where you can set up interaction between the oscillators and filter/envelope. Other key features include oscillator sync, polyphonic portamento, and unison mode.

Classic Prophet-5 sounds include washes (encompassing pretty much every pad Phil Collins ever wept over), bells, and glides. The genuinely analog synth's tuning is ever an issue, and no two instruments will ever really sound the same, making purchasing one a skill rather than purely a question of money.

Often recorded and ripped off on the sample CD market, the Prophet-5 has recently come to prominence through emulation and samples by Yamaha (the PLG150 plug-in for the SW1000XG sound card and the S80, CS6X, and MU100/1000/2000 synths), as well as Native Instruments' Pro-5 and, to some extent, Steinberg's Model E software synth plug-ins. All, of course, are digital, and so rather miss the point.

The Prophet-5 remains a classic among classics, well worth seeking out if you have the money to buy a good one or the skills to maintain one that is less stable. With its current high profile, we can expect more software/modeled versions to appear, but there's nothing like driving the real thing.

ROBERT PERRY

The Prophet-5 from Sequential Circuits was the first microprocessor-based programmable polyphonic synthesizer.

THE LIST

1. **Prophet-5 (Sequential Circuits)** See "In the Spotlight."

2. **MS-20 (Korg)** This squeaky-sounding, monophonic synthesizer is highly sought after. A techie's delight, the front panel includes its own patch bay. Baby sibling MS-10 is a worthy substitute.

   A=$1,200; B=$900; C=$500

3. **Juno-106 (Roland)** An early MIDI synthesizer. Easy to tweak, the 106's 6-voice analog synth engine is good for thin but cool basses and washes. Harder to find than the Juno-60 (see item 4).

   A=$700; B=$550; C=$300

4. **Juno-60 (Roland)** This pre-MIDI analog synthesizer offers 6-voice polyphony, dedicated knobs and switches, and a killer chorus.

   A=$600; B=$450; C=$300

5. **B-3 (Hammond)** The granddaddy of rock organs, this tonewheel instrument is large, expensive, and irreplaceable. It's for grown-ups only, not wannabes. The more compact A-100 has essentially the same guts as a B-3 and may cost as little as half the price.

   A=$5,000; B=$2,500; C=$1,500

6. **TB-303 (Roland)** A quirky little box of bass sounds with a built-in sequencer, the TB-303 bass synthesizer fueled the dance-inspired vintage-synth revolution. It has been much sampled and emulated, but real ones are still sought after and hard to find.

   A=$1,100; B=$800; C=$600

7. **Stage 73 (Fender Rhodes)** Fender's glassy-sounding electric piano was a staple sound of retro funk and jazz fusion. It has a wooden action based on hammer-struck metal tines. The Rhodes is heavy and needs constant minor repairs, but you can do most maintenance yourself.

   A=$650; B=$500; C=$250

8. **2600 (ARP)** It's not for everyone, but this monophonic synthesizer is still the height of cool with its patch bay, "mad scientist" design, and squeaky bonk sounds. A classic instrument for learning synthesis.

   A=$2,500; B=$2,000; C=$1,600

9. **Memorymoog (Moog)** A powerful, complex polyphonic synth, the Memorymoog had many teething troubles back in 1982. Units working today are expensive but highly sought after.

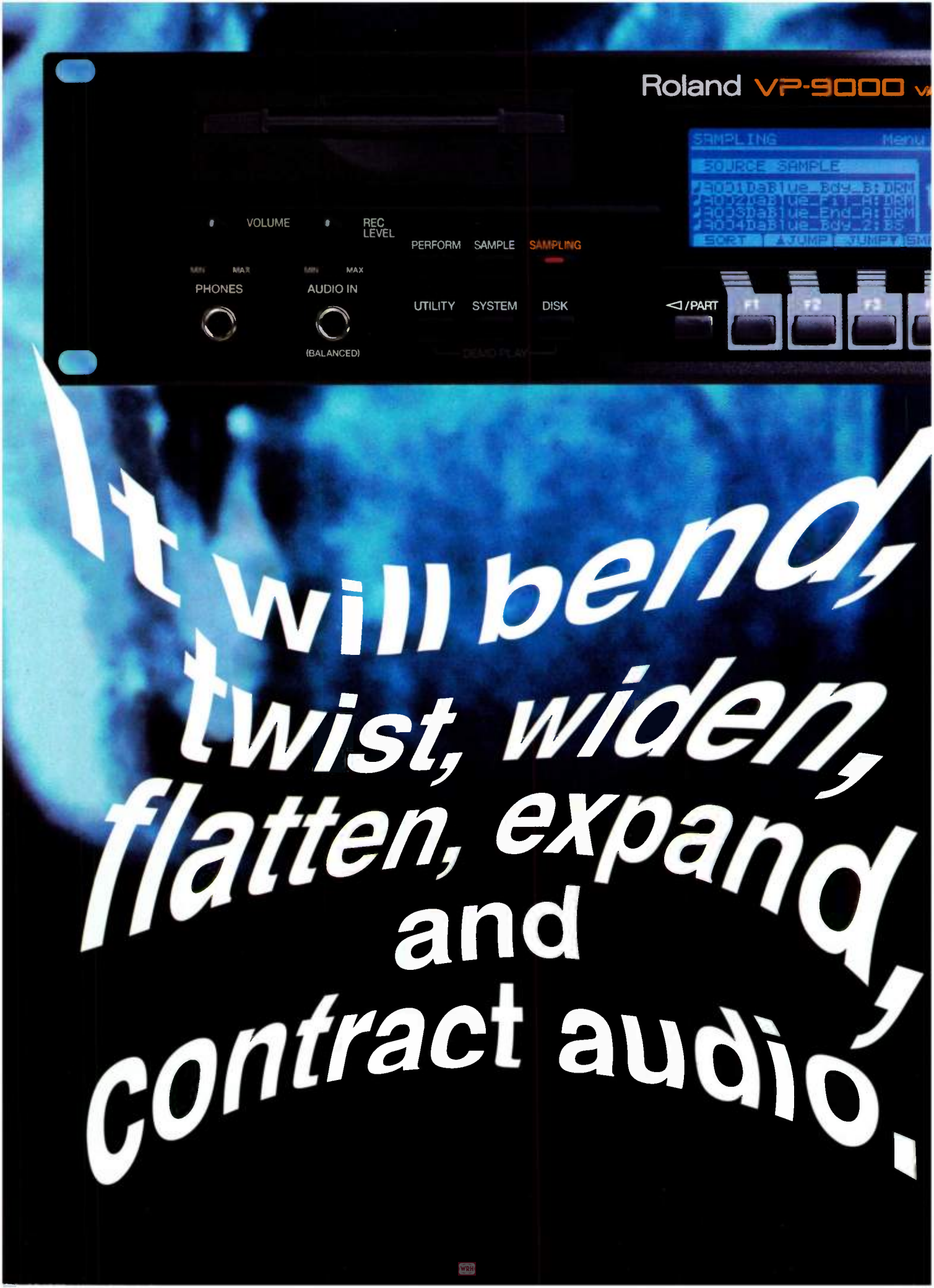
   A=$2,500; B=$1,800; C=$700

10. **Rogue (Moog)** Not Moog's best monophonic synth, the Rogue has nevertheless enjoyed a comeback recently. It features dual oscillators (but with shared controls), is very easy to use, and is good for bass lines.

    A=$500; B=$350; C=$250

Price Guide: The quoted prices reflect typical street prices you must expect to pay in U.S. dollars. The buy-in on vintage instruments, as with vintage cars, is just the beginning, though. Most of the original manufacturers are long gone, so maintenance and repairs are expensive.

A=like new; B=like, it's okay for its age; C=like hell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TECH PAGE

By Scott Wilkinson

Molecular Magic

Progress in the development of music technology depends on the continuing improvement of computer circuitry, which has more or less followed Moore's Law for the past 40 years. Unfortunately, the number of transistor elements in an integrated circuit can't continue to double every 18 to 24 months forever; in fact, many experts believe this pace of miniaturization will become cost-prohibitive by 2015. In addition, the size of these elements will soon reach a threshold established by the need to dissipate heat and control the leakage of electrons within the circuit.

Individual molecules could replace conventional circuit elements.

If the size of these circuit elements is to continue shrinking beyond that point (with a corresponding increase in processing speed and memory capacity), a fundamentally different technology must be developed. One promising approach seems to be the use of individual molecules as electronic switches and memory elements. Recently, research teams led by Mark Reed at Yale and James Tour at Rice University announced that they had developed just such a molecular switch and memory cell, giving this fledgling technology a big boost forward.

One of the main difficulties with this technology is controlling the flow of electrons through individual molecules. At this size scale, electrons are constrained to specific, discrete energy levels, as described by the laws of quantum physics. These energy levels are manifested as "clouds" called *orbitals*, which surround the nuclei of the molecule's constituent atoms. A molecule must have empty orbitals that overlap in certain ways in order to conduct electrons. If the orbitals overlap in different ways, no electrons can pass through the molecule.

This concept is the basis of the molecular devices constructed by the Yale and Rice teams. Their switch consists of a molecule called nitroamine benzenethiol sandwiched between two gold contacts. When a certain voltage is applied to the contacts, the resulting electric field twists the molecule, changing the overlapping structure of its orbitals and preventing electrons from flowing through it. When the voltage is reduced below the threshold value, the molecule snaps back to its original shape, and current can flow.

Interestingly, this switch can be easily modified to act as a binary memory cell by storing a charge within a specific section of the molecule. (A stored charge blocks conduction, representing a binary 0; without a stored charge, conduction is high, representing a binary 1.) In experiments with this memory cell, the stored charge could be retained for nearly ten minutes, unlike with conventional DRAM, which must be refreshed every few milliseconds.

In another experiment at Yale, a single benzene molecule was held between two tips of a modified scanning tunneling microscope (see "Tech Page: Nanocomputers" in the June 1996 issue of **EM**). The resistance of this molecule was measured in the tens of millions of ohms, and it could sustain a current of 0.2 microampere at 5 volts (see **Fig. 1**), which translates to roughly 10^{12} electrons per second traveling through the molecule. This is a much higher current than anyone expected, especially considering that the electrons must pass through the molecule one at a time.

So far, only molecular switches with two terminals have been devised. If these devices are to become the building blocks of electronic components in the future, a three-terminal switch must be built to replace the trusty transistor, in which one terminal controls the current between the other two. In addition, there are currently no molecular devices that can amplify current, which transistors can do. However, if these and other hurdles can be overcome, electronics of all types (including music technology) will take a quantum leap forward, jumping far beyond the exponential curve of Moore's Law and providing nearly unlimited processing power and memory capacity in the musical tools of tomorrow.

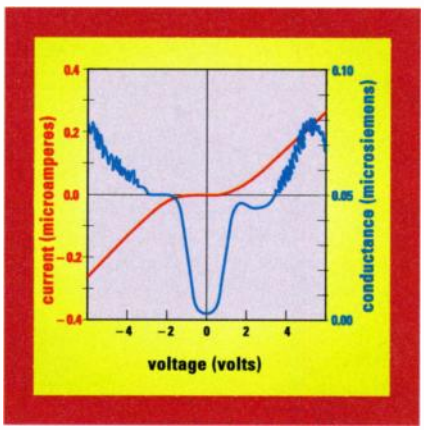

FIG. 1: The conductance (blue) of a single benzene molecule depends on the voltage applied to it, as does the current flow (red), closely matching theoretical predictions.

Have Some Fun Down Below

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- **Overdrive** - The tube overdrive utilizes the pre-amp,s 12AX7 tube to create distortion that can be as subtle and warm as a classic "flip top" or as nasty as a "chainsaw on 11".
- **Subwave** - The Subwave generator employs a mixture of precision analog slope detection and fast digital logic to produce a clean, pure and accurate sub-octave.
- **Bassynth** - The Mo' Bass synthesizer uses Wave Form Modeling and an ultra-fast tracking system to process a signal like a classic analog synthesizer.
- **Chorus** - The chorus produces a deep, rich analog effect and has adjustable depth and rate controls.
- **Mo' EQ** - This Feed Forward Band-Pass EQ design produces a phase-aligned boost and cut not unlike the cherished EQ's from the 60's.

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THE Bottom Line

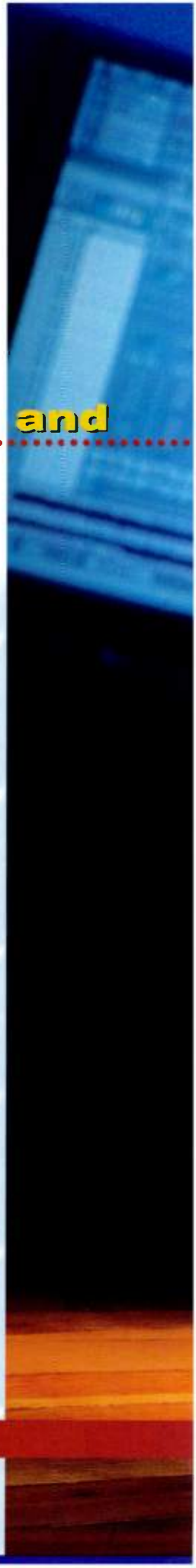
There's a big difference between rock-bottom and

By Michael Cooper

Producing a slammin' bass track starts with getting a great recording. A well-recorded bass guitar track can grace a mix with warmth and power, but a poorly recorded one can obscure it like a murky cloud. Which microphones are best for recording electric bass? How does mic placement affect the sound? Should you use a DI box? What about compression and EQ?

We'll get to all of that sexy stuff, but first let's address how to set up the instrument itself. Unless your source sounds great to begin with, you'll just be dealing with a "garbage in, garbage out" situation. Put another way, a skillful recording of a lousy instrument is just that.

Now, let's go bottom-fishing!



Master CLASS

Rocking the Bottom.

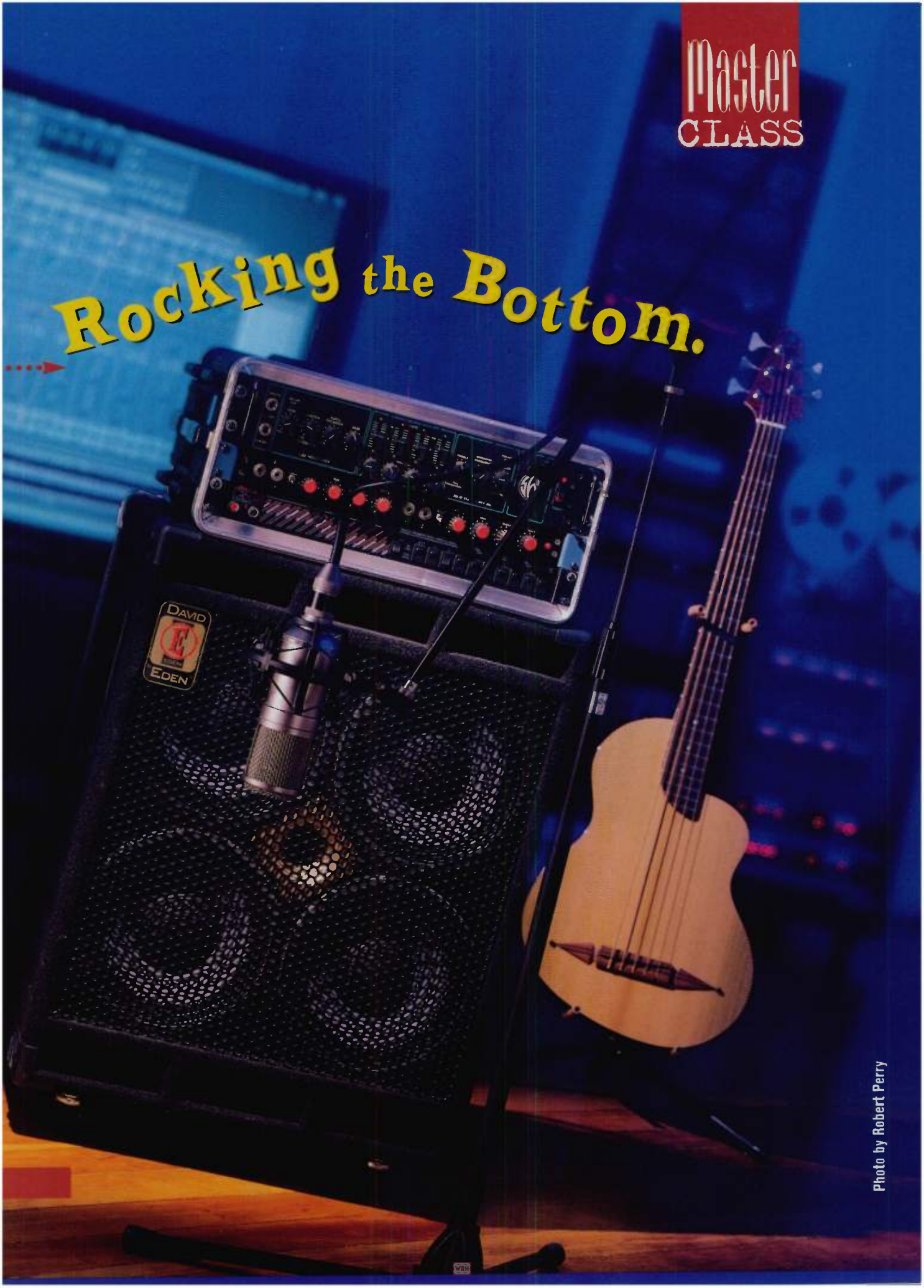


Photo by Robert Perry

*Actual unit is 19" wide and will not fit in your computer drive bay.

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How much would you expect to pay for a mic pre with all these features? A thousand? Eight hundred? Less than six hundred? **You're getting warmer.**

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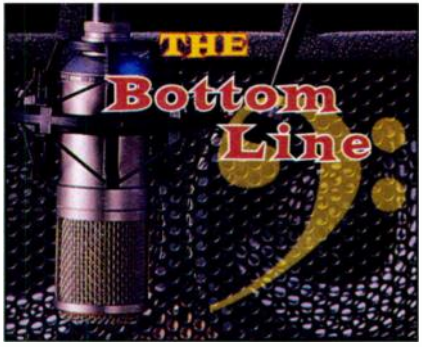

FIRST BASS

Beyond proper tuning and intonation, the three most common problems with electric bass guitars are grounding noises, fret-related artifacts, and poor height adjustment of the pickup.

The time to hunt down the cause of ground-related hum and buzz is *not* just before you press the Record button. Most DI boxes have a ground-lift switch that may kill the noise, but what if you are not going direct? Fortunately, if the hum goes away whenever the player is touching the strings, there's an easy solution. Attach one end of a piece of wire to the guitar's tailpiece section, at a point where it will be out of the way and won't make any noise as it moves about (for example, wrapped tightly around a string behind the bridge). Stick the other end of the wire into the rear pocket of the player's pants. This usually eliminates the problem.

Fret noise can result when an instrument's string height, or action, is too low. The best solution is to raise the action, but that will adversely affect the intonation, so you'll need to adjust it, too. What can be done if you must record immediately? Borderline fret-noise problems are often avoidable if you simply play with a lighter touch (which is usually a good idea anyway). In my experience, most extraneous bass-track noises are caused by heavy-handed or otherwise poor technique. A moderate and consistent attack yields the most even tone, decreases the amount of corrective compression you'll need, and avoids the insidious *clackety-clack* of fret slap that plagues many amateur bass tracks. There's simply no way to roll off enough highs to rid a track of these artifacts—that is, not without making the bass sound as if it's being played through a bale of wet cotton. In this case, an ounce of prevention is definitely worth a pound of cure.

Before the session, have the bassist play a chromatic scale from top to bottom and back on each string, with all EQ and tone controls on the instrument and amplifier set flat or bypassed. Do all the notes on a particular string tend to sound either boomy or thin? If so, you may need to adjust the pickup height for a more consistent response across the full range of the instrument. If the notes sound boomy, move the pickup farther away (down) from the strings; if the notes sound thin, move it closer. Failure to nip this problem in the bud will force you into riding the fader on certain notes or applying massive amounts of frequency-conscious or split-band dynamics processing at mixdown. Again, an ounce of prevention . . .

Now that the instrument is ready to rumble, it's time to set up the amp, microphone, and DI box for recording.

SPLIT PERSONALITY

You probably noticed I mentioned using both an amp and a DI box. If you have enough open tracks to record the miked amp and the DI signal on separate tracks, by all means do so. You'll get two different timbres for the same performance and far greater flexibility in sculpting the final sound at mixdown. The miked amp will have more ambience, and the DI will usually sound clearer and more focused. When you mix, you'll be able to choose which timbre is more appropriate or, more likely, combine the two tracks for a fat hybrid sound (more on this later). In fact, if you're pressed for tracks but have two available mixer channels, you can combine the two signals via the multitrack bus—adjusting each fader to favor one sound over another if desired—and record the summed channels to one track.

No matter how many tracks you decide to use, you'll need to split the signal at the DI box so that one path goes to the mixer and the other goes to your bass amplifier and speaker cabinet (see **Fig. 1**). For this purpose, most DI boxes feature an unbalanced input and an unbalanced output—typically on ¼-inch phone jacks—along with a balanced output, usually on an XLR connector. Simply plug the bass guitar into the DI's unbalanced input, connect the unbalanced output to an instrument input on your bass amp, and route a mic cable from the DI's balanced output to a mic input on your mixer. The DI box converts the bass's high-impedance, unbalanced instrument-level signal to a low-impedance, balanced microphone-level signal that gets routed to its balanced output. But before the conversion, the DI splits the signal and sends the unbalanced input signal—unchanged—from its unbalanced output to your amp.

You can choose from a number of DI boxes, ranging from inexpensive solid-state models to pricier tube offerings. The Stewart Audio ADB-1 ($109) and the GRM BPH Missing Link are two cost-effective solid-state workhorses. The BPH box sounds a little brighter and more

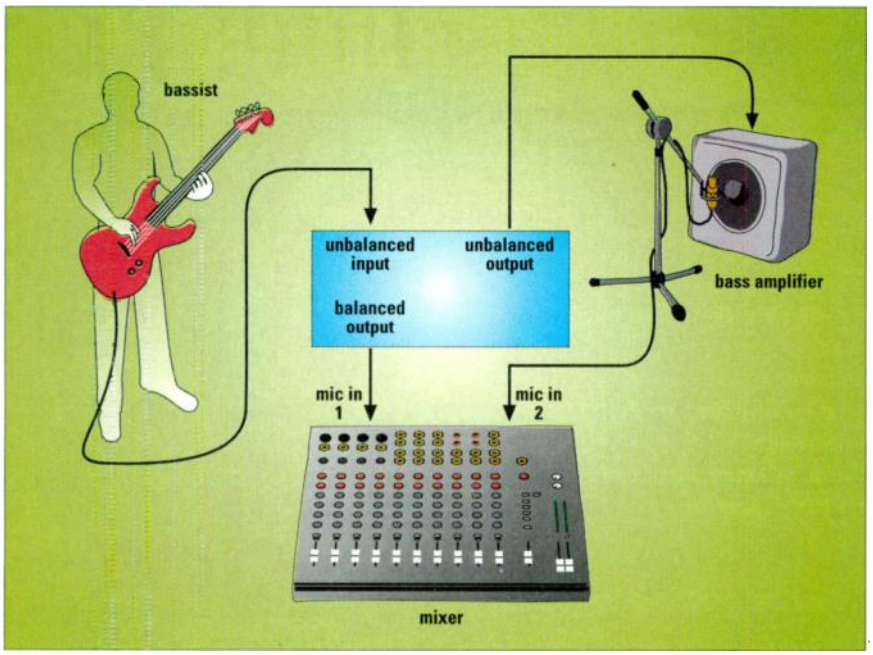

FIG. 1: A DI box can be used to split the bass guitar's signal into two paths. Patch the unbalanced instrument-level output to a bass amplifier/speaker cabinet and the balanced microphone-level output to a mic preamp or mic input on your mixer.

open, but the ADB-1 nevertheless offers plenty of presence. (Unfortunately, GRM recently closed shop, so the BPH is no longer available; but you might be able to find one secondhand.)

If you can afford them, the Demeter HdI-1 Stereo Tube Direct/Line Driver ($899) and the Ridge Farm Gas Cooker ($1,279) will take your sound to another level. Both are tube DIs that add a warm, lush dimension to bass guitar. I'm slightly partial to the Demeter unit; it offers a bit more presence and definition than the Gas Cooker, which has a softer sound.

AMPED UP

Because loud sources with long wavelengths (in other words, bass frequencies) record best in big rooms, you should put the bass cabinet in the largest room you have—unless you're recording a drum set simultaneously, in which case you should use your second-largest room for the bass. By recording bass and drums in separate rooms, you'll achieve the isolation needed to perform punch-ins on the bass track without having to deal with clunker notes that leak into the drum mics.

If possible, place the bass cabinet in an acoustically dead room. Adding digital reverb to a bass track rarely improves it, so why would you want natural reverb on that track? A dead room gives you a tighter sound. A carpeted space will do in a pinch, but a room that's correctly treated with acoustic foam or fiberglass wall panels will sound much better.

All rooms, even those that have been professionally treated, have at least a couple of lingering bass room *modes*, or narrow notches, in the low-frequency response that will sound either boomy or weak. These problems will be evident only in certain parts of the room. In fact, moving the bass cabinet just 6 to 12 inches can make a profound difference in the sound. Before you set up the mic, move the bass cab around while playing a scalar motif to find the spot with the most even frequency response. Bear in mind that moving the cabinet closer to a wall (or especially into a corner) will boost the overall bass response. But again, some individual notes may sound weak if your placement results in room-mode interference.

Many bassists make the big mistake of going for a cabinet position that gives the biggest bottom end. They also often boost the bottom frequencies on the

For manufacturer information, please see Contact Sheet, p. 171.

amp's onboard equalizer to excess. But what works in a live situation doesn't always work in the studio. The sound you produce should be reasonably balanced across the bass and middle frequencies—one that you can later tweak to complement the mix without applying tons of corrective EQ.

PUT THIS THERE

I generally use cardioid microphones when recording bass; placed on-axis (pointed straight at the source), they give a hint of room tone but focus mostly on the direct sound emanating from the cabinet. My hands-down favorite mic for recording electric bass is the Lawson L47MP ($1,995), a reasonably priced tube condenser that provides a fat, luxuriant sound. My favorite dynamic mic for bass recording is the AKG D112 ($338). An admittedly pricey alternative, the Neumann U 87 condenser mic ($2,825) has also given me great results.

I like to place the mic 1 to 2 feet away from the cabinet. If you're miking a cab with multiple drivers, stick your head near each speaker in turn and listen. (If the amp is too loud for comfort, just note from the control room how the mic sounds on each speaker.) Because every speaker has a slightly different personality, put the mic opposite the one that offers the closest sound to what you're going for.

To get the brightest sound, place the mic directly in front of the bass cabinet and point it straight at the center of the speaker cone; for a softer sound, put it about 45 degrees off to either side of the cabinet (but again pointed at the speaker cone). If you're getting a lot of fret slap, buzz, or other extraneous sounds, pointing a directional mic slightly away from the cone will roll off the extreme highs and reduce the noise somewhat. Just make sure the mic isn't pointing at another sound source when you position it, or you may get unwanted bleed.

MORE THAN THE SUM

Even once you're getting a great sound from both the mic and the DI, there's still room for improvement. You can combine the two tracks for a fatter sound than either delivers on its own, but merely summing the tracks together tends to yield less-than-spectacular results because the two signals are typically out of phase with each other.

What causes this? By the time the signal from the bass cab reaches the mic, its waveform has progressed partially through its cycle, whereas the DI'd signal is captured almost instantaneously. The two signals are in different phases of their cycle, so they will probably interfere with each other destructively upon reaching the mixing console (see Fig. 2). One likely result is a reduction in the amplitude of the combined signal. For reasons too complex to discuss here, the resultant weakening of the sound usually affects the bass frequencies—exactly the band we wish to reinforce!

The solution? Delay the DI signal by the same amount as the miked signal so that both are in perfect phase alignment. A good rule of thumb is to delay the DI signal by 1 ms for each foot that the mic is placed away from the cabinet. This is easily done; most digital mixers allow you to delay individual channels in 1 ms increments. If you're mixing on an analog board, you can patch in a digital delay on the DI signal's channel insert.

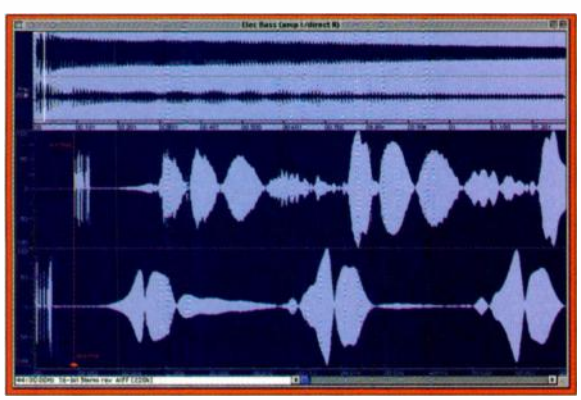

FIG. 2: Due to the distance between the speaker cone and the microphone diaphragm, a miked signal is inherently delayed relative to the DI signal from the same source. The resulting interference typically causes a reduction in amplitude, especially of bass frequencies. The solution is to delay the DI signal so that it is in phase with the miked signal.

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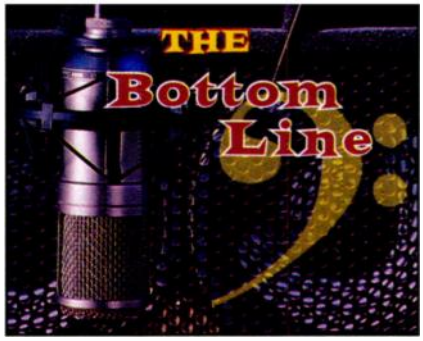

Listen to the combined mic and DI sounds while fine-tuning the DI signal's delay time in 1 ms increments.

You'll know when it's right, because the sound will be huge. In fact, this procedure may give you *too much* bass. Trust your ears, and tweak the delay time until it sounds right to you. (If you don't have a digital delay available, try reversing the channel's polarity to improve the sound.)

TIGHT SQUEEZE

I always use compression when recording electric bass on full-production numbers. Because the human ear is not very sensitive to bass frequencies, any significant level fluctuations tend to result in weak notes. I've yet to meet a bass player who can deliver the perfect attack envelope and sustain on every note, so for a consistently full sound throughout a mix, compression is a must.

I generally prefer soft-knee compression on electric bass, with ratios ranging from 2:1 to 4:1. However, on slap bass I sometimes go with a hard-knee setting for tighter control of peaks. To get a really even sound that doesn't jump out, I'll set the compressor's attack time somewhere between 1 and 10 ms; for a punchier sound that emphasizes the attack of each note, I'll try lengthening it to 20 ms or so.

A release time of around 500 ms is good for adding sustain to a part with long, sparse notes. When notes are coming fast and furious, though, I'll use a relatively short release time; this lets the compressor recover from attenuating a loud note in time to avoid squashing the attack of a quieter note that follows. But use caution when setting the compressor's release time: too fast a setting can result in very audible distortion. The reason for this is complex, but suffice it to say that bass wavelengths are so long that a quick change in their level (per short release time) can transform them into something approaching a square wave. A release setting of 100 ms or longer is usually safe.

SHAPE SHIFTING

I never record electric bass with EQ. Instead, I prefer to massage the sound through mic placement. Your sound will be better preserved if you EQ only once—and because you'll probably end up tweaking the EQ at mixdown, why risk making wrong decisions early on? Therefore, the following comments refer to equalization at mixdown.

When the bass sounds too thumpy—that is, when each note sounds as if a large object is being dropped—use a highpass filter or shelving EQ to roll off frequencies below about 50 Hz. For a bigger bottom without increased rumble, try boosting at around 80 Hz. If the bass is too boomy, try cutting in the neighborhood of 125 to 160 Hz. A cloudy or muddy bass is often improved by cutting around 200 Hz; this is usually preferable to boosting the mids, which can cause a harsh or "wooden" sound. As with all matters pertaining to sound, your ears are your best guide to using EQ effectively.

JAY BLAKESBERG

Les Claypool of Primus takes a final listen before recording a bass track.

TROPHY FISH

Instrument setup, room acoustics, cabinet position, microphone choice and placement, phase relationships of combined DI and mic signals, compression, EQ—all of these details are important. Pay careful attention to every facet of the recording process, and you'll be on the fast track to landing the Big Bass!

Michael Cooper *is the owner of Michael Cooper Recording, located outside the small resort town of Sisters at the base of the Oregon Cascades.*

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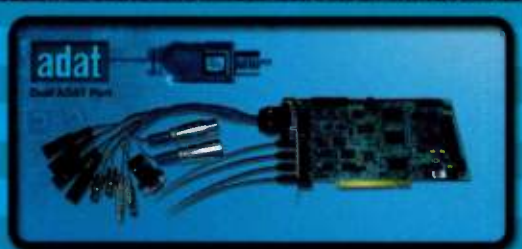

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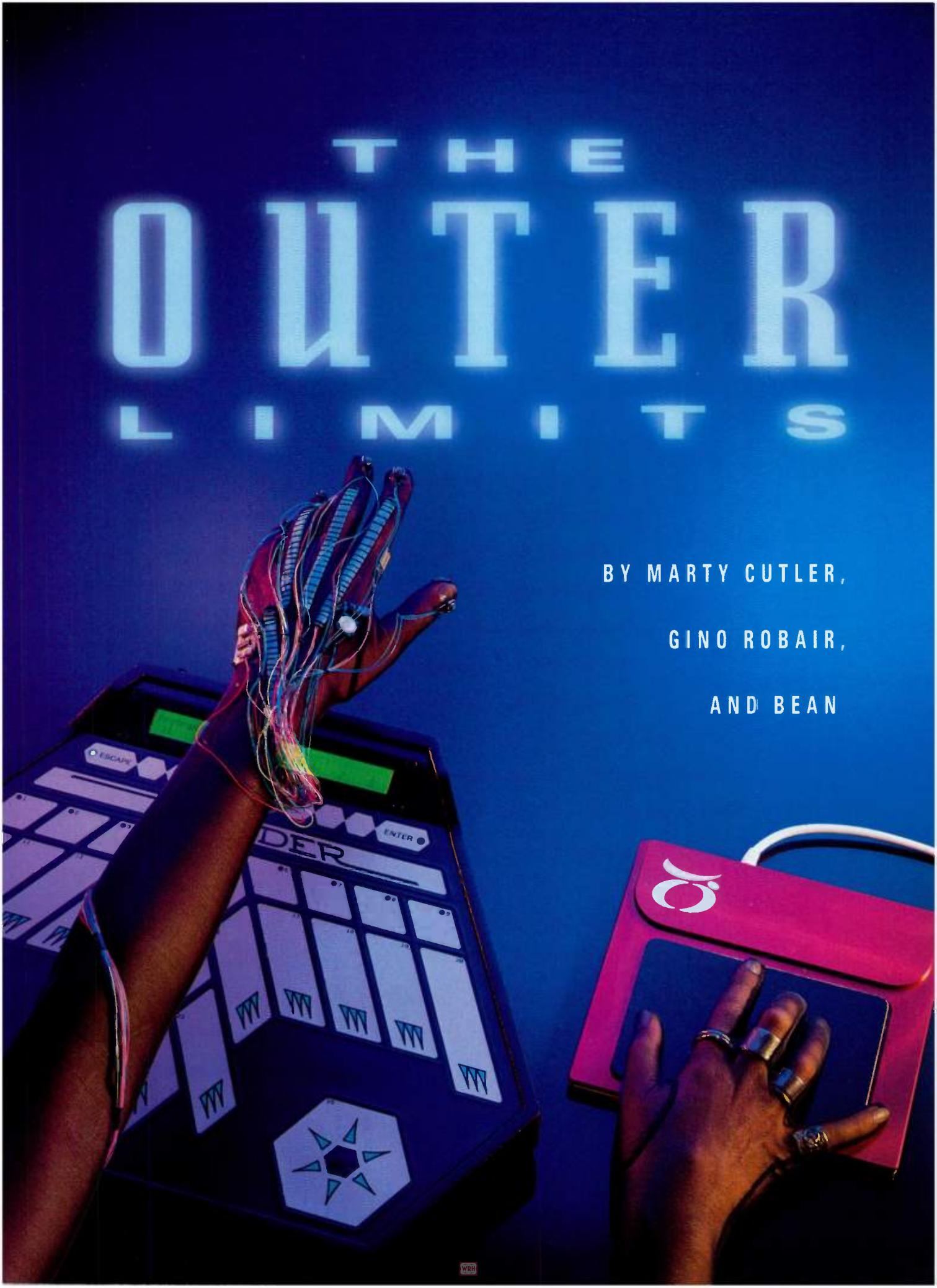


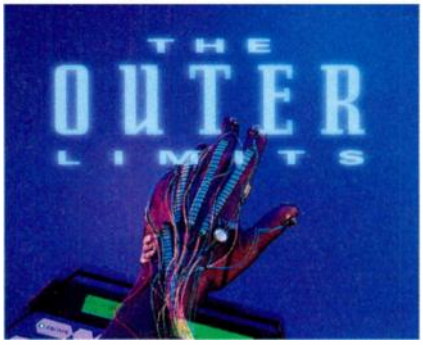
A SURVEY OF UNCONVENTIONAL MUSICAL INPUT DEVICES.

Over the years, innovative approaches to using physical gestures in electronic music have been highlighted in the pages of EM. Although some of the technologies we've covered have had mainstream commercial success, many technologies have remained—either by design or by accident—on the fringes.

However, like artistic and musical works, the commercial success of a new controller shouldn't be the sole criterion for judging its worth. Like hammers and chisels, controllers are merely tools—albeit, in some cases, rather sophisticated tools that may require a major paradigm shift in order to understand their full potential. Ultimately, these new tools are only a means to a musical end; a controller's effectiveness at getting across musical ideas will be the greatest factor in its success.

David Wessel, esteemed researcher of gestural controllers and director of the Center for New Music and Audio Technologies (CNMAT) at the University of California at Berkeley, put it best when he recently noted, "We're on the verge of a controller renaissance." This is primarily due to the growing number of musicians and engineers fighting to keep electronic music a unique medium of expression rather than a means of mimicking established forms. Many composers and musicians are using input devices that retain elements of traditional instruments, while others are tracking gestures in new ways by measuring motion, light, gravity, temperature, air pressure, proximity, and anything else you can imagine. Rarely in the history of music has there been so much work—and such varied results—in instrument development.

PHOTO BY BILL SCHWOB



With that in mind, we decided it was high time to survey the current approaches to alternative input devices for electronic music. Some of the approaches are of the most personal and intimate kind, whereas others are geared for the mass market. This article will cover both extremes, as well as the universe of approaches in between. Commercially available MIDI controllers based strictly on conventional instruments, such as percussion pads, guitar, bass, and wind controllers, and variations on the standard piano keyboard (such as accordion controllers) will not be covered.

IT'S ALL ABOUT INPUT

Over the centuries, every culture has developed ways to express itself musically. By contrast, the field of electronic music, just over a century old, is perhaps moving into its adolescent stage, metaphorically speaking. Few of the earliest performance-based electronic instruments have survived this short test of time, the notable exceptions being the theremin and the Ondes Martenot. But until recently, technology imposed strict limitations on what a performer could do in real time.

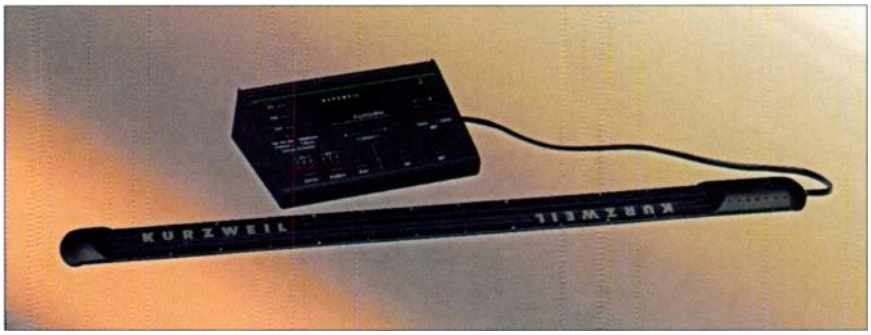


FIG. 2: More than just a ribbon controller, the Kurzweil ExpressionMate can send Note On and a variety of controller messages.

These days, the tools needed to analyze and use multiple streams of input data in musical contexts are readily available and shrinking in size and price. In fact, everyday computer input devices, such as joysticks and graphics tablets, are sophisticated and inexpensive enough to work in musical contexts. And as musical-instrument transducer systems get smaller and more powerful, acoustic and gestural sensors are becoming easier to use with traditional instruments.

Already, external cable connections are beginning to disappear on instruments; external cables will disappear completely as microtechnologies become more available. Imagine the possibilities presented by miniature computers (including power supply and wireless transmitter) that are less than a cubic millimeter in size. This technology is what Kris Pister at U.C. Berkeley's Department of Electrical Engineering and Computer Sciences terms "smart dust" (http://robotics.eecs.berkeley.edu/~pister/SmartDust): microtechnology that, perhaps within this decade, will have a major impact on real-time performance applications.

MIDI OR BUST

Even though technologies change rapidly, well-designed instruments never become obsolete.

Recent technological progress has allowed designers to use powerful processors in smaller spaces and to overcome difficulties in precise pitch extraction; however, they still come up against the bandwidth limitations of MIDI. No matter how small and unobtrusive the sensors are, MIDI still imposes a speed limit of 31.25 Kbps. And although faster data-transmission schemes abound, none have gotten enough popular support to dethrone the MIDI 1.0 specification. Yet engineers and artists have worked around the problems presented by MIDI to create input devices that allow new and exciting ways of making music.

CONTROL SURFACES

MTC Express. One of the newest and most promising touch surfaces being developed is a 3-D controller that uses *smart fabric*—a soft material developed by the Canadian Space Agency that contains an array of sensors interconnected by a network of fiber-optic cables. The MTC Express ($495), from Tactex Controls (www.tactex.com), is a square of smart fabric, measuring 5.75 by 3.75 inches, that is covered with a padded surface and housed in an anodized aluminum slab (see **Fig. 1**). The entire unit weighs just 17 ounces.

The MTC Express can track multiple contact points within a 2-D *(x-y)* field, with a sensitivity of around 100 dots

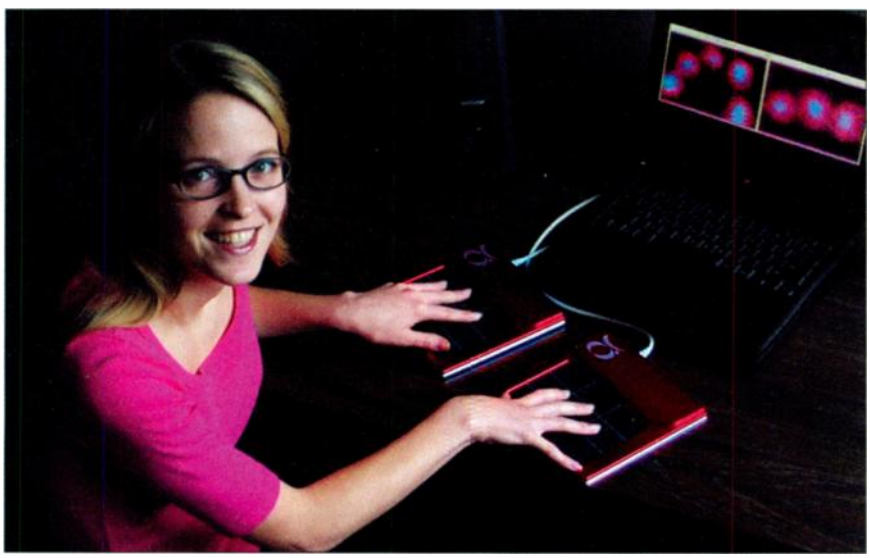


FIG. 1: The MTC Express, from Tactex Controls, can track the Velocity and position of several stimuli simultaneously.

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per inch. It also measures 256 levels of pressure. The surface of the smart fabric is covered with numerous *taxels,* each connected to a pair of fiber-optic cables. Because of the sensor density, the MTC Express can track very subtle physical gestures.

Light from an LCD is sent down one of the cables and is returned over the other. Sensors are used to track the deformation of the fibers by measuring the amount of light sent back down the cables when the fabric is touched. As pressure is exerted on the surface of the MTC Express, variations in light are returned to the sensors.

ExpressionMate. At first, the Kurzweil ExpressionMate ($549) looks like the ribbon controllers that were used with analog synths in the '60s and '70s (see **Fig. 2**). But unlike older ribbons, this one can send an impressive array of MIDI messages. The ribbon surface is divided into three sections, each individually assignable. The unit also includes three 16-step arpeggiators that can send and receive data on separate MIDI channels. The control box can be conveniently mounted on the keyboard or on a mic stand.

Jam Bass. The Jam Bass ($253.50), by Kellar Bass Systems, is a MIDI controller (with internal synth) that attaches to the neck of an electric guitar or bass. The control surface is made up of two rows of 14 pads that mimic the fret layout below the E and A guitar strings. The pads are played with the thumb while the other fingers are on the fretboard. Using a ribbon cable, the control surface is attached to the Circuit Pack, which contains the processor, synth, and audio and MIDI outputs. You can change Synth Voice and Performance modes using the pads.

Thunder. Although it debuted more than a decade ago, the Thunder ($1,990), by Buchla and Associates, gives the performer a sophisticated touch-control surface. The thunderbird-style surface design is the result of ergonomic considerations—the layout comes from tracings done around the designer's hands, and the long, feather-like control strips sit nicely under the fingers. Each of these control strips can track two control dimensions: pressure and position (see **Fig. 3**). All ten fingers can send pressure and position data simultaneously. Although the Thunder is no longer manufactured, a limited number of the controllers are still available directly from Buchla and Associates.

A more recent development by the company is the **Marimba Lumina** ($2,995), an instrument that combines the familiar design of a 3½-octave mallet controller with advanced electronic technology and Buchla-style ingenuity. Designed by Donald Buchla with input from percussionists Mark Goldstein and Joel Davel, the Marimba Lumina is manufactured by Nearfield Multimedia, specialists in precision antenna technology.

The Marimba Lumina comes with four color-coded, foam-covered mallets that contain tuned circuitry. Embedded in each bar, strip, and pad on the surface of the instrument is a radio antenna that can track and identify the mallets, allowing each mallet to have independent control functions. Although cosmetically it bears some resemblance to a more conventional mallet controller, the Marimba Lumina is a highly sophisticated instrument capable of mapping a variety of responses to performance gestures over its various control surfaces.

A special "Gold Edition" Marimba Lumina ($8,000) is a 4½-octave version of the instrument that features gold-plated bars and a curved frame that allows players to reach the furthest notes easily. (See "What's New" in the October 1999 issue of **EM**.) Both instruments include a Yamaha DB51 XG synthesizer, so they can be used without an external sound source.

Finally, there is the **Marimba Lumina 2.5** ($1,995), a new 2½-octave version of the instrument (see "What's New" in this issue).

Starr Labs controllers. Harvey Starr, who heads Starr Labs (http://catalog.com/starrlab), has designed a number of variations on the MIDI guitar controller theme. Avoiding the common pitch-to-MIDI schemes used in guitar controllers, Starr's devices are more user interfaces than MIDI guitar controllers. Starr's controllers often combine guitarlike fingerboards with keys on the neck instead of strings. Sometimes a breath controller and joystick are thrown in for good measure.

The following examples by Starr Labs represent only a fragment of the company's output. Any of the configurations can be customized to fit the needs of the musician.

The Mini-Z ($1,395) is a Velocity- and Pressure-sensitive 24-fret fingerboard designed for tapping. Options include a 4-way joystick, a breath controller, and a programmable strip along the side of the neck that can add Modulation, Pitch Bend, or crossfades between sounds. The Mini-ZS ($1,795) includes the optional joystick and a set of six Velocity-sensitive string triggers. The Mini-ZX ($1,695) adds a set of drum machine–style trigger pads. The Mini-ZXS ($1,995) contains all of the above: joystick, trigger pads, and string triggers (see **Fig. 4**). Note that the prices quoted above are for basic models only; any added options or customization costs extra.

Starr Labs' MT-48DD ($2,195) was

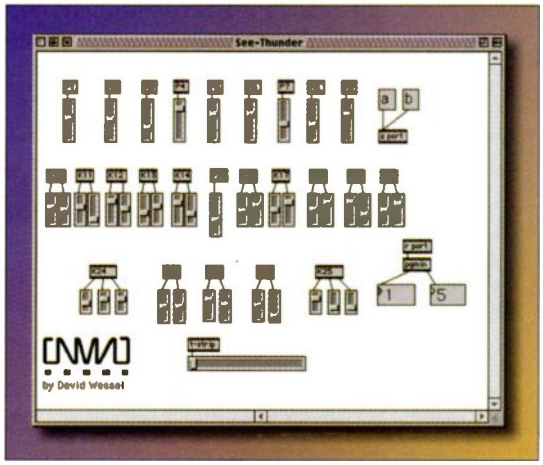

FIG. 3: David Wessel's custom Thunder interface. Notice that some of the controllers have two sliders: one for vertical finger position, the other for pressure.

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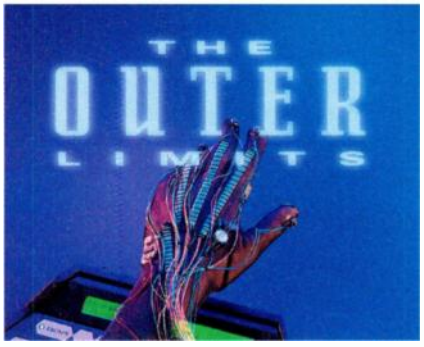


originally designed for bassist Billy Sheehan, who wanted pedals that were better suited for bass playing than the traditional pedal configuration. The unit consists of a 4 × 12 array of 2-inch rubber mounds that are playable with mallets as well as with feet. Each mound is individually programmable and can send a MIDI event or group of events—up to eight per mound—including notes, chords, or even SysEx messages. The floor unit connects to a stand-mountable programmer that holds up to 32 user programs.

A collaboration between Harvey Starr, Stephen Taylor, and microtonalist Ervin Wilson has produced the Wilson 990 Generalized Keyboard Controller ($7,500). Inspired by the Generalized Keyboard that R.H.M. Bosanquet developed in 1875, it is designed to work both as a microtonal performance controller (with the ability to map multiple tonal systems) and as a more traditional controller offering multiple mini-keyboards on a single surface.

The Wilson 990 includes nine ranks of 90 keys. Each rank is assigned its own MIDI channel—in fact, each key can transmit multiple user-defined MIDI messages. The instrument comes with tuning software that is compatible with E-mu and Ensoniq sound modules, as well as Symbolic Sound's Kyma system.

Groups of keys can be defined for different musical purposes, and different setups can be edited, stored, and recalled using a provided editor/librarian program. In addition to the banks of keys, the Wilson 990 has four assignable sliders and a 4-way programmable joystick. A smaller 288-key version ($3,200) is also available.

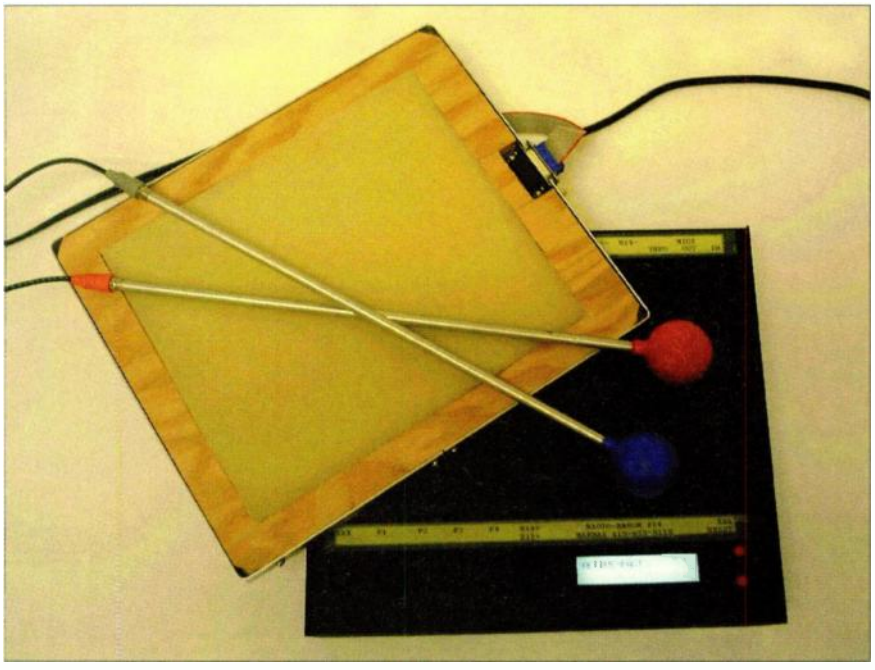
Besides these commercially available products, there are a couple of proprietary touch-sensitive controllers that offer interesting solutions to specific performance requirements.

FIG. 4: Instruments from Starr Labs can be customized with various controllers to fit the performer's needs. Shown here are the Mini-ZXS and Mini-ZS, which include Velocity-sensitive string triggers.

JamODrum. Developed by Tina "Bean" Blaine and Tim Perkis at Interval Research in Palo Alto, California, the JamODrum is meant to inspire people to engage in spontaneous, collaborative music making. In fact, the community drum circle became a metaphor that guided the form and content of the team's work. The designers also intended the JamODrum as a way for participants to explore the relationships between rhythm and graphics. The resultant object—a 7-foot circular table that includes six MIDI drum pads and doubles as a video-projection surface—was something that people could gather around for jamming.

Blaine and audio engineer Kris Force spent several months slicing, dicing, and processing thousands of samples to create a custom library for the project. During the JamODrum's development phase, several interaction methods were available. For example, in the call-and-response method, the sequencer plays short rhythmic patterns that trigger synchronized flashing of the "call" area in the center of the screen. The call patterns are followed by space for players to copy the pattern, directed by response cues. "Your Turn" indicators allow everyone at the table to play together, to be split into subgroups, or to support solo sections. Once the players catch on to the system of when to play and when to listen, opportunities emerge for more-experienced players to improvise within the form. Although some players have found this rhythmic learning approach too structured to be entertaining, others have enjoyed its "Simon says" aspect.

Of the many interaction methods explored, the JamODrum designers found that call-and-response was the most successful in bringing novice and expert players together for musical collaboration.

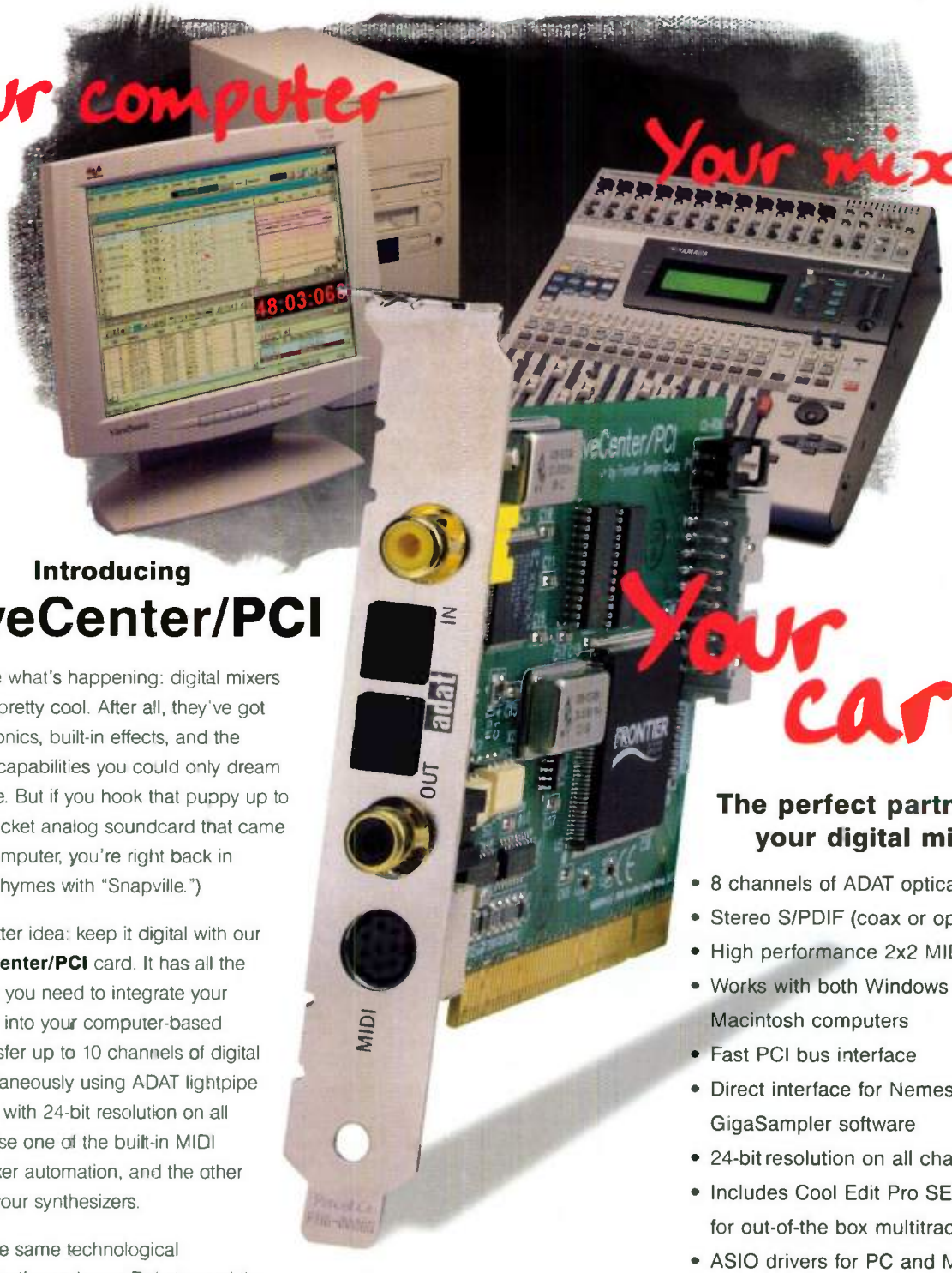


CRAIG STUART SAPP

The Radio Drum's Whack mode sends data whenever the base unit is struck; in Continuous mode, the base unit tracks the position of each mallet in 3-D space.

Your computer

Your mixer



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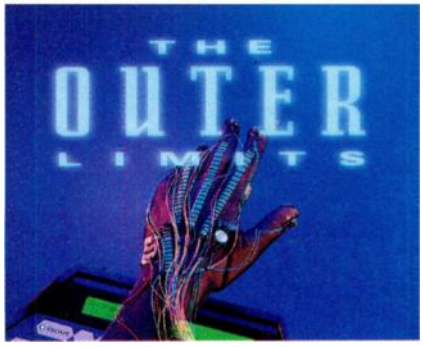

A JamODrum installation that scales from 6 to 12 participants is currently on exhibit at the Experience Music Project in Seattle. A three-person JamODrum was recently donated by Paul Allen/Vulcan Ventures to the Entertainment Technology Center at Carnegie Mellon University in Pittsburgh (www.etc.cmu.edu).

Talking Stick. Under the direction of Bob Adams, a small group of musicians and technologists at Interval Research—including Geoff Smith, John Eichenseer, Jesse Dorogusker, Mark Goldstein, and guitarist/producer Michael Brook—joined forces to create a touch-sensitive, tubular instrument called the Stick (no relation to the Chapman Stick). The project combines customized circuitry with an array of force-sensitive resistors (FSRs) that take multiple data measurements with one touch. Because Brook intended the Stick to be played in a way similar to an acoustic bass, a vertical strip of FSR linear potentiometers was used in lieu of a fretboard. Location and velocity information is determined by the amount of surface pressure applied by the player's fingers. To independently measure force and position, the team developed a custom library of *Max* patches for the Stick.

With plans under way for her work *Songs and Stories from Moby Dick,* Laurie Anderson, with the help of Bob Bielecki and in collaboration with Interval Research, extended the capabilities of the Stick controller. Repurposed specifically for Anderson's hybridized approach to music, movement, and spoken word, the new Talking Stick features a linear potentiometer and a pressure-sensitive actuator for the manipulation of sampled audio, as well as a wireless transmitter for sending control information.

Anderson uses the Talking Stick to evoke the clicking patterns in the language of sperm whales and the creaks and groans of a ship. John Eichenseer, Lukas Girling, and Dominic Robson used Cycling '74's *Max/MSP* to create a variety of granular synthesis patches for the short sound fragments. During performance, these fragments are modified and resequenced in real time.

Besides the four Talking Sticks featured in *Moby Dick,* three other Sticks are in existence—one at Stanford University, one at the Berklee College of Music in Boston, and the one in the possession of Michael Brook.

FIG. 5: Laetitia Sonami's Lady's Glove includes sensors that detect the distance between the glove and the floor.

MIDIBall. Fans rushing a stage at a concert in Tokyo inspired Candice Pacheco, cofounder of D'Cūckoo, to design a gigantic beach ball that creates music as the audience bats it around. The MIDIBall, a wireless 5-foot sphere, converts radio signals into MIDI commands that trigger audio samples and real-time 3-D graphics with every blow. The biggest challenge was finding a plastic material that would be durable enough to protect embedded sensors and withstand heavy hitting, yet would appear to float.

The MIDIBall also required wireless technology with a threshold sensitive enough to reliably interpret a range of raps, slaps, and punches without double-triggering. After experimenting with several different sensors, Pacheco ended up inserting an RF transmitter in a sleeve sewn into the middle of the MIDIBall. The MIDIBall debuted at the Grateful Dead's Mardi Gras show at the Oakland Coliseum in 1992.

STRINGS 'N' THINGS

Research and development in the field of bowed-string controllers have been going on for some time; examples include IRCAM's (Institute of Research and Coordination in Acoustics and Music) SuperPolm for violinist Suguru Goto, Tod Machover's work with the hypercello, and Peter Beyls's use of multiple infrared sensors on violins at Brussels University in Belgium.

However, the international ambassador of the extended violin is Jon Rose. Over the years, the English-born inventor/performer has implemented a number of technological innovations for the instrument and has also developed some unique "deconstructed" bowed-string instruments. Rose's interactive setups, developed with help from STEIM (STudio for Electro-Instrumental Music), combine an accelerometer on the bowing arm, an ultrasound sensor mounted on the bow, a bow-mounted sensor that measures bow pressure on the strings, and three MIDI footpedals (www.euronet.nl/users/jrviolin).

BOLD AS GLOVE

Sophisticated glovelike controllers continue to be popular with performers of electronic music. At the end of the '80s, Tom Zimmerman and Jaron Lanier's DataGlove had scored some notoriety. When Mattel used the technology in its own junior version of the controller—called the PowerGlove—musicians such as Mark Trayle were able to hack into the greater potential of the $79 toy.

The Hands. In 1984 in the Netherlands, Michel Waisvisz began performing with an instrument he helped develop called The Hands. The original controller was made up of a group of keys and sensors mounted under his fingers and thumbs. The data collected by the sensors was translated into MIDI using a microcomputer and custom software that eventually became the SensorLab, marketed by STEIM. Over the years—with engineering help from Frank Balde, Johan den Biggelaar, Bert

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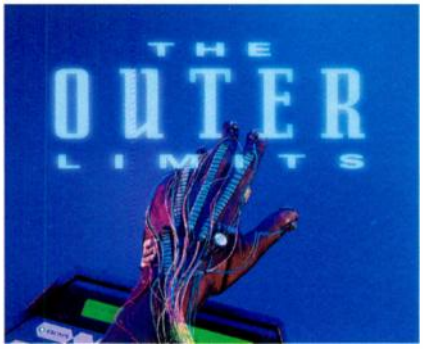

Bongers, Peter Cost, Tom Demeijer, Wim Rijnsburger, and Hans Venmans—Waisvisz has made incremental improvements to his gestural hand controllers. But Waisvisz keeps technological upgrades to a minimum. This allows him to master the performance techniques necessary for exploring the limits presented by the controller.

The latest version, Hands II, is a more refined version of the original controller—with upgraded wiring and components—that measures finger, hand, and arm movements. The distance between the hands is also measured, using ultrasound sensors. Hands III is currently being developed at STEIM by Jorgen Brinkman.

Lady's Glove. In 1991, Laetitia Sonami (www.sonami.net) began her work on the Lady's Glove by attaching magnetic sensors to the fingers of latex gloves. Since then, the Lady's Glove has gone through a series of radical design changes, most recently with the help of engineer/designer Bert Bongers through a sponsorship from STEIM.

In its present implementation, the Lady's Glove (see **Fig. 5**) is a full-length Lycra glove with an accelerometer that measures hand speed; numerous motion and pressure sensors; and ultrasound transmitters and receivers that detect the distance between the glove and the floor.

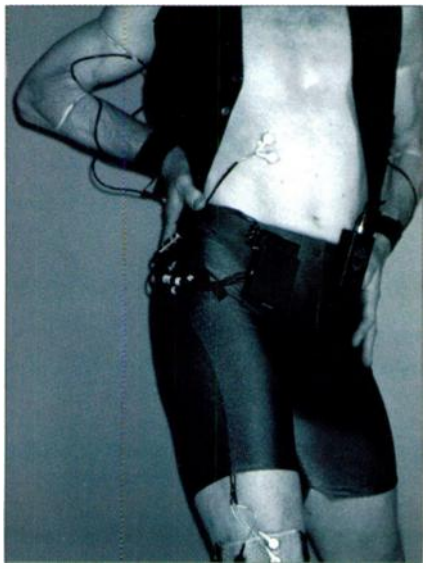

FIG. 6: The BodySynth can track up to 12 EMG sensors simultaneously for translating muscle movement into MIDI data.

FIG. 7: All of the I-CubeX sensors come prewired and ready to use—no soldering is necessary. As many as 32 sensors can be used with the system at one time.

Sonami uses the Lady's Glove in live performances to control sound, mechanical devices, and lights via MIDI—mostly in solo situations but also in improvisations with other instrumentalists. Her current setup includes a STEIM SensorLab processor and a Mac laptop running *Max/MSP*.

WE SING THE BODY ELECTRIC

For decades, composers have been using electrical signals from the body as a source for electronic music. Most of these systems were built using parts originally designed for medical or scientific purposes. Although artists working with biofeedback continue in this manner today, a number of companies are marketing systems that are directly applicable to music.

BioMuse. Researchers Hugh S. Lusted and R. Benjamin Knapp have created BioMuse (www.biocontrol.com), an interface that analyzes and interprets the signals from up to eight simultaneous bioelectric sensors and translates them into MIDI data.

BioMuse has been used primarily with electromyographic (EMG) sensors that measure the flexion and extension of muscles. However, other sensors can be used with the system, including those that read eye movement (electrooculographic) and brain waves (electroencephalographic, or EEG).

BodySynth. The BodySynth ($1,499), developed by Ed Severinghaus and Chris Van Raalte, uses EMG sensors attached to the body of the performer (see **Fig. 6**). The basic setup comes with four EMG sensors, a two-position switch, the Body Unit, a wireless transmitter, and a remote processor that handles the necessary A/D conversion and signal processing and includes a collection of algorithms for musical handling of the MIDI data.

Input from each of the four EMG sensors can be mapped to any of the remote processor's eight MIDI output channels (or *system* channels, as the designers call them). The BodySynth can handle up to 12 EMG electrodes simultaneously.

Once they are attached to the body, the EMG sensors are plugged into the Body Unit, a device roughly the size of a cigarette pack that is worn by the performer. The Body Unit comes with four EMG amplifiers and a gain control for each of the four channels. The performer also wears a wireless transmitter that sends the signals from the Body Unit to the remote processor. Each BodySynth is configurable to fit the needs of the user.

I-CubeX. The I-CubeX ($625), manufactured by Infusion Systems (www.infusionsystems.com), is a comprehensive system that can translate up to 32 analog voltages into MIDI data from a varied host of gestural and

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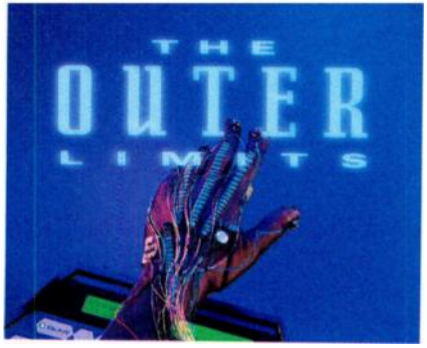

environmental sensors (see **Fig. 7**). The I-CubeX Digitizer handles the I/O; besides MIDI information, the unit can also output 1-bit voltages (that is, 0 or 5 volts). In performance, the I-CubeX can be used with or without a computer. It has editors for both the Mac OS and Windows 95 that allow you to store sensor setups, enabling it to function as a stand-alone unit.

Each I-CubeX system comes with a Turn sensor and a See actuator. Additional sensors are available that measure temperature, light, pressure, acceleration, distance, and proximity; all are specifically created for use with the I-CubeX. For example, the TapTile is a 12-inch-square pad that measures pressure when it is stepped on or danced on. Another device, the TouchGlove, contains six sensors—one used in the palm and five on the fingertips.

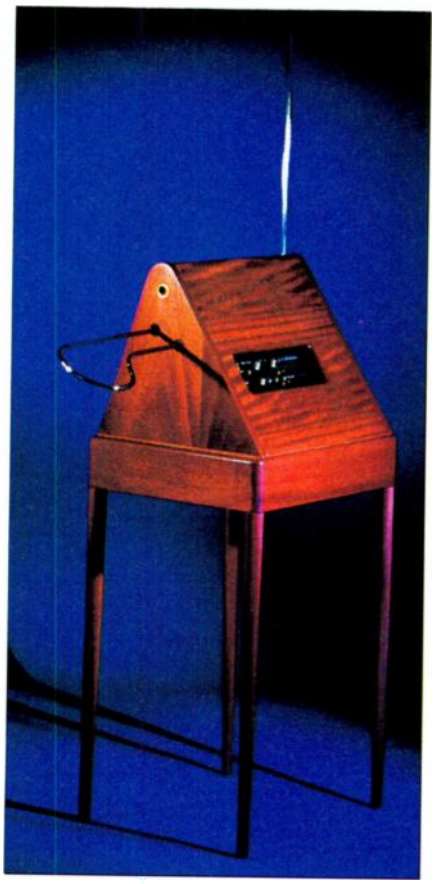

FIG. 8: The Big Briar Ethervox theremin is a world-class performance instrument with extensive MIDI capabilities.

GoFly/IRFly. Infernal Devices (www.infernaldevices.com) offers two environmental sensors in its Sensopede series of products. The GoFly ($95) is a tiny heat sensor (1.25 by 1.5 inches) that can be used to detect the motion of people in a room. The IRFly Ranging Detector ($59) is a 1.25-by-1.5-inch infrared detector that ignores other light and heat sources. Both devices work with processors made by Infusion Systems, with Beehive Technologies' ADB I/O, and with STEIM's SensorLab (see the sidebar "Preaching to the Converters").

IBVA. IBVA Technologies (www.ibva.com) sells a system that couples EEG brain-wave sensors with Mac software specifically tailored to musical applications. The single-channel IBVA (which stands for Interactive Brainwave Visual Analyzer) Core system ($1,300) includes a headband with electrode sensors, a wireless transmitter and receiver, and a Pin Input extension pack for connecting other types of biofeedback sensors.

Software accompanying the Core system includes the *Step 1 Expansion Pak* (containing various control applications), *Alps+* for brain wave–to–MIDI control, and a software synthesizer. In fact, the IBVA system complies with the General MIDI specification.

MIDIVox. An interesting technique for tracking the voice nonacoustically involves electroglottography (EGG). An EGG sensor measures laryngeal behavior through changes in electrical impedance across the throat. The MIDIVox ($1,295) uses EGG sensors for converting pitch and intensity data from the larynx as MIDI, binary, analog, and gate output. Invented by SynchroVoice, the MIDIVox is now available from HealingMusic.net.

The MIDIVox is made up of two components: a neck band (available in blue or black) with four biosensors, and a 1U rack-mount interface module. The hypoallergenic neck band is wrapped around the singer's neck and affixed with Velcro so that two of the sensors are on either side of the Adam's apple. The neck band attaches to the processor with a ribbon cable.

FIG. 9: The ultrasonic sensing capabilities of the Soundbeam 2 make the system ideal for situations that require noninvasive biofeedback.

Since its review in the July 1992 issue of **EM**, the MIDIVox has been upgraded with new motherboards and EPROMs, larger biosensors, and a new Velcro neck band.

TOUCHE PAS

Until the 20th century, the sense of touch has been one of the most important elements in playing musical instruments. With few exceptions (primarily the voice and the aeolian harp), earlier instruments required physical contact to make them work. Recently, however, this fundamental principle has changed.

Some gestural controllers operate by measuring the capacitance of an object. The capacitance (or ability to hold an electrical charge) varies based on the object's distance from an adjacent object. Once the measurements of these changes are recorded, they can be converted to MIDI information with the assistance of A/D converters.

Other controllers use beams of light or ultrasound. For example, when an object is moved within a field of infrared light, optical sensors measure the increasing and decreasing amount of reflected light and generate MIDI data based on the values produced by these measurements. (For a more technical description, see Scott Wilkinson's article "Interactive Light" in the December 1995 issue of **EM**.) This particular technology is not a recent development—several MIDI guitar controllers have been developed that measure reflected light as an alternative to pitch-to-MIDI conversion, where fingers placed on the fretboard interrupt an infrared beam, and the altered length of the beam is then converted to a MIDI Note message.

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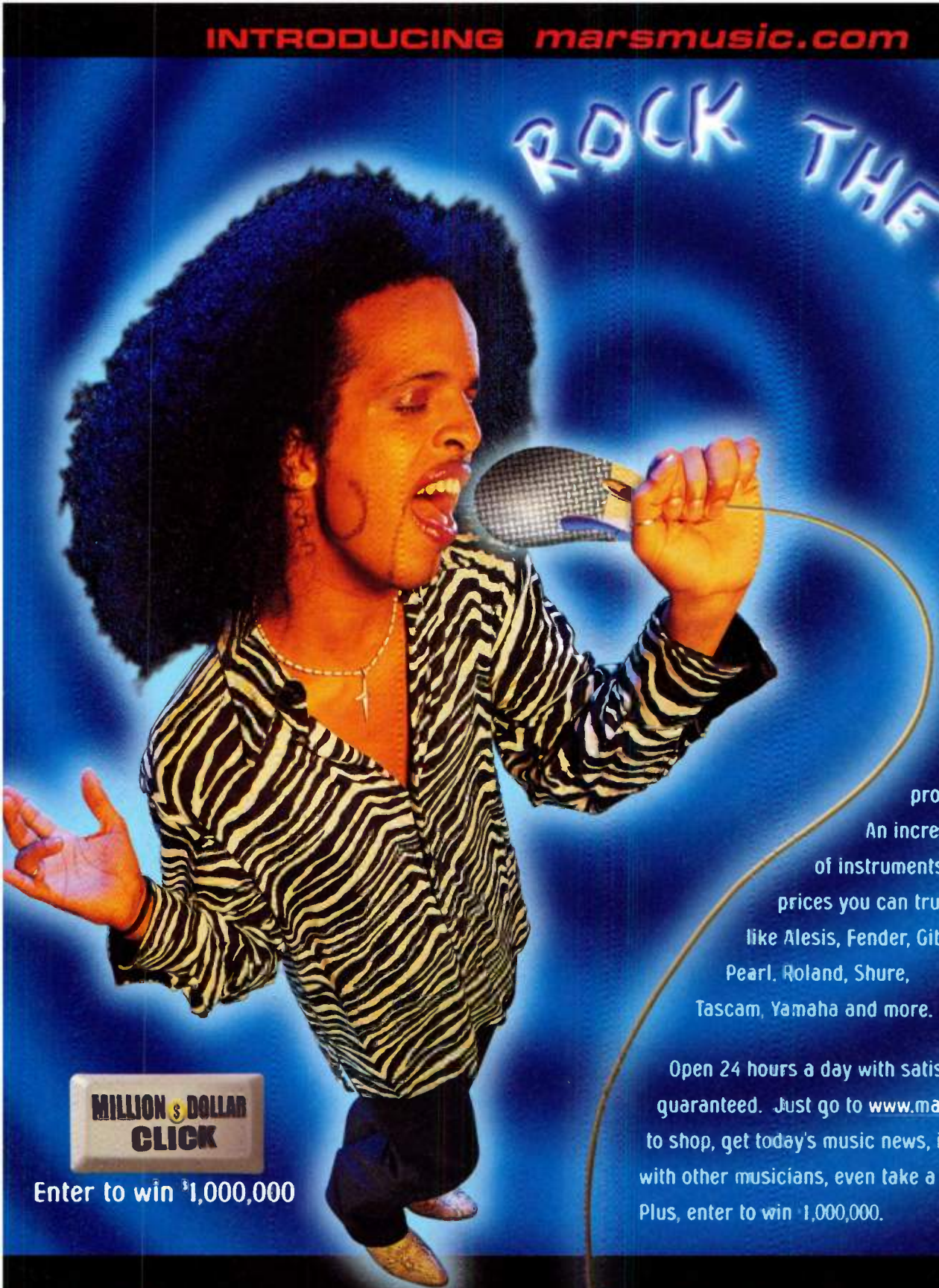

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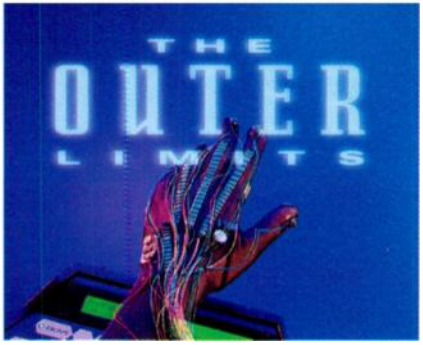

Radio Drum/Radio Baton. Developed by Bob Boie and Max Mathews, the Radio Baton and the Radio Drum track the 3-D movement of two or more batons over a base unit. The ends of the batons are covered with copper tape and topped with large foam balls that resemble mallets. Each baton transmits a discrete frequency that is localized by measuring the electrical capacitance between the tip of the baton and the array of receiving antennas embedded in the base unit.

The system allows performers to predefine behaviors of the batons/mallets. For example, Mathews wrote a conductor program to provide new ways of interpreting and performing traditional music scores. This software, coupled with the Radio Baton, enables singers and soloists to create their own orchestral accompaniment, process their voice, or work with algorithmic compositions. A program written by Andrew Schloss lets a performer conduct Standard MIDI Files. In this mode, the baton sends motion information to a computer, which then interprets the baton's signals and sends MIDI commands to a synthesizer for playback.

An interesting example of a work created using the Radio Drum is composer David Jaffe's pairing with Schloss in the duo Wildlife. With Jaffe playing a Zeta violin and Schloss using the Radio Drum, two computers interpret and respond to each player's actions, superimposing the output of one instrument onto the other. For example, a glissando on the Zeta violin can change the pitch of notes played on the Radio Drum, or the drum can modify the output of the Zeta. Performing in such situations requires the musicians to develop new interactive skills, especially when their musical intentions are wrested away from them by other musicians.

Ethervox MIDI theremin. The theremin is arguably one of the finest and best-known gestural controllers. Big Briar's Ethervox (www.bigbriar.com) offers several enhancements to the traditional theremin, including the addition of more complex waveforms and a filter that can be modulated by pitch (see **Fig. 8**). The Ethervox theremin can control external sound sources and can be played from a MIDI sequencer.

In many ways, the Ethervox is fairly straightforward in its MIDI implementation. Pitch Bend is transmitted, as is Control Change 7 (volume). The device can also send and receive Note On, Note Off, Velocity, Program Change, and System Exclusive messages. As you would probably guess, the Ethervox sends a constant stream of Pitch Bend messages. Fortunately, the user can scale the updating of Pitch Bend and Volume information to thin out the MIDI data stream.

Big Briar's most popular theremin, the Etherwave ($369 assembled; $299 kit), doesn't have MIDI capabilities but does boast a 5-octave range as well as controls for waveshape and brightness, and it comes with an instructional videotape.

Dimension Beam. Developed by Interactive Light, the Dimension Beam uses an infrared beam to track the position of an object moving within its field. This invisible beam is shaped like an elongated egg balanced on one end, and it has 128 layers that can be assigned specific MIDI values.

One of the interesting aspects of the Dimension Beam is that, although the device may have seemed a bit esoteric when it was first released in the mid-'90s, it has since found commercial acceptance: Roland licenses the technology (now referred to as DBeam, and no longer sold to the public by Interactive Light) for use in many of its products, including the SP-808 Groove Sampler, the HPD-15 HandSonic drum controller, and the MC series of Groove Boxes.

Lightning II. Buchla and Associates' Lightning II ($1,990) is a spatial controller that features a pair of wireless wands, a half-rackspace processor, and a stand-mountable remote receiver. The Lightning II uses infrared trigonometry to track the vertical and horizontal position as well as the velocity of each wand. It divides the performance space into eight Zones, configured in a 4 × 2 array. A Stimulus from either wand can be assigned to each of the Zones. Stimuli include movement within a Zone; entering or exiting a Zone; and clicking, double-clicking, or releasing the buttons. You can also use footswitches with the Lightning II, for yet another level of control.

The processor contains a 32-voice, 18-bit Kurzweil MASS sample-playback chip that provides a General MIDI sound bank. Each postage stamp–size memory card can store 30 presets. A preset can hold up to 40 patches that contain user-definable mapping of gestures to responses.

Soundbeam. Developed more than a decade ago by EMS, the English company famous for its popular Synthi and

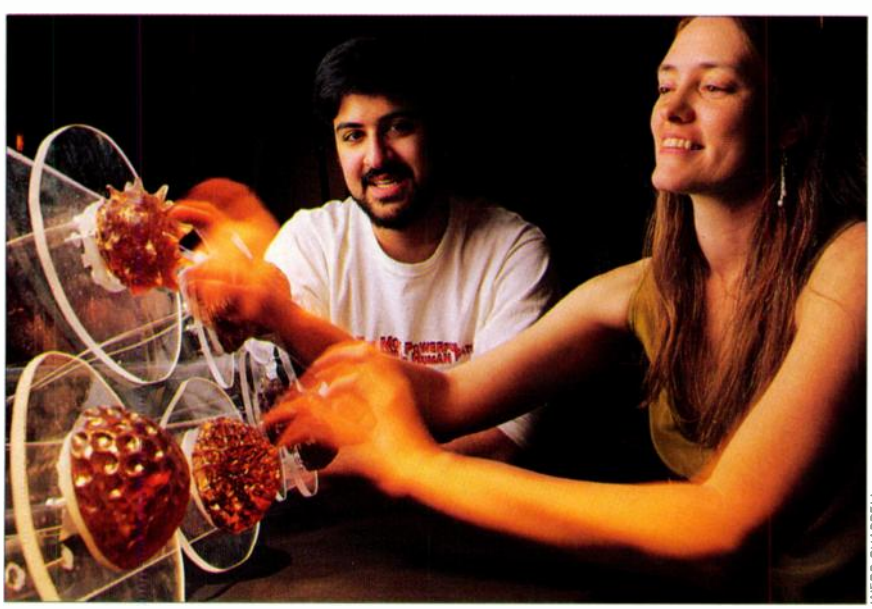
WEBB CHAPPELL

FIG. 10: The translucent, pressure-sensitive rubber pads of the Rhythm Tree are an inviting interface for sonic exploration in the Mind Forest.

For manufacturer information, please see Contact Sheet, p. 171.

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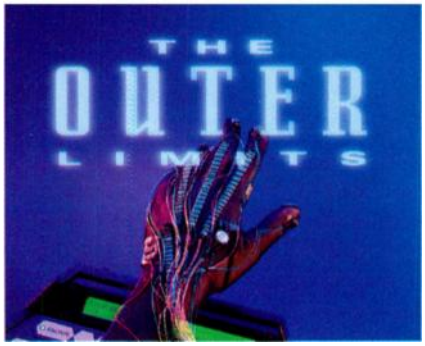

VCS3 analog synthesizers, the Soundbeam (www.soundbeam.co.uk) is an ultrasonic MIDI-control system favored in special-education situations where noninvasive biofeedback is needed (see **Fig. 9**). With the recent release of the Soundbeam 2 ($2,777), EMS has enhanced the feature set of the original model to include the ability to track the speed of a moving object within the ultrasonic field, as well as proximity and on/off status. The Soundbeam 2 also allows you to divide each ultrasonic beam into 64 sections, each of which can be assigned its own notes, chords, or MIDI control parameter.

Up to four ultrasound beams can be used simultaneously, each with its own MIDI channel. The Switchbox ($250) sends data from eight additional controllers (such as switches and joysticks) to the Soundbeam 2 controller, and it works simultaneously with the beams. The beams have a variable range from 2 to 20 feet, whereas sensors can be placed more than 150 feet away from the controller. The Soundbeam 2 comes with presets containing pitch sequences, as well as a large bank for user-defined sequences.


JOE PARADISO

FIG. 11: Tod Machover of MIT's MediaLab performs in the Sensor Chair, which senses the position and movement of the performer's arms and upper body.

OptiMusic. The OptiMusic system (www.optimusic.com) uses reflected, visible light beams as controllers and is also useful in physical-therapy situations. The system comes in two versions: the single-beam OM-L1 and the 7-beam OM-L7. Both versions are controlled by the *OM-PCI* light-to-MIDI control software.

The lights sense the reflection from performers moving within the beams. The color, shape, angle, sensitivity, and distance between the lights is customizable. The OptiMusic system allows up to 99 notes per beam and can work with up to 32 light beams. It will be available in September.

HOT OFF THE SHELF

One thing changing the alternative-controller landscape is that standard control devices from the graphics and gaming worlds are becoming increasingly powerful, plentiful, and lower in price. And, more and more of them feature Universal Serial Bus inputs. "In fact," notes CNMAT's David Wessel, "USB is just now beginning to mature as we speak."

Among the devices popular with electronic musicians are the Wacom graphics tablets. For example, Wacom's UD-1212-R offers, among other things, 32,000 points along an *x-y* axis and pressure and angle sensitivity. In addition, each UltraPen—the little stylus that is used as an input device—can have its own ID.

Matt Wright, musical-systems designer at CNMAT, uses a Wacom tablet when performing. In recent performances with Wessel and Pakistani singer Shafqat Ali Khan, Wright used the tablet to play additive-synthesis sound descriptions (using *MSP*) of Khan's voice. Wright uses templates to indicate how the sound

Alternative Controllers in EM

REVIEWS	ISSUE
Big Briar Ethervox	05/98
Buchla and Associates Lightning II	08/96
Buchla and Associates Thunder	08/90
Cycling '74 *MSP*	10/98
Interactive Light Dimension Beam	07/96
Kurzweil ExpressionMate	05/00
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ARTICLES	**ISSUE**
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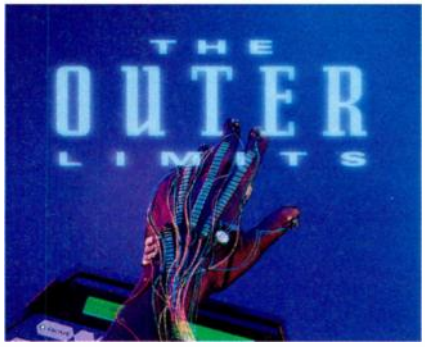


descriptions are mapped horizontally across the tablet. This allows him both to scrub through the sound in either direction (with the pitch kept independent of the scrubbing speed) and to visually locate particular musical parts so he can set the UltraPen directly onto them.

"Joysticks have also matured over the years," comments Wessel, "and some include enough control options—buttons, triggers, movement direction—for sophisticated music making." After some research into the subject, composer Bob Ostertag suggested to Wessel and CNMAT that the Cyborg 3D USB by Saitek (www.saitek.com) was one such controller worthy of investigation in this area.

BRAIN OPERA

Perhaps the most prolific source of research into alternative controllers is MIT's MediaLab, under the direction of composer Tod Machover and Joseph Paradiso. The MediaLab's many developments have moved beyond the ivory tower and are now used in prestigious venues around the globe.

Paradiso is the technology director of the Things That Think consortium, a group captivated with the infusion of intelligence into everyday objects. He also leads MIT's Responsive Environments group, which has developed controllers used in musical/graphical board games, as well as "smart sneakers" that, when worn during performances, endow dancers with the ability to produce continuous musical output.

Since the mid-1980s, Machover has been passionate about augmenting the expressivity of traditional instruments—keyboards, strings, and percussion—with computer systems that measure and interpret human expression and feeling. These "hyperinstruments," which are tailored specifically for professional musicians, expand the capabilities of existing instruments and redefine the ways in which people interact with objects that may or may not typically be associated with making music. As sensors, software, and signal processing have become more sophisticated, the development of hyperinstruments has evolved to include interactive musical instruments for amateur musicians as well.

In 1996, Machover created a work that blends live hyperinstrumentalists with audience participation—both live and via the Internet—in the polymorphous production known as the "Brain Opera" (http://brainop.media.mit.edu). After two years of touring, the Brain Opera and its associated gadgetry are still undergoing constant revisions and upgrades. Many of the controllers described here will become permanent installations in Vienna's House of Music when it opens this summer.

For some attendees of the Brain Opera, the most engaging aspect is not the actual performance but the opportunities for hands-on musical interaction. This takes place within an eclectic assortment of sculptures known collectively as the Mind Forest.

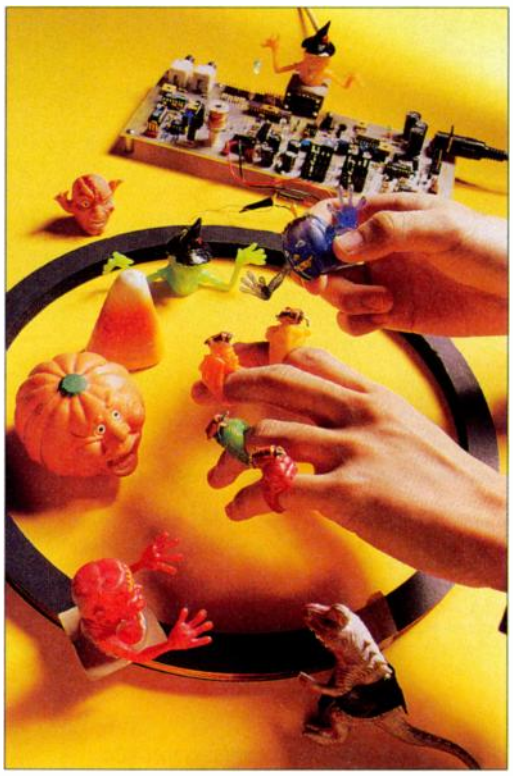
Rhythm Trees. From the gigantic pods of the Rhythm Trees hang 300 translucent rubber drum pads that trigger vocal samples when struck (see **Fig. 10**). Implanted in each pad is a pressure-sensitive piezo-electric strip that can accommodate a wide range of strike velocities. Networks of 30 pads are routed to a PC running custom software under Windows NT. As performers strike the pads, the software looks for patterns between players and generates new rhythms in response, creating a kaleidoscopic array of sounds, lights, and images in the process.

Singing and Speaking Trees. The Singing Trees respond with audiovisual feedback to the tonal quality of notes sung next to them. A well-sung note results in a calm, atmospheric response from the system, while badly sung notes receive a more complex response. Speaking Trees, on the other hand, allow people to record stories, memoirs, lyrical phrases—in other words, to speak on any topic at all. Speaking Trees automatically edit and process the recordings and incorporate the sound bytes into each Brain Opera performance.

Harmonic Driving. One sculpture that closely approximates an arcade-style video game is the Harmonic Driving controller. Responding to video generated by Rolf Rando's 3-D rendering system on an IBM RS/6000 computer, participants use a steering wheel to navigate through a multicolored course complete with bends, turns, and potholes. Melodies and harmonies are created that correspond to the path taken; icons placed in the course signify "hot" or "cool" musical tracks. The driver determines whether the ride is a rhythmic journey or a wandering detour of ambient sound. In the true spirit of a video game, the player is given a skill rating at the end.

Sensor Chair. Normally, one would think of a chair as something you sit on while making music with an instrument. But the Sensor Chair captures movement of the arms and upper body and converts those motions into music while the performer is sitting in a chair (see **Fig. 11**).

Using the Sensor Chair, the performer becomes an extension of a transmitting antenna embedded in the chair's cushion. Four receiving



WEBB CHAPPELL

The MIT MediaLab has developed a collection of "music toys" that give young people the chance to create interactive electronic music.

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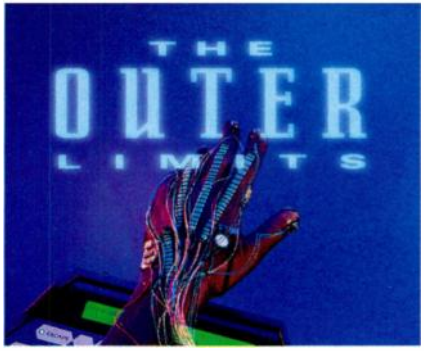

antennas mounted on poles around the Sensor Chair allow body gestures to control sound. Joe Paradiso, Neil Gershenfeld, and Ed Hammond developed the chair's hardware, and Pete Rice and Eran Egozy devised the interpretive software. The mystical nature of this new controller even attracted the magicians Penn & Teller, who used it in a routine to highlight the innovations of music, magic, and machines.

Gesture Wall. Movement from a participant's entire body modifies the ongoing sounds and projected images as they stand near the Gesture Walls. Beneath the floor are plates that transmit a low-voltage electrical signal to the participant's body through his or her shoes. Sensors mounted around the projection screen above the walls receive these electrical signals as they leave the body. This allows the instrument to follow precisely even the subtlest of gestures.

Future Music Blender. After wandering through the Mind Forest, visitors to the House of Music will have an opportunity to explore a new addition to the Brain Opera—the Future Music Blender. Chris Dodge, Alex Westner, Peter Colao, and Ed Hammond worked with Tod Machover to create a sonic sculpture designed to collect music samples that could easily be incorporated into a performance medley. While some of the sounds are activated from a prepared database, other samples will be generated by visitors to the Mind Forest. Using a Sensor Chair retrofitted with a "multimodal mixer" for control, people will be able to access, select, and play samples. Simply waving a hand in the air will enable a visitor to "blend" sounds that are then complemented by musical accompaniment (generated through custom algorithmic software) to create larger compositions.

Music toys. The latest round of controllers is disguised as "music toys." With names like Simple Things, the Big Thing, and Music Shapers, they are made from as many squeezable, stretchable, and reconfigurable parts and materials as possible. (Even Play-Doh is used as a conductive material to manipulate sounds.) The ultimate goal behind the creation of these controllers is to distribute them to music-education programs in five host cities (New York, Boston, London, Berlin, and Tokyo). The culmination of the project will be a series of Toy Symphony compositions and performances with local symphony orchestras.

As the name implies, Simple Things make simple sounds, such as individual notes or sample playback, and are intended to be handheld stand-alone devices. Josh Strickon, Abie Flaxman, Tristan Jehan, and Diana Young use infrared links to exchange sounds between Simple Things and to synchronize groups of Simple Things.

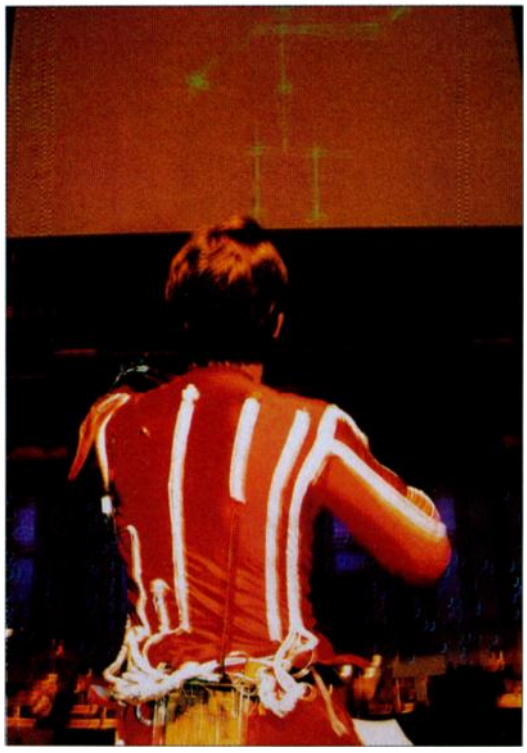
RICH FLETCHER

FIG. 12: Boston Pops conductor Keith Lockhart wears the Conductor's Jacket during 1998's Tech Night at the Pops.

Music Shapers are fabrics, furniture, balls, and spatial instruments that offer fun, tactile ways to explore different aspects of music. Designed by Maggie Orth and Gili Weinberg, these malleable instruments provide new ways to physically shape and manipulate musical sounds and textures by measuring the exertion of force and pressure on stretchable objects. This tangible approach to playing music is inspired by the desire to create flexible interfaces to complement the multidimensional aspects of synthesizers and computer-generated music.

The Big Thing—a multitiered structure designed by Orth, Weinberg, Dan Overholt, and Mary Farbood—is intended to be the brain that controls the network of interconnected music toys. The Big Thing enables young people to compose, arrange, and perform music in a 3-D construction kit, letting them experience musical expression by changing the physical relationships between a variety of sensing objects, connectors, and "chunks." Each chunk contains sounds or commands that can be reorganized by moving, twisting, and interconnecting with

GET WITH THE PROGRAM

One of the most popular commercially available software applications for sound artists who need flexibility in mapping physical gestures to MIDI is an object-oriented programming language called *Max* (Mac; $395) available from Cycling '74 (www.cycling74.com). Created in 1987 by Miller Puckette at IRCAM and later developed into a commercial product by David Zicarelli, *Max* provides a graphical user interface for combining the basic building blocks used in an object-oriented environment. A Windows version is on the horizon.

Cycling '74's *MSP* lets you create, analyze, and process audio and is designed for use with *Max*. The full version of *MSP* ($295) requires *Max* 3.5.8 or higher. A free runtime version of *MSP*, which comes with the free *MaxPlay* application, allows you to play, but not create, *MSP* patches.

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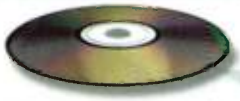

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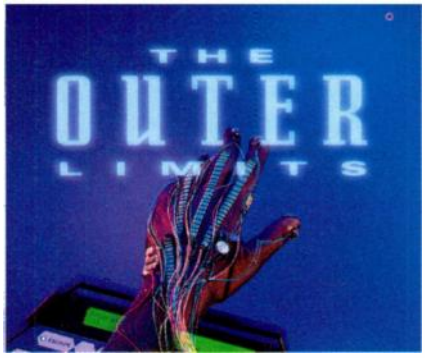

other chunks to create "islands" of sound. The sensor objects can be used to add touch sensitivity or gesture-controller functions. Obviously, children will need a bit of coaching before they can fully understand the capabilities of these giant Lego-like controllers and music toys, but the prospects for collaboration are encouraging.

There are many more controllers—too many to list in this article—that have also been an outgrowth of development throughout MIT's MediaLab. Among these are "musical bottles" that control different sounds and patterns of colored light when the stoppers are removed; musical threads that are sewn into a denim jacket and emit sounds; and gesture-tracking digital batons that provide position, orientation, and surface-pressure information.

Conductor's Jacket. Wearable computers are not an essential part of most people's wardrobe—unless you happen to be hanging around Teresa Marrin Nakra. Interested in finding new avenues for musical and emotional expression while studying at the MediaLab, Marrin Nakra mounted a collection of EMG sensors to her upper body, with the wires strapped inside a "conductor's jacket" to collect a variety of physiological measurements.

After taking readings on heart rate, respiration, skin conductivity, temperature, and muscle tension, Marrin Nakra hoped to find a correlation by mapping these measurements to the gestures and rhythmic timing of conducting. She was able to convince a number of well-known conductors, including Keith Lockhart of the Boston Pops, to try out the Conductor's Jacket in performance so that data pertaining to these unknown relationships could be collected (see **Fig. 12**). To her surprise, Lockhart was more than willing to get wired for his audiences; he even requested a flashier jacket than the one that was originally provided.

STEIM

As a research center dedicated to the performing arts, STEIM (STudio for Electro-Instrumental Music) has been a hotbed of alternative-controller research (www.steim.nl). Notable developments include The Hands, developed with Michel Waisvisz, as well as the Sweatstick and the MIDI Conductor. Important computer applications for use in live performance have also come from STEIM, such as LiSa, for live sampling; BigEye, which converts video into MIDI data; and Image/ine, for real-time video manipulation.

A number of prominent performers using live electronics have developed highly personalized instruments at STEIM, including Jon Rose, Bob Ostertag, Laetitia Sonami, Miya Masaoka, and Kaffe Matthews.

STEIM also features an exhibition called the Electro Squeek Club, where visitors can experience firsthand a collection of audio and video pieces. Some are completed installations, while others are in development at the center. Visitors are encouraged to explore the individual properties of each of the exhibits, which include Crackle Boxes, Babblephones, the Electronic Baby Mirror, and the BeBop Table. The artists represented include Michel Waisvisz, Bert Bongers, Jorgen Brinkman, and Tom Demeyer, among many others.

IRCAM

The research center in Paris known as IRCAM (Institute of Research and Coordination in Acoustics and Music) has been at the forefront of music and technology for decades. Research into

PREACHING TO THE CONVERTERS

A number of converters are available for translating analog signals to digital ones.

The SensorLab (www.steim.nl/sensor.html) is a voltage-to-MIDI converter developed at STEIM for use with any type of interactive controller. Although popular with many artists, the SensorLab is currently out of production. Keep an eye on the developer's Web site for further details.

The ADB I/O ($199) by Beehive Technologies (www.bzzzzzz.com) allows you to use up to eight input sensors with a Mac. You can connect up to four units, for a total of 32 I/O channels. The device accepts sensors from Infernal Devices and Infusion Systems and can work with Hypercard, Supercard, AppleScript, Macromedia *Director*, Symantec C/C++, and Cycling '74's *Max*. A beta version of a *Max* object created by David Zicarelli for the ADB I/O can be downloaded for free from the Beehive downloads page.

To accommodate different types of sensors (both gestural and environmental), IRCAM has begun marketing its AtoMIC Pro ($665). The AtoMIC Pro translates sensor information (electrical voltages) into MIDI data. The device was designed to be open-ended, so it can work with any type of controller or signal. It has 32 analog inputs (using two multipin connectors), eight digital inputs and outputs on multipin connectors, one MIDI input, and four MIDI outputs.

CNMAT has developed a low-latency, high-quality multichannel interface for use with laptop computers in live performance situations. Code-named the Rimas Box (after its primary developer, researcher Rimas Avizienis), the interface uses the 100BaseT Ethernet port to communicate with the computer, allowing the device to simultaneously handle 64 channels of sample-synchronous control-rate gesture data, 10 time-stamped MIDI I/O streams, and up to 10 channels of 24-bit audio. "Latency measurements show that we can get signals into and back out of *Max/MSP* in less than 7 milliseconds," says CNMAT director David Wessel. "One of the most important features of our interface is that data from sensors is treated as signals that are synchronized at the sample level with the audio. This provides the user with a very high degree of control intimacy."

The Rimas Box, which is designed to sit neatly under a laptop computer, is currently being manufactured in a limited quantity for final beta testing.

For manufacturer information, please see Contact Sheet, p. 171.

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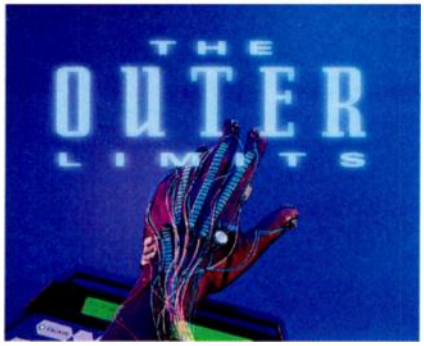

musical input structures has led to the development of several controller prototypes, including the SuperPolm and an extension of the computer mouse, dubbed Jerry.

This and other information has been assembled for a CD-ROM titled *Trends in Gestural Control of Music,* by Marc Battier and Marcelo Wanderly, and is available from the Electronic Music Foundation (www.cdemusic.org). Sections of the disc are dedicated to performance issues, definitions of gesture, and gestural analysis. It also includes a roundtable discussing the "Present and Future of Gestural Control in Music," with contributions by such luminaries in the field as Donald Buchla, Mark Goldstein, Joel Chadabe, Tod Machover, Teresa Marrin Nakra, Robert Moog, Jean-Claude Risset, Laetitia Sonami, and Michel Waisvisz.

FINAL PERSPECTIVE

It is interesting to note that many of the controllers surveyed here are continually being refined—some could even be considered works in progress. Some readers may feel that there is a gratuitous use of new technologies behind some of these new musical-input devices, but deeper investigation reveals that musical results are the chief motivating force behind most of the controllers.

Although some of the input devices in this survey are theatrical, the ultimate goal is for the results to transcend the novelty of the visual aspects that a device presents. In most cases, the artistic success of a particular controller will depend on its transparency in the creation of the music: the main purpose behind all of these devices is the natural and immediate translation of physical gestures into music.

Some of the controllers we've examined here are based on the highly personal goals of their developers, whereas others are created with mainstream applications in mind. Performers who want to develop their own controllers need to define the gestures they wish to use and then find the best way to measure these gestures and translate the results into a useful data format, such as MIDI. Sometimes a series of gestures may require more than one type of sensor.

A number of companies have already developed the various components needed in an interactive control system (such as sensors, signal converters, and software). All that inquiring musicians, dancers, or artists need to do is spend some time configuring their own systems and learning how to use them.

Ever since **Marty Cutler** *started as assistant editor for* **EM**, *he has referred to his banjo as a "real-time 5-string arpeggiator." Armchair thereminist* **Gino Robair** *is an associate editor for* **EM**. **Bean**'s *music-making methods include sneaking into schools around the Bay Area with her group, RhythMix. Special thanks to David Wessel, David Jaffe, Donald Buchla, Alex Artaud, Peter Elsie, Joel Chadabe, Mary Gallardo, Miya Masaoka, Pamela Z, Bela Fleck, Bob Applebaum, and Jimi Tunnell.*

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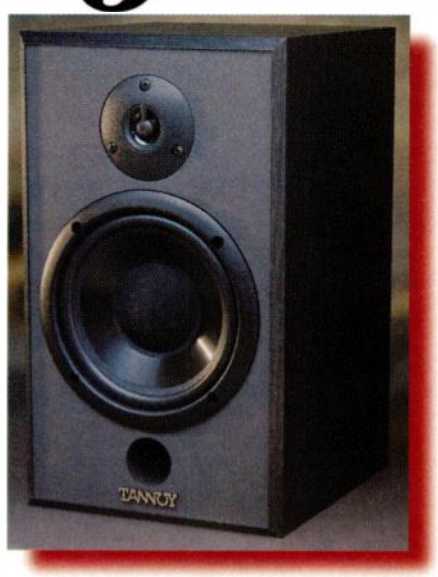

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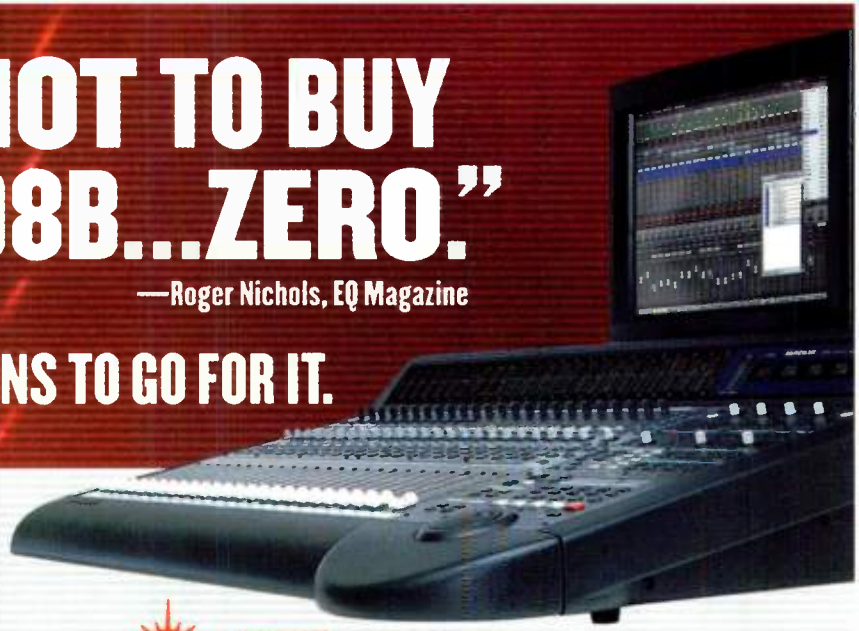

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Rediscovering the

Illustration by Laura Williams

What was the first sequencer? That depends on your definition of *sequencer*. Does it have to be electronic and involve synthesizers, or is it any device that plays music according to a "program"?

Preprogrammed mechanical instruments have been around for centuries—think calliopes, hurdy-gurdies, and music boxes. Mozart even wrote a couple of pieces for a mechanical organ.

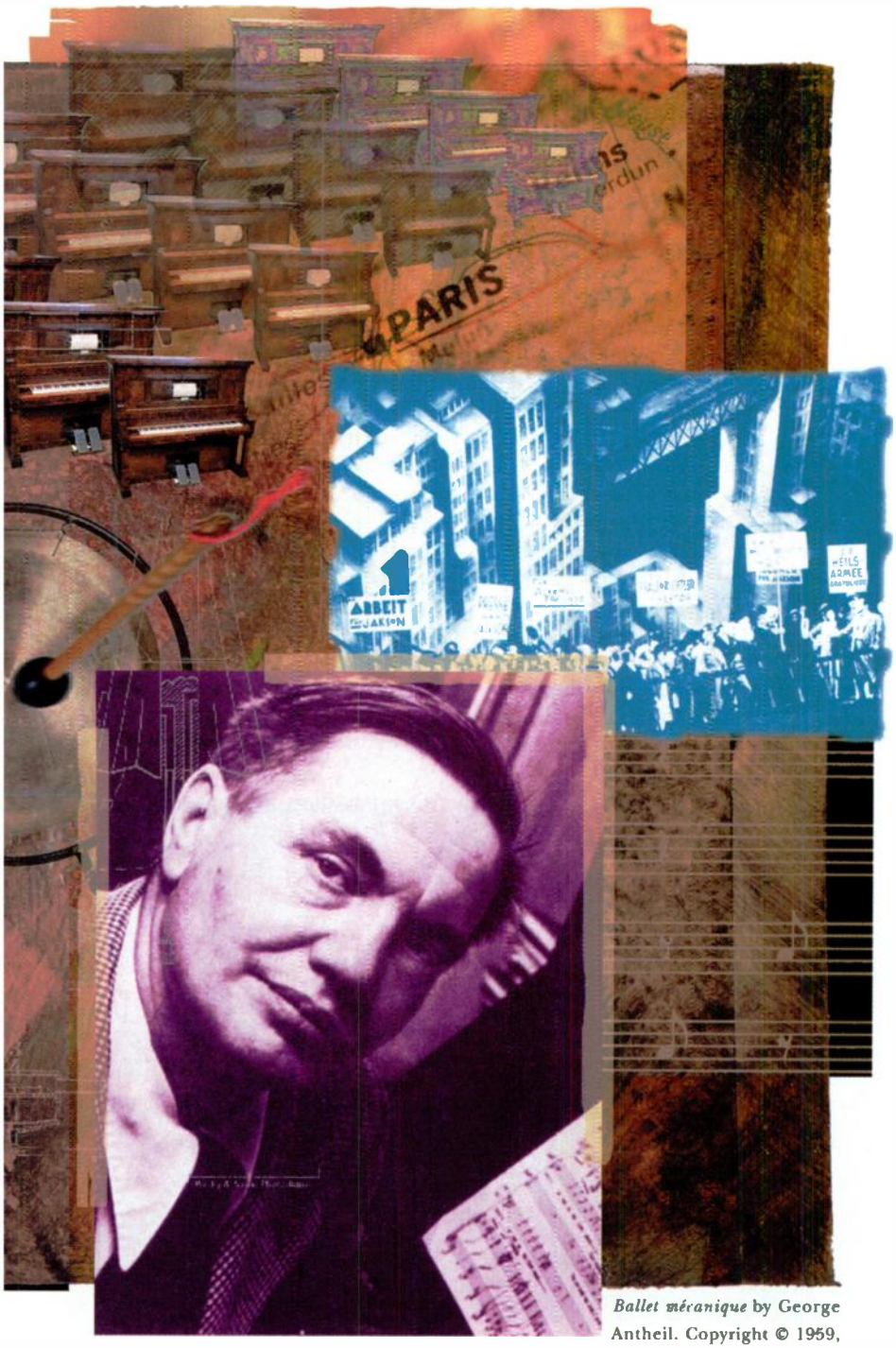
The technology reached its zenith at the end of the 19th century with the invention of the player piano. Programmed music in the home soon became wildly popular: within a few years, automatic music-producing hardware and its attendant software (piano rolls)

BY PAUL D. LEHRMAN

became fixtures in the upper-middle-class parlors of America and Western Europe.

One of the biggest drawbacks of player-piano technology was that you couldn't sync two or more instruments with each other. To create mechanical ensembles, inventors grafted additional instruments—violins, bells, organ pipes, and drums—onto player-piano mechanisms, which resulted in

Ballet Mécanique



Ballet mécanique by George Antheil. Copyright © 1959, 1986 by G. Schirmer, Inc. (ASCAP). This edition © 2000 by G. Schirmer, Inc. (ASCAP). International copyright secured. All rights reserved. Reprinted by permission.

Modern technology brings a 75-year-old score to life.

monstrosities like the Orchestrion. Still, the music was coming from one instrument.

George Antheil, a young American composer living in Paris in the early 1920s, refused to accept the technological limitations. He envisioned the music of the future coming from ensembles of mechanical instruments, linked together like looms in a factory. His *Ballet pour instruments mécaniques et percussion* (1924), popularly known as *Ballet mécanique,* embraced industrial technology. It calls for 16 synchronized player pianos (referred to as *pianolas* in the score) playing four different parts (four pianos play each part), along with a percussion ensemble (see **Fig. 1**). The orchestration is for two conventional pianos, three xylophones, four bass drums, a gong, a siren, seven electric bells, and three airplane propellers. By most definitions, Antheil created the world's first multitrack sequence.

Rediscovering the Ballet Mécanique

THE IMPOSSIBLE DREAM

Antheil was relying on Parisian piano manufacturer Pleyel to help him achieve his goal. Pleyel had patented a method of slaving any number of player pianos to one master instrument by means of a complex system of electrical pulses and self-adjusting paper-roll mechanisms. (Pleyel's creation bears a striking resemblance to today's time-code-based synchronization systems.) Unfortunately, either the system was never built, or if it was, it proved impractical for public performance.

Only after he had finished composing *Ballet mécanique* did Antheil realize that it couldn't be played. He then composed a reorchestrated version for multiple conventional pianos and only one player piano.

Today, Antheil's dream of a gigantic machine-controlled performance can at last be realized. Locking together 16 player pianos is simple, thanks to MIDI-compatible player pianos from manufacturers such as PianoDisc, QRS, and Yamaha. With the assistance of publisher G. Schirmer, Yamaha, and a host of consultants, technicians, and musicians, I helped make the dream a reality.

WHO WAS GEORGE ANTHEIL?

Antheil, the son of a shoe salesman, was born in 1900 in Trenton, New Jersey. A piano prodigy, he toured Europe at the age of 21. He fell in love with the expatriate scene in Paris, which was brimming with artists such as Ernest Hemingway, James Joyce, Pablo Picasso, Erik Satie, and Igor Stravinsky. Antheil planted himself at the center of this remarkable assemblage and became Paris's "Bad Boy of Music" (he later used the nickname as the title of his autobiography). In this heady atmosphere, he wrote a number of pieces celebrating the machine age. But none was as "mechanistic" as *Ballet.*

Ballet mécanique is quite long—1,240 measures—and can take 26 to 36 minutes to perform (depending on the tempo). The piece is unremittingly cacophonous and brutally rhythmic, incorporating more than 600 time-signature changes (see **Fig. 2**). The xylophones play in parallel major sevenths, the pianos boom out huge repeated chromatic clusters (which at times require the players to use their forearms), the siren rises and falls above the din, and the bells and airplane propellers provide "pedal points" to keep the noise floor high (see **Fig. 3**). Snatches of jazzy melodies occasionally bubble up, only to be subsumed by the sheer wall of sound.

Ballet mécanique also introduced a new element to musical composition: silence. The piece contains several sections, some as long as 20 seconds, in which absolutely nothing happens.

The reorchestrated version of *Ballet mécanique* (1926) was a roaring success (that is, if the amount of controversy a work generates is a measure of its success, which was the Parisian attitude at the time). The public greeted the first performance with boos, catcalls, and whistles; fistfights between Antheil's supporters and detractors broke out in the auditorium and in the street. The event inspired the greatest artistic riot since the premiere of Stravinsky's *Rite of Spring* 13 years earlier, and the young Antheil became the toast of the town. "Antheil had Paris by the ear," composer Aaron Copland wrote.

An American promoter tried to recreate the spectacle the following year in New York City's Carnegie Hall, but the effort fell flat. New York audiences were apparently too jaded to appreciate *Ballet mécanique,* and technical difficulties induced laughter and derision. Antheil's reputation as a serious composer never fully recovered.

Antheil enjoyed a few successful years in Germany as an opera composer before the Nazis banned his music because he was non-Aryan. Antheil then returned to the United States and settled in Hollywood, where he built a solid, if undistinguished, career as a film composer and orchestrator. In 1952, he again reworked *Ballet mécanique,* this time into a much shorter, tighter version that excluded the player piano entirely. Antheil died of a heart attack in 1959.

OUT OF THE CLOSET

The earlier versions of *Ballet mécanique* languished in a closet in the home of Antheil's widow until the late '70s, when she gave them to Charles Amirkhanian, a composer and historian in San Francisco. Amirkhanian subsequently published many other Antheil pieces under the name Antheil Press. In the early '90s, he sold the publishing rights to Antheil's catalog to G. Schirmer, the New York–based music-publishing giant.

Ambitious percussion ensembles often played the 1952 version of *Ballet mécanique* (and today it still remains the most popular choice), but until November 1999 neither of the older versions had been heard for many

BARRY HETHERINGTON/COURTESY YAMAHA

FIG. 1: George Antheil's *Ballet pour instruments mécaniques et percussion* (1924) is scored for 16 synchronized player pianos and an ensemble of conventional pianos, xylophones, bass drums, a gong, a siren, electric bells, and airplane propellers. The premiere performance took place on November 18, 1999, in Lowell, Massachusetts.

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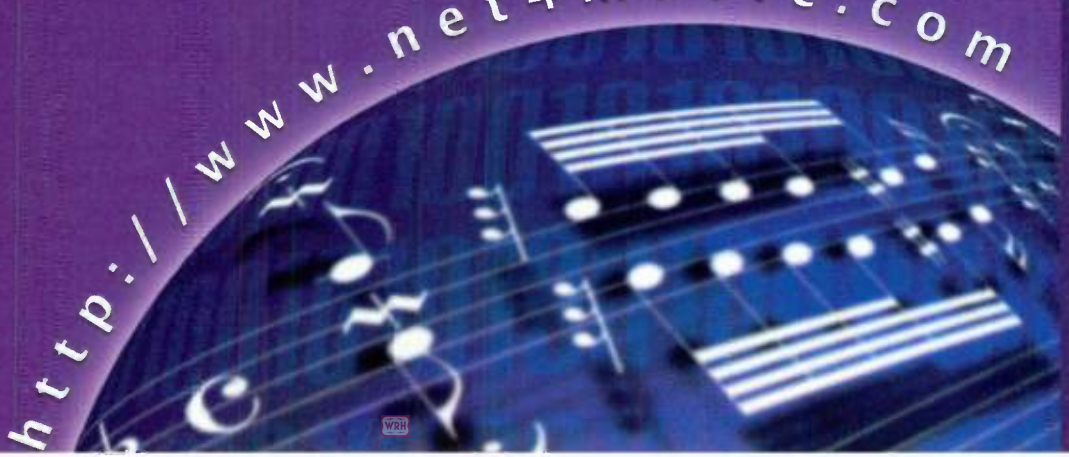


years. In 1989, conductor Maurice Peress revived the single-player-piano version in a concert at Carnegie Hall, but no one has performed it since. Early in 1999, the German Ensemble Moderne performed the multiple-player-piano version for the very first time, using 2 player pianos instead of 16. Musicologist and scientist Jürgen Hocker modified the 1920s pneumatic instruments used in this performance, customizing them to respond to MIDI.

Bill Holab, G. Schirmer's publications director, saw the original 1924 version as a great opportunity, and he began working on a version of *Ballet mécanique* that any contemporary performing group (with sufficient resources) would be able to play. The necessary technology, of course, was MIDI. Aware of Yamaha's Disklavier line of MIDI-compatible player pianos, Holab approached Yamaha and persuaded the company to supply Disklaviers for the piece's first performance. Then Holab contacted me.

MIDI ASSIGNMENT

Holab was familiar with my work for **EM** and *Mix*, as well as with the book *MIDI for the Professional*, which I cowrote with former **EM** editor Tim Tully. When he asked me if I was interested in helping with the project, my jaw dropped.

What Holab didn't realize was that I already knew about *Ballet mécanique*. Thirty years earlier, at a music camp in Vermont, a percussion teacher had given me a reel-to-reel tape of the 1952 version, which I listened to dozens of times. The earlier versions, however, were unknown to me. Needless to say, I was thrilled to have the opportunity to help Antheil's impossible dream come true.

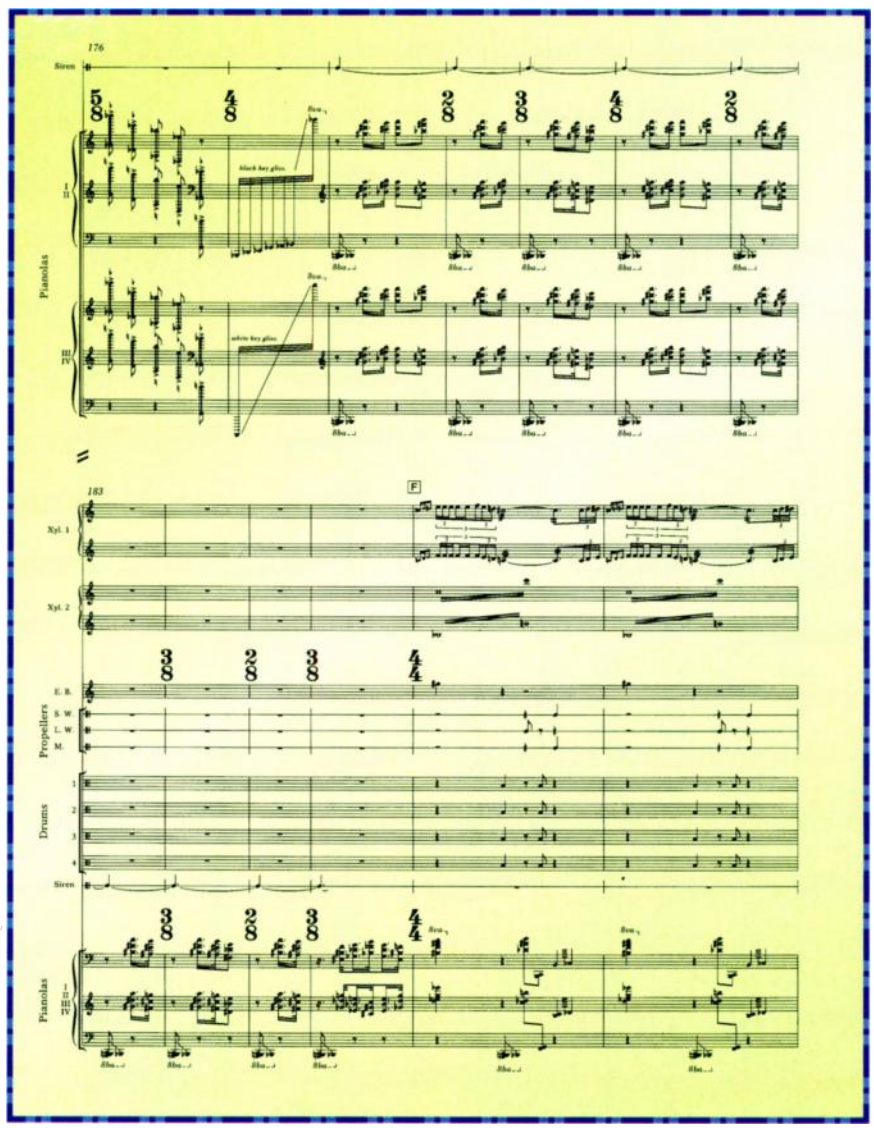
Holab asked me to create a set of MIDI sequences that he could send along with the printed score and parts to groups who wanted to perform the piece. He knew that the groups would have to deal with many technical issues. My specific assignment was to research these issues and then write a booklet to accompany the score and MIDI files. I offered to do even more: I figured that many ensembles would have a hard time procuring sirens, bells, and airplane propellers, so I proposed to create samples of those sounds and include them with the other materials. Holab readily agreed.

SEQUENCING THE SEQUENCE

Freelance editor George McGuire had used Leland Smith's *Score*, a PC notation program, to enter Antheil's original score into a computer for publishing purposes. *Score* doesn't output MIDI files, but some third-party add-ons do. Holab and I tried to create a sequence from McGuire's file, but the unusual time signatures (11/16, 7/32, and so on), the huge number of meter changes, and the sheer volume of notes (some measures contain clusters of 23 notes in *each* of the player-piano parts) made the MIDI files a useless jumble, and no sequencer I tried could even open them.

I then contacted inventor and composer Trimpin (see "Performing Musician: Taming the Elements with MIDI" in the December 1999 issue of **EM**). Trimpin, who is an expert on player pianos, owns a copy of the rolls for the 1926 single-player-piano version of *Ballet mécanique*. He had invented a scanning device capable of converting the paper rolls into MIDI data, and he had created Mark of the Unicorn *Performer* files from his rolls.

But three problems prevented me



COURTESY G. SCHIRMER

FIG. 2: The instruments scored here are xylophones (abbreviated as Xyl. 1 and 2); electric bell (E. B.); small wood, large wood, and metal propellers (S. W., L. W., and M.); drums; siren; and player pianos. The score refers to the player pianos as pianolas. Note the numerous meter changes in this excerpt.

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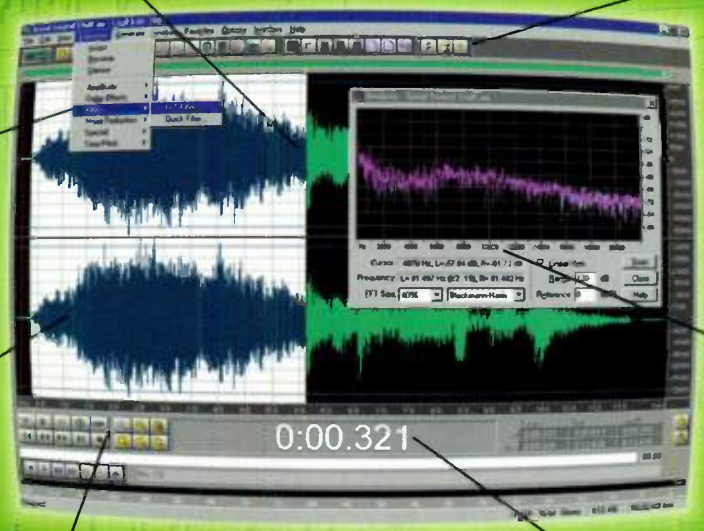

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from taking advantage of his work. First, there was no clean way to separate Antheil's original four parts from this "combined" file. Second, the barlines in Trimpin's files didn't correspond to those in Antheil's score, so they would have had to be entered by hand—an extremely complicated operation. Finally, Antheil himself had never been particularly happy with any of the rolls, so I would have had to check every note against the score for accuracy.

Ultimately, the most sensible option was to create the files from scratch—all 1,240 measures. I loaded the notes into Opcode's *Vision* 3.6 but soon realized the program couldn't handle sequences longer than 999 bars. Fortunately, version 4.01 handled the 1,240 bars without protest. But *Vision* doesn't like bars with more than 32 beats, so I had to convert some of Antheil's more expansive time signatures into a metric equivalent that the application could handle; for example, I changed 64/8 into 32/4. *Vision* didn't blink at ridiculous time signatures like 11/16 and 7/32.

STEP-BY-STEP

Since nuance of performance is not a high priority with the player-piano parts, I took advantage of a sequencer feature that I usually avoid—step time. Step time allowed me to build the impossibly complex chords one note at a time.

Unfortunately, the copy and paste functions were of limited use: although the score has plenty of duplication, Antheil often made subtle changes to repeated phrases. For example, a phrase in a bar of 4/4 will be slightly modified (perhaps by the removal of an eighth note) in the following bar of 7/8. These two bars would themselves be repeated, but the fourth bar would be slightly different from the second—a different eighth note would be missing. So after cutting and pasting a section, I had to make additional changes by hand.

LENGTHS AND DYNAMICS

A player-piano roll is made of paper. If you cut a hole in the paper that corresponds in length to exactly one eighth note and then you punch another eighth note right after it, the second note won't play. You must leave some paper between the holes to allow the hammer to recover and strike the second note. MIDI needs much less time between a Note Off and the next Note On—one sequencer "tick." But even a MIDI-driven player piano, which uses solenoids to move the hammers and keys, needs time to recover.

Because *Ballet mécanique* is full of repeated chords (at one point, the same 16th-note chord repeats 300 times), I had to decide how long each note should sound. I chose an arbitrary duration of 80 percent, which worked fine (most of the time).

Additionally, Antheil's score has no dynamics markings. Elsewhere he wrote that *Ballet mécanique* should be "played as loud as possible." Setting all the note Velocities to 127, however, would break the pianos; they aren't designed to take that kind of sustained punishment. So I set the note Velocities to 80, which gave me plenty of room to experiment with the dynamics. This choice also worked well (most of the time).

HEARING IS BELIEVING

So I could hear what I was doing, I borrowed four MicroPiano modules from Kurzweil, installed them in my home studio, and rewired the room, adding a second pair of speakers behind me. The four player-piano parts surrounded me as I sequenced them. The setup was terrific for proofing the parts, because despite the incredible atonal cacophony of the piece, if anything was the least bit wrong with the texture at any point (say, a wrong note) the problem stuck out *spatially* even more clearly than it did musically. Entering all of the notes took about six weeks.

Next, it was time to test the sequences on real instruments. Modern player-piano mechanisms are very different from the pneumatic systems of the early 20th century, and I wasn't sure that today's pianos could handle Antheil's demands, even with the reduced Velocities and shortened note durations. In addition, modern pianos are designed primarily to be used with their own internal computers. They all have MIDI inputs, but they behave somewhat unpredictably when driven by external MIDI signals. I wanted to make sure that the files would work with the three major brands of MIDI player pianos: Yamaha, QRS, and PianoDisc (the latter two are sold under a variety of brand names).

My first test was with an upright Disklavier at the MIT MediaLab. I installed *Vision* on one of the lab's Macs and ran my sequence. Troubles set in immediately: notes were dropped, rhythms were jerky, and the sustain pedal wouldn't release. MIT's Disklavier is one of the first that Yamaha made, and the MIDI implementation in the ancient onboard CPU was, to put it politely, a little flaky.

George Litterst, a software developer, teacher, and consultant for Yamaha, invited me to his basement studio, where he had a Disklavier conservatory grand with more recent firmware. On this piano the sequences ran much better, but I still encountered problems.

The first complication had to do with polyphony. Antheil's score calls for chords of up to 23 notes, but the Disklavier's polyphony is limited to 16. Over that limit, the solenoids become too much of a drain on the power supply, and a last-note-priority voice-stealing algorithm comes into play.

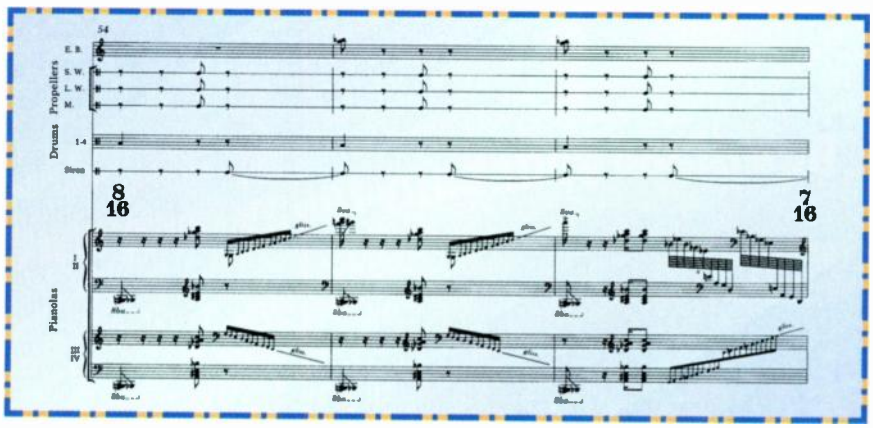

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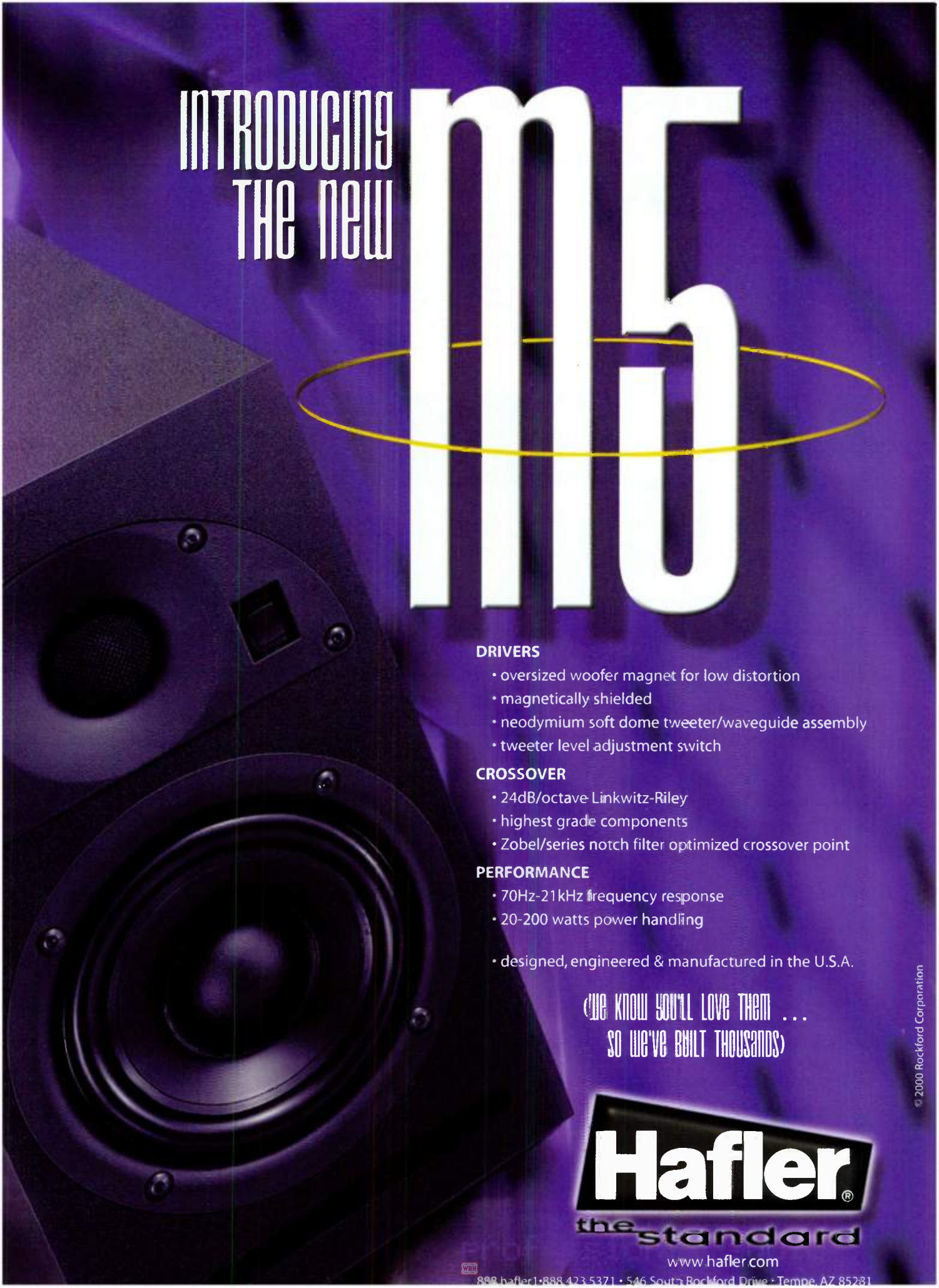
FIG. 3: The electric bell, propellers, drums, and siren provide "pedal points" for the pianolas.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DELAYING GRATIFICATION

The Disklavier's method of handling incoming MIDI data posed another interesting problem: there's a built-in 500-millisecond delay between its responses to Note commands. Why? Think of an electronic synth simultaneously receiving two notes at different Velocity levels. Although the amplitudes of the two notes will be different, they will sound at exactly the same time. With an acoustic piano, however, *velocity* refers to the speed of the keystroke. If you simultaneously send an acoustic piano two Note commands with different Velocities, the solenoid-controlled keys will *start* to move at the same time, but the key with the higher Velocity will strike the string before the key with the lower Velocity does.

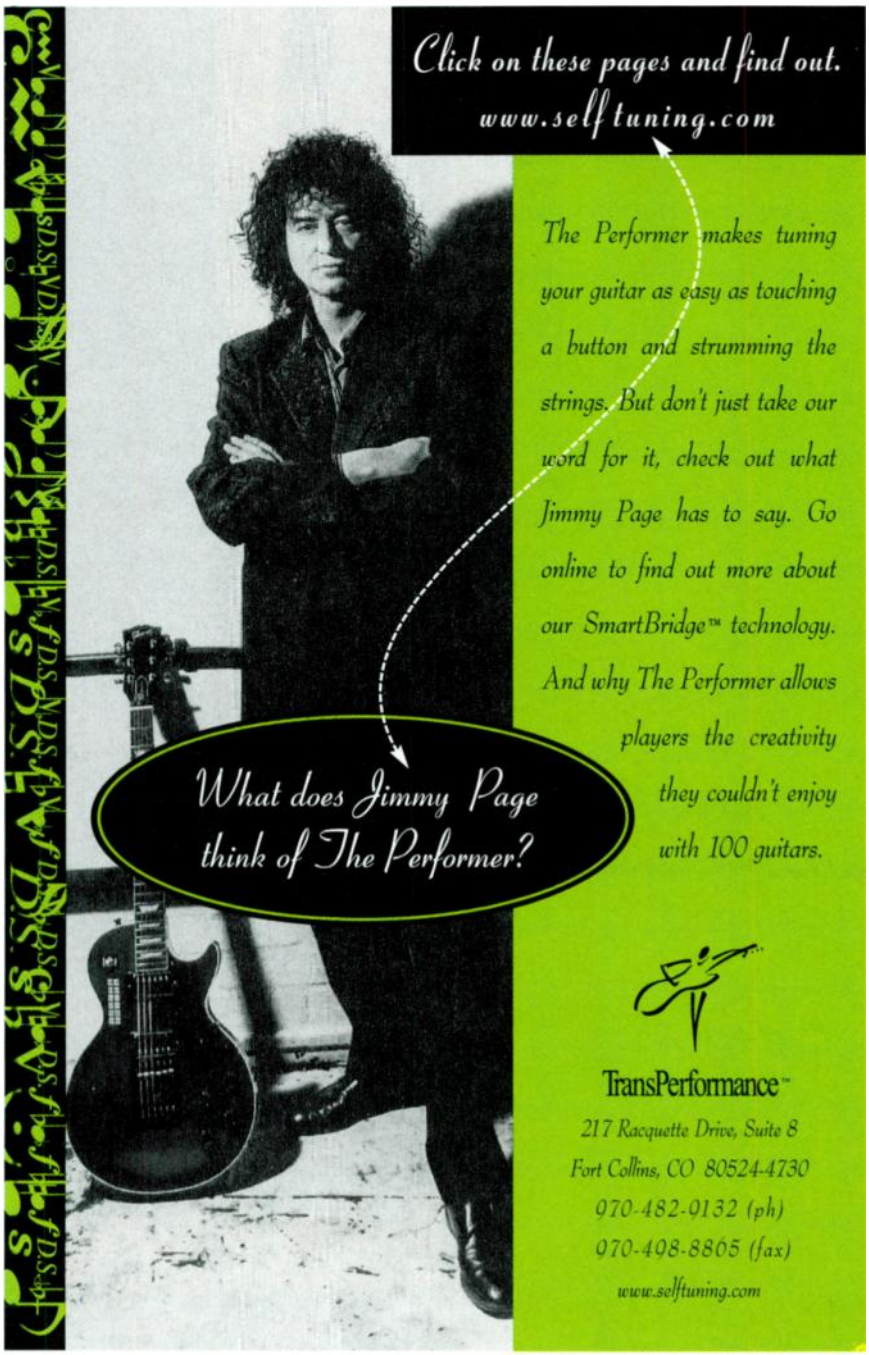
The premiere performance of Antheil's 1924 version of *Ballet mécanique* has just been issued on compact disc by the Electronic Music Foundation (www.cdemusic.org).

Yamaha has compensated for the time difference with its 500 ms "predelay," which is reduced according to the individual note Velocities. High-Velocity notes end up more delayed than low-Velocity notes. This delay can be switched off, but without it the MIDI response is extremely "squishy" and unpredictable because other crucial MIDI-data parsing takes place during the delay interval. So whereas the delay feature solved Yamaha's problem, it complicated my work considerably.

THINNING THE SCORE

Even with the latest firmware, Litterst's Disklavier couldn't quite handle Antheil's score. Large-chord tremolos and extended fast trills caused it to miss notes. I experimented with note durations and Velocities and found that the trills behaved better if I increased the Velocity to 99—Velocities greater than 99 made the Disklavier sound as if the hammers would fly off the keys. In some cases, setting the durations to 60 percent or shorter helped, as it seemed to give the keys more time to recover. Randomizing durations so that all the solenoids didn't release at once also helped. Occasionally, however, setting the durations to 120 percent did the job better: having the Note Off occur *after* the next Note On invoked some kind of fast-recovery feature in the Disklavier, allowing it to play the passages without falling over.

However, no amount of tweaking could make the really large chords and tremolos sound right, so I simply thinned them out. In almost every

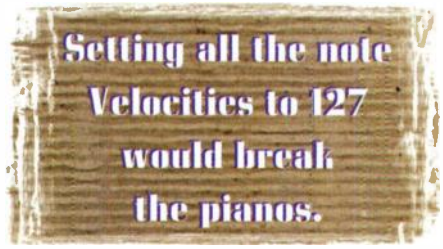


case, the part in question was doubled across at least two and usually all of the player-piano parts; I stole different notes from the different parts, and the effect wasn't audible.

BEYOND DISKLAVIER

Finally, I tested my files on other MIDI player pianos. The Piano Mill, a dealer in Newton, Massachusetts, had both PianoDisc and QRS systems on its huge showroom floor. I brought a computer to the store early in the morning, when I was less likely to disturb any customers.

QRS's system behaved similarly to Yamaha's, with 16-note polyphony (last-note priority), the same fixed 500 ms delay, and the same problems with repeated chords. The PianoDisc systems were a different story—they had a polyphony limit of 32 notes and could play most of Antheil's chords without glitches. Their delay time was much shorter than that of the Yamaha instruments: anywhere between 50 and 150 ms, depending on how the system was configured. With fast repeating chords, however, PianoDiscs had the same problems as the Yamahas. I included all of this information in my documentation for G. Schirmer so that performing groups tackling *Ballet mécanique* would understand what they were dealing with.



SAMPLE MAKING

While investigating the player-piano situation, I was also working on the samples that I had promised to create for G. Schirmer. I auditioned dozens of airplane sounds from a variety of effects libraries on disc and online. Antheil's score, which stipulates small wood, large wood, and metal propellers, requires them to sound for varying lengths of time, from one eighth note to several dozen measures. To cover the range, the samples had to be loopable; that is, their pitch couldn't change. But the propellers in all of the library sounds were active in some way—flying by, starting up, or winding down—so they were unsuitable for my purposes.

Tim Tully solved this dilemma by going to a private airfield with a portable DAT machine and taping stationary airplanes. His recordings were terrific, and I got three very different prop samples. I looped them in BIAS's *Peak* and loaded them into my Kurzweil K2500 sampler. I mapped them over three sections of the keyboard and set the pitch-bend sensitivity at 12 semitones so that others could add some Doppler effect in real time.

I recorded a fire-engine siren directly to DAT, which yielded a sample that looped easily and had the characteristic falling tone during the release. For the bell samples, I used an old alarm bell augmented by bells that I purchased at hardware stores. I recorded them directly to disk in my studio.

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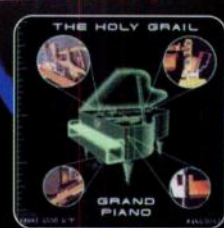

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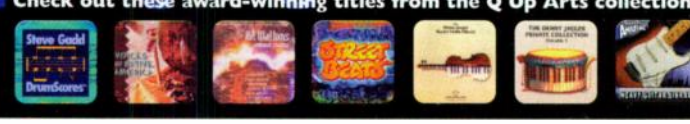

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Rediscovering the Ballet Mécanique

PAUL D. LEHRMAN

To keep the ensemble synchronized with the MIDI sequencer, the conductor must listen through in-ear monitors to a click track augmented by vocal cues.

MIDI-controlled performance of *Ballet mécanique* right in my own studio. All I had to do was sequence the live piano and percussion parts. Compared with what I had gone through to get the player-piano parts, sequencing was a snap. The note entry took about two days.

Employing a combination of Roland, Kurzweil, and E-mu synthesizers along with the four MicroPianos, I created the first performance of the original *Ballet mécanique,* for which I was the sole audience. It was a great moment.

I burned a couple of CDs of the MIDI version and sent them off to Bill Holab and Charles Amirkhanian. My job for G. Schirmer was pretty much done. But I wanted to take this project through to its logical conclusion.

GOING LIVE

The University of Massachusetts at Lowell, where I had been on the faculty since 1988, has a first-class percussion ensemble led by Jeff Fischer, one of the Boston area's top freelance percussionists. Lowell offers an excellent program in sound-recording technology and boasts a wealth of technical expertise among the faculty and students, as well as top-notch recording and production facilities. In the same building as the studios is a 1,000-seat concert hall with all the amenities of a professional theater, including lighting, sound systems, and tie lines to

FILLING OUT THE PROGRAM

The chance to do a concert with 16 player pianos doesn't come up very often. To make the most of it, I searched for other composers and pieces that might benefit from this unique opportunity. Richard Grayson, chairman of the music department at Occidental College in Los Angeles, sent me MIDI files for three pieces using various combinations of MIDI synths and Disklaviers, and I saw immediately that they would fit into our concert perfectly.

Two of the compositions used a fascinating shareware program called *MIDIGraphy,* which graphically displays notes and other commands onscreen. It's similar to the piano-roll notation of many sequencers, but it has more options and jazzier graphics. One piece, in fact, *Fantasy on Broadway Boogie-Woogie,* used as its raw material a painting by Mondrian. Grayson broke down the artwork into individual elements and then created a sequence that reconstructed the elements aurally and visually, so that as the piece played, the painting assembled itself on the screen. We displayed the graphics using a Macintosh-compatible video projector connected to Grayson's PowerBook.

The morning of the concert, however, we made a disturbing discovery: while *MIDIGraphy* is OMS compatible, it can address only one OMS cable at a time. It seemed as though we would have to take apart our multicable MIDI network to play Grayson's pieces. Fortunately my student assistant realized that we could attach a second MIDI interface to Grayson's computer and simply run a MIDI cable from it to an unused input on my Kawai switcher. All we had to do between pieces was change the source selectors on the switcher.

From Germany, Jürgen Hocker sent me MIDI files for two of the *Studies for Two Player Pianos* by the late American expatriate composer Conlon Nancarrow. Nancarrow developed his own musical language using player pianos almost exclusively. But because he didn't have access to MIDI until late in his life, he was able to hear only a few of his multiple-player-piano pieces played in proper sync.

I worked out an arrangement of the saltarello-presto movement from Mendelssohn's Symphony no. 4 (commonly known as the Italian symphony). Very fast and contrapuntal, it lends itself to multiple pianos; my version used eight different parts, each played by two Disklaviers.

To round out the program, Jeff Fischer chose three compositions for percussion ensemble. *Double Music* (1941), a piece by John Cage and Lou Harrison, uses brake drums, water buffalo bells, sistrums, and a gong that's lowered into a tub of water as it's played. Ritmicas nos. 5 and 6 (1930), by Cuban composer Amadeo Roldàn, are probably the first works ever written for percussion ensemble. They use the whole vocabulary of what we now call Latin percussion, integrating African, Caribbean, and jazz rhythms in a way that still sounds fresh.

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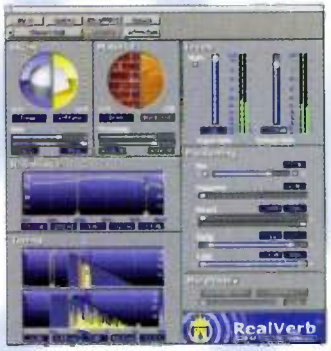

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Rediscovering the Ballet Mécanique

the recording rooms. Since the hall regularly books professional theatrical performances, it has a full-time box-office manager and a publicity office. With its unique resources, Lowell seemed the perfect place to present the world-premiere performance of *Ballet mécanique*.

Michael Bates, director of academic relations for Yamaha, had promised G. Schirmer that the company would provide 16 Disklaviers to the first ensemble that performed *Ballet mécanique*. I told Bates my idea, and his only question was, "When do you need them?"

Then I approached Fischer. Not only did he know about the 1952 version of *Ballet mécanique* (the one without player pianos), but he had actually played it. I showed him the 1924 score, and although he realized immediately that it was very different from the piece he knew, he decided that his ensemble could play it.

In the weeks that followed, I recruited the two live pianists that the piece requires. One was Juanita Tsu, head of Lowell's piano department; the other was John McDonald, a composer and pianist on the faculty of Tufts University. He, too, had played the 1952 version.

But Tsu and McDonald were not to play conventional grand pianos. Their parts would never be heard amid the din of a percussion ensemble, samples, and 16 player pianos. Miking them seemed more effort than it was worth. Instead, the pianists would play 88-note MIDI keyboards controlling two Kurzweil MicroPianos, which would be fed through speaker wedges placed beside the two performers on the stage floor (see **Fig. 4**).

So it came to pass that a computer played acoustic pianos while human beings played electronic pianos. The irony would have delighted George Antheil.

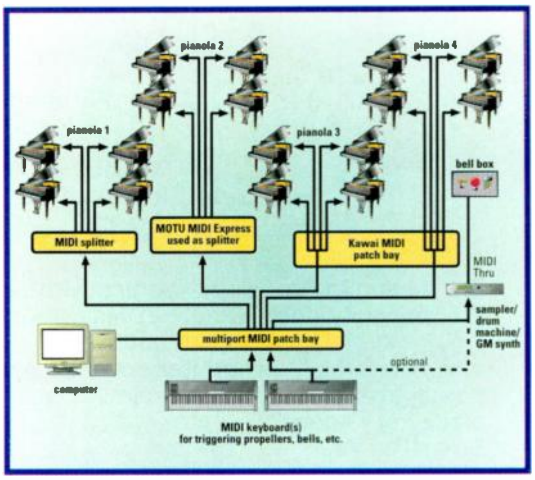


FIG. 5: On-time delivery of MIDI data is crucial in *Ballet mécanique*. We used MIDI splitters to ensure that all of the player pianos in a group were in sync.

BELLS, BELLS, BELLS

As the concert date grew nearer, it occurred to me that real bells might work better than samples. On the Web, I came across the Edwards Signals company and found more bells than I could possibly have imagined. I ordered four with similar voltage and current requirements.

I also contacted MIDI Solutions, a company located in Vancouver, British Columbia. MIDI Solutions makes a MIDI-to-relay converter, a device that opens and closes eight different relays in response to MIDI commands. The converter worked great, and because a little SysEx doesn't scare me, programming it was straightforward.

Unfortunately, the converter's relay contacts were not rated high enough in current capacity to handle the substantial amperage that the bells draw. So I recruited Coleman Rogers, an engineer and fellow Lowell faculty member, to help design and build a system whereby the MIDI Solutions relays triggered *other* relays to control the bells.

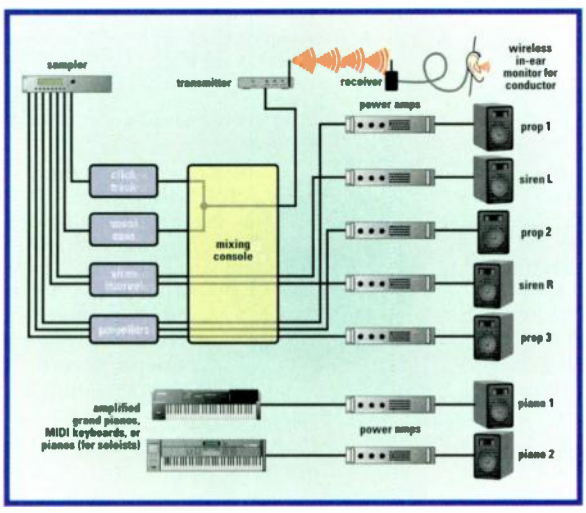


FIG. 4: To be heard over the player pianos, the piano soloists played 88-note MIDI keyboards controlling Kurzweil MicroPianos. Notice also how each of the sound-effect samples is given its own power amplifier and speaker.

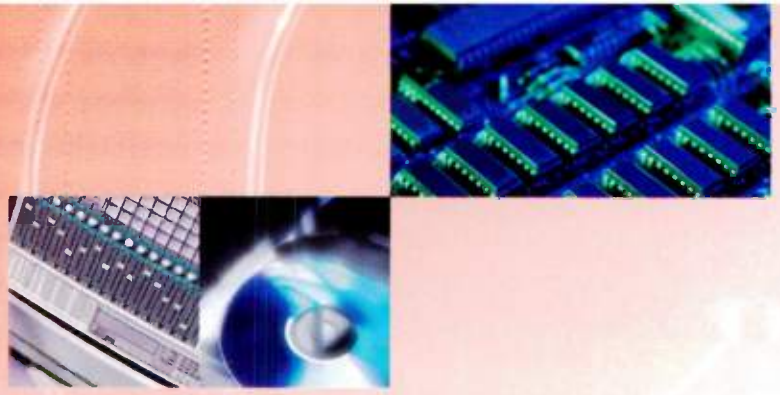
WHO'S IN CHARGE?

Ballet mécanique is played at a constant tempo, but when an ensemble and computer have to stay in sync through 600 time-signature changes and several long silences, who is leading whom? Should the player pianos follow the conductor, speeding up and slowing down according to his direction? Or should the conductor follow the computer? And how do you get a conductor to follow a machine?

There are plenty of ways to make a sequencer follow a conductor, but it seemed very unlikely that any existing software-based systems could handle *Ballet mécanique*. Most autofollowing programs are designed to work with relatively simple meters, but *Ballet mécanique* clearly has a large number of meter changes. A single mistake by the conductor could throw off the whole system.

A musician would find it very difficult to control the sequencer's tempo in real time, especially if the response of the player pianos was delayed by half a second (as with the Disklaviers). When the results of a tempo change aren't heard instantaneously, the performers are likely to overshoot it.

We therefore decided that the computer would be the master and Jeff Fischer, the conductor, would be the slave. I wrote a click track into the sequence using kick drum and sidestick sounds—the kick on strong beats and the stick on weak beats—which Fischer would listen to through headphones. He and I went over the score in minute detail, deciding how to subdivide bars with odd meters such as 5/8 and 11/16. We first used a drum



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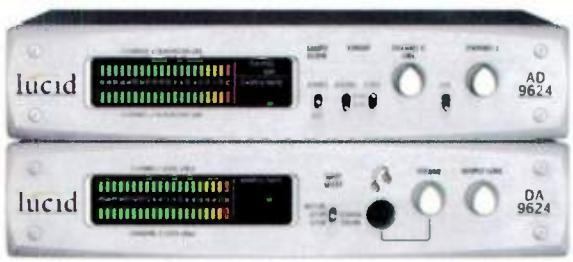

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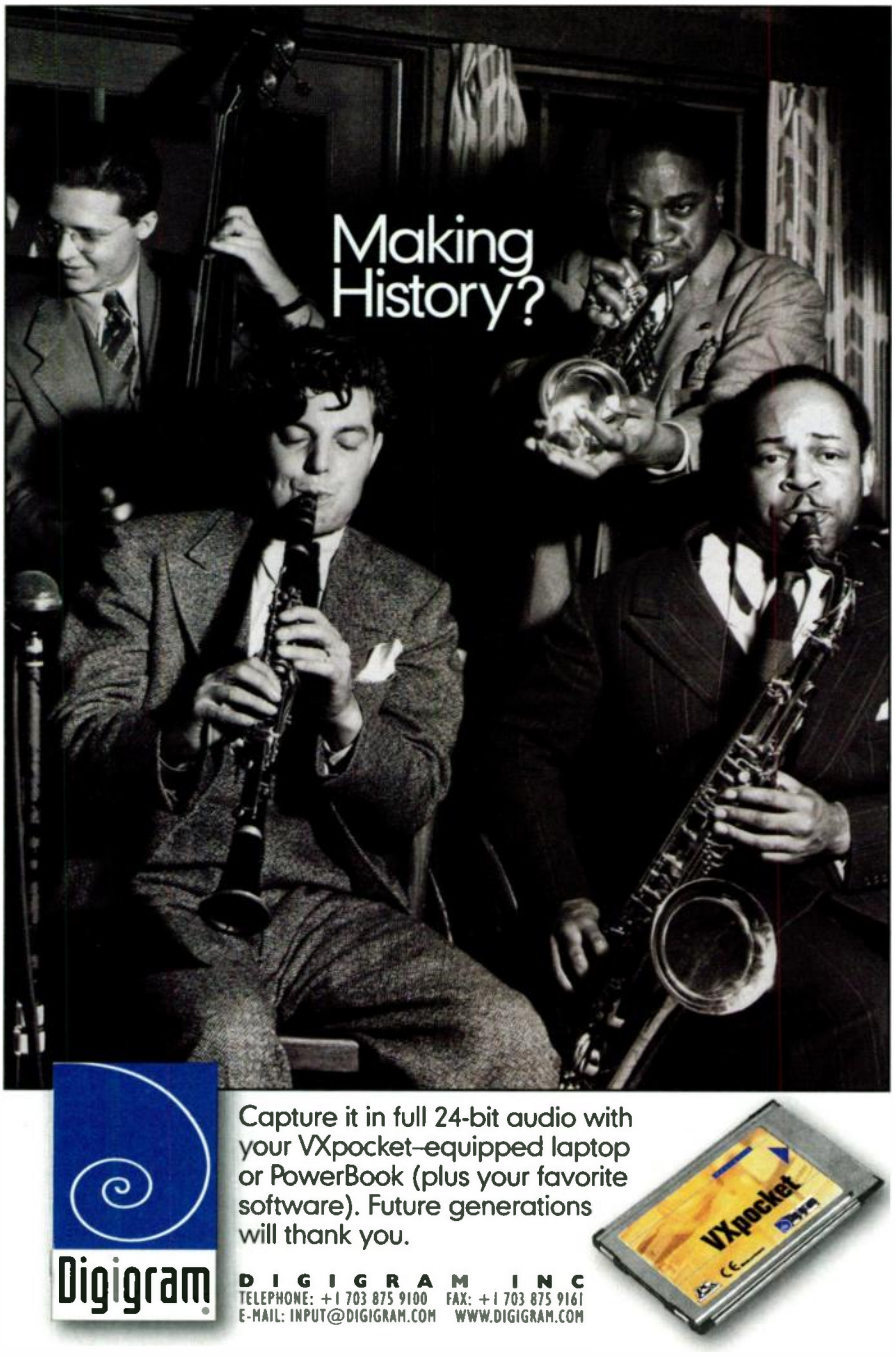
machine for the click track, but that didn't work. The snare and kick drum got lost in the sound of the four bass drums and three xylophones (later four, because three people alone couldn't play the parts) flailing away on stage. So we then used a cowbell and loose snare with a long decay for the click track. The sounds were so different from everything else that there was no way Fischer could miss them.

I put vocal cues for rehearsal letters into the sequence so that Fischer could find his place again if he got lost. I also added "countdowns" to certain bars to prepare him for important transitions that would otherwise be difficult to hear. The most important countdown was at the beginning. Because of the Disklaviers' built-in delay, they needed a head start. I inserted three extra beats at the top of the sequence, during which my voice said "3, 2, 1," and the first chord on the player pianos entered half a second before the fourth beat. Knowing the piece's tempo, we easily calculated how far in advance, in beats and ticks, the pianos had to enter.

We eventually replaced the headphones with a Shure PSM600 in-ear monitoring system. It worked well, and it prevented the audience from hearing the click during those long silences (as they might have with conventional headphones). In fact, it occurred to me that the piece could quite possibly be performed without a conductor if *every* member of the ensemble wore a personal monitor.



MIDI NETWORKS

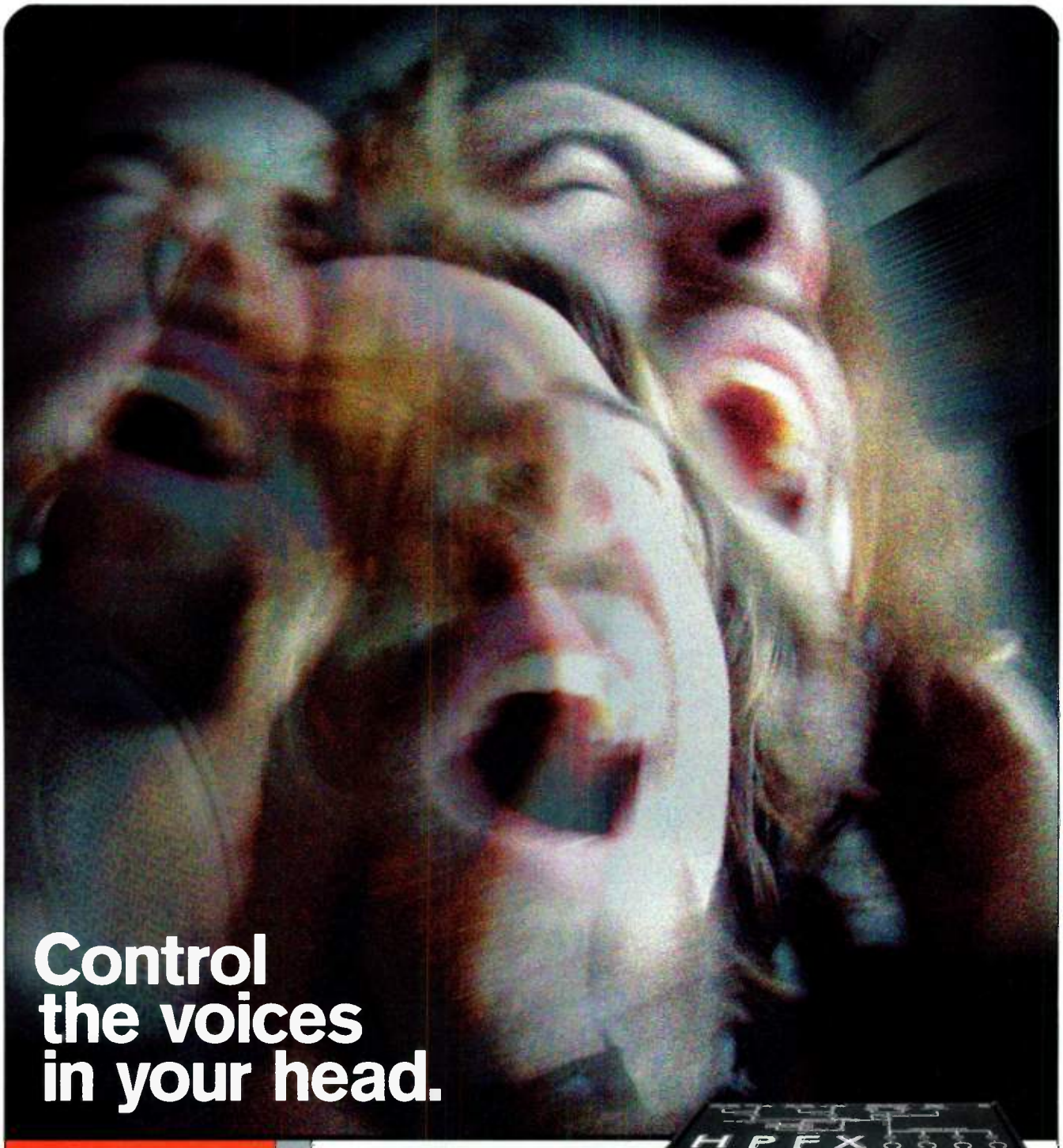
Because of the density of the MIDI data in *Ballet mécanique,* a single MIDI cable can't handle all of the information. A MOTU MIDI Time Piece allowed me to assign (using OMS) a MIDI output to each group of pianos. (I set aside a fifth output for the bells.)

But when I started working with the Disklaviers, I made a startling discovery. Remember that 500 ms delay? It shows up not only at the keyboard but also at the piano's MIDI-Thru jacks! So in a daisy chain of four Disklaviers, each responds later—by half a second—than the one before it.

The solution was to use MIDI splitter boxes. We used a Roland 1 × 4 MIDI-Thru box for one group of pianos, a MOTU MIDI Express in 1 × 6 mode for another group, and a Kawai 4 × 8 manually switched MIDI patch bay for the remaining groups (see **Fig. 5**).

GETTING IT DOWN

To record this important event, I recruited Jonathan Wyner, a local classical engineer and owner of M-Works Mastering. Together we decided not only to record the concert but also to schedule a second session during which we could do a studio-quality recording. Along with technical director Bill Carman, Wyner and I outlined two recording setups. The concert setup was relatively simple: a pair of cardioid microphones in ORTF configuration on the stage, just behind the conductor's podium; and a pair of spaced omnis and a coincident pair of figure-8



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mics in the first row of seats. The hall is very live, so setting additional mics farther from the stage was unnecessary.

For the postconcert recording sessions, we added spot mics on the xylophones, gong, bass drums (a pair in mid-side configuration), the four groups of Disklaviers, and the speaker array at the back. We also took direct feeds from the samplers and synths. To offset the boominess of the hall and approximate the sound of a full house, we covered the balcony and the rear of the orchestra seats with 144 blankets.

Thanks to the generosity of the professional audio-manufacturing community, we were able to produce a top-notch recording. EAW provided the speakers; from Shure came the personal monitor; Apogee Digital loaned us three AD-8000 analog-to-digital converters and donated DTRS tape; Tascam came through with three DA-88s; Millennia Media contributed 16 channels of mic preamps; and Redco Audio donated cables.

THE PERFORMANCE

As I listened to the final dress rehearsal, I was overwhelmed by the power of the piece. Although listening to the MIDI re-creation of *Ballet mécanique* in my studio had been exciting, the sheer volume of sound that filled the concert hall was stupendous. The ensemble's playing was considerably slower than my sequenced version (achieving Antheil's specified tempo isn't humanly possible in some parts), but the live musicians brought drama, shape, and musicality to the piece—elements that were far less evident in my MIDI version. It was quite a moment.

The performance went much more smoothly than any of us had a right to expect. The ensemble played brilliantly, and nothing significant went wrong. The concert (see the sidebar "Filling Out the Program") ran almost three hours, but none of the 1,000 people in the audience left. Instead they gave the ensemble a well-earned standing ovation.

A LONG, STRANGE TRIP

The most remarkable thing about the *Ballet mécanique* project is that it never stopped being fun. The technical challenges; the musical research; the "Aha!" factor (when I figured something out); the "Wow!" factor (as I heard the piece develop); and meeting people, drawing them into the project, and seeing them become as enthusiastic as I was—every aspect was a tremendous rush.

I feel very lucky to have had the opportunity to work on such a fantastic project and to have poured so many of my passions and skills into it. It took 75 years and many generations of technical development, but here, at the close of the 20th century, we have finally made George Antheil's youthful dream come true.

Paul D. Lehrman *is a composer and author, the "Insider Audio" columnist for* Mix, *and the editorial director of* Mix Online. *Visit his* Ballet mécanique *Web site at www.antheil.org.*

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Stand and DELIVER

Keyboard stands are a bit like coat hangers or car batteries: you must have them, but you don't want to spend your life researching or even particularly caring about them as long as they work. At least that's what I thought until one happy lunchtime when EM editor Steve O. asked me to evaluate a representative collection of stands.

What a revelation! Having required the services of keyboard stands since (gasp) the '60s, and having used every form of keyboard stand from Mom's ironing board to multilayered scaffolding, I was amazed at the range and variety of the models and designs available today. One company alone offers almost 80 different models. What is this, a secret branch of the Inventors Guild? Patents seem to fly about like UPC stickers, and over the past few weeks I've probably seen more variations on locking devices than your average prison inspector. It doesn't just seem crazy—it *is* crazy.

To keep this project manageable, I focused on keyboard stands from four companies: Yamaha, K&M, Quik Lok, and Ultimate Support Systems. Because the latter two companies offer an extraordinary number of models, I checked out several stands from both.

If you think that any old keyboard stand will do, you're courting trouble.

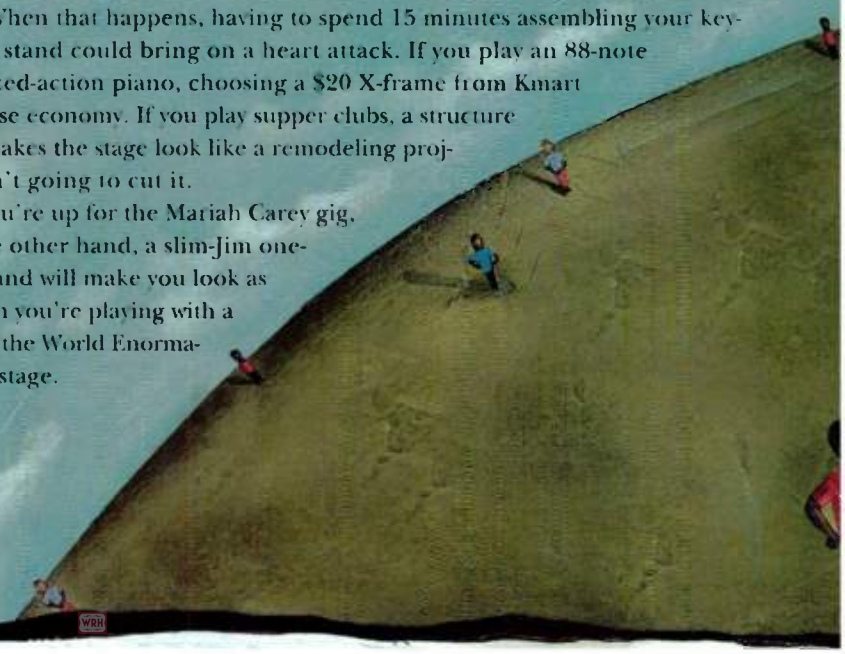
By Julian Colbeck

THE SIMPLE CHALLENGE

The purpose of a keyboard stand is to take the weight of one or more keyboards being played on stage or in the studio. In itself that's not an earth-shattering accomplishment, but there are considerations that include assembly speed, adjustment potential, the wobble factor (particularly if you're the Jerry Lee Lewis of electronic keyboards), the look, the size, the extras, and the cost.

If you play a lot of one-night stands, you're occasionally going to arrive late. When that happens, having to spend 15 minutes assembling your keyboard stand could bring on a heart attack. If you play an 88-note weighted-action piano, choosing a $20 X-frame from Kmart is a false economy. If you play supper clubs, a structure that makes the stage look like a remodeling project isn't going to cut it.

If you're up for the Mariah Carey gig, on the other hand, a slim-Jim one-tier stand will make you look as though you're playing with a toy on the World Enormadome stage.



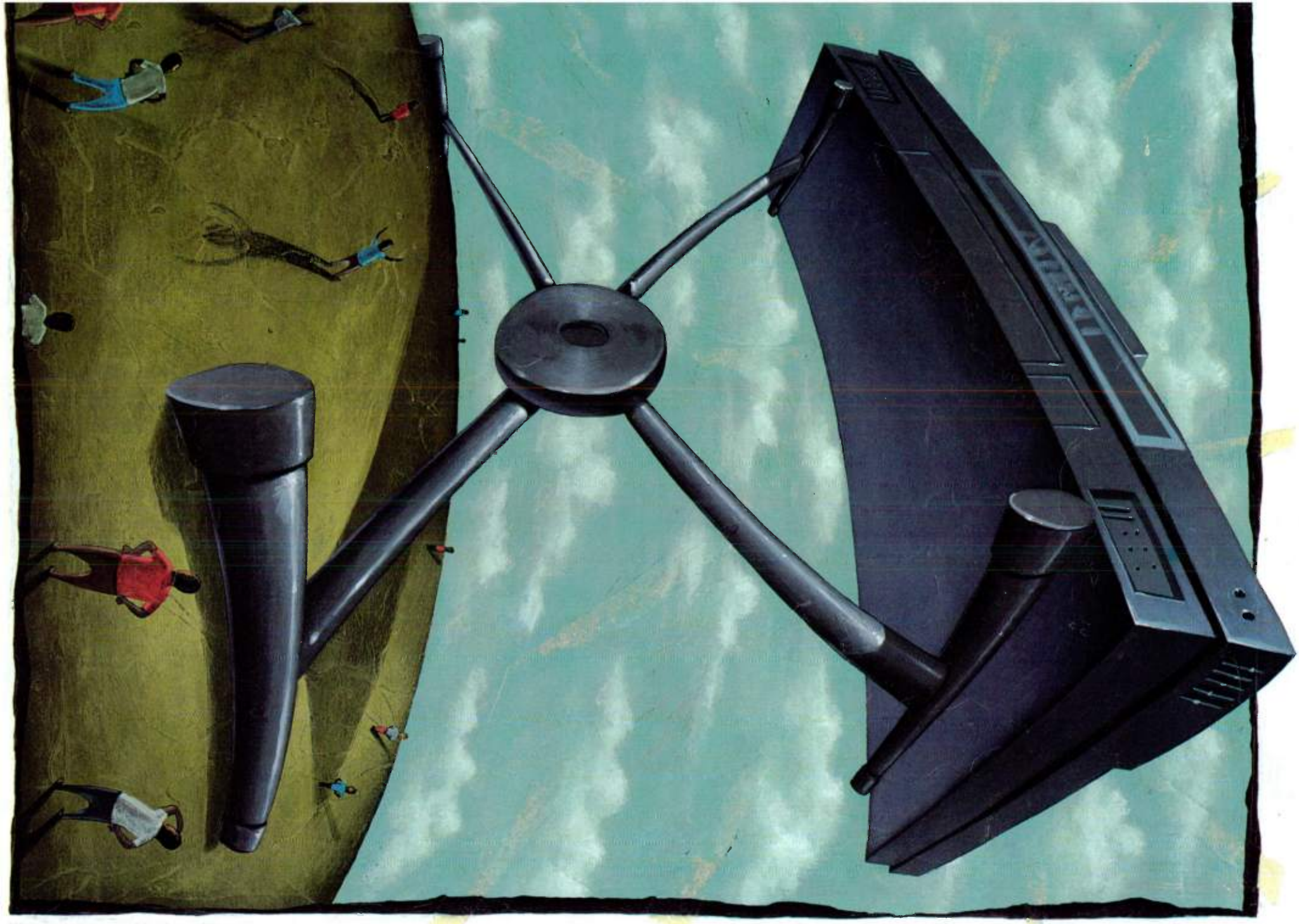


Illustration by Nathan Ota

Stand and DELIVER

Appropriateness is the keyword when looking at keyboard stands. Consider the type of keyboards you already have or are likely to have within the year, what type and size of venue you'll be playing, and your own lifestyle. Are you punctiliously early for every gig, or do you tend to skid in at the last minute? Are you "handy" or a klutz? Do you care how you and your rig look on stage? If so, what appeals to you: a busy, techie look; a clean and empty look; or down-home clutter?

The range of models I tested, while not exhaustive, nonetheless embraces most of the current thinking on the design of keyboard stands. Factors discussed and identified here should enable you to assess any similar model "direct from the Czech Republic" that you might find at your local music store. Let's take a look at our representative sample.

YAMAHA YKA 7000 X-FRAME

This simple X-frame stand ($99.95) is beautifully made (see **Fig. 1**). It has no rough edges, its oversize rubber feet keep it in place on even the most raked of stages, and you can set it up more or less instantly.

All X-frame stands look alike from a distance. The differences lie in the particular mechanism that locks the frame in place and in the relative sturdiness of each model. Not only is the YKA 7000's Quick Action locking device very rugged, but the simple spring-loaded pin that sets the stand's height is both immediately obvious and easy to adjust quickly: just grip the lever underneath one of the support bars and then fold or unfold the frame to the height you desire.

FIG. 1: Yamaha's YKA 7000 is a pro-quality X-frame stand that features a well-built, easy-to-use locking mechanism.

The support bars themselves have thick rubber gripping rings to keep your keyboard nice and steady. Retractable extensions support deeper instruments. I tried the extensions with my fattest synthesizer, a Roland JD-800. It fit, but just barely. The extensions' flip-up, locking safety clips must be carefully angled to stop them from jamming a key at the front or obscuring an output at the back, but it's a snug and safe fit.

Without going overboard, the YKA 7000 is a good-looking, pro-level stand. In my estimation, it's a high-quality interpretation of a tried-and-tested design.

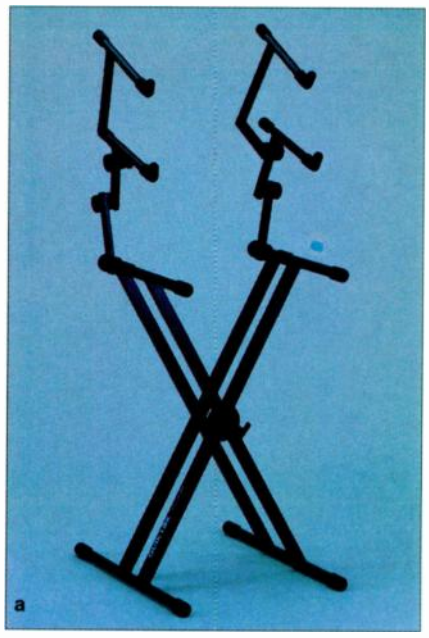
QUIK LOK QL-623 X-FRAME

What if you have a load of keyboards but your gig doesn't pay you loads of money? Then you're looking for a triple-tier X-frame stand like the Quik Lok QL-623 ($199.95), which sprouts a series of extensions that let you rig three keyboards or instruments on top of one another (see **Fig. 2a**).

The QL-623 has a solid metal construction that doesn't seem "industrial." You adjust the basic stand height with a spring-loaded lever that inserts a metal tongue into a series of holes on a circular metal plate. Although the stand was perfectly sturdy in the studio, I was concerned that after a couple of tours, the relationship between tongue and hole could possibly get realigned to the point of danger. (Of course, I was unable to confirm that long-term prognosis in the short time I had to test the stand.)

The bars for tiers 2 and 3 slip onto the end of the main supports. You adjust their angles using a pair of toothed metal "cookie-cutter" cups aligned around a central plastic bushing. I like the fact that both width and rake of the tiers are adjustable. You can, for instance, have an arrangement whereby tier 2 is angled very steeply and tier 3 is completely flat—or vice versa.

When the QL-623 is fully loaded with three instruments, the wobble factor is potentially dangerous; you'll need to play around with angles as well as keyboard size and placement until the wobble is minimized. Setup and teardown is fairly quick, as long as you can transport the stand without having to remove the tiers every time. But if you don't dismantle the stand, it is, understandably, bulky.



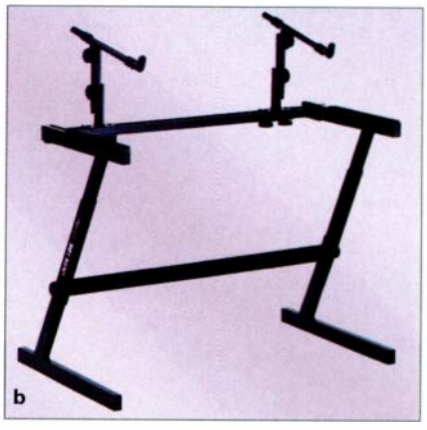


FIG. 2: Quik Lok's QL-623 triple-tier X-frame stand (a) allows you to adjust the width and rake of each tier independently. Sturdiness, ample foot room, and a professional look are among the obvious strengths of Quik Lok's double-tier IS Z-726L Z-frame stand (b).

Overall, the QL-623 is a good choice for budding Rick Wakemans on tight budgets. Quik Lok also offers a single-tier stand, the QL-746 ($99.95), and the fully adjustable double-tier QL-641 ($169.95).

QUIK LOK IS Z-726L Z-FRAME

Weighted keyboards, digital pianos, organs, and the like will not be terribly safe on an X-frame stand. A stand's specs might say it can withstand the weight of 100 pounds or more, but your instrument will not only be precarious as it dangles over the ends of even a fully extended pair of support bars—it's going to look inappropriate

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Stand and DELIVER

as well. In this scenario, a Z-frame stand would be a better choice.

I liked Quik Lok's double-tier IS Z-726L ($279.95) for its sturdiness and all-around professional look (see **Fig. 2b**). Setting up this fairly substantial stand took 10 to 15 minutes the first time around—and believe me, I'm no handyman. You'll learn to do it more quickly with a bit of practice. Assembly of the high-grade steel stand follows a screw-fit bolt-and-hole design (the documentation trumpets that the Z-726L is all "computer-controlled welded"). The Z-frame is built to take up to a 250-pound load.

You should consider this model only if you have an 88-note instrument (or its equivalent in length) because the main frame's 44-inch width cannot be altered and won't fit most 61-note keyboards. For smaller instruments, check out the regular Quik Lok Z-726 ($269.95), which is 34 inches wide and well suited to 61-note keyboards.

The Z-726L's second tier is fully width-adjustable. Two arms bolt (literally) onto the backplate and can be angled any which way. Gripping supports prevent a steeply angled keyboard from sliding back down onto your fingers. It's a sensible arrangement, and there is no wobble at all. Unlike most X-frame stands, this Quik Lok Z-frame provides unlimited space for pedals. Numerous options include a mic boom, a two-page sheet-music holder, and shelves that can accommodate small speakers, mixers, and the like.

Setup is not as speedy as with an X-frame stand, of course, and this model wouldn't be the thing to take to a blues jam. But for a smart residency, a supper club, or certainly a pro tour with a keyboard tech in tow, Quik Lok's IS Z-726L Z-frame is just the ticket.

QUIK LOK QL-609 X-FRAME

Quik Lok's name does suggest speedy setups, and no stand sets up more quickly than the QL-609 X-frame ($69.95) (see **Fig. 3a**). You simply open the stand to its widest position and then slowly adjust inward until the arms reach your desired height. There's really nothing else to set. A design like this doesn't seem as if it would hold much weight, but in fact the unit is recommended for instruments up to 180 pounds.

Accessories fit easily onto this stand. Options include the QLX-4 adjustable microphone boom ($39.95) and the QLX-5BK music stand ($44.95). I checked out the mic boom but did not receive a music stand with the test unit. Mic stands are the bane of the singing keyboardist's life: they root you to one spot while the microphone sways and droops this way and that over the course of a set. I can't imagine why, in some 30 years of playing onstage, I've never used an attached mic stand like the QLX-4. Although this device may not always help the droop factor, it keeps the fundamental relationship between mouth and mic somewhat stable. The QLX-4 clamps onto the end of one of the keyboard supports and has a nifty locking mechanism; height, angle, and boom length are all adjustable. You can further expand the QL-609 X-frame's utility with a variety of optional add-on tiers.

As with other X-frame designs, the QL-609 suffers from some wobble—despite the nicely designed adjustable cam—due to the height and depth of the stand's feet. But I love its setup speed and range of accessories.

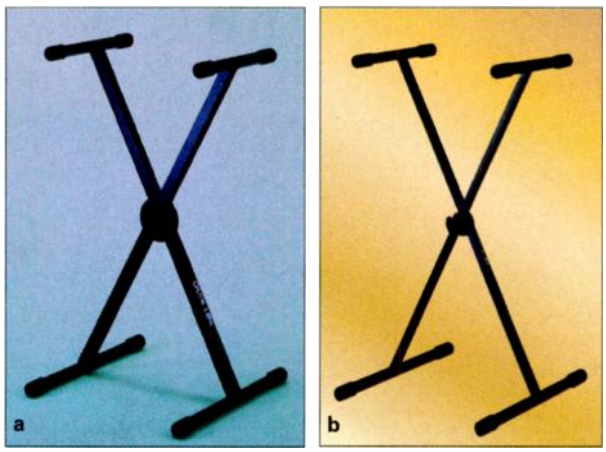

FIG. 3: Quik Lok's QL-609 X-frame (a) sets up in seconds and can be accessorized with options such as a music stand and a mic boom. If you just need a simple and easily assembled stand for light use, consider Quik Lok's T-10 X-frame (b).

QUIK LOK T-10 X-FRAME

This very basic X-frame stand ($44.95) is suitable for players with minimal instrumentation and a minimal budget (see **Fig. 3b**). The unit can be set up quickly, and you adjust its height using little gripper plates that screw together to lock. It didn't exactly inspire my trust, though, especially when my first attempt to tighten the plates resulted in a quarter-inch area of paint flecking off around the mechanism. (According to the manufacturer, the problem has been fixed.)

To minimize wobble, Quik Lok uses generous rubber sleeves on both the top and the bottom of the stand for keyboard rests and feet. However, the overall quality of construction suggests that this stand is best restricted to light home or studio use. The company makes a double-braced version, the T-20 ($59.95), as well as TL versions of the same accessories offered for the QL-609.

ULTIMATE SUPPORT SYSTEMS APEX

The Apex ($270) has to be the most stylish and cunningly original keyboard stand ever (see **Fig. 4a**). The legs sprout from the base of a triangular column and unfold and click into place to form a stable platform from which the column rises at an angle of about 70 degrees. In a small compartment at the top lie four support arms, which slot into a pair of movable housings that determine keyboard height. Construction is of anodized aluminum, and Ultimate Support guarantees the Apex for life.

The first time you set up the stand, you will need a few extra minutes to set the position of the arm housings, cable clip, and so on. After that, it sets up in seconds, packs up in seconds, looks great, and is extremely well balanced—but only to a point (I'll explain in a moment).

Keyboards, even 88-note weighted ones, sit very snugly on either tier of the stand. For larger instruments, you can use 18-inch arms, called *tribars*, rather than the standard 13-inch arms. My wide-body Roland JD-800 is a little cramped on the Apex, and leaning too heavily on one end of a longish instrument will make it flip up.

For manufacturer information, please see Contact Sheet, p. 171.

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Stand and DELIVER

I've owned and used Apex stands since 1989. I've taken them all over the United States a dozen times, as well as to South America and Japan and all around Europe. They were even thrown about in some madman's van on a particularly hairy gig in Transylvania (I kid you not). And I've never had a problem with them.

Nevertheless, the Apex does have some limitations that I've had to work around. The first involves pedal space: the Apex's feet splay out at an angle of approximately 80 degrees to the column, thus providing an impediment (literally) to footpedals. The answer? Buy a slab of 1-inch particle board, cut out slots for the legs, and glue Velcro-type fastener strips on the surface to keep your pedals in place. This is a good thing to do with any type of stand, but with the Apex it is crucial.

Second, although the longer tribars handle the shape and weight of an 88-note keyboard, the Apex will wobble significantly if you try to lean into a large keyboard—say, to play hard-driving rock 'n' roll licks—especially in the lower and upper few octaves of an 88-key instrument. This stand is best suited to musicians who play with a light to moderate touch.

ULTIMATE SUPPORT SYSTEMS DELTEX

On the face of it, the less expensive Deltex ($180) looks just like the Apex (see **Fig. 4b**). But don't be fooled: where the Apex is a dream, the Deltex is a pain; where the Apex is rock solid, the Deltex feels insubstantial; where the Apex is simple, the Deltex is complicated.

Instead of legs that unfold—the real beauty of the Apex's design—the Deltex's legs must be attached and detached separately for every use and stored in an included tote bag. Rather than slipping snugly into their housings, the arms (which appear to be made from vastly inferior-grade metal) hang loosely—and indeed, their recommended load capacity is less than half that of the Apex.

Given that the Deltex requires you to use special keys for setup (which you'll lose in no time) and provides considerably less weight capacity and security than the Apex, I can honestly see no reason to purchase it.

ULTIMATE SUPPORT SYSTEMS IQ-3000 X-FRAME

The IQ-3000 ($130) is a very sturdy stand that uses double struts, high-grade rubber sleeves to grip and protect, and a canny "memory" locking mechanism for maintaining setup height (see **Fig. 4c**). In fact, the locking mechanism's chunky pair of spinning plates resembles nothing so much as a Transformer; twirl it and you'll expect it to change into a Martian Support Vehicle or some such thing. Luckily, instructions for the 7-position memory lock are explicit, and although grabbing and twisting the two plates without the whole stand falling on top of you is a little tricky, once the stand's been adjusted it opens to the correct height every time.

Optional extra tiers (the IQT-100 and IQT-200; $60 each) for the IQ-3000 fasten onto the back of the stand. I found the method of attachment a bit confusing at first, but the whole arrangement is impressively strong once you've set it all up. Tiers 2 and 3 can be angled this way and that (in 7.5-degree increments) to suit your keyboard size and desired playing position.

Although I find any triple-tier design on an X-frame stand a little worrisome, the IQ-3000's double-strutted frame and exceptionally high-grade metalwork and fittings make it as trustworthy a stand as I've come across. Ultimate Support recommends that tier 2 hold nothing heavier than a 100-pound instrument, and 75 pounds is the maximum for tier 3—fair enough. (To put these numbers in perspective, a Korg M1 weighs less than 50 pounds.) The bottom tier can hold up to 300 pounds, which should be more than adequate, unless your keyboard weighs more than a Saint Bernard.

Even when loaded, the IQ-3000 is nice and steady. The extra-thick rubber end caps, which can be twist-adjusted to different thicknesses on one side if you need to adjust relative height, certainly contribute to the stand's sturdiness. So does the generous 22-inch

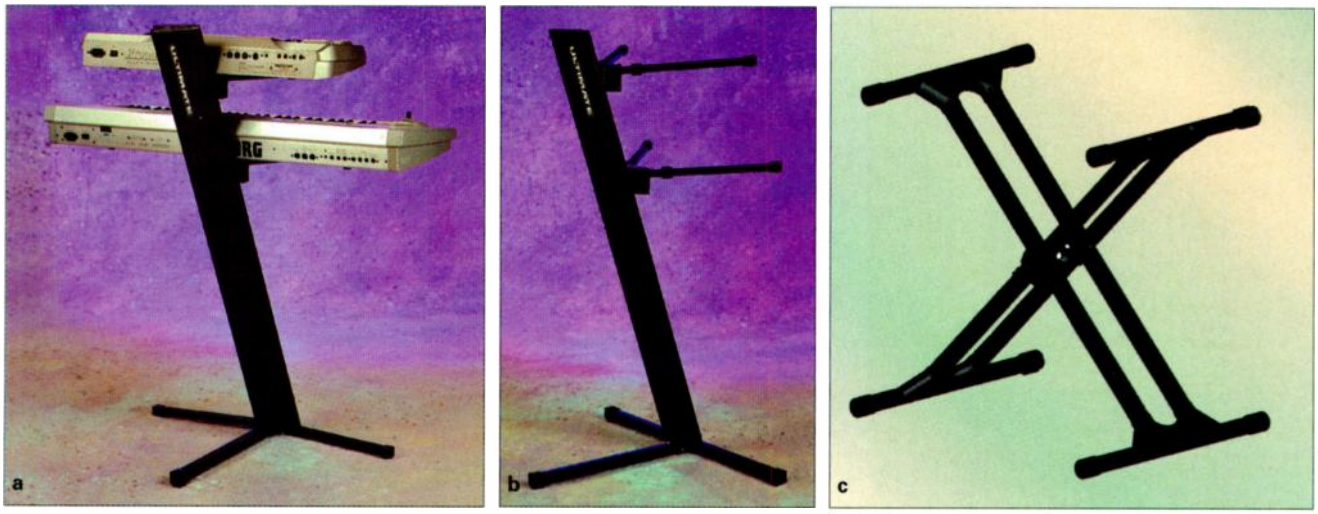

FIG. 4: Ultimate Support's Apex (a) is the coolest and most innovative stand I tested, but its design does not leave much room for footpedals. Ultimate Support's Deltex (b) is in some ways like a lower-end Apex stand; it lacks the latter's strength and convenient unfolding legs. If you want a steady and strongly built triple-tier X-frame, Ultimate Support's IQ-3000 (c) should be high on your list. (The two extra tiers are optional.)

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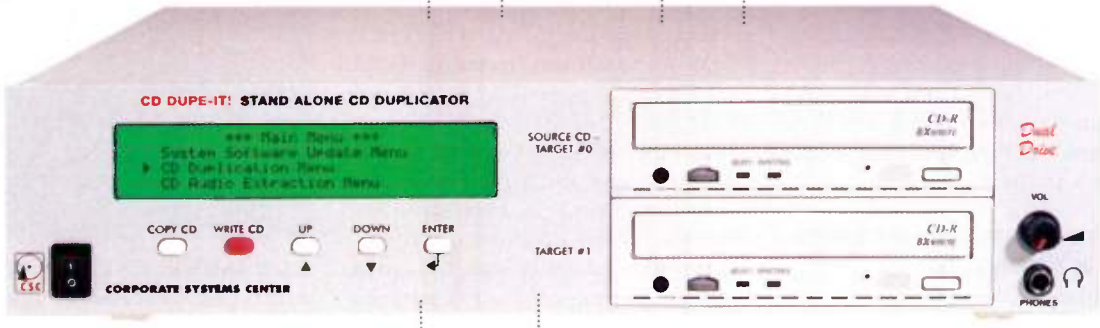

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Stand and DELIVER

span of the bottom legs. The IQ-3000 looks cool, too: the top and bottom of the unit have a sculpted molding that smooths out the typical shaped-edge look of an X-frame.

ULTIMATE SUPPORT SYSTEMS IQ-2000 X-FRAME

This double-strutted X-frame stand ($80) strikes a good compromise between the heavy-duty design of the IQ-3000 and that of many simple X-frames on the market (see **Fig. 5a**). The double struts reduce some of the potential for movement, and as with the IQ-3000, the rubber end caps can be twist-adjusted to balance out an uneven floor. (The IQ-2000's end caps are not in the same league of thickness as the IQ-3000's, however.)

The locking mechanism is a straightforward tongue-and-plate system. Its 4-stop "memory" is based on Ultimate Support's original memory-lock design. Because there's not much tongue protrusion (as it were), I fear that a bash or two could severely impair the stand's reliability. The bottom legs' 20-inch span is generous, and the 17-inch width of the keyboard arms accommodates wider instruments very satisfactorily.

Even though the IQ-2000 does not offer the top-quality features of the IQ-3000, it is still a major cut above the standard X-frame design.

ULTIMATE SUPPORT SYSTEMS APACHE A-FRAME

Some keyboard players want to be seen, whereas others like hiding behind racks of instruments. If you're among the latter, Ultimate Support's A-frame design may be for you (see **Fig. 5b**).

Named to reflect its angled (as in the letter *A*) design, the triple-tier Apache is, not surprisingly, somewhat bulky. Once you've set up the basic frame, you can slide each tier's angled brackets along the support bar to customize width or angle for almost anything: keyboards, music stand, drum machine, computer—you name it. Each tier can hold up to 150 pounds.

The primary limitation of the Apache design is its overall width—60 inches on the AP-26BPT version ($310), 48 inches on the AP-22BPT model ($280)—which may restrict the stand's utility for 88-note keyboard users. Size is also an issue: these imposing stands are bulky to store, and they occupy a lot of space onstage. True, you can use the stand at a 90-degree angle in the studio, but don't even think about doing this while performing live. A significant amount of setup time is required, too.

With the A-frame design, there is no wobble at all, which is especially important if you're an energetic player. On the other hand, A-frame stands can make your rig look like the keyboard department in a music store. This design has been around for a while; although classic in its functionality, it harks back somewhat to the days of stages cluttered with stacks of keyboards.

FIG. 6: K&M's no-frills Model 18962 X-frame stand is quite serviceable for light jobs.

A similar but double-tier Dakota model is also available in two widths, the 60-inch DK-18BPT ($264) and the 48-inch DK-16BPT ($218). As with the Apache, each tier can hold 150 pounds.

K&M MODEL 18962 X-FRAME

Germany's Kōnig & Meyer is a very experienced builder of stands for keyboards, harmonicas, brass instruments, speakers, and more. The two K&M stands I examined are distributed by two unrelated companies—Ultimate Support Systems and Gorg International—and the two distributors list different prices for the same stands. Certain accessories are offered only by Gorg, and in these cases, I list Gorg's price. In addition to the two X-frame

FIG. 5: Ultimate Support's IQ-2000 X-frame (a) is somewhat less elegant than the pricier IQ-3000, but it is an excellent choice for the money. A-frame stands like Ultimate Support's Apache (b) provide maximum space and stability but are generally rather bulky and take longer to set up than X-frame and Z-frame models.


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Stand and DELIVER

stands I tested, K&M makes the Model 18950 A-frame ($210), the double-strut aluminum Model 18980 ($159.90), and the double-braced steel Model 18990 ($85.90). These were not available for review, however.

The lightweight (7-pound) Model 18962 ($46 from Ultimate Support; $35.90 from Gorg) is a classic single-strut X-frame featuring a pair of flop-down metal strips that lock together at eight different height points with a locking screw (see **Fig. 6**). The design is simple and very secure, although it is rated for only up to 90-pound loads.

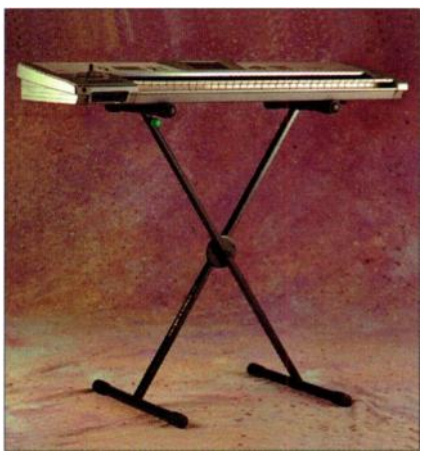

FIG. 7: K&M's Model 18940 single-strut X-frame sets up quickly, holds up to 165 pounds, and accepts an optional music stand and mic boom.

The Model 18962—apparently K&M is not big on product names—comes with no frills. Its single-thickness rubber end caps mean it's going to be only as sturdy as the floor and your playing style permit. You can add a second tier (Model 18968, $57), which is composed of two L-shaped brackets that lock into the back of the main keyboard frame. The brackets are strong, but you can't adjust their fixed 90-degree angle.

Single-strut X-frames will do their job onstage, of course. But at this level, you shouldn't expect much in the looks department. And if your fellow band members include run-about guitarists or dancers, you might want to consider something a little sturdier.

K&M MODEL 18940 X-FRAME

An X-frame stand with a tongue-and-plate locking mechanism, the Model 18940 ($63 from Ultimate Support; $59.90 from Gorg) is another example of a very simple design and has a load recommendation of up to 165 pounds (see **Fig. 7**). The 18940 can be used with several of K&M's accessories, principally a music stand (Model 18949, $41.70 from Gorg); an adjustable mic boom (Model 18946, $46.50 from Gorg); and adjustable, tilt-style tier arms (Model 18941, $27 from Gorg).

The 18940 is a single-strut stand with adjustable rubberized end caps on the feet and the keyboard rest. To open and close the stand quickly, you pull a patented quick-release lever on the upper right-hand side beneath the keyboard rest; this action inserts or retracts the metal tongue from its plate. It's a nice feature.

TAKE A STAND

More choices and variables seem to abound among keyboard stands than among keyboards themselves. And although your choice of stand is not as crucial as your choice of instrument, it will have far-reaching effects on your comfort, performance, and possibly even your job as a keyboard player.

After basic functionality, I'd say that the overall look of a stand and the space it occupies are the most important things to consider when choosing a keyboard stand. Z-frames and A-frames, of course, offer lots of leg and pedal space. X-frames are ergonomically ideal but tend to look a little dorky in any venue beyond a small stage—and they can, depending on your stature, interfere with your access to footpedals. My suggestion of a custom-cut piece of particle board (as described in the Apex entry) really makes sense no matter what type of stand you go for.

Your choice of stand helps define how your equipment looks on stage. To the untrained eye, all instruments look the same, but a stand can make you and your rig look professional, amateurish, techie, sloppy, or important. So spend some time making the right choice.

Julian Colbeck, *besides playing in Transylvania, has toured everywhere from Trenton to Tokyo and from San Jose to São Paulo, with artists as varied as ABWH/Yes, Steve Hackett, John Miles, and Charlie.*

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Musical PCs

Let the experts customize your next computer while you make music.

By Brian Smithers

The past year has seen the coming of age of the computer preconfigured for audio. While vendors have been building specialized computers for industries such as CAD/CAM and video for years, musicians have had to buy mass-market machines or else build their own. Now, however, four companies—Audio Computing, FAQ Systems, IQSystems, and Wave Digital—are offering customized PCs designed from the ground up for the demands of digital audio. Each company takes a slightly different approach to system design, yet all four strive to overcome the all-things-to-all-people PC paradigm that's responsible for most of the desktop musician's technical headaches.

BRUCE MACPHERSON

After speaking with all four vendors, the first thing I noticed was that the odds of talking directly to the person in charge are quite good. If you're like me, that's one of the key reasons for doing business with small independent companies instead of mass manufacturers. That doesn't mean that these are one-person operations, but you'll certainly never have to suffer the uninformed guesses of a salesperson who doesn't know MIDI from maxi.

The second thing I noticed was that each vendor believed that a computer should behave like any other piece of gear in your studio. You don't spend hours sorting out IRQ conflicts on a new mic preamp, so why should you have to do that with a new computer?

TIME EQUALS MONEY

Ken Fennell of FAQ Systems in Norcross, Georgia, says that a big reason musicians buy computers from him is that it saves them time: "Commercial studios are too busy to worry about building and configuring their own systems, and musicians setting up their own personal studios would rather spend their time making music."

We all know from painful experience just how time-consuming it can be to set up a new computer with a new audio

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FIG. 1: Audio Computing offers a complete line of customized music-production computers ranging from entry-level to high-end systems.

interface and software. If you've bought a mass-market computer, your first task is to undo all the idiot-proofing and "ease-of-use enhancements" the manufacturer has saddled your machine with. You then remove AOL, Microsoft *Office*, and a half-dozen other programs from the Startup group so they're not running all the time, take out all the cute little icons from the System Tray to reclaim 25 percent of your system resources, then run the System Configuration utility to ferret out all the other little resource parasites hiding in the background.

Don't forget to turn off Fast Find and any antivirus programs, because these can hijack your hard drive when you're in the middle of recording. Also be sure to modify your virtual memory settings; the general-purpose defaults are the direct opposite of the optimal settings for hard disk recording. (Check with your audio software manufacturer for more specifics.)

On your second week of vacation, assuming your motherboard has an open PCI slot, you install the new audio card, run its setup program, and cross your fingers. You did remember to disable the motherboard's integrated game-compatible audio to avoid IRQ conflicts, didn't you? If at this point you're lucky enough not to have to reinstall Windows or reformat your hard drive, you still need to scour the card manufacturer's Web site for software and driver updates, each of which can have potentially crippling side effects.

In the best-case scenario, configuring your machine will take you two hours. Usually, though, it will take you half a day or more. To decide whether a preconfigured system is right for you, simply calculate the cash value of your time and effort.

THE VALUE OF EXPERTISE

Just planning a hardware purchase can consume an enormous amount of time and mental energy. First you need to research the basic specs of the gear you're considering, then surf the print and electronic media to see whether the hardware is living up to its advertised claims. What's the latest word on video cards interfering with PCI audio cards? Which audio cards have been updated to 24-bit, 96 kHz capability? Which have ASIO 2.0 or GigaSampler drivers? Wouldn't it be great to know someone who has already done all that research for you?

Tim Kirk is the brains behind Innovative Quality Systems (IQSystems), the sibling of Innovative Quality Software, which makes the *SAW* line of digital-audio programs. Kirk has tested and used major audio hardware products and has some hard-earned opinions on which devices work best with the *SAW*-based systems that his company designs. He can recommend a video card that not only doesn't interfere with the digital audio stream but will allow you to connect a second video monitor. The audio interface he recommends has a latency of just 128 samples, or 2.9 ms at 44.1 kHz.

Ever stop to consider the structural rigidity of your DAW's case? Gil Griffith of Wave Digital points out that a cheap chassis can allow the motherboard to flex, leading to loose connections with cards and possibly even the processor. To prevent this, Griffith uses a heavy-gauge, extruded sheet-metal chassis. If you call a mass-market computer maker, can the salesperson tell you with certainty that their computer chassis will hold a full-length PCI card such as the Lexicon Core 32 or the Pro Tools Mixplus? A vendor of preconfigured audio computers can tell you, even if you didn't know enough to ask.

Are you planning to include a CD-R drive in your new computer? Is it compatible with your chosen CD-burning software? By building systems from a set of components they've tested for compatibility with each other and with audio hardware and software, preconfigured-system manufacturers save their clients from having to reinvent the wheel.

THE LITTLE THINGS

All four vendors offer turnkey systems that are ready for recording straight out of the box. They've installed the hardware, loaded the software, and configured everything to work together from the start. Fennell of FAQ Systems says his company's goal is for the client's questions to be of the "How do I do this?" variety instead of the "How do I fix this?" ilk.

In addition to custom configuring the software environment, FAQ takes great care to label everything clearly as each system is packed for shipping. That kind of forethought cuts the amount of end-user confusion, yielding more productivity for the client and less time and money wasted on needless tech support for the vendor.

One of the ways these specialized vendors save their customers configuration headaches is by preventing unnecessary programs from running at startup. Wave Digital figures it frees up several audio tracks just by providing a System Tray that's uncluttered compared to a mass-market machine. Audio Computing points out that something as simple as running your ATA hard

FIG. 2: Wave Digital's Cubase Basic system is an affordable, entry-level system based on a 500 MHz Pentium III CPU.

For manufacturer information, please see Contact Sheet, p. 171.

Sonic Foundry Vegas Pro

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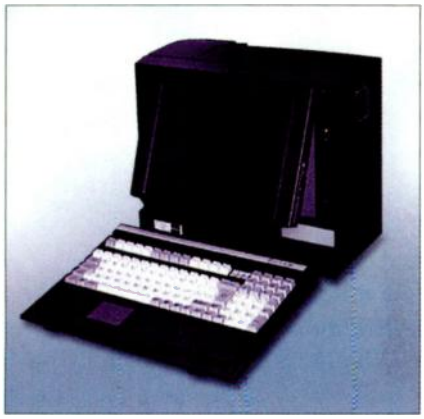

FIG. 3: Innovative Quality Systems' portable "lunch box" computer includes two hard drives and an integrated flat-panel monitor.

drive in DMA mode can improve performance significantly. To keep your audio setup pristine, FAQ Systems suggests you run your business applications from a second hard drive partition that has a separate installation of Windows; and, of course, they are happy to set that up for you.

To ensure reliability, systems are typically "burned in" for 24 hours after assembly and then tested before shipping. Since most component failures occur early on, this burn-in period weeds out problems before they can become a customer's nightmare. For commercial studios and live performance installations, the increase in reliability alone is worth the cost premium of a customized system.

SERVICE AND SUPPORT

To provide quality service after the sale without driving up costs, these vendors offer a variety of free tech support options. While phone support isn't toll-free, you won't be kept on hold forever, and you'll get personalized attention. Most important, you'll never have to explain to a technician what a dongle or a MIDI channel is, which you probably would have to do when dealing with a major PC manufacturer.

When a session isn't hanging in the balance, you can reach tech support by e-mail and should get a response the next day. While nitty-gritty software support is ultimately between you and your software manufacturer's tech support experts, your vendor can often steer you to the right spot on the software maker's Web site or even research a question for you. All four vendors' Web sites have extensive links to support sites for the hardware and software they sell.

For a small fee, IQSystems will set up your system for remote technical support using *PC Anywhere*. That way, Tim Kirk can see exactly what's going on with your machine and take care of it firsthand rather than have you read error messages to him over the phone.

You may find that the biggest payoff in buying a computer preconfigured for music comes at upgrade time. For example, if you're feeling the inevitable RAM pinch, you'll be glad your motherboard has three slots with a maximum capacity of 768 MB. When you want to add a MIDI interface, you'll appreciate the fact that your machine has two USB ports and ample PCI slots. All four vendors will help you upgrade for a reasonable fee, saving you the time and trouble of being your own technician.

Upgrades are handled on a case-by-case basis, and support depends on the nature of the upgrade. At least one of the vendors is contemplating a trade-in program to help customers recoup some of their investment when upgrading. These companies are eager to build long-term relationships with customers, so don't hesitate to ask how they can help you with a planned upgrade.

There are other advantages to doing business with specialty shops like these. As you'd expect, IQSystems works very closely with its software counterpart to provide comprehensive *SAWPro* and *SAWPlus32* support. For those just getting started in desktop music, FAQ Systems has made arrangements with Alexander Publishing to bundle online training courses with its systems. And for anyone with the need and the budget for high-end gear, Audio Computing is an official agent for CreamWare's SCOPE system and the officially recommended supplier of turnkey systems for Steinberg's *Nuendo*. All four vendors offer rack-mounted versions of their computers, and IQSystems even has a portable system for remote recording.

THE PRODUCT LINES

If you're considering buying a preconfigured computer system, your first step is to check out these vendors' Web sites. Each is chock-full of information on the vendor's qualifications, preferences, and product lines. You can choose from well-thought-out bundles or request a quote on a custom configuration. There are too many options to cover fully here, but below are a few examples to whet your appetite. (Monitors are not included except where noted.) Keep in mind that pricing and availability change constantly.

Audio Computing's Web site (www.audiocomputing.com) has a line of computers to work with your existing audio hardware (see **Fig. 1**) and a line of turnkey systems, most of which are named after jazz musicians. The Wynton III is a well-equipped entry-level turnkey system with a 600 MHz Pentium III processor, 128 MB of RAM, a 6.8 GB Ultra-DMA 66 drive for the O/S and your software, and a separate 10.2 GB Ultra-DMA 66 audio drive. Audio and MIDI I/O are handled by Midiman's Delta 44 (4 in/4 out) and USB Midisport (2 in/2 out), respectively. *Cubasis VST* 3.7 and a custom bundle of audio and MIDI software complete the package for $1,639.

For those with bigger budgets, the Mulgrew II features a 750 MHz Pentium III, 256 MB of RAM, a 9.1 GB Ultra/160 SCSI O/S and program drive, an 18.2 GB Ultra/160 SCSI audio drive, and an 8×4×24 CD-RW drive. Audio and MIDI functions are handled by CreamWare's Pulsar system, including the Sonic Rocket Booster (which adds four more DSP chips), the A16 analog I/O interface, and a software bundle that includes Steinberg's *Cubase VST/24*, *WaveLab*, *Free-Filter*, and Waves' *Renaissance Compressor*. The price of all this power is $7,095.

FIG. 4: FAQ Systems' Web site offers several configurations for different musical applications.

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AUCKLAND 09-373 4712 MILANO 002-89120540 STOCKHOLM 08-730 5100 KUALA LUMPUR 03-737 0935

THE E-MU PC

E-mu/Ensoniq has its own version of the preconfigured music computer—the E-mu PC, for sampling, sequencing, and recording (see Fig. A). Consisting of a 500 MHz Pentium III with 128 MB of RAM, a 13 GB hard drive, and a CD-RW drive, the E-mu PC features E-mu's Audio Production Studio hardware, which provides MIDI I/O, analog and S/PDIF I/O, DSP effects, and SoundFont support using system RAM. For audio I/O, parent company Creative Technology's SBLive card is built into the front panel of the computer case. The machine also includes Steinberg's *Cubase VST* software, preinstalled and optimized for the Audio Production Studio. The E-mu PC is available for $2,595 through E-mu's Web site or from select retailers.

FIG. A: The E-mu PC features sampling, sequencing, and recording capability, thanks to its built-in Audio Production hardware.

Wave Digital Systems (www.wavedigital.com) lists its product line by software bundle and hardware horsepower. An example of its entry-level line is the Cubase Basic system, which offers a 500 MHz Pentium III processor, 64 MB of RAM, and a 10 GB Ultra-DMA 66 hard drive (see Fig. 2). Steinberg's *Cubase VST* and Midiman's Delta 44 complete this $1,899 system.

Wave Digital Systems' product line includes dual-drive systems in EIDE or SCSI variants and peaks out with the aptly named Ludicrous models. The Cakewalk Ludicrous system combines a 750 MHz Pentium III, 256 MB of RAM, a 9 GB Ultra/160 SCSI program drive, and an 18 GB Ultra/160 SCSI audio drive. *Cakewalk Pro Audio Deluxe* and MOTU's 2408 mkII bring the total to $5,079.

IQSystems (www.iqsys.com) takes a no-compromise approach to system design with an "entry-level" machine called the SP-1 550 that starts at $3,500. It's a 550 MHz Pentium III with 256 MB of RAM, a 20 GB EIDE audio drive, and a 13 GB EIDE program drive running Windows NT. The price includes the LynxONE audio interface and a 17-inch monitor but does not include the *SAW* software.

For remote recording, IQSystems' portable "lunch box" system, the SPL-P3500, combines a 500 MHz Pentium III processor, 512 MB of RAM, two 40 GB Ultra-DMA 66 hard drives, an integrated flat-panel monitor, and Windows NT (see Fig. 3). Audio I/O is provided by the Sonorus StudI/O 16-channel ADAT Lightpipe interface. The SPL-P3500 is ready for expansion, too, with four drive bays and up to seven available expansion

slots. This degree of portability will set you back $8,500 without software.

FAQ Systems (www.faqsys.com) has built a series of machines that are tailored to the needs of the NemeSys *GigaSampler* line of products. The SCSI GigaSampler model comes with a 600 MHz Pentium III, 256 MB of RAM, a 9 GB SCSI program drive, and an 18 GB SCSI audio drive. Add a Frontier Dakota interface and *GigaSampler*, and the price comes to $3,269. For $275 more, you can have it rack-mounted (see **Fig. 4**).

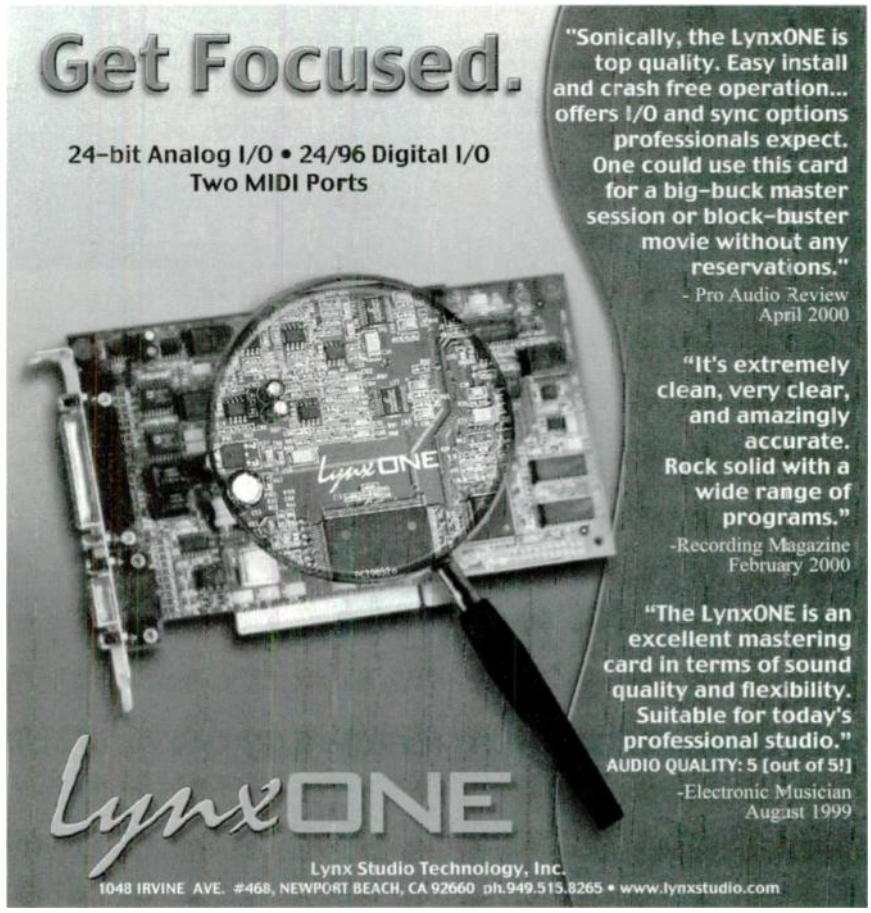
The "budget" end of FAQ Systems' lineup is the GL series, which includes a 550 MHz Pentium III processor with 128 MB of RAM, a 13 GB Ultra-DMA 66 program drive, and a 20 GB Ultra-DMA 66 audio drive. With Sonic Foundry's *Vegas* and a Delta 44 audio card, the total damages run to $2,379.

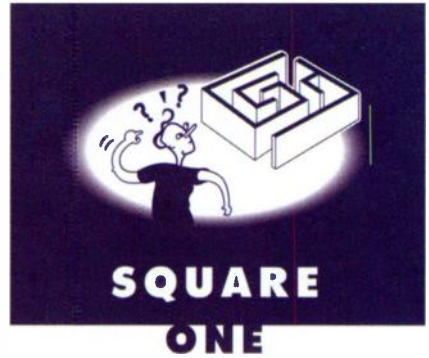
Don't hesitate to ask vendors about different software or different audio and MIDI interfaces. You may get a well-thought-out explanation of why the suggested program or interface is better, but ultimately any of these vendors will put together the machine that you want.

If you've already made a substantial investment in audio hardware, you can have a new computer built around your existing gear. Pricing and support naturally vary depending on the specific circumstances, but you shouldn't think of preconfigured computers as all-or-nothing solutions. You can continue to use your favorite gear with the advantage of expert setup and testing, and you get to spend your time making music instead of performing computer surgery.

So how much does all this expertise and attention to detail ultimately cost? It varies, but the prices above represent an added premium ranging from $200 to $1,000 or more, depending on the complexity of the system. When shopping, however, be sure you're comparing apples to apples. That $500 Pentium III at your neighborhood superstore probably doesn't have a second audio drive, four full-length PCI slots, or Intel-certified RAM. If a preconfigured system will save you costly downtime or if you'd rather spend your time being a musician instead of a technician, that premium could be money well spent.

Brian Smithers *is a musician and conductor at Walt Disney World. He also hosts a Web site devoted to making music with laptops at http://members.aol.com/notebooks1.*





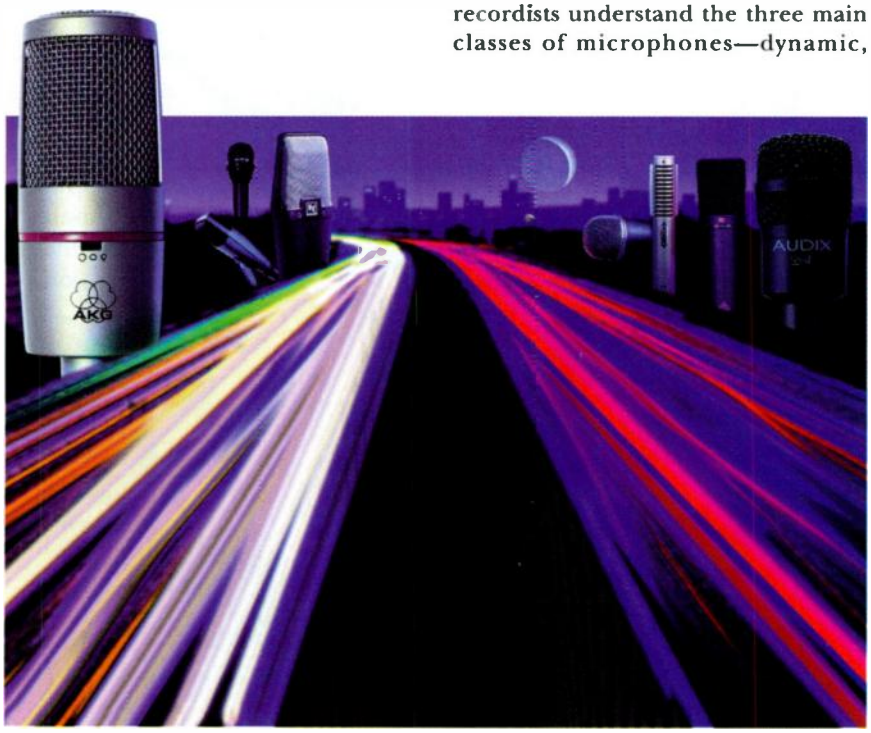
Mics in the Mix

A beginner's guide to navigating the microphone maze.

By Myles Boisen

Whether you have a closet full of mics or are contemplating your very first microphone purchase, selecting the proper mic for a recording application is crucial. Based on the e-mail I receive from **EM** readers, and on recurring discussions at audio newsgroups, it would also seem that deciding which mics to buy (and what to do with them once you have them) can be an agonizing process.

This article will help beginning recordists understand the three main classes of microphones—dynamic, ribbon, and condenser—and how they differ from one another, and explain why one type may be preferable over another for different recording applications. Before getting into specifics, though, let's identify some features that most microphones—whether for studio or stage—share. Perhaps the most important of these features is the *diaphragm,* a lightweight, delicate membrane that responds to changes in sound-pressure level. Protection for the diaphragm is provided by a wire-mesh or other type of *grille,* which typically also serves to identify the *address,* or active, surface of the mic.



DMITRY PANICH

The physical energy of the diaphragm's movement is *transduced* (that is, changed to electrical energy) by a variety of methods, each of which belongs to a distinct category of microphone electronics. Subsequently, the internal electronics provide an output signal via a male 3-pin XLR or multipin jack.

MICS YOU CAN EAT

The most common type of microphone is the dynamic. Most dynamic microphones employ a relatively massive, moving-coil diaphragm that is impervious to damage from rough handling or extreme sound pressure. The low cost and rugged construction of dynamic mics make them ideal for live sound, and certain models made by Shure, Sennheiser, Audix, Beyerdynamic,

roll your own.

Ever wish that you could take your studio on the road? Keeping a piece of gear around for just one sound? E-MU now lets you "roll your own" custom sound ROMs for the Proteus® 2000 using any E-MU® Ultra Sampler. Fill the Proteus 2000 with custom sound ROMs, and your dream of instant access to all your favorite sounds in a portable, permanent package is a reality!

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Featuring 128 voice polyphony, expansion up to 128 MB of internal sounds, 32 MIDI channels, and a lightning-fast processor, Proteus 2000 is already the platform of choice for demanding musicians around the world. Whether you expand your universe of sounds by "rolling your own" custom ROMs or take advantage of E-MU's expansive library of "pre-rolled" sound ROMs, the Proteus 2000 will deliver superior performance at a price you can afford.

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The 32 MB Orchestral Sessions Vol. 1 expansion ROM offers you the most realistic and comprehensive collection of section strings available. Meticulously sampled and intuitively arranged, these new string samples include various bowing styles, pizzicato, tremolo and other effects for all section strings.

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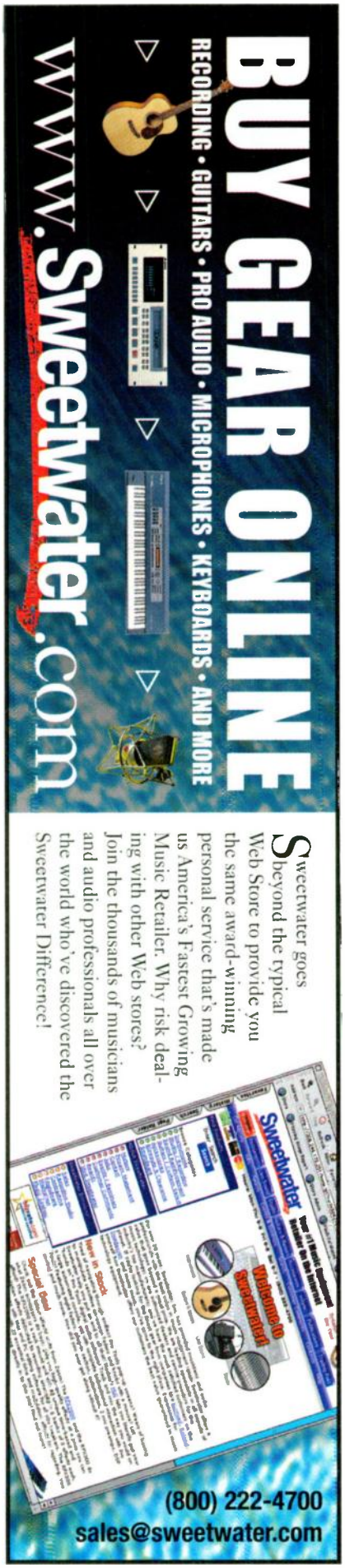

AKG, and Electro-Voice often do double duty in the recording studio.

With very few exceptions, modern dynamic mics are front address and designed for unidirectional pickup in a *cardioid* polar pattern. This means that sound arriving *on-axis* (that is, in front of the mic at the end of the cylindrical body) is emphasized, while sound arriving *off-axis* (that is, at the sides and rear of the mic) is suppressed or rejected.

The term *cardioid* derives from the heart-shaped pattern of the microphone's "hot zone," or on-axis area. However, I find it easier to think of the pattern as being in the shape of an apple, with the microphone as the stem (see **Fig. 1**). This pattern has obvious benefits for live sound, where monitor speakers may be placed in front of a performer—and therefore are pointed at the rear of the microphone. But dynamic mics are also an asset in the studio, where their focused pattern and limited sensitivity to distant sounds is useful for "tuning out" unwanted sound sources.

The dynamic mic is always the best candidate for controlling *leakage* (when excess room sound or the sound of other instruments "leaks into" the mic) and, likewise, for maintaining the maximum separation of sounds when close-miking. This makes it a natural choice for miking a drum kit, where, for instance, the snare-drum mic may be within two to three inches of both a tom-tom and the hi-hat cymbals. Models such as the Shure SM57 and Sennheiser MD 421 are preferred by many engineers for snare and toms, respectively, as well as for some hand drums. Dynamic mics are generally not used for high-frequency sources such as cymbals and metallic percussion and are not optimal for distant miking of room sound or a group of instruments.

Some dynamic mics are specially designed for recording bass drum, and they feature an extended low-frequency response as well as a high-end emphasis to bring out the attack of the bass-drum pedal. These mics can also be put to good use on acoustic bass, tuba, and speaker cabinets for electric bass and organ.

Though leakage is rarely a problem when miking guitar amps, dynamics are also widely favored for this application. Because most dynamic microphones have a midrange frequency

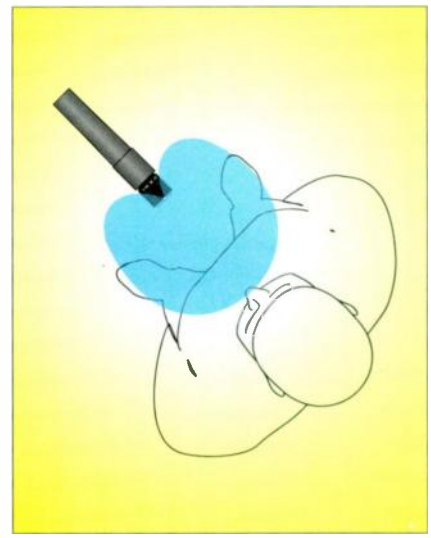

FIG. 1: The cardioid pattern resembles the shape of an apple, with the microphone as the stem.

response that is optimized for vocals, they will enhance the equivalent range of amplified guitar tones as well as that of brass-band instruments. And, in contrast to other types of microphones, the dynamic is unfazed by high sound-pressure levels and can further aid the engineer by filtering out boomy lows and grating highs at the extremes of the frequency spectrum.

Vocalists accustomed to using handheld dynamic mics on stage may feel more at home using them in the studio and, in some cases, will prefer the sound of a dynamic over a more expensive condenser microphone. There is no reason not to try a blue-collar dynamic as a main vocal mic; George Benson's "This Masquerade" is a good example of a hit song in which the vocal was recorded with a dynamic microphone. For singers who like to "eat the mic" but don't want to produce a disproportionate amount of bass response (due to the proximity effect), some deluxe models provide low-cut filters. This feature enables the user to trim the low-frequency output of the mic via single or multiple switch positions, and typically it's the only "extra" found on dynamic mics.

MICS YOU SHOULD BABY

The ribbon, or velocity, microphone is an early form of dynamic mic that was ubiquitous in broadcasting, film sound, and music recording from the 1930s through the 1960s. Vintage RCA ribbons can still be found in studios today, and three companies—Coles, Royer,

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situations, can be a drawback when having to contend with excess leakage, say in multiple-mic setups for ensemble recording. In addition, condenser microphones aren't just "plug and play"; rather, all types require a power source for the internal amplifier circuitry. Most contemporary solid-state condenser mics run on 48-volt phantom power, which is commonly supplied by mixing consoles or outboard gear. Tube condenser mics, on the other hand, have dedicated power supplies, and some electret condensers run on batteries.

Condenser microphones are generally favored by engineers for recording vocals, acoustic guitar, piano, woodwinds, strings, cymbals, percussion, mallet instruments, sound effects, ambience, and any source requiring lots of detail. Condensers are thus an essential ingredient in any classical and modern-jazz recording, and they are relied upon in all manner of pop music to put a bright, high-end sheen on sources. Professional stereo and live-concert recording is made possible by the use of carefully matched condenser pairs or dedicated stereo microphones.

There are many different kinds of condenser mics, each with its own uses and idiosyncrasies. We'll examine three more closely: small-diaphragm condensers, large-diaphragm condensers, and tube condenser mics.

SMALL, SMALL WORLD

All condenser mics use ultrathin, low-mass diaphragms, but those measuring ½-inch or less in diameter are in a class all their own. Highly prized for their superlative high-end and transient response, small-diaphragm condensers are often the first choice of engineers worldwide for use on drum sets (as overheads), hi-hat, percussion, acoustic guitar, mandolin, banjo, piano, classical ensembles, and more. However, the honesty and sharp treble emphasis of this design may be unflattering or lacking in warmth on some sources, and for this reason it is not a common choice for low saxophones, bowed bass and cello, male vocals, or distorted electric guitar.

The majority of small-diaphragm condenser mics are front address and single pattern, usually cardioid. But many of the major manufacturers offer modular systems with an assortment of interchangeable, single-pattern capsules with differing polar patterns. Other companies, such as Earthworks, have made their mark by producing very-small-diaphragm condenser mics that have the same accuracy and extended frequency response as scientific measurement microphones.

FEELING LARGE

Nothing gets the engineer's juices flowing quite like a large-diaphragm condenser. These are the fetish items of the recording world, renowned for their rich midrange, thunderous low-end response, creamy highs, and larger-than-life quality.

With the exception of a few models, all large-diaphragm condensers are side address, and their elegantly rounded grilles often afford a clear view of the 1-inch or larger capsule mounted inside. Since the advent of the home-recording boom, many no-frills models have come on the market, most offering only a fixed cardioid pattern, a basic mount, and (sometimes) a carrying case. For bigger budgets, the sky's the limit—your Rolls Royce large-diaphragm mic may be handmade and finished in 24-carat gold, with elaborate suspension mounting, custom-made screws and cables, and more (see **Fig. 3**). Whatever your tastes, the large-diaphragm mic is a must-have for recording lead and background vocals, saxophones and other reeds, and it's commonly used on low-end instruments such as acoustic bass, electric bass, jazz guitar, bass clarinet, hand drums, tom-toms, and bass drum.

TUBE JOB

All condenser mics made before the mid-1960s used vacuum tubes in their internal amplification circuitry. Yet despite the lower cost, convenience, and reliability of newer, solid-state transducers, vintage tube mics are more popular now than ever. In fact, large-diaphragm tube mics made by Neumann, AKG, and Telefunken in the 1950s and 1960s are responsible for the lush vocal sounds on many of today's big-budget pop productions. Renewed interest in these classic mic designs (not to mention skyrocketing prices) has spawned a new crop of large-diaphragm tube transducers that is within reach of the personal-studio owner.

In the digital-recording age, tube mics have become a hot commodity for home recording, especially on vocals.

FIG. 3: Some manufacturers, such as Baltic Latvian Universal Electronics (BLUE), pull out all the stops for their top-of-the-line mics. The hand-built BLUE Bottle tube mic features eight interchangeable capsules, each with a different sonic "flavor," to accommodate practically any application.

If it's accuracy you're after, look elsewhere. However, once you've tracked with a great tube mic, you'll understand why many engineers prefer these microphones for vocals, lead instruments, guitars, amplified keyboards, acoustic bass, and many other sources. The secret is in the tube itself, which adds subtle coloration, compression, and harmonic distortion to the sound.

Although large-diaphragm tube mics get most of the attention, small-diaphragm models are still plentiful and relatively affordable on the used market. In recent years, some of these have been retrofitted with new, large-diaphragm capsules made by Baltic Latvian Universal Electronics (BLUE), expanding their usefulness beyond their traditional duties as microphones for drum overheads, percussion, and stringed instruments. In addition, a new "medium-diaphragm" (¾-inch)

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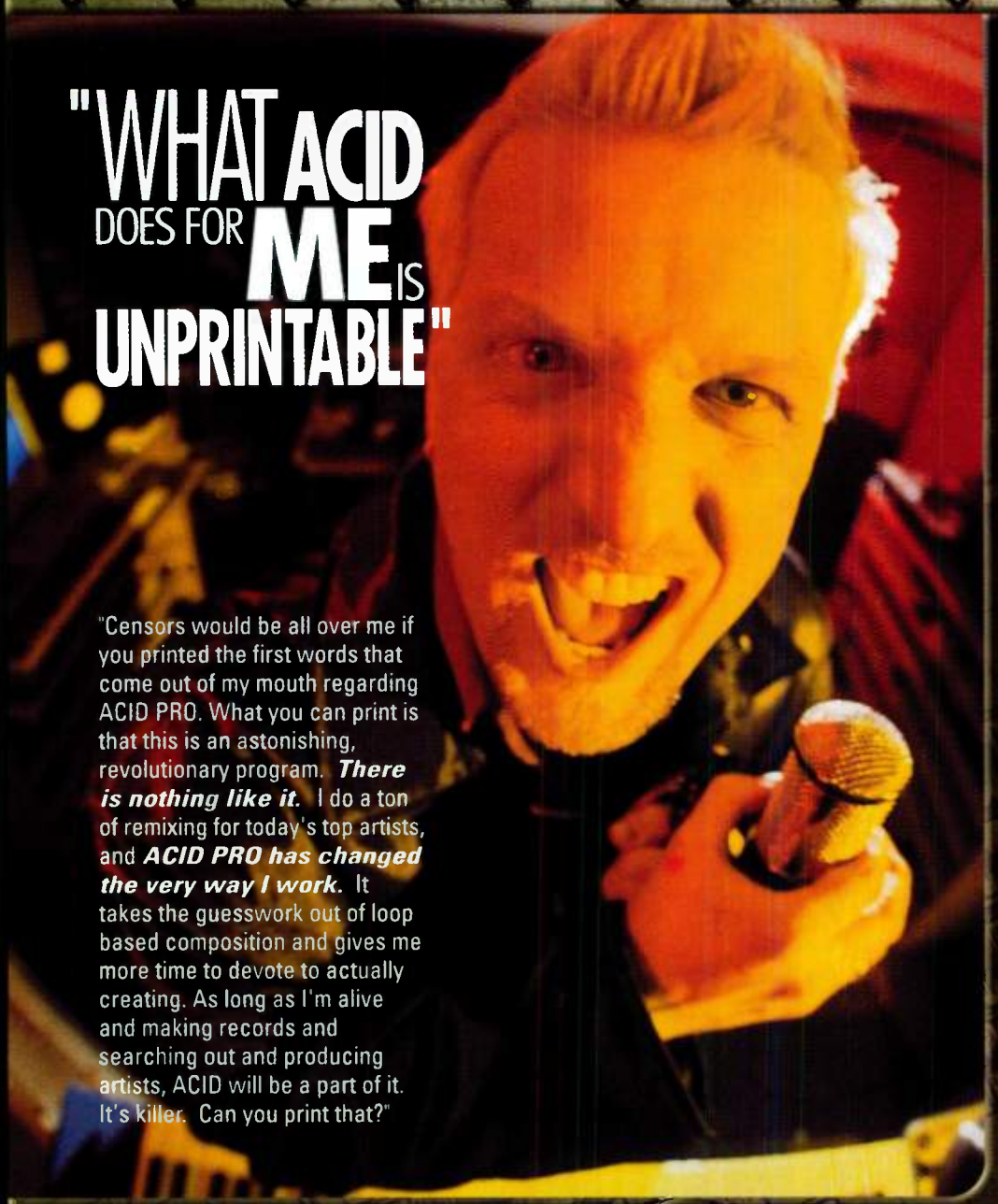

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tube microphone is being marketed by GT Electronics (a division of Alesis).

IT DOESN'T STOP THERE

Though dynamic, ribbon, and condenser mics account for most of the music that gets recorded these days, other types are also available. One very useful (and popular) kind is the boundary effect microphone (the generic name for the PZM, or pressure zone microphone, trademarked by Crown), which is notable for capturing direct and reflected sound in phase. Other special types of mics include contact mics (the piezo electric, for example), which operate via direct vibrations from the instrument; crystal mics; and ceramic mics. These microphones are beyond the purview of this article, however.

AND THE WINNER IS...

Hopefully, this article has answered some of your questions about the different microphone types and what each does best. If you're like most of the folks I talk to, though, I'll bet that one big question is still unanswered. For most people, it goes something like this: "Mirror, mirror, on the wall, what's the best mic of them all?"

Now, repeat after me: there is no single "best" microphone for any recording job. Some microphones do one thing very well, whereas others work well for a variety of applications. Moreover, it's easy to convince yourself that a particular mic sounds good on almost anything—especially if it's all you can afford.

Every musician is singular, as is every instrument, room, song, and so on. The combination of these elements yields a sonic result that is as unique—and irreproducible—as a snowflake. In your studio, on a given day with your equipment and knowledge, a microphone may sound very different than it would in my studio, or in the hands of Steve Albini, or on a Beatles record. What counts is that you know how to get the best results from the microphone at hand—and that those results sound right to *you*.

Myles Boisen *is a guitarist, producer, composer, and head engineer/instructor at Guerrilla Recording and The Headless Buddha Mastering Lab in Oakland, California. He can be reached by e-mail at mylesaudio@aol.com.*

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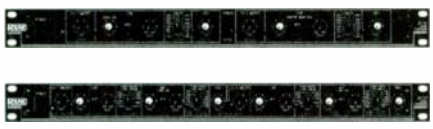

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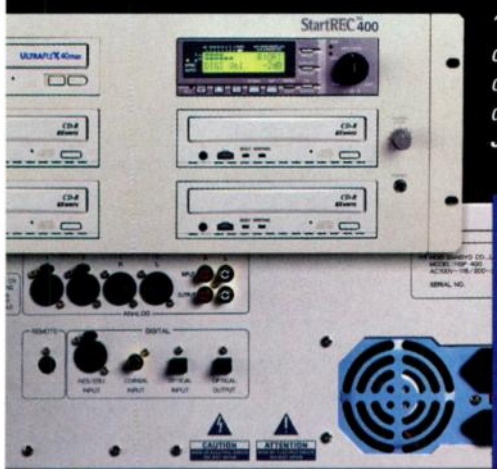

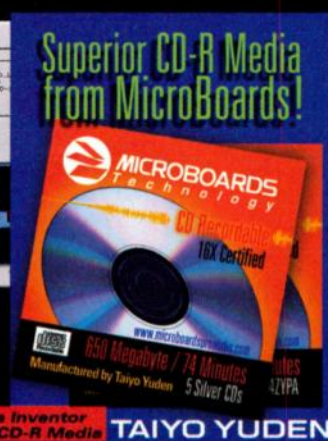

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Expert Advice

A grab bag of useful tips and techniques.

Compiled by Mike Levine

Welcome to "Operation Help." This month, we'll concentrate on answering reader questions. Topics covered include noise-reduction formats for cassette, analog recording, and M-S miking with PZMs. If you have a gear or technical question, please e-mail it to us at emeditorial@intertec.com.

QUESTIONS FROM READERS

Rub-a-Dub-Dub

Q: I'm in the market for a dubbing cassette deck (my old one just died on me) that I want to use to duplicate my demos. I need some help with the noise-reduction options. What is HX Pro and is it better than Dolby B or C? What would be the best type of noise reduction for applications where I'm sending the tapes to people with different types of decks?

David Parise
via e-mail

A: Actually, HX Pro is not a noise-reduction format in the strict sense of the term. Instead, it's a process that Dolby developed to enable hotter signal levels to be recorded to tape with less distortion and better high-frequency response. By recording a hotter signal, you end up with a better signal-to-noise ratio, so using an HX Pro–equipped deck can result in tapes that are less noisy.

As for Dolby B and C, the important thing to remember is that you want the cassettes you send out to be compatible with the machines that they'll be listened to on. Therefore, given the choice between Dolby B and Dolby C, you would probably want to choose B—even though it's inferior to C—because it's a much more universal format (this is especially true when it comes to portable personal stereos). If it were me, I'd eschew noise reduction entirely (I've found that tapes recorded with noise reduction on one cassette player don't always sound right when played back on another cassette player) and simply record my cassettes with as hot a signal to tape as

FIG. 1: The AudioWrite Pro from Microboards Technology functions as both a computer-based and a stand-alone CD-R unit.

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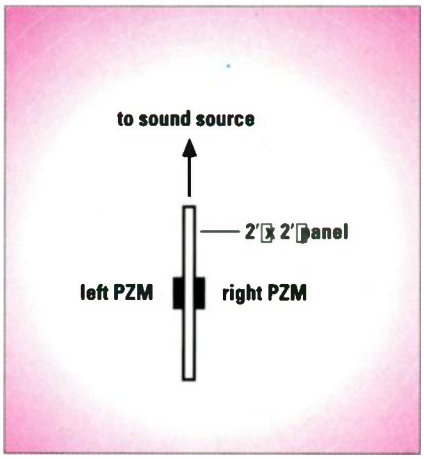

FIG. 2: Two PZMs can be mounted back-to-back on a plate to form a near-coincident mic pair.

possible (preferably with an HX Pro–equipped tape deck).

Before purchasing another deck, you should also be aware that dual-cassette machines rarely offer the same recording quality as a good single-cassette deck. So if you really want to stay with the cassette format, you might consider replacing your defunct dual deck with a pair of single machines.

However, before you invest more money in cassette decks, you should seriously consider putting your final product on CD instead. Yes, it will cost you more in the short run, but the improvement in sound will be dramatic. And with so many musicians putting their demos on CD, do you really want to continue to send out cassettes?

If you have a computer, you can purchase a CD-R drive for relatively little money and burn your CDs from that. And if you don't have a computer, stand-alone CD-R decks are available from a number of manufacturers. There are even products, such as the AudioWrite Pro from Microboards Technology (see **Fig. 1**), that function either with a computer or as stand-alone units.

You didn't mention what type of deck you were mixing down to, but if you need a digital mixdown deck in addition to a CD burner, you can get units—such as the Alesis Masterlink—that handle both functions.

For a more detailed rundown on the various CD-R and mixdown decks on the market, I recommend you take a look at **EM**'s *2001 Personal Studio Buyer's Guide*. Check both the "Digital Mixdown Machines" and "CD Recorders" categories.—*Mike Levine*

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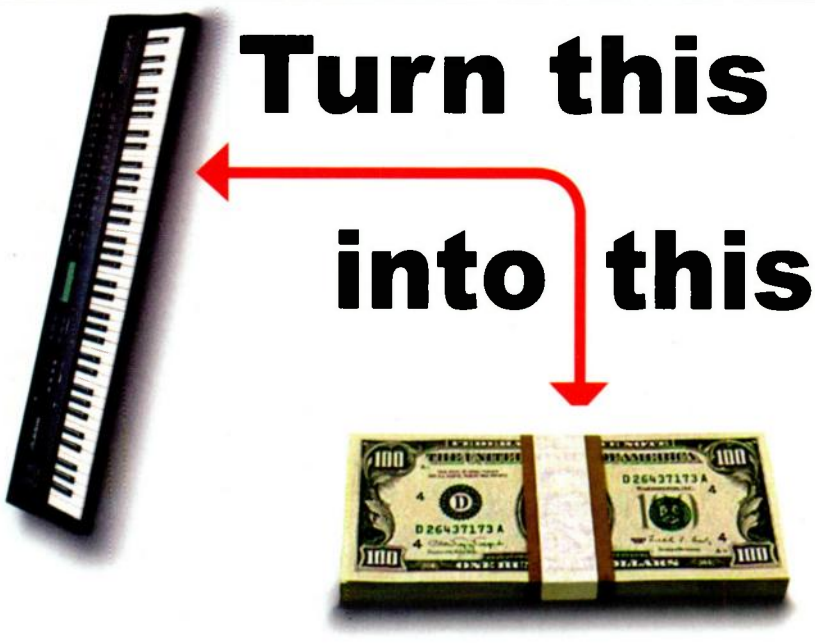

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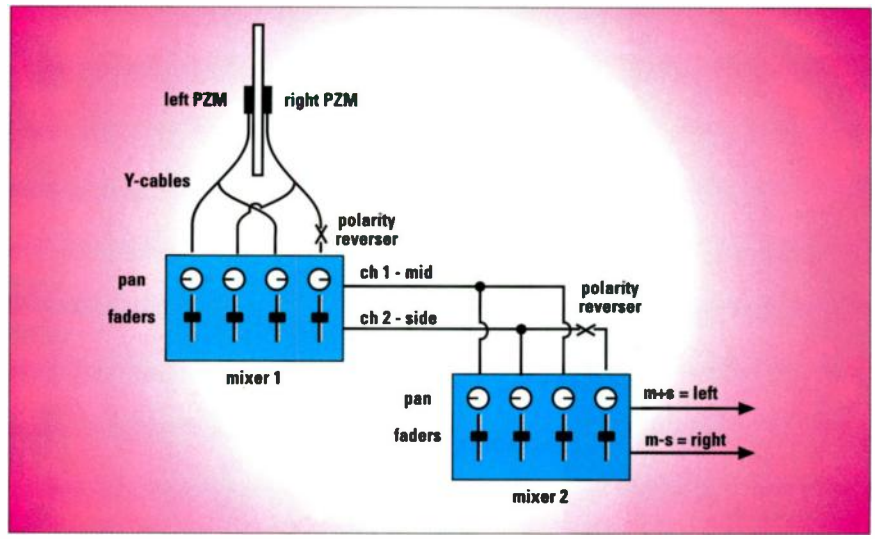


FIG. 4: This depicts how to sum-and-difference the mid and side signals to get left and right signals. By varying the mid-side fader ratio in mixer 1, you can alter the stereo spread.

Back-to-Back, Belly-to-Belly

Q: I had a sudden inspirational flash regarding mid-side miking procedure. I thought I would float it past you for consideration, critique, etc. Not having a figure-8 mic for the side component of the matrix, would it be possible to use a pair of Realistic PZM mics back-to-back (perhaps with a Perspex sheet sandwiched between the two mics to increase isolation between their respective pickup fields), then phase-reverse one of the PZMs and feed it, together with the other normal-phase PZM and forward-facing cardioid, into a mixer for summation in the usual M-S fashion? I suspect the PZMs would not strictly sum together to fully approximate a figure-8 mic, lacking a true 90-degree dead zone, but how close do you think they would get to this ideal?

The back-to-back on a Perspex sheet array is often promoted as a good basic orchestral stereo-miking technique, hoisted above the conductor's head and perpendicular to the orchestra; this is simply an elaboration on that to make it M-S: of course, one would plan on getting the mid-cardioid mic as close as possible to the side array. Any reflections on this proposal?

Ray Thomas
via e-mail

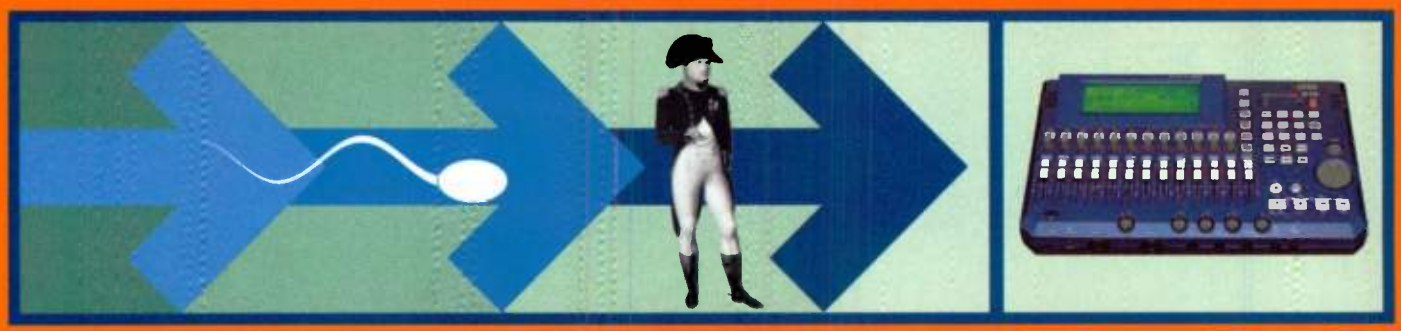
A: Yes, you can put a pair of PZM mics back-to-back on a 2-by-2-foot sheet of Plexiglas and make them act like a single figure-8 mic by summing them together with their polarities reversed.

I brainstormed with Bruce Bartlett from Crown about using PZM mics for mid-side applications. We concluded that it's possible to use the same pair of PZM mics as both the figure-8 side capsule and the omni "mid" capsule. Basically, by splitting the signal among four input strips on a mixing console and summing them together—both in-phase to create an omni-pattern mic, and out-of-phase to create a figure-8 mic—you can make a variable-pattern mid-side mic.

According to Bruce Bartlett, "You can create an omni-mid/bidirectional-side M-S microphone by mounting two PZM mics on either side of a large boundary, such as a 2-by-2-foot panel. Aim the edge of the panel at the sound source. Now you have a left-aiming PZM and a right-aiming PZM that are virtually coincident" (see **Fig. 2**). You can also create a mid and side signal from these two PZMs by using Y-cables, a polarity reverser, and a 4-input mixer (see **Fig. 3**).

It's also possible to matrix a pair of back-to-back PZM mics into a mid-side mic pair because the in-phase summed signals make an omni pattern, while the out-of-phase summed signals make a figure-8 pattern. This mid-side signal is then fed to a second mixer, where the side information is mixed to stereo with a polarity-reversed channel on one side. The "mid" signal is fed to both the left and right channels in-phase, via the pan pot (see **Fig. 4**). Of course, this can all happen in a single mixing console if you have enough subgroups to mix to.—*Mike Sokol*

Small, but effective



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REVIEWS

BOSS

BR-8

Boss offers guitarists true plug-and-play recording.

By Steve Broderson

Though it is the "baby" of the Roland disk-based recorder line, the Boss BR-8 is by no means an infant. This digital multitrack boasts many of the features of its older, bigger VS-series siblings, along with a few innovations that are worthy of the family name. Having used the Roland VS-840 extensively over the past two years, I can testify to its ease of setup and operation. The BR-8 offers those same qualities and more, and though it does cut some corners, it's difficult to imagine a songwriting tool that can take a writer from musical sketch to finished master in fewer steps.

Anyone can use the BR-8, but it is clearly designed for guitarists. For starters, it has a dedicated high-impedance (Hi-Z) guitar input, and if you plug an instrument into it, the currently selected track is automatically labeled "Guitr." The BR-8 also has an instantly accessible chromatic tuner, a healthy selection of Roland's COSM (Composite Object Sound Modeling) guitar amps, and multi-effects for both six-string and bass guitars. In fact, the BR-8 really blurs the line between a multi-effects processor and a portable digital studio, but please, guitarists, don't set it on the floor and push the buttons with your feet!

FIG. 1: The Boss BR-8's front panel is well designed and easy to use, with lots of buttons, knobs, and sliders for direct access to recording and editing functions.

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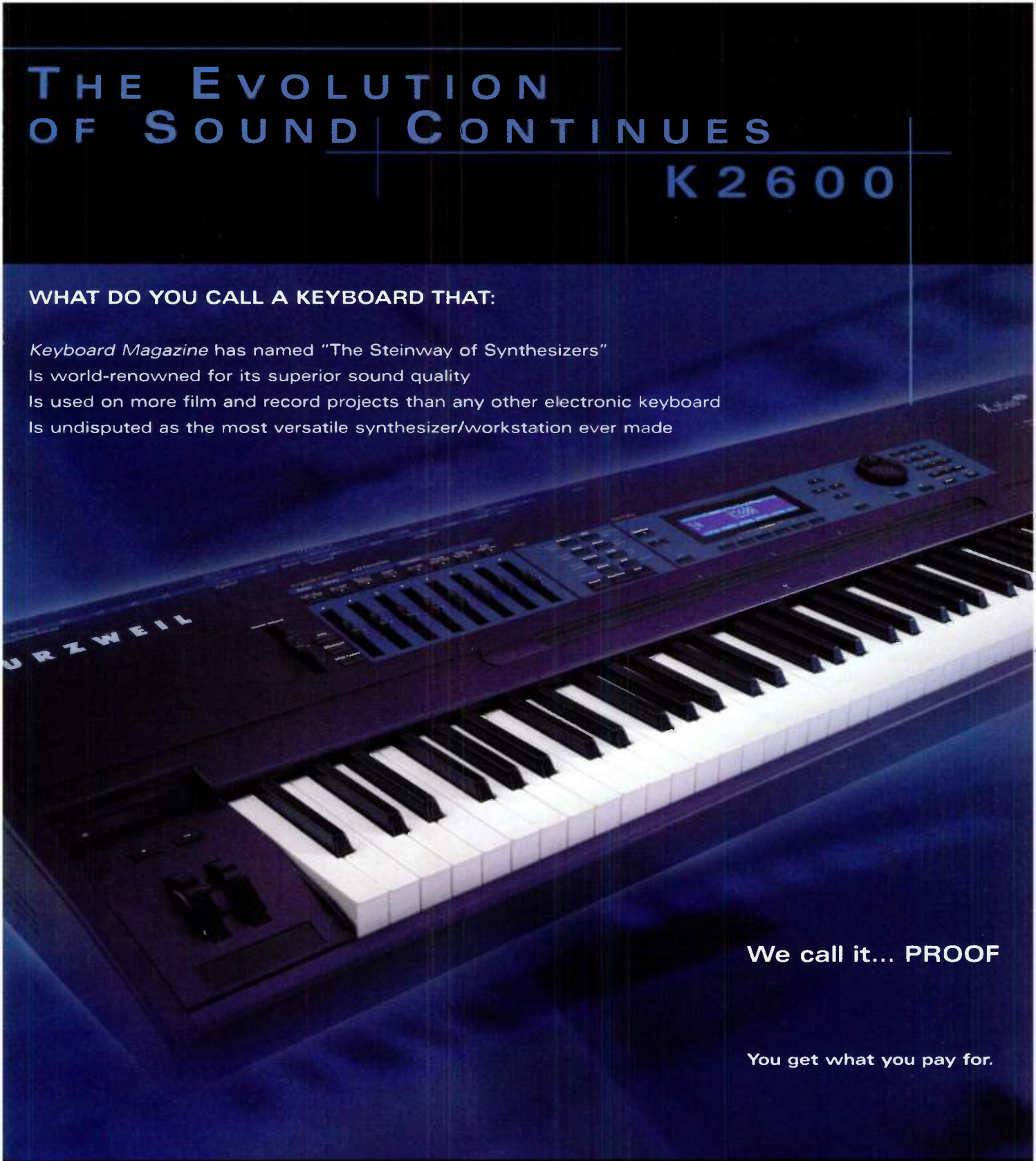

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DIAL DIRECT

Digital workstations typically boast myriad features, but accessing their user interfaces often requires paging through interminable screens and submenus. In contrast, the BR-8's main features are readily accessible with the push of a button or twist of a knob (see **Fig. 1**), and the unit even self-configures its internal signal routing in response to which input you choose. "Ease of use" appears to have been the mantra of the BR-8's designers, and its interface is both intuitive and well designed.

The backlit LCD is easy to read and presents information clearly and logically, using instrument icons to help you locate banks of dedicated effects. A large data wheel makes adjusting parameters easy, though there is no Shift button for changing parameter values in increments of 10, as on the VS units. Curiously, the BR-8 has two input level controls—one for controlling input gain and another for controlling the signal sent to the effects bus—probably because the channel faders perform the same function as track-cue knobs would during recording.

PATCH ME THROUGH

The rear panel has three ¼-inch inputs (one labeled "Guitar/Bass" and two labeled "Mic") along with a stereo pair of unbalanced RCA line inputs (see **Fig. 2**). The Mic inputs are TRS for balanced signals, but if you want to use a condenser mic, you'll have to first route the mic signal through an external mixer with phantom power.

As I've mentioned, the unit configures its internal routing according to the input you use. For example, plugging a guitar into the Guitar/Bass input takes you straight to the COSM amp-modeling effects bank. Similarly, the Mic inputs are routed to a vocal-effects bank, and the line inputs to yet a different effects bank. The input selections may seem a bit limiting at first glance, but remember that this machine was designed to help you get your songwriting ideas down quickly and efficiently, not to be on the receiving end of a multibus mixer.

Output options are pretty basic and include an optical S/PDIF digital (but no coax) stereo output, a stereo pair of unbalanced RCA analog outs, and a MIDI Out. Conspicuously absent are a computer interface (such as SCSI or USB) and a MIDI In connection. These were apparently sacrificed in the interest of convenience, low price, and ease of use. Still, when you're copying or backing up data using the unit's single 100 MB Iomega Zip drive, the disk swapping could leave you yearning for an external drive. Speaking of swapping, the BR-8 lets you reformat your songs for compatibility with Roland's entire line of VS recorders, opening the door for long-distance collaboration and interfacing with a huge installed base of VS products. Bear in mind, though, that currently you can change files from BR-8 to VS format but not the other way around.

The BR-8's internal digital mixer has gain, EQ, pan, and effects sends on each channel. I was disappointed to discover that the mixer's EQ section lacks a sweepable midrange control (although you do get sweepable mids in the Insert effects).

FRET-FRIENDLY FX

The BR-8 boasts dual effects processors, a luxury usually found only on larger, pricier units. Dual processors provide many more options than a single processor during bouncing or mixdown, and the BR-8 is currently the only unit in its price range that features them. The two effects processors handle both Insert effects (applied during tracking to one channel at a time) and Loop effects (applied to several or all channels at once, like an effects send). The processors can be used in combination, and there are even three algorithms designed for simultaneous recording and processing of guitars and vocals (one algorithm per input).

Besides the amp and cabinet COSM models, all the usual time-based effects (chorus, delay, flange, and so on) are at your fingertips, as are some passable acoustic- and bass-guitar simulators. The vocal-effects bank includes a few modeled "high-end" mic simulators (to improve the sound of a dynamic mic), a noise gate, and a de-esser.

BR-8 Specifications

Number of Tracks	(64) virtual tracks; 2-track recording; up to 8-track playback
Recording Resolution	24-bit
Sampling Rate	44.1 kHz
Frequency Response	20 Hz–20 kHz (+1/–3 dB)
Total Harmonic Distortion	≤0.15%
Maximum Recording Time (single track)	highest quality: 50 min; lowest quality: 75 min
Inputs	(1) Guitar/Bass (–10 dBm); (2) Mic (–40 dBm); (1) stereo Line (–10 dBm)
Outputs	(1) MIDI Out; (1) ¼" stereo headphone; (1) RCA stereo line; (1) optical S/PDIF
Pedal Connections	(1) ¼" footswitch; (1) ¼" expression pedal
Power Supply	9 VDC adapter
Dimensions	15.75" (W) × 3.56" (H) × 10" (D)
Weight	7.75 lbs.

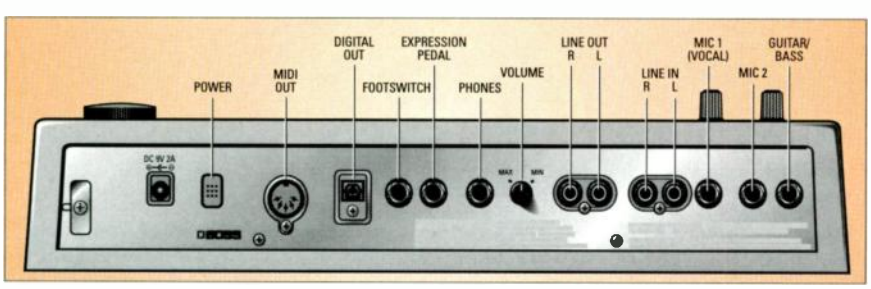

FIG. 2: The BR-8 provides guitar, microphone, and line inputs as well as analog and optical S/PDIF outputs.

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- Steinway 9' grand piano

The BR-8's effects are organized graphically, like stompbox effects. They even include icons representing the instruments for which the effects are intended, which makes it easy to see what you're changing. Unfortunately, you can't change the order of effects within the chain; for example, you can't put the compressor after the preamp. All of the effects, some of which are stereo, are processed at 24-bit resolution, and I found them to be very good generally. Some of the preset settings are a bit extreme (harsh equalizers and huge, compressed overdrives, for instance), but the shortcomings are easily remedied with a few tweaks, and all of the presets at least provide good starting points for creating custom sounds.

On the back of the BR-8 you'll find a jack for an optional expression pedal (EV-5), which can be used for controlling volume, pitch-shifting, and/or wah-wah effects. Like I said, this box loves guitars.

FAST TRACKS

The BR-8 provides 2 tracks of simultaneous recording and 8 tracks of simultaneous playback. For each of the 8 primary tracks there are 7 additional virtual tracks, yielding a total of 64 virtual tracks. The BR-8's button-click ease replaces the extensive mixer routing you have to do on similar units. Select the input, select the track, select the virtual track, and hit Record. Sure, you can fill in details such as whether you want to record the track dry or with effects, but this little box wants you to get tracking fast. The BR-8 let me record a processed guitar sound within about 15 seconds of plugging in the unit, and little inspiration can be lost in that amount of time.

Navigating a song is easy once you set a few marker points, and punch-ins can be accomplished with an optional momentary footswitch or with the Auto Punch feature, which has its own set of dedicated buttons. Setting Auto Punch in and out points is easy, and the punches are perfect (as long as you're playing in the pocket, of course).

The BR-8 also includes all the usual nonlinear editing tools. You can cut, copy, paste, move, and exchange work within and among all 64 tracks. Those tools, combined with track markers and MIDI Clock, make editing a no-brainer. If you didn't track to a click, you can still locate the beginning of a sound using Scrub. Unfortunately, the BR-8's scrubbing feature does not include a waveform display.

The single-level Undo and Redo commands let you edit without fear of a permanent goof. Many similar units offer multiple Undo layers, but the BR-8's single-level implementation means it has less data to keep up with, which improves the unit's tracking efficiency. In addition, an Optimize command throws away leftover editing and event data, which frees up space for more track time. The BR-8 uses a mild data-compression scheme to extend its recording time, and you can select from three grades of audio resolution. Up to eight sets of mixer and effects settings (Scenes) can be stored along with your song for easy recall of a mix-down or bounce.

The BR-8's track-naming capabilities really had me cheering. As you can imagine, with 64 virtual tracks it's easy to (dare I say it?) lose track of your musical bits and pieces. To help you keep them straight, the BR-8 automatically assigns track names based on the input you're recording through. The first track recorded through the Guitar/Bass input is called Guitr1-1; Mic input tracks get Mic labels. If you're sneaky and plug a synth into the Guitar/Bass input, you can go back later and edit the name of any track. This is a great feature for any recorder, and even more so on an entry-level one.

WHAT'S MORE

One of the BR-8's handiest features is its built-in rhythm generator, which

BOSS
BR-8 portable digital studio
$845

FEATURES ■■■■
AUDIO QUALITY ■■■■
EASE OF USE ■■■■
VALUE ■■■■
1 2 3 4 5

PROS: Easy to use and very guitar-friendly. Large feature set. Many dedicated front-panel controls. Dual effects processors.
CONS: No external storage options. Limited EQ and input sections.

For manufacturer information, please see Contact Sheet, p. 171.

provides 80 preset patterns to start you grooving. These patterns aren't meant to end up in your final mix, but they let you immediately track to bars and beats of MIDI Clock. What's the advantage? When your mix has to fit into 100 MB of disk space, it makes sense to keep as many instruments as possible in MIDI land. Because the BR-8 generates MIDI Time Code and MIDI Clock, you can sync a drum machine or drive sequenced tracks from a keyboard and submix them with an outboard mixer—all without using up valuable memory. The rhythm generator provides inspiration when you need it (like right now!), a groove to lock into, and the means to create a song with far more than eight tracks.

The BR-8's toolbox also includes an onboard Phrase Trainer and a Center Cancel feature. The Phrase Trainer lets you record a section from a CD or tape and then slow it to half speed while maintaining the pitch. Center Cancel removes vocals and instrumental parts placed dead center in a mix (though it's not always completely successful with every recording).

▼

The BR-8 can do just about everything but restring your Strat.

Finally, when you power down you don't instantly lose all your data (as you do with most other all-in-one workstations). The BR-8 first prompts you to save your work. The disk drive then spins down, ejects the Zip disk, and shuts off.

IT'S A TAKE

The BR-8 was designed to be a self-contained idea machine that, if used efficiently, could take songs from scratch tracks to a finished production with a minimum of hassle. In fact, if you write and compose on a guitar, the BR-8 can do just about everything but restring your Strat. What with its built-in rhythm generator, bass simulator, and other effects, a musician armed only with a BR-8 and an electric guitar could easily produce the basic tracks for a demo.

The BR-8 is the best value among the current crop of entry-level digital multitrack recorders, and it will serve you well as long as you're willing to be flexible and live with a few restrictions. For example, its inability to record more than two tracks simultaneously may make it unsuitable for recording a full band's demo.

The Zip disk's 100 MB capacity is also an issue, but being in the midst of my fourth full-length CD produced on a Zip-equipped VS-840, I can testify that the obstacle is easily overcome. The key to success with the BR-8 is taking advantage of the onboard editing tools and MIDI sync capabilities. The 100 MB ceiling might even be a benefit, because it forces you to plan ahead, tighten up your songs, and make more focused arrangements. In other words, use the BR-8 wisely, and you may never want to roll tape again.

Steve Broderson *writes for a Lexington, Kentucky, advertising agency. He has written and produced original music with home recording gear for 14 years.*

M AUDIO

DELTA 1010

Flexible, high-quality 24/96 audio recording, mixing, and routing.

By Allan Metts

Midiman's new M Audio division was created to focus solely on digital recording products for Macs and PCs. The Delta 1010 audio interface, the division's current flagship product, is a fine way to kick things off.

The Delta 1010 consists of a PCI card and a 1-rackspace breakout box with ten discrete channels of 24-bit, 96 kHz audio I/O. The system also provides one MIDI In and one MIDI Out port, word-clock I/O, and comprehensive mixing, monitoring, and routing capabilities.

PLUG IT IN

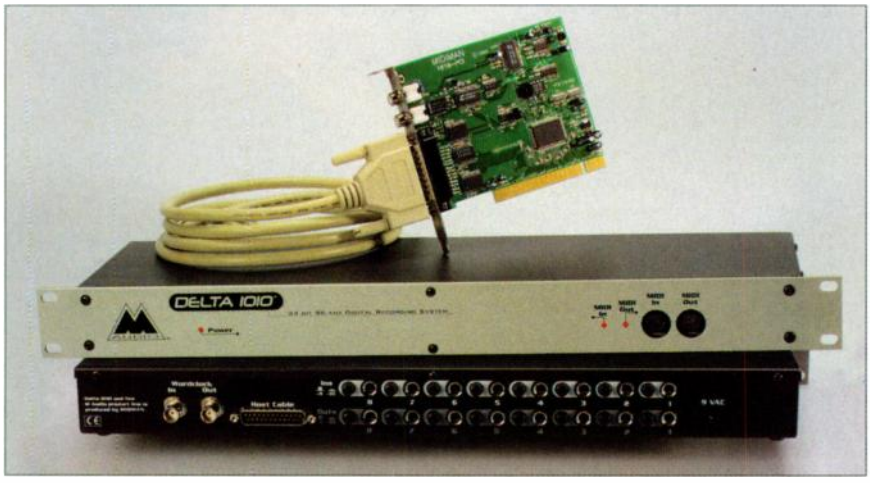
One of the first things I noticed about the Delta 1010 was its extensive driver support. I prefer a Windows NT environment and was happy to see that my OS of choice is supported, as is Windows 2000. If you use Windows 95 or 98, the Delta 1010 supports DirectX, ASIO 1, ASIO 2, EASI, and GigaSampler drivers. Macintosh users get support for the Apple Sound Manager, ASIO 1, and ASIO 2 (the EASI driver for the Mac was in beta testing at press time).

You can also use the Delta 1010 under Linux; drivers can be downloaded from 4Front Technologies (www.opensound.com) and the Alsa Project (www.alsa-project.org). A limited-time download of the 4Front Open Sound System (OSS) driver is free, but you'll need to pay a $40 licensing fee for a permanent version. There is no charge for the Alsa driver.

I popped the Delta 1010 card into a spare PCI slot and had no trouble installing the appropriate drivers. My PC also contains a LynxStudio Lynx-One card, and the two products coexisted beautifully, with no compatibility problems. If you have enough spare PCI slots, as many as four Delta cards can be installed into the same computer.

The PCI card includes stereo S/PDIF input and output on RCA connectors. A DB-25 connector accommodates the cable to the rack unit; everything else is on the breakout box. This is a nice arrangement because it keeps all the DACs, and therefore the analog audio, well away from the electromagnetic and grounding nightmare inside your computer. It also reduces the number of cables that leave your equipment rack.

Speaking of cables, the Delta 1010's 6-foot DB-25 cable wasn't long enough to reach from my computer to my preferred rack location, so I connected a cheap DB-25 extension cable to the stock cable, and it worked fine. (M Audio now ships the Delta with a 10-foot cable—the officially recommended maximum length—but has successfully tested the system with 12-foot cables.)



The rack-mount breakout box for M Audio's Delta 1010 contains all the converters and the TRS analog I/O jacks, as well as the word-clock and MIDI ports and the MIDI activity indicators. The audio ports are in the rear; the MIDI ports are, oddly, in the front. S/PDIF I/O is provided on the PCI card (top), which connects to the box via a standard DB-25 cable.

RACK OF AGES

The Delta 1010's rack unit houses all the A/D and D/A converters and provides the I/O connectors for analog audio, MIDI, and word clock. The front of the unit is rather spartan, providing only MIDI In, MIDI Out, MIDI activity indicators (for both input and output), and a power indicator.

The action is on the back of the unit, which sports eight analog inputs and eight analog outputs, all on ¼-inch tip/ring/sleeve connectors. Each input and output has a button switch next to it that lets you configure the connector for either +4 dBm or –10 dBV signal levels. I really like the ability to establish the signal level for each connector, and the back-panel switches are great for "set and forget" installations. However, I wired the Delta 1010 into a patch bay, so I didn't always know what I'd be connecting the unit to. In such a situation, software control over the setting would be much more convenient.

Rounding out the rack unit's back panel are BNC connectors for word-clock I/O, a DB-25 connector for the computer cable, and a power connector for a lump-in-the-line transformer. All in all, the Delta box is laid out in a logical fashion. I could make arguments for moving the MIDI I/O to the back and putting one or two channels of audio I/O at the front. I also would prefer a built-in power supply. But these features would most likely have led to a higher price for the system.

SOFT GOODS

When you install the Delta 1010 software, you get a new applet in your Windows Control Panel folder, *Delta Control Panel*. I immediately set up a more convenient shortcut to this program, because I knew I'd be accessing it often. Launching the program brings up *Delta Control Panel*, with several pages of controls. If you install multiple Delta cards, they will all share the same Control Panel; a set of radio buttons within the applet lets you choose between the cards.

The Delta 1010 comes with a built-in digital Monitor Mixer that can mix up to ten stereo sources (five playing from disk, plus ten hardware inputs configured as stereo pairs). Each source gets its own fader group on the

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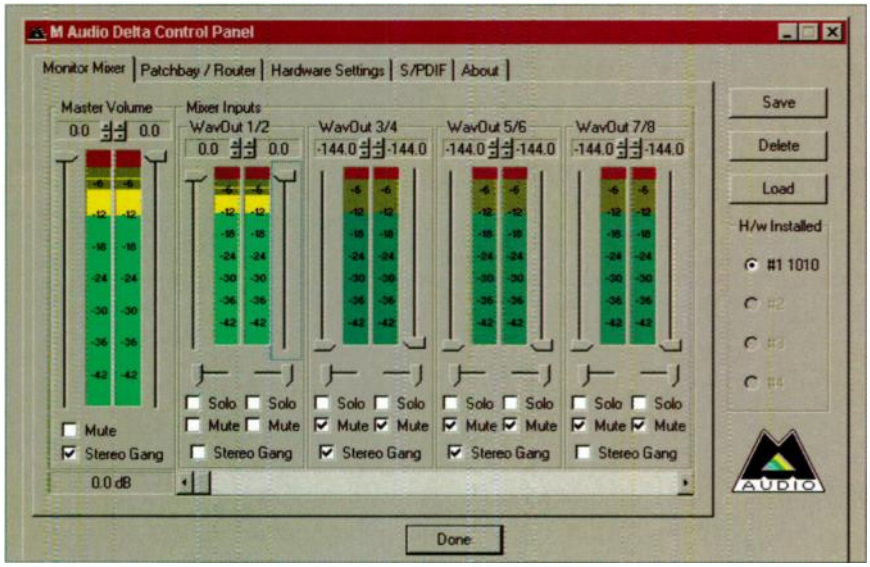

FIG. 1: *Delta Control Panel*'s onscreen controls allow you to mix live audio appearing at the hardware inputs with tracks played back from disk.

Monitor Mixer page of the Control Panel (see **Fig. 1**). The inputs from disk are labeled "WavOut 1/2," "WavOut S/PDIF," and so forth, matching the names of the outputs you can choose in your audio-recording program.

Each fader group includes level and pan controls for both the left and right channels. *Two* pan controls? You read correctly. With two pan controls, you can send the right input channel to the left channel on the master bus, and vice versa. For most stereo mixing, you'll keep the left channel panned left and the right channel panned right.

The left and right level controls can be ganged together and operated as one. But if you do this, both controls must occupy the same position, which means you can't set one fader 3 dB below the other and have them maintain that relationship as you move them. Numerical displays indicate the fader position, and handy little up/down buttons are for fine-tuning.

Separate mute and solo controls are provided for the left and right channels of each input. Tricolored virtual peak/level meters indicate the signal at each source to round out the fader-group features. Unfortunately, the Delta doesn't come with a persistent indicator to show a digital-overload condition. The Master fader group lacks solo and pan controls but is otherwise just like the Input fader groups.

Overall, I found the Monitor Mixer to be useful and intuitive. However, the *Delta Control Panel* window isn't resizable, and only four Input fader groups are visible at a time. (You access the others by moving a scrollbar at the bottom of the window.) I have a 19-inch monitor and would welcome the ability to see all of the faders and meters on the same screen.

VIRTUAL PATCHING

Let's say you're mixing signals to a Master fader group; where does the output of this Master go? The Control Panel's Patchbay/Router page lets you choose one stereo input source for each stereo output (see **Fig. 2**). The analog inputs and outputs are all grouped into stereo pairs—1 and 2, 3 and 4, and so forth—so you can't choose one source for analog output 7 and a different one for output 8.

Each output can internally connect directly to any hardware input (bypassing the Monitor Mixer and any audio programs you may be using). This opens up some interesting possibilities. Need an extra A/D converter? Just connect the S/PDIF output to a pair of analog inputs. Or do it in reverse for a D/A converter. How about a five-way stereo signal splitter-merger? Simply connect all five stereo outputs to the same stereo input. You can even reverse the left and right channels of the S/PDIF input.

The Delta allows you to connect each output to a playback signal from your audio program (again, these are called WavOuts in the Control Panel). In this case, you can't choose just any WavOut for any output; WavOut 1/2 is only for hardware outputs 1 and 2, WavOut S/PDIF is only for the S/PDIF output, and so forth. This scheme makes some sense: you have the ability to choose your output destination in your audio program, and it could be very confusing if WavOut 5/6 were being

Delta 1010 Specifications

Analog Inputs	(8) balanced ¼" TRS
Analog Outputs	(8) balanced ¼" TRS
Digital I/O	(1 pr.) RCA stereo S/PDIF (on PCI card)
Sampling Rates	8 to 96 kHz
Sampling Resolution	8 to 24 bits
Sync Ports	(1 pr.) BNC word-clock I/O; can also sync to S/PDIF
Other Ports	MIDI In, Out; DB-25 connect to breakout box
Indicators	MIDI activity LEDs
Drivers Supported	Windows 95/98/NT/2000: DirectX, ASIO 1, ASIO 2, GigaSampler, EASI; Mac: Sound Manager, ASIO 1, ASIO 2 (EASI driver in beta); Linux: third-party drivers
Bundled Software	*Delta Control Panel*
Operating Level	+4 dBm or –10 dBV (individually switchable per analog I/O port)
Dynamic Range	D/A: 108 dB; A/D: 109 dB
THD (@ 0 dBFS)	D/A: <0.0015%; A/D: <0.001%
Power Supply	9 VAC lump-in-the-line external
Dimensions	1U × 5.25" (D)
Weight	4.62 lbs.

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rerouted to hardware outputs 3 and 4.

To mix all of the available Delta 1010 audio channels with an external audio mixer, you connect each hardware output to its corresponding WavOut source and run all the cables to your mixer. Alternatively, you can mix down with the Monitor Mixer. Analog outputs 1 and 2 have the Monitor Mixer as an available source that can be connected on the Patchbay/Router page. The S/PDIF output can be connected in the same way, which is useful for connecting to a DAT or other mastering deck. I would prefer that analog outputs 3 to 8 also allow connections to the Monitor Mixer. Although I don't really need such a capability, not allowing these connections seems like an unnecessary restriction.

LIFE IN THE DELTA

When the Patchbay/Router page and Monitor Mixer are used together, the Delta 1010 offers tremendous flexibility. Working with the system, I realized I could use it without an external mixer in a small studio. To put this theory to the test, I set up some typical recording scenarios without a hardware mixer.

Actually, the first scenario didn't involve any recording—I call it the "just sit down and play" scenario. Most sound cards fail this test. Sometimes I don't want to fire up my audio program and configure tracks for recording; I just want to play a keyboard and hear the music I'm making. Creating this simple setup was easy in *Delta Control Panel:* I just routed the output of the Monitor Mixer to the set of outputs that connects to my studio monitors. I could even have bypassed the Monitor Mixer altogether had I used only one pair of the Delta 1010 inputs.

The second scenario was another common one. For this, I wanted to record ten tracks simultaneously and then mix it all down. For tracking, I created ten tracks in my audio program and assigned each of them to a Delta 1010 input. I monitored the tracks by connecting my studio monitors to analog outputs 1 and 2 on the Delta 1010 and then assigning the Monitor Mixer to these outputs. Only one stereo mix is available at a time, however—so if you're tracking a band, no one can have a separate custom mix.

For mixdown, I assigned the tracks in my audio program to the five stereo WavOut devices and connected my mixdown deck to the S/PDIF output on the Delta 1010. The studio monitors were still patched to analog outputs 1 and 2. I connected both sets of outputs to the Monitor Mixer feed in *Delta Control Panel* and performed the mixdown—albeit clumsily, because the Monitor Mixer doesn't support any automation or external hardware controllers. Too bad.

Scenario 3 was a little more complex. Here I wanted to record audio tracks while listening to a mix that contained previously recorded audio as well as what I was currently playing. This scenario also was not difficult to set up. I simply assigned my audio program to the inputs I wanted for recording, and I played the previously recorded audio to the WavOut devices. Because the Monitor Mixer can mix signals from the WavOuts and hardware inputs simultaneously, I was all set.

Scenario 4 was just like the third one, except I wanted to patch in an external effects processor for the audio I was recording. No problem. I routed my source directly to a set of outputs that went to the effects processor, bypassing the Monitor Mixer. With this configuration, I couldn't share the effects unit with any other inputs, but I did have access to both the wet and dry signals within my audio program.

M AUDIO
Delta 1010 audio interface
$1,000

FEATURES ■■■■
AUDIO QUALITY ■■■■■
EASE OF USE ■■■■■
VALUE ■■■■
1 2 3 4 5

PROS: Offers 24-bit, 96 kHz operation; balanced I/O; comprehensive driver support; and powerful built-in mixing and routing capabilities. Outputs can be routed internally to inputs. Sound quality is excellent.
CONS: *Delta Control Panel* is a fixed-size window. No automation or external controller support. Connector and trim-switch placement is inconvenient for some applications. Ganged L/R faders must have identical values.

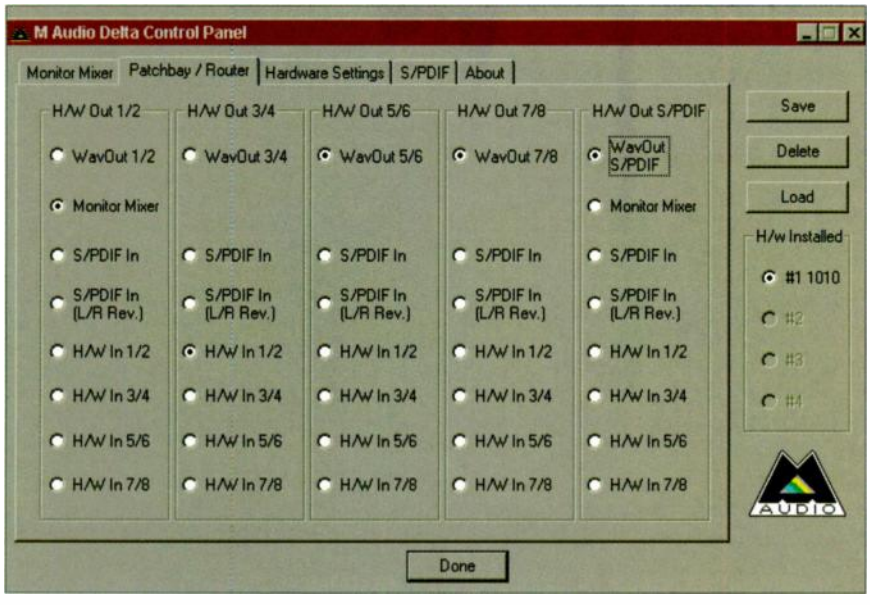


FIG. 2: The Delta 1010 provides extensive signal-routing capabilities that can be configured in *Delta Control Panel.*

THE KITCHEN SYNC

The Delta 1010 can act as its own synchronization source, or it can slave to incoming word-clock or S/PDIF signals. An indicator on the Hardware Settings page in *Delta Control Panel* tells you when you have successfully locked to an incoming sync source. The system supports sampling rates as low as 8 kHz and as high as 96 kHz. Unless you're synching to an external source, you'll typically choose a sampling rate in your audio program, but you

For manufacturer information, please see Contact Sheet, p. 171.

can also select it in the Control Panel.

Because the chosen sampling rate affects the fidelity of the Delta 1010 mixer, you might want to take advantage of two additional checkboxes. The first, Rate Locked, prevents an external audio program from changing the sampling rate to anything other than what is selected in *Delta Control Panel*. The other checkbox, Reset Rate When Idle, allows an external program to change the sampling rate; however, the rate snaps back to the Control Panel setting whenever the Delta 1010 isn't being used. This is handy for keeping the mixer running at a high-fidelity setting while still allowing lower-fidelity recording when the need arises.

Besides the sampling rate, you have control over the DMA buffer sizes the system uses. (There are separate settings for WAV and ASIO audio.) You can also tell the Delta 1010 to synchronize the start of playback and recording across all audio channels.

You have a choice between two digital interface formats: "consumer" (true S/PDIF) and "professional," which is actually an AES/EBU data stream over S/PDIF electrical connections. You also have control over the SCMS copy-protection bits and signal preemphasis.

DELTA FORCE

If you haven't figured it out by now, the Delta 1010 provides a treasure trove of audio routing, mixing, and recording features. You can even save entire sets of *Delta Control Panel* settings to disk and restore them whenever you like. With this capability, you can set up the Patchbay/Router and Monitor Mixer just right for tracking, then switch to a mixdown configuration with a few mouse clicks.

The product's documentation is clear and complete. You get a nice printed manual that thoroughly describes both hardware and software and provides details on several typical configurations. (Electronic versions of the manual are available on the Midiman Web site.) *Delta Control Panel* has no online help, but I didn't need it.

While we're on the subject of things that are clear and complete, the audio quality of the Delta 1010 is very good indeed. The sound is clear as a bell, and I found no nasty digital artifacts during my tests. For a system in this price range, that's impressive.

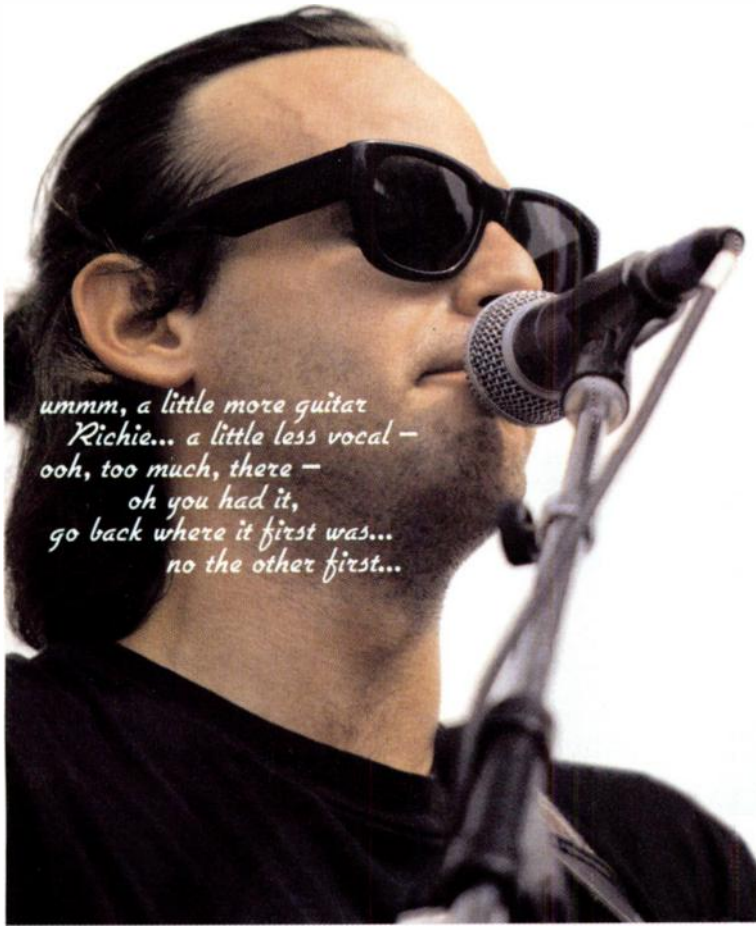
Delta 1010
Minimum System Requirements

Mac: G3; 64 MB RAM; Mac OS 8.6 (MIDI port requires OMS 2.3.7)

PC: Pentium/300 MMX (Pentium II/350 for 96 kHz operation); 64 MB RAM (128 MB for 96 kHz operation); Windows 95/98/NT/2000; UDMA EIDE or SCSI hard drive

The Delta 1010 is a great product at a fair price. You can pay less for similar products, but you'll probably have to give up some of the features the Delta provides. If you have a need for ten channels of audio I/O, extensive routing capabilities, and a nice digital mixer—and who doesn't?—give the Delta 1010 a good, hard look.

Allan Metts *is an Atlanta-based musician, software/systems designer, and consultant.*



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K O R G

MS2000R

Korg's new analog-modeling synth is a techno dream come true.

By Geary Yelton

Synthesizers that digitally model analog synthesis are nothing new. Instruments such as the Yamaha AN1X, Roland JP-8080, Nord Lead, and Access Virus have made analog modeling almost commonplace in the electronic-music studio. Korg synthesizers such as the Prophecy and Z1 have been capable of emulating analog synths for years, but the MS2000 ($1,100) is Korg's first instrument to model analog synthesis exclusively.

The MS2000 is a 4-voice instrument with a 16-step sequencer, arpeggiator, and 16-band vocoder. It can play up to two timbres simultaneously, either split or layered. It stores 128 programs in eight banks of 16 sounds each. All the memory locations are user-programmable, so you can replace all the factory programs with your own original programs.

The MS2000 includes a 44-note keyboard, whereas the MS2000R is 4U rack-mount; both feature a distinctive metallic aqua-blue front panel. For this review, I spent a month with the MS2000R. With the exception of a keyboard, the two units are virtually identical. The only other significant difference is a Keyboard button on the MS2000R, which lets you play the row of 16 Select keys as if they were a keyboard with fixed Velocity.

A primary idea behind the MS2000 is a modernization of three classic analog devices rolled into one. It's touted as the reincarnation of the MS-20, Korg's diminutive analog synth introduced in 1978, combined with the Korg VC-10 vocoder and SQ10 analog sequencer. These three items are still in demand among the retro-techno crowd, and Korg hopes to capture part of that market with the new offering. Unlike many instruments marketed for dance music production, the MS2000 is a well-rounded, versatile virtual analog synth for almost any electronic musician.

KORG
MS2000R analog-modeling synthesizer
$799

FEATURES ■■■■
EASE OF USE ■■■
QUALITY OF SOUNDS ■■■■■
VALUE ■■■■
1 2 3 4 5

PROS: Compact, solid construction. Lots of real-time control. Reasonably priced.
CONS: Limited polyphony. Keyboard version has no keyboard Aftertouch. Sketchy documentation.

GETTING AROUND

Thanks to a wealth of front-panel controls, the MS2000R's user interface is superb. A total of 49 buttons and 35 knobs gives you plenty of real-time control to reach out and grab the sound. A backlit yellow-green LCD shows 32 alphanumeric characters, and a multitude of red LEDs indicates the status of various buttons.

Finding your way around is a breeze. The panel is divided into functional sections, much like a vintage analog synth. These sections include Audio In, Oscillator 1 and 2, LFO 1 and 2, Mixer, Filter, Amp, Arpeggiator, Portamento, Effects, and so on. For the most part, the buttons and knobs provide an abundance of visual feedback.

There are two primary modes in addition to Global mode. Performing is done in Program Play mode, and you can edit most sound parameters on the fly. As with traditional analog synthesizers, changing sounds in this manner is part of the performance. In LCD Edit mode, the LCD displays the value of the parameter being tweaked whenever you turn a knob anywhere on the panel. It also displays a series of edit pages that you step through with the Page buttons or select directly with the Select keys. Of course, Global mode lets you adjust tuning, assign pedals, and perform various utility functions.

PATCHING THINGS UP

The signal flow within the MS2000 is pretty straightforward (see **Fig. 1**). Both oscillators generate basic synthesizer waveforms, including sawtooth, pulse, and triangle, and the shape of these waveforms can be altered manually or by any of the available modulators. Oscillator 1 also offers a sine wave, which can be used as the carrier and be cross-modulated by the sawtooth, pulse, or triangle wave from oscillator 2. Both ring modulation and phase sync are possible by applying oscillator 2 to oscillator 1. These effects can be combined using a technique called RingSync, which yields some pretty interesting results.

In addition to the basic waveforms, oscillator 1 provides a Vox wave that resembles a human voice, 64 different DWGS waves (which I'll explain in a moment), and noise. Unlike a sampled voice, the Vox wave maintains its formant structure as it changes pitch. Its harmonic content can be altered manually or be modulated by applying an

The Korg MS2000R (shown here) and MS2000 digitally model the behavior of analog synthesizers and provide lots of knobs and buttons, just like an analog synth.

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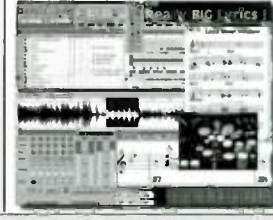

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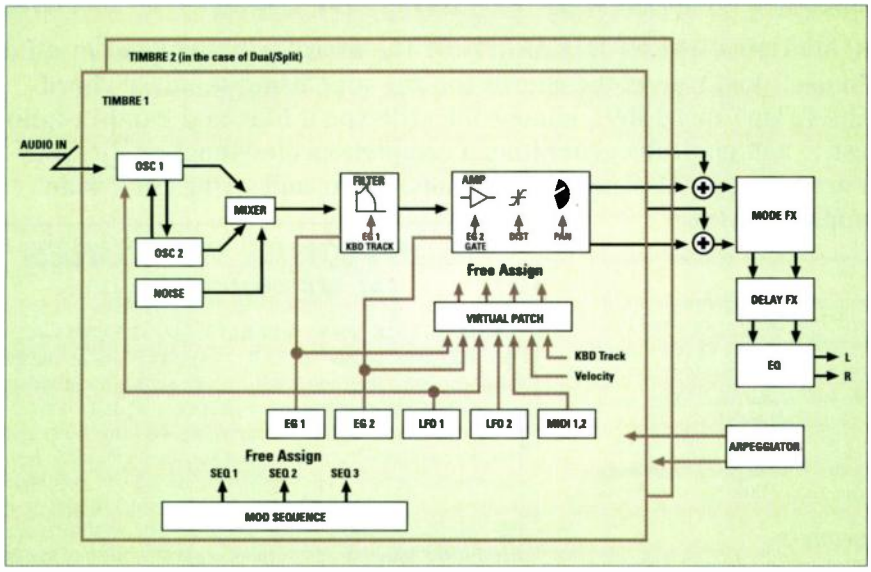

FIG. 1: The signal path is straightforward and highly reminiscent of analog synths of yore.

LFO or any other modulator. Going a bit beyond traditional analog synthesis, the DWGS (Digital Waveform Generation System) waves are single-cycle PCM wavetables. These waves are a carry-over from the DW-6000 and 8000, which Korg made in the early '80s. DWGS waves can be stepped through manually by turning a knob or be wave-sequenced with the Mod Sequencer.

The other sound source is a pair of Audio In jacks. One accepts line-level signals, and the other can be switched to accept either line-level or mic-level signals. This means you can use the MS2000 to process other instruments or audio recordings. Audio In also provides a source for the vocoder's carrier and modulator signals.

Like many synthesizers, the MS2000 has two envelope generators, which are both of the ADSR variety. EG1 is normally routed to the filter, and EG2 shapes the amplitude. However, both EGs can be disassociated from their default assignments, and they can also be routed to modulate other parameters.

There are two types of resonant lowpass filter with slopes of 12 and 24 dB/octave to simulate the most popular analog filters, as well as 12 dB/octave resonant bandpass and highpass filters. In addition, the resonance can be cranked up to self-oscillation. Filter cutoff can be modulated by EG1, Velocity, keyboard tracking, and any other modulation source. The envelope can be applied with positive or negative polarity, effectively raising or lowering the cutoff frequency. Keyboard tracking also tracks notes played by the Mod Sequencer.

Two LFOs can each generate one of four waveforms, including sample & hold. The LFOs can be synchronized to the internal clock, which also controls sequencer tempo, or an external MIDI source. The phase of the LFOs can be synched to the onset of each note, phrase, or MIDI Clock. If LFO frequency is controlled by clock tempo, it can cycle once or twice every beat or every four beats.

Where other synthesizers have matrix modulation, the MS2000 has something called Virtual Patch. This is simply a means of routing modulation sources to modulation destinations. A list of eight sources, including envelopes, LFOs, and Velocity, can be routed to eight destinations, including pitch, filter cutoff, and LFO frequency. This list is silk-screened on the front panel, and LEDs indicate the selected items. Four knobs are dedicated to setting modulation depth in the Virtual Patch section. Turning a knob instantly lights the LEDs to show you its associated modulation routing, and all Virtual Patch settings can be stored in a Program.

There are two effects processors—modulation and delay—followed by a 2-band EQ. Modulation algorithms include chorus/flange, phaser, and ensemble. You can specify the modulation LFO speed and depth or feedback, depending on which effect is selected.

The MS2000 offers three types of delay. Of course, there's a simple stereo delay. In the CrossDelay algorithm, the right and left feedback paths are swapped (see **Fig. 2a**), and in the L/R Delay algorithm, the delayed sound is output to the left and right alternately (see **Fig. 2b**). Delay time can be synchronized to MIDI Clock, and the depth can be varied for more or fewer repetitions. Reverb is conspicuously absent, but I didn't miss it.

UP, DOWN, AND AROUND

For any instrument that hopes to make a dent in techno music, an arpeggiator is practically essential. The MS2000's onboard arpeggiator is pretty basic—the patterns are straightforward, and there are no user-programmable patterns. Arpeggiator settings can be saved as part of any program, and a pattern can be applied to either or both timbres in Split or Dual (layer) mode.

There are six arpeggio types: up, down, random, trigger, and two alternating patterns. Alt 1 goes from the bottom note to the top note in a chord and back down again. Alt 2 does the same, but it repeats the notes at the top and bottom before changing direction. The Trigger pattern plays up to four notes in a chord simultaneously and repeatedly, all triggered by the clock.

The Arpeggiator section sports two knobs. One controls tempo and has an LED that flashes in time with the clock. The other is Gate, which adjusts the length of each note. A Latch button determines whether an arpeggio keeps playing when keys are released,

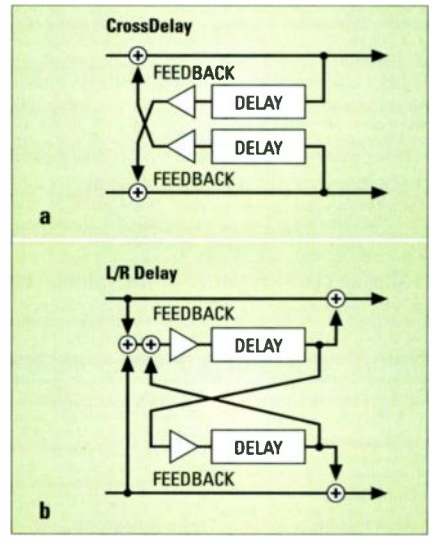

FIG. 2: The CrossDelay algorithm swaps the right and left feedback paths (a), while the L/R Delay effect bounces the delayed signal between the right and left outputs (b).

For manufacturer information, please see Contact Sheet, p. 171.

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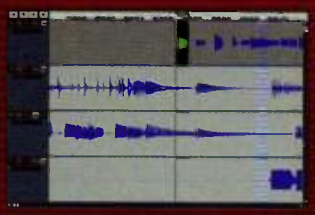

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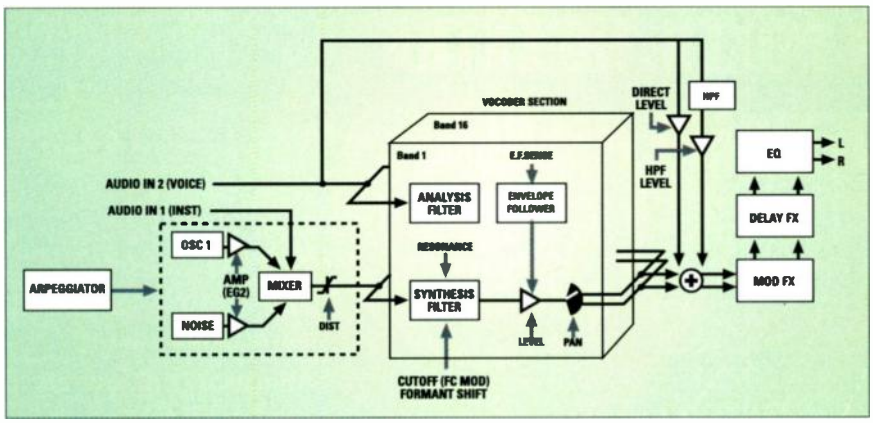


FIG. 3: The vocoder section applies the harmonic characteristics of a synth program or other instrumental sound to the signal from Audio In 2, which is typically a voice.

and a Range button determines the pitch range of the arpeggio from one to four octaves.

In Program Play mode, you can't tell at a glance what type of arpeggio you've selected or what its range is. Fortunately, you can display these parameters in LCD Edit mode, even while playing the instrument and running the arpeggiator.

STEP IN TIME

The 16-step Mod Sequencer is one of the coolest features of the MS2000. It's very reminiscent of analog sequencers from the 1970s, but with several enhancements made possible by digital technology. Each program can include one 3-track sequence, which can play forward, in reverse, or alternately forward and reverse, and it can play only once or loop continuously. Korg refers to the three tracks as Sequence 1, 2, and 3, and each one controls a different parameter that is selected from a list of 30. These include all the parameters you can control in real time using the front-panel knobs, as well as pitch and step length.

When the Sequence Edit button is pressed, each of the 16 knobs and buttons at the bottom of the front panel represents one step in the sequence; turning a knob changes the selected parameter for the associated step. For most applications, one track controls the pitch to play a short melody. This is useful for repeating riffs or ostinato bass parts. Playing a note on the keyboard transposes the pitch of the entire sequence as it plays, and holding down several notes triggers several parallel sequences that are identical but transposed. You can use another track to establish a fixed interval between the two oscillators, making it possible to play a harmonic line along with the melody. Normally, each step is equal in duration, but it's possible to play notes of varying duration by letting one track control step length.

If oscillator 1 is playing DWGS waves, one track can play a different waveform at each step. With this technique, each note played on the keyboard can quickly step through a series of up to 16 different waveforms. This is true wave sequencing.

There are dozens of other possibilities. By controlling noise level, one track can play noise-based percussion to accompany the pitch track's melody. Assigning another track to control filter cutoff can produce more complex percussive sounds. By assigning the pan-pot parameter to a track, you have precise control over the panning of each note. As you can imagine, creative applications are plentiful. I only wish there were more than three tracks per sequence, but I'm not complaining.

Unfortunately, turning knobs is the only method for entering data into the Mod Sequencer. For pitch, this is a little clumsy because the knob's range spans four octaves. Specifying the pitch from a keyboard isn't possible with the MS2000. As a result, entering pitch data is much slower than it would be if you could simply play the notes you want each step to play.

However, you can record front-panel knob movements in real time using a technique called Motion Rec. For example, if you press the Mod Sequence Record button, trigger the sequence, and then turn the filter-cutoff knob, the knob's position is recorded into each step as it plays. The actual knob movement isn't recorded, but its value at the moment each step begins is entered.

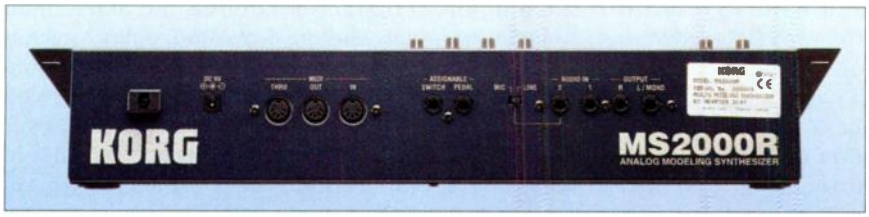
SINGING SYNTH

In addition to playing Programs, the MS2000 provides a Vocoder mode that lets you modify the sound of the synth and/or an external sound source connected to audio in 1 with external signals from a microphone or other sound source connected to audio in 2 (see **Fig. 3**). This produces the popular effect of making the synthesizer talk or sing. The sound that's modified is called the *carrier*, and the modifying sound is called the *modulator*.

The vocoder sends the modulator through a bank of 16 bandpass filters;

MS2000R and MS2000 Specifications

Audio Outputs	(2) ¼" TS
Audio Inputs	(2) ¼" TS
Additional Ports	MIDI In, Out, Thru; ¼" footswitch jack; ¼" footpedal jack; ¼" stereo headphone jack
Polyphony	4 voices
Multitimbral Parts	2
Sound Engine	analog-synthesis modeling
Keyboard	44-note, Velocity-sensitive (MS2000)
ROM/User RAM Programs	0/128
Removable Storage	none
Sequencer	3-track, 16-step
Effects	(7) chorus/flanging, phasing, ensemble, delay, CrossDelay, L/R Delay, 2-band EQ
Dimensions	MS2000: 28.8" (W) × 5.8" (H) × 14.5" (D) MS2000R: 18.8" (W) × 3.4" (H) × 9.1" (D)
Weight	MS2000: 15.6 lbs MS2000R: 6.2 lbs



On the back panel, the MS2000 and MS2000R include MIDI In, Out, and Thru ports; one footswitch input; one continuous foot-controller input; two audio inputs (one that accepts line-level signals and one that can be switched between mic- and line-level); and two audio outputs.

the entire bank is called the *analysis filter*. An envelope follower responds to changes in loudness within each band and controls another bank of 16 bandpass filters; this bank is called the *synthesis filter*. The carrier signal is routed through the synthesis filter, which imparts the modulator's characteristics onto the carrier.

The center frequencies of the 16 bands in the synthesis filter can be shifted manually or under the control of any modulation source to alter the sound of the vocoder, and you can specify the amount of resonance for these filters. There are also four preset formant shapes that interact with the center frequencies to further modify the sound. In addition, you can "remix" the levels of all 16 bands to emphasize different frequency ranges. If the modulator signal is rhythmic, such as a signal from a drum machine, the carrier signal plays rhythmically, because the vocoder responds to changes in loudness as well as timbre.

The MS2000's vocoder can be used to modify external sounds, not just sounds from the synth itself. For example, if you play a sample of a string ensemble into audio in 1 and talk into a mic connected to audio in 2, you should theoretically hear the sound of a choir of strings. When I tried this, I could tell the mic was shaping the strings, but it took a lot of tweaking to find the right combination of parameter settings to achieve satisfactory results. Once I found the right combination, processing other sounds took much less time.

BETTER SOUND

So how's it sound? Fat! Some might even say "phat." Pardon my blasphemy, but I'm starting to prefer the sound of virtual analog over real analog synthesizers. To my ears, the MS2000 sounds much better than the original MS-20. The resonant filters are thicker and juicier, and the extra waveforms give the MS2000 an added dimension of timbral complexity compared with a real analog synth.

The factory programs provide so much variety that it's easy to forget there are only 128 of them. The majority of sounds are slanted toward techno music, but there are plenty of shimmering new-age tones along with various bread-and-butter analog timbres. Great pads, sweeps, and sound effects are in ample supply, and there are a few very nice vocal sounds, too. There are six vocoder programs, ranging from a synthesized choir to the voice of the devil.

Emulations of traditional instruments are in short supply, but that's to be expected in a synth like this. There are a few electric pianos and Hammond organs. For synth bass, look no further—these are some of the best I've ever heard. And don't forget that you aren't stuck with any of these programs. If you don't like something, replace it with something else.

ANALOG HEAVEN

Korg has another winner on its hands. The sound is great, and the real-time control is even greater. There's not much to dislike about the MS2000 and MS2000R. It would be better if it had more polyphony. Four voices are barely enough, but this instrument makes a mighty big sound as it is.

If you need a vocoder in your rig, this one should do nicely. If you're looking for a new approach to creating melodies, you might like using the Mod Sequencer. If you're trying to re-create sequencer music from days gone by, you might just love it. However, I wish it would let you enter notes in some way other than turning knobs. Still, its faults are few and its pluses are many. The MS2000 and MS2000R should make a welcome addition to just about any electronic-music production arsenal.

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CUBASIS VST 1.0 (WIN)

An entry-level music-production suite that packs a professional punch.

By Zack Price

Most entry-level music software lacks a significant number of features compared with top-of-the-line products, but occasionally you will find a "beginner's" program that is both inexpensive and surprisingly powerful. Steinberg's *Cubasis VST* bundle, which is based on the highly successful *Cubase VST* (see the review in the April 1999 issue of **EM**), is such a product. In fact, it is the most powerful inexpensive music-production program currently available.

As you might expect, *Cubasis VST* doesn't have all the MIDI features of its professional counterpart, but the two programs share a surprising number of features, such as Virtual Instruments and both VST and DirectX plug-in support. *Cubasis VST* even includes two options not packaged with *Cubase VST:* a stereo audio–editing program *(WaveLab Lite)* and a CD-burning application *(Master Unit;* see **Fig. 1***)*. Together the three programs make *Cubasis VST* a potent package for beginners and musicians on a tight budget.

GET THE BALL ROLLING

Installing *Cubasis VST* is simplicity itself. Just insert the CD-ROM and click on Install in the startup window. The CD-ROM first offers to load Adobe *Acrobat Reader* 4.0 for viewing the accompanying instruction files. (Earlier versions of *Acrobat Reader* should be removed first.) Next you can choose to load any or all of the three programs. Naturally you'll want to install *Cubasis VST*. However, you might not want to install *WaveLab Lite* if you already have a digital audio–editing program. *Master Unit* supports only SCSI-based CD-R drives, but you might find the software useful even if you don't have a device of this type (more details later).

Before you start *Cubasis VST* for the first time, you need to set up your system's MIDI I/O devices. For this particular task, don't launch *Cubasis VST* from the desktop. Instead, go to the Programs section of the Start menu and find the *Setup MME* utility, which is installed along with *Cubasis VST*. Running *Setup MME* opens a dialog box that lists all the MIDI devices in your system. You can rearrange the order in which the devices are used by highlighting a device and moving it up or down in the list. You can also disable any MIDI device to prevent *Cubasis VST* from using it.

When you run *Cubasis VST* for the first time, you'll also need to set up your computer's audio devices. Once you're in the program, pull down the Audio menu and select System; the Audio System Setup dialog box appears with a variety of performance options (see **Fig. 2**). If you plan to do audio recording, select the ASIO multimedia driver as the preferred device (this is the default option). If you're going to simply play back digital audio, you might want to choose the ASIO DirectX driver instead. It usually exhibits lower latency, making real-time fader and knob adjustments more precise. But keep in mind that DirectX supports audio output only, so don't try to use this driver for recording.

After you've selected the appropriate ASIO driver, click on the ASIO Control Panel button to open the ASIO Multimedia or DirectX Setup screen. Although the manual instructs you to choose an audio card from the "preset list of cards," my version of *Cubasis VST* had no presets. If your version doesn't have presets either, simply create and store a custom setup for your audio card by clicking on the Advanced Options button inside the Control Panel window. Each card in your system can have its own setup.

Next, select the number of audio channels you intend to use. *Cubasis VST* lets you assign up to 64 virtual audio tracks to as many as 32 audio channels, but the actual number of usable channels depends on your computer's processing power, hard disk speed, and other factors, such as the number of activated plug-ins and the way you use the program (I'll discuss the details shortly). In most cases, starting with eight audio channels is sufficient; you can always add more if your system can handle it.

Finally, select the Disk Cache Scheme that most closely matches the way you plan to use digital audio in *Cubasis VST*. Briefly, when the computer reads data

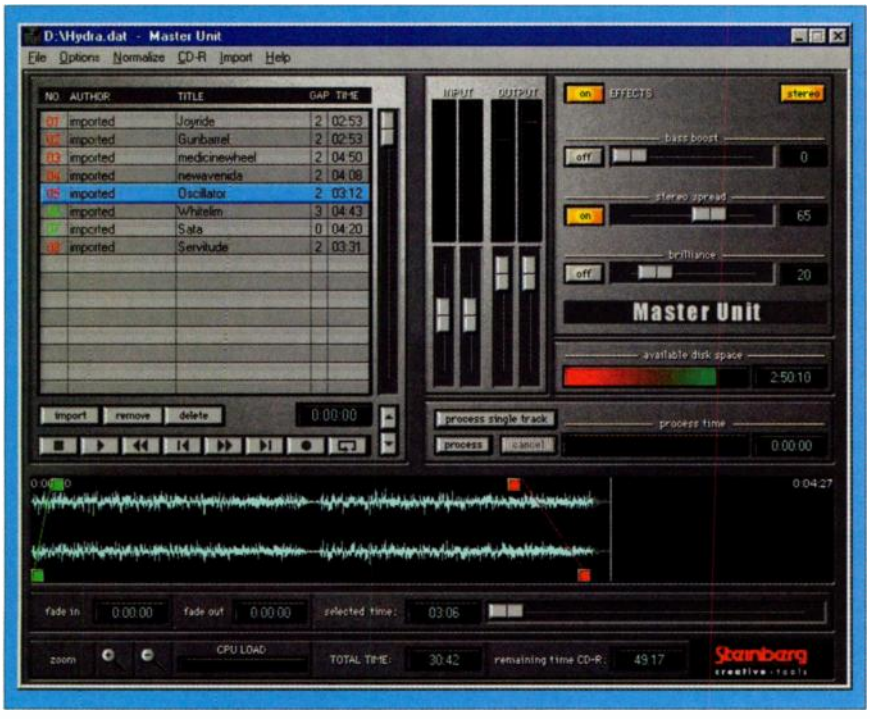

FIG. 1: *Master Unit* is an easy-to-use CD-burning application with a variety of features, including CD-audio and MP3 importing, bass- and treble-frequency boosting, stereo-image enhancement, and fade-in/out controls for each track.

FIG. 2: The Audio System Setup dialog box appears when you run *Cubasis VST* for the first time. Here you access your sound card's control settings, specify the default audio channels and sample rate, and select the disk-caching scheme associated with your intended audio-production method.

from a hard disk, the data is first transferred to an intermediate RAM storage area, or cache. Using the correct type of disk caching can improve computer performance. For instance, if you plan to use *Cubasis VST* like a tape recorder, so that each track will basically be one long recording, the program won't rely heavily on disk caching. Select scheme 1 in this case. On the other hand, if you're going to use *Cubasis VST* more as an assembly tool in which short audio segments are played repeatedly, then the program will rely heavily on disk caching for smooth performance. Select scheme 3 in this case. If you intend to use a combination of the techniques, select scheme 2.

MIDI MUSIC MADNESS

Not surprisingly, *Cubasis VST* has the look and feel of its parent program, *Cubase VST*. The Arrangement window is much the same in both programs, and manipulating the Transport, Locators, and Parts is similar as well. The recording process is also basically the same: select the appropriate track, set the Locators for the recording start and end points, and hit the Record button. But each program offers a different number of features.

For example, in *Cubasis VST*, you can record and play back up to 32 channels of audio and MIDI in any combination for a total of 64 tracks, whereas *Cubase VST* supports 64 audio channels and an unlimited number of MIDI channels. Nevertheless, the number of tracks available in *Cubasis VST* is more than adequate for users with modest needs. In addition, *Cubasis VST* has only two principal types of tracks: Audio and MIDI. You can create Mix tracks for automating fader, knob, and button movements, but you don't get the Style, Group, and other specialized track types found in *Cubase VST*.

I expected *Cubasis VST* to contain fewer specialized track types, but I was surprised and disappointed to discover that it offers no Drum track for creating rhythm patterns with a drum grid. The Drum track has been a mainstay of Steinberg sequencers for many years, and it has always been an invaluable tool. (Interestingly, the *Cubasis VST* manual refers to a Drum Edit window that is distinct from the regular Key Edit window. Unfortunately, no Drum Edit feature exists in the program.)

Like *Cubase VST*, *Cubasis VST* has three different MIDI editors: Key Edit, List Edit, and Score Edit. Key Edit is a traditional piano-roll MIDI editor; it graphically displays note information in its window's upper panel and Velocity information in the lower panel. *Cubasis VST* also displays Channel Aftertouch, Pitch Bend, Modulation, Volume, and Pan events in the lower panel.

To view or edit other controller messages, you must use List Edit. This screen is also for detailed editing of individual events such as Program Changes and for altering individual notes. If you prefer, you can edit notes in the Score Edit window, which you'll also use when preparing your music for printing.

The only quantizing option in *Cubasis VST* is Over Quantization, which moves notes to the proper quantization start points without altering their durations. As a die-hard MIDI manipulator, I was initially disappointed that *Cubasis VST* didn't have at least some of *Cubase VST*'s specialized quantization options. However, most beginners (and many experienced users) just want to make sure that their MIDI performances play back properly in time, and Over Quantization is probably all they'll ever use.

DIGITAL AUDIO DEMENTIA

As I mentioned earlier, *Cubasis VST* supports up to 32 audio channels (see **Fig. 3**). This is certainly less than some professional digital audio sequencers offer, but it wasn't long ago that *Cubase VST* itself had only 32 channels. Each channel has a 2-band parametric equalizer, two effects sends, and

FIG. 3: The Arrangement window, shown in the upper right of this image, displays the audio segments contained in each track as well as the Audio Mix track that was created when fader movements were recorded in the VST Channel Mixer in the bottom half of the window.

For manufacturer information, please see Contact Sheet, p. 171.

FIG. 4: *Cubasis VST* includes three VST Instruments: *LM-9*, *VB-1*, and *Neon*. Also shown (lower left) is a freeware VST Instrument from FXpansion.

an effects insert. However, you can use a maximum of six insert effects.

As in *Cubase VST*, the effects sends and inserts support VST and DirectX plug-ins. The program comes with only a few VST plug-ins and no DirectX plug-ins, but hundreds of excellent freeware, shareware, and commercial plug-ins are available.

There are several ways to create audio tracks in *Cubasis VST*. Of course, you can record audio into different tracks as you would with a tape recorder. You can also import 16-bit WAV and AIFF files into an Arrangement, as long as they have the same sample rate. (A folder on the CD-ROM contains 300 MB of audio files in several formats.) *Cubasis VST* lets you import audio files created in Steinberg's *ReCycle* sample-loop editor (see the review in the December 1999 issue of **EM**). *ReCycle* slices a loop and makes separate samples from each beat or note. You can then change the loop's tempo without affecting pitch or edit the loop as if it were built from individual sounds. Numerous CD-ROMs feature ready-made *ReCycle* files, and you can use *ReCycle* to make your own loops.

Cubasis VST also imports TRK (Track) files from Mixman Technologies' *Mixman Studio* and *Mixman Studio Pro*, applications for creating music by mixing and matching beats and loops (see the review in the November 1999 issue of **EM**). Track files are similar to *ReCycle* files in that both are loop oriented, but *ReCycle* files maintain their original pitch because each slice in the loop is triggered at the tempo of the Arrangement. Track files, on the other hand, are whole

loops or loop segments that can be adjusted to play back with the tempo and key of a *Cubasis VST* sequence.

Cubasis VST's Audio Pool displays all the audio files in a song and all the Audio Segments associated with each audio file. As you might guess, splitting an audio file in the Arrangement window creates a Segment. This splitting technique is useful for deleting an audio track's silent parts (which for all practical purposes are useless) and for creating smaller chunks of digital audio data. But this is the extent of *Cubasis VST*'s audio-editing capabilities. For more precise editing work, you'll need a separate audio-editing program, such as the included *WaveLab Lite*.

VIRTUALLY INSTRUMENTAL

Cubasis VST includes three software synthesizers in VST Instrument format: the *LM-9* drum machine, the *Neon* analog synth, and the *VB-1* physical-modeling bass synth (see **Fig. 4**). *LM-9* is a 9-voice polyphonic drum machine, *Neon* is a 5-voice polyphonic "analog" synthesizer, and *VB-1* is a 4-voice polyphonic physical-modeling bass synth. All the devices can receive data directly from *Cubasis* tracks; simply choose an Instrument from the Audio menu and assign it to the output of a MIDI track.

Both *Neon* and *VB-1* respond to MIDI Note On/Off, Volume, Pan, Pitch Bend, and Mod Wheel messages. *LM-9* responds to MIDI Note On/Off messages only, but you can adjust its Velocity sensitivity. In addition, each drum sound can be individually adjusted for volume and pan position in the stereo field. You can apply effects to the output of any VST Instrument, just as you would to digital audio tracks, and VST Instrument tracks are included with regular audio tracks when you mix down.

Cubasis VST lets you use up to four VST Instruments, but your computer's capabilities, the number of audio tracks and plug-ins in use, and so on will determine if you can run that many. For example, you might run two instances of *Neon*, one of *VB-1*, and one of *LM-9*. These Instruments are not multitimbral, but you can open multiple instances of them.

As with VST plug-ins, additional VST Instruments are available from Steinberg and other third-party sources. Check out Ben Turl's K-v-R VST Instrument Banks site (www.k-v-r.freeserve.co.uk).

MIX AND BURN

Once you've mixed your music down to stereo in *Cubasis VST*, you might

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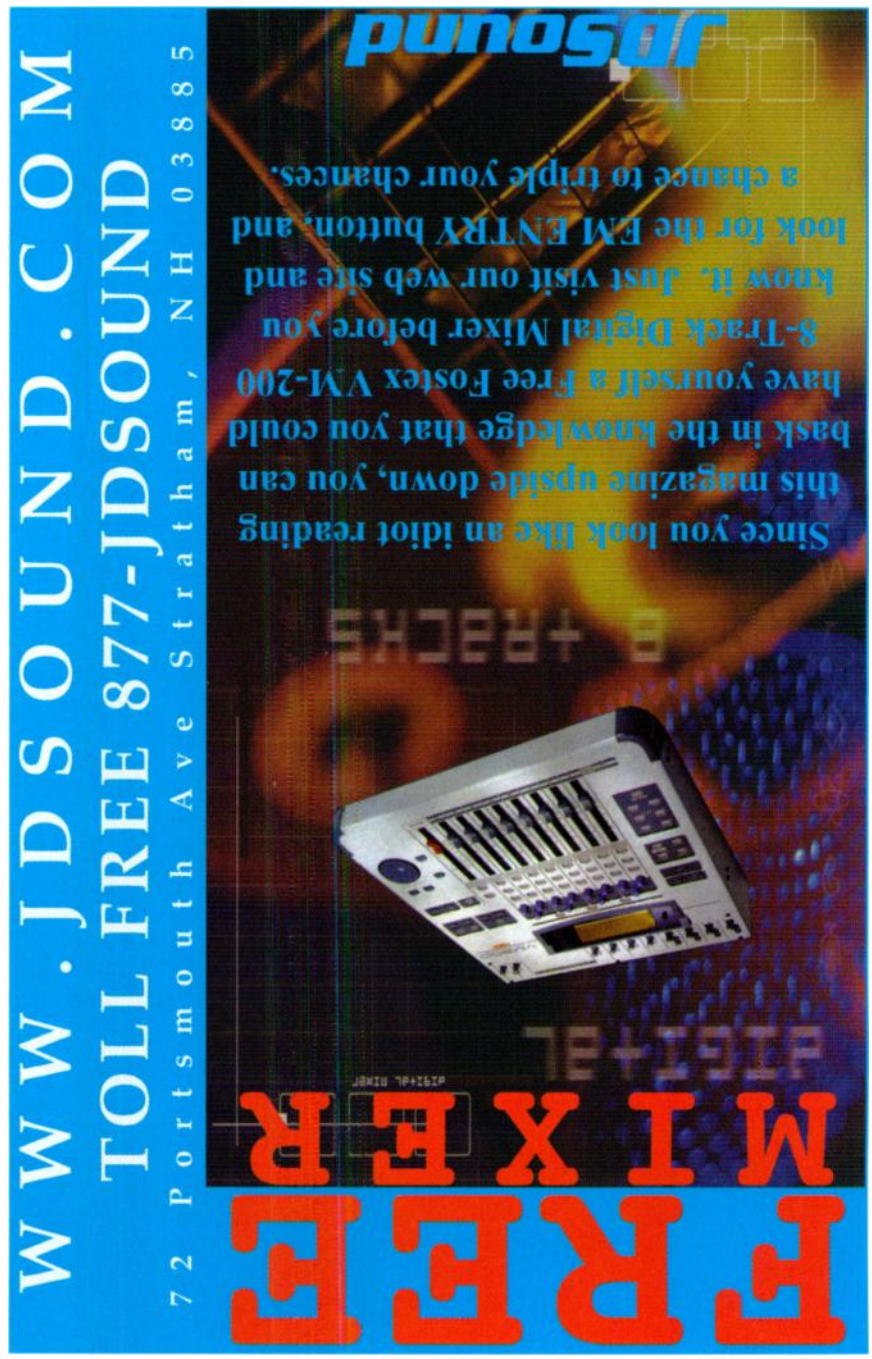
$99

FEATURES ■■■
EASE OF USE ■■■■
AUDIO QUALITY ■■■■
VALUE ■■■■
1 2 3 4 5

PROS: Surprisingly powerful entry-level digital audio sequencer. VST Instrument support. Includes stand-alone audio-editing and CD-burning programs.
CONS: MIDI features might be too basic for some. No Drum Edit function.



want to make a CD or, at the very least, arrange a sequence of songs for dubbing onto a master tape. *Master Unit* is just the tool for the job. As you can see in **Fig. 1**, you load audio files into the tracklist and arrange them as you like. You can also import MP3 files (which are converted into WAV files) and tracks from audio CDs. It's also possible to record audio directly into *Master Unit*.

Master Unit provides many useful features. For example, you can adjust the gap time (from 0 to 4 sec) between each track. Each track's start and end times are adjustable in the waveform display below the tracklist; just move the Start and Stop markers to the desired positions. You can also add a linear fade-in or fade-out by moving the appropriate Fade marker.

Master Unit includes an effects section that can be set for individual files. The Bass Boost effect adds bass to tracks that lack depth or punch. Interestingly, this effect boosts frequencies in a band centered at 60 Hz with a Q of 4. In contrast, the Brilliance effect adds treble by boosting frequencies of 5 kHz or more. The Stereo Spread effect helps narrow-sounding mixes by widening the stereo field, making the sound more transparent and open.

Cubasis VST
Minimum System Requirements
Pentium II/200; 64 MB RAM; Windows 95/98; SCSI CD-R (for use with *Master Unit*); MME or ASIO-compatible sound card

Before you burn a CD, *Master Unit* must first calculate the effects settings and create new audio files, which do not replace the older, unprocessed files. (Unlike some CD-burning software, *Master Unit* does not process effects in real time.) You can process one track at a time or all tracks at once. After the processing, the entries in the tracklist refer to the new files. Afterward, you can normalize or readjust start/stop and fade-in/out points if you like. Once everything is ready, just burn the CD or dub the material to tape.

FINAL THOUGHTS

Steinberg tells me that *Cubasis VST* is intended to be a simple but powerful tool for creating music with a drag-and-drop interface. Considering the program's ability to record and import a variety of audio files and standard MIDI files, I'd say that Steinberg was successful on that score. And although the product is ostensibly geared toward the beginning and hobbyist music maker, I certainly find it helpful at the professional level. In fact, I use it extensively with my laptop to create cut-and-paste arrangements whenever I am away from my "big rig."

Cubasis VST is the most powerful entry-level music-production suite on the market. The program's MIDI features are a little too limited, but it more than makes up for this deficiency with its digital audio capabilities. I particularly like the fact that VST Instrument support is available as part of the basic package, and the separate digital audio–editing program and CD-burning application just sweeten an already great deal.

Zack Price *is a digital audio editor and a Windows digital audio consultant in the Chicago area.*

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RØDE

CLASSIC II

Another wonder from down under.

By Karen Stackpole

When **EM** reviewed the original Røde Classic tube mic in July 1997, and then again in a comparison of five tube mics in February 1998, the mic received kudos both times around. Not content to rest on its laurels, though, Røde has since made several improvements on the original design, culminating in the release of the Classic II. This new addition to the Røde family of microphones boasts an edge-terminated diaphragm; redesigned circuitry for lower self-noise and improved sonic performance; a beefed-up cable; and a sturdier mounting system. Hey, who says you can't improve on a classic?

The Røde Classic II mic offers some critical refinements over its predecessor, including lower self-noise, improved bass response, and smoother highs. The Classic II comes complete with a power supply, 30-foot premium cable, shock-mount suspension, stand-mount adapter, and custom aluminum flight case.

A CLASS ACT

The Classic II, which looks much like the Classic but without the L-arm swivel bracket, is burly and built to last. The cylindrical casing is machined from solid brass and sports the same classy, matte-nickel finish as the original. No screws are visible, and the lines are simple and uninterrupted, giving the mic a smooth and streamlined appearance. The sturdy, open-weave, double-mesh grille affords a glimpse of the mic's gold-sputtered diaphragm, and Røde's signature gold dot marks the cardioid address side of the mic.

The power supply is a handsome box outfitted on one side with three chicken-head knobs. The middle knob enables the user to select one of nine polar patterns: omnidirectional, cardioid, figure-8, and six interim positions. The left knob provides two highpass filter options (one steeper than the other, but both rolling off at 125 Hz). The right knob offers 10 and 20 dB attenuation pads, as well as a flat setting. A mellow blue light on the front panel indicates that the power is on and that the tube will be hot to trot after a brief warm-up period.

The rear panel of the power supply provides an on/off switch, a voltage selector, and jacks for the special multi-pin plug, an XLR output, and an IEC power cable. A new feature on the updated power supply is a ground lift (called an "earth lift" in Australia), which is handy if you experience hum from grounding problems in the studio.

Though few things appear different on the surface, the Classic II employs some fundamental design modifications internally. I popped open the hood and found, as advertised, a dual, edge-terminated, gold-sputtered 1-inch diaphragm. According to Røde, edge-termination allows the diaphragm to move unrestricted by a center wire, resulting in fuller low-end response. Fellow engineer and **EM** reviewer Myles Boisen, who had tested the original Classic, took a listen and was impressed by the sonic improvements: he thought not only that the lows sounded fuller and flatter but that the highs were smoother, too.

Further dissecting the mic, I next discovered a well-organized PC board complete with a Jensen transformer and a General Electric 6072 twin-triode tube. Those are some impressive guts—and much more to my liking than what lay inside the fetal pigs I had to dissect in high school!

ACCESSORIZE, ACCESSORIZE

The Classic II is well accessorized. For starters, it comes with both a simple mic-stand adapter and a sturdy new "birdcage" shock-mount. Either of these ingeniously designed devices can be secured snugly between the base of the mic and the cable connector, negating any chance of slippage. Though made of plastic, both mounts have metal threads and seem extremely durable. I've recently seen a proliferation of mics—including some premium brands—accompanied by flimsy mounts with plastic threads. Røde, to its credit, has not taken the cheapie route and instead appears to be designing its parts for the long haul.

Also included with the Classic II is a redesigned, double-shielded, oxygen-free copper, multicore cable. Thick and impervious to kinks and tangles, the 30-foot cable terminates in massive—and I do mean massive—12-pin connectors with threaded sleeves for securely fastening them to the mic and power supply. These behemoth connectors have the solid feel of the precision-engineered connectors once standard with high-end European tube mics, and they are quick and easy to insert and tighten down, inspiring confidence in the design. On top of that, all of these components (plus the mic, power supply, and power cable) come nestled in form-cut foam embedded in a rugged aluminum flight case.

RØDE TEST

I tested the Classic II both in the studio and on location for some of my remote recording jobs. I certainly wasn't worried about damaging the mic when on location—the thing is built like an armored truck. Using Monster Cable and a Focusrite Green preamp, and recording direct without processing to a Panasonic SV3800 DAT recorder, I put the Classic II through the paces on male and female vocals, nylon- and steel-string guitars, clean and distorted electric guitars, electric bass, acoustic upright bass, flute, saxophone, drum

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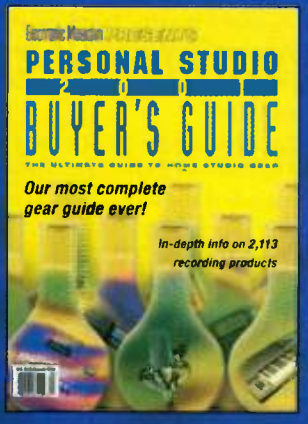

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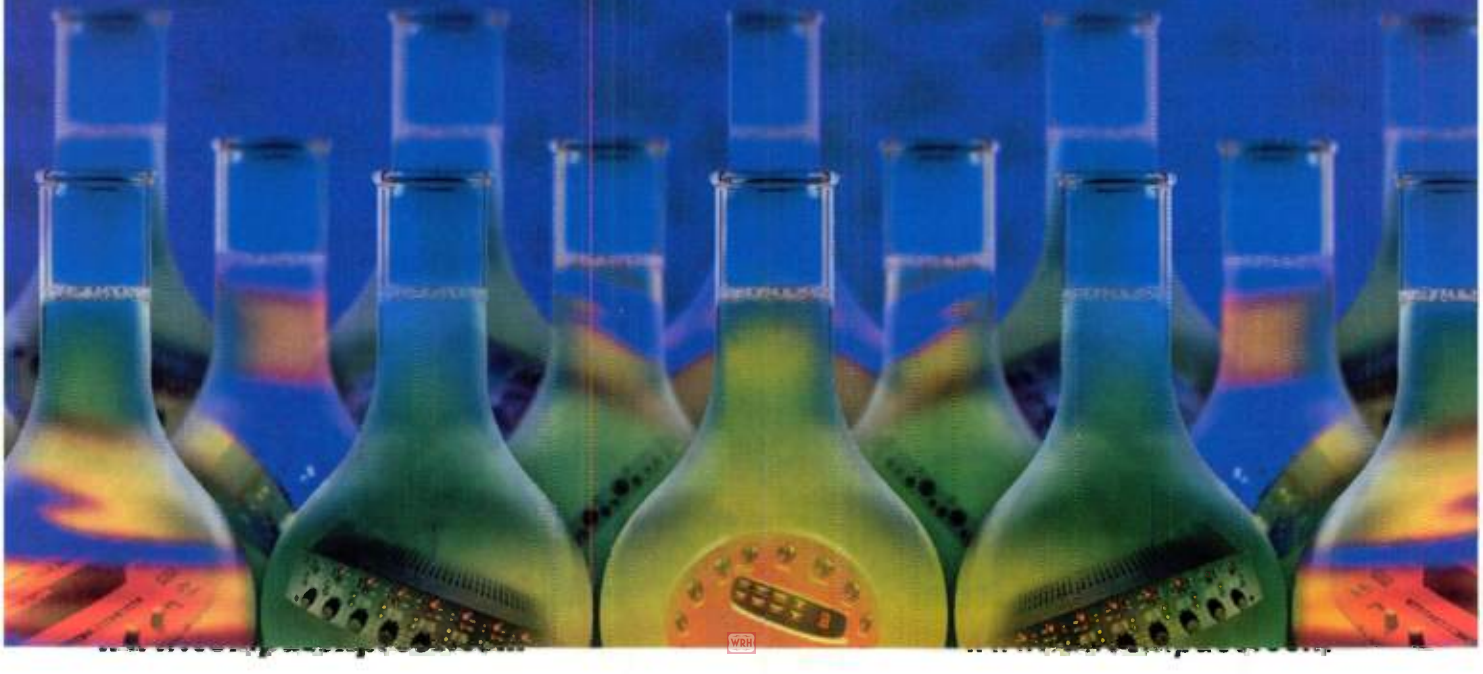
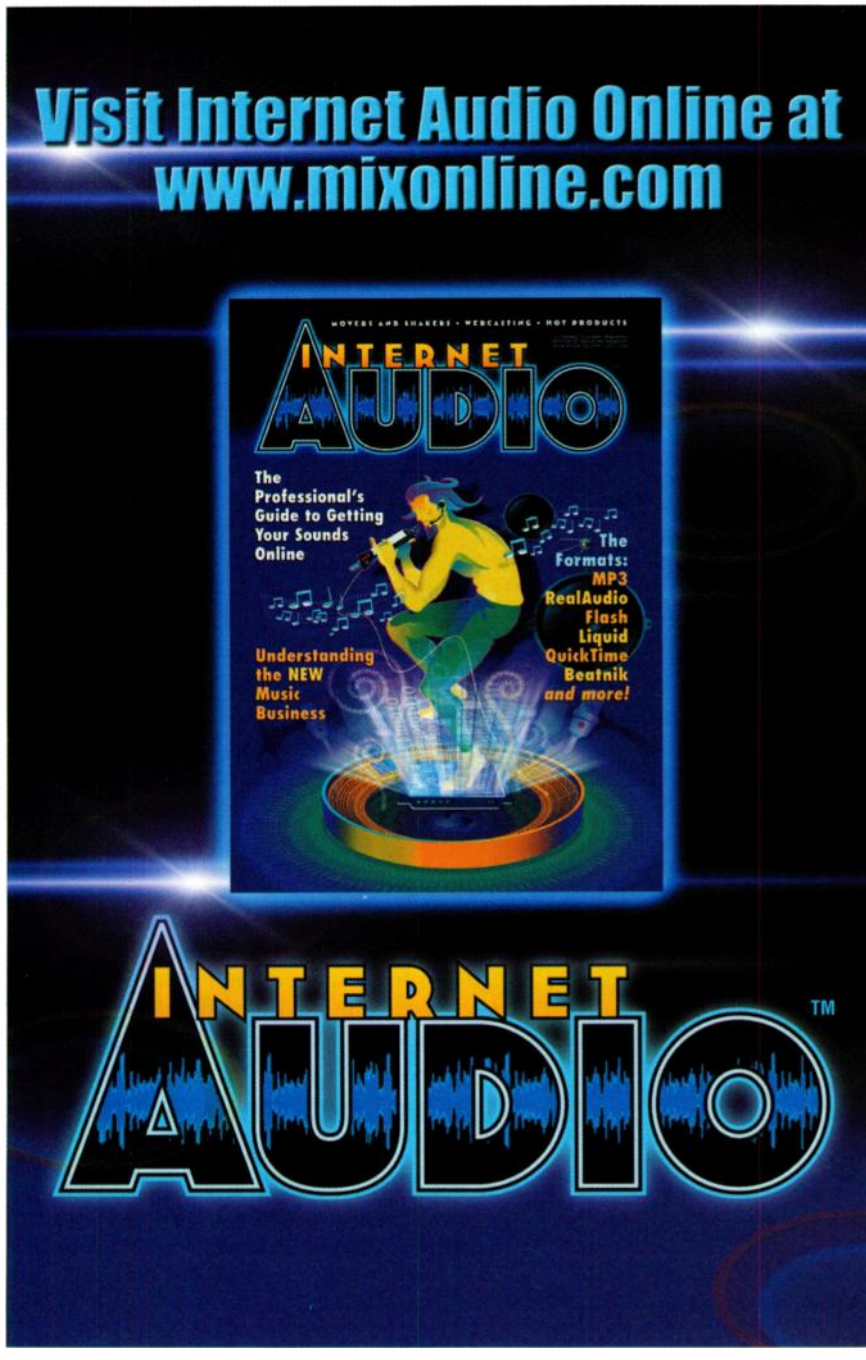


Classic II also sounded good on the male vocals I tracked, but here the attenuated mids made for a less robust sound than I got with the Neumann and Lawson mics. However, my subject's voice was fairly thin and reedy to begin with—characteristics that the Classic II only emphasized. I suspect that the Classic II would be most complementary on a male singer with a full, low voice. Also, on an overly midrangy or nasal vocalist, this microphone's characteristic sound might help to smooth out the sound.

THWACK, DING, AND BOOM

As a room mic on drum set, the Classic II sounded overall very good, but again the definition and body of the snare drum were slightly underrepresented. Also, the low end tended to be a bit boomy. (Once again, this tendency was easily tamed by engaging the highpass filter.)

I also used the Classic II to mic a number of percussion instruments, including tambourine, maracas, shakers, dumbek, frame drum, wood block, and chime. The mic proved a fine choice for shakers and hand drums—thanks largely, I think, to its full lows and natural-sounding high end. As mentioned previously, though, the wood block revealed the mic's penchant for playing down certain midrange frequencies: the recorded sound had lots of attack (meaning good transient response) and sufficient lows, but overall was a bit thin and lacking in body. This is not meant as a negative comment about the mic—many great vocal mics, after all, would prove less than ideal for particular percussion instruments—but simply as an indication of the Classic II's sonic predisposition.



STRUM AND THUMP

On both acoustic and electric guitars, I tend to prefer a mic that fully represents the mids and low mids—in contrast to many engineers who like a mic that plays down those frequencies. Therefore, for my tastes, the Classic II (in cardioid) didn't do full justice to the rich, warm tone of a Takamine nylon-string classical guitar or to a strummed steel-string guitar. Overall, the sound was slightly thin and the low strings were rather thuddy and boomy.

Of course, one of the great things about this mic is the big selection of tones available via the various polar patterns. After toggling through all the pattern selections and experimenting with placement, I found that if I put the mic in omni and placed it approximately 18 inches from the 12th-fret position, angled toward the sound hole, a fuller, more balanced sound emerged. The lows were still a bit boomy, but engaging the gentle bass rolloff on the power supply tightened things up nicely. The results had a bit less sparkle than I would have liked, and not all the harmonics were fully represented, but the sound was definitely usable.

The Classic II didn't sound bad on electric guitar, but again, it wouldn't be my first pick in this application, due to its emphasizing of the wrong elements. Specifically, the high end was overly exaggerated and the lows were too boomy, whereas, again, the mids were not quite well enough represented.

The Classic II fared better on electric bass, where it captured plenty of attack and low end. But I especially liked this mic on acoustic upright bass. The extended lows afforded by the edge-terminated diaphragm really filled out the bottom end—so much so

RØDE
Classic II large-diaphragm tube condenser mic
$1,995

AUDIO QUALITY ■■■■
VALUE ■■■■
1 2 3 4 5

PROS: Natural-sounding highs. Full lows. Nine selectable polar patterns. Two high-pass filters and attenuation pads. Well built. Well accessorized.

CONS: Slight lack of midrange tone. Slightly "flat" sound (lack of depth) when distant miking. Highs can sound sizzly, especially in figure-8 pattern.

that I found myself rolling off the lows again to tighten up the sound.

FULL THROTTLE

I brought the Classic II to a location-recording gig at Yoshi's Jazz House at Jack London Square in Oakland, California, to record the Full Throttle Orchestra, a large ensemble composed of tenor and alto saxes, flute, trumpet, upright bass, electric guitars, and drums. I positioned the mic at the edge of the stage, about six feet in front of the "horn section" (which included the flute), set to the cardioid pattern so as to minimize room noise. The Classic II sounded clear and bright on the flute—very impressive. On the saxes, though, the sound was a bit edgy and lacking in body for my liking. The mic captured sufficient "bite" from the trumpet, but I would have preferred a warmer sound.

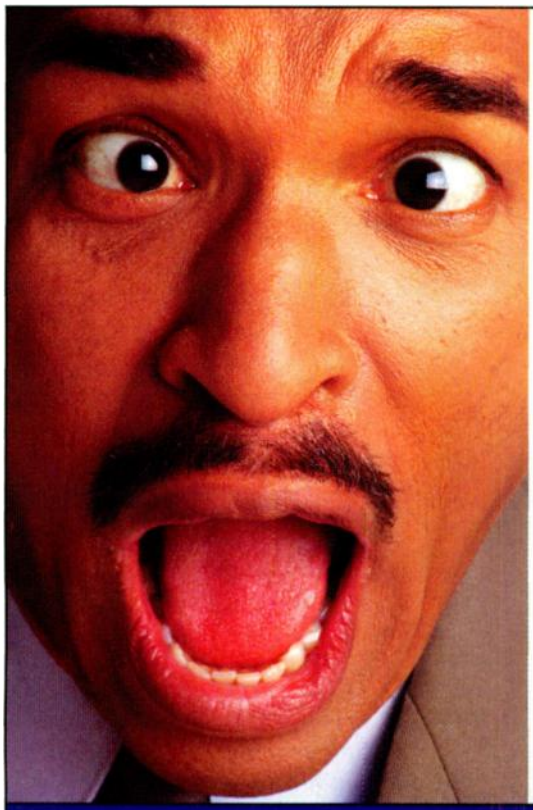
ONE FOR THE RØDE

Tastes in large-diaphragm tube condenser mics run the gamut. Some folks like fat low mids and smooth highs; others want sparkly highs and attenuated lows. There's no right or wrong, of course, just what floats your boat and works best for the source and song.

The Røde Classic II brings another distinctive voice to the table. Characterized by bright, sometimes sizzly, yet natural-sounding highs; mildly attenuated mids; and big, full lows, this mic is almost certain to attract a loyal following. Thanks to its nine polar patterns, the Classic II is quite a versatile choice, too. And if quality of construction is a principal concern, look no further: you'd be hard pressed to find a more sturdily built microphone and cable.

In my tests, the Classic II performed admirably on a range of instruments, especially vocals, small hand drums, assorted percussion, upright acoustic bass, electric bass, and flute. It also earned a gold star in loudspeaker tests. However, to my ear, the slightly shy midrange response made it somewhat less suited to recording acoustic guitars, electric guitars, and horns. Of course, no microphone is perfect for every sound source—which is why engineers typically have a selection of mics. But for any studio looking to enhance its mic collection with a distinctive-sounding, quality-built tube transducer, the Røde Classic II deserves a serious audition.

Karen Stackpole *is a recording/mastering engineer and an instructor at Ex'pression Center for New Media.* *Special thanks to Myles Boisen for his contributions.*



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WAVE MECHANICS

SOUNDBLENDER 1.05 (MAC)

Plug-ins packed with parameters and possibilities.

By Peter Freeman

Having distinguished themselves with their previous work for Eventide on the DSP4000 and the ModFactory upgrade for the H3000, the folks at New Jersey's Wave Mechanics have considerable experience in making powerful DSP audio software. Now, with the SoundBlender plug-in package, the company has turned its attention to the TDM platform.

SoundBlender is actually a pair of TDM plug-ins: *PitchBlender* and *TimeBlender*. *PitchBlender* is a 2-channel effects processor that combines pitch-shifting, delay, filtering, panning, and modulation. *TimeBlender* is nearly identical to its counterpart, except that it offers reverse pitch-shifters in place of the standard ones. (A reverse pitch-shifter samples snippets of sound and plays each one backward; the backward samples can then be processed with filters, feedback, and modulation.)

SoundBlender requires a Digidesign Pro Tools system with at least one "classic" PCI DSP Farm card or 24 Mix card (it won't even run on a NuBus TDM system). Both SoundBlender plug-ins offer extensive processing capabilities that require a great deal of computational horsepower. It's therefore not surprising that each instantiation of a SoundBlender plug-in uses an entire DSP chip on either type of Pro Tools card. Nevertheless, it's worth the processing cost.

I reviewed the stand-alone version of SoundBlender, which is currently available only for the Mac. Wave Mechanics also offers a Mac and Windows NT version, but only as part of the pricier UltraTools plug-in package ($895).

PANELS AND PARAMETERS

SoundBlender's plug-ins employ a deceptively simple layout that belies their impressive capabilities for creatively processing sounds. The SoundBlender window has five main areas: Levels, Bpm, Trig, Parameters Control Panel, and Modulation. Along the top of the window, you'll find the Pro Tools Inserts/Sends Editor panel, which includes a drop-down menu for selecting presets. Because *PitchBlender* and *TimeBlender* are similar in design, I'll focus primarily on *PitchBlender* for the following descriptions and point out differences between the two where applicable.

The Levels controls consist of simple Input and Output sliders with corresponding stereo metering. The Bpm area is used for adjusting SoundBlender's tempo source (via a pop-up menu) and for setting its internal tempo with a pop-up slider or from the keyboard. The possible tempo sources are None (internal), Master Trigger, SideChain, and Input. The Master Trigger mode derives a tempo from *PitchBlender*'s Master Trigger (explained shortly); SideChain uses the *PitchBlender* SideChain input (which can be any available TDM input or output); and Input derives the tempo from the audio signal that is actually passing through the plug-in.

The Trig area features a pop-up menu for selecting any of eight trigger sources, which include None (internal), SideChain, Input, Output 1, Output 2, and Mod Outputs 1, 2, and 3. A small fader is provided for setting the trigger threshold with the mouse.

The Parameters Control Panel area houses *PitchBlender*'s adjustable effects parameters, which are grouped into seven "pages": Main, Pitch, Pitch Mapper, Delay, Filter, Signal Flow, and Expert. Each page has six parameter sliders, which you can drag with the mouse. You can also enter specific settings by simply selecting a parameter's value and typing in a new number.

TURNING PAGES

The Main page (see **Fig. 1**) lets you control the Wet/Dry Mix, Feedback, Master Pitch, Master Delay, Mod Depth, and Mod Rate parameters. These are global settings, but they are dependent on other parameter settings in *PitchBlender*.

As you might expect, the Pitch page provides control over the plug-in's pitch parameters, which include Shift 1 and 2, Pan Shift 1 and 2, and Level 1 and 2. The available pitch transposition range extends from –2,400 to +2,400 cents (±2 octaves).

The Pitch Mapper page allows you to map specific harmony pitches to incoming notes for generating "intelligent" harmonization and arpeggiation. The arpeggiation function is particularly

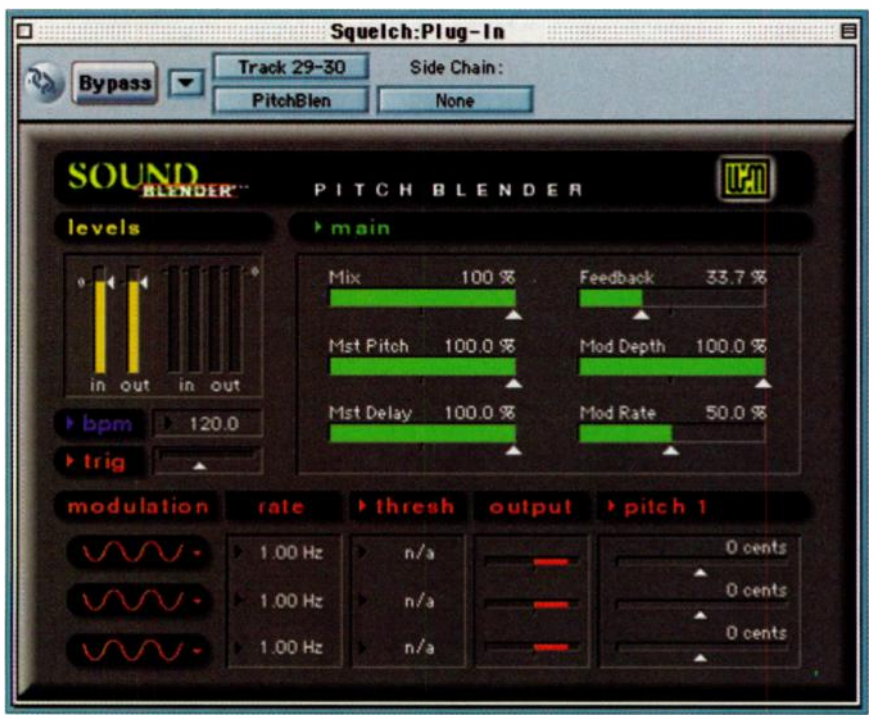

FIG. 1: *PitchBlender*'s Main page provides controls for setting levels (on the left), six parameter sliders (in the center), and a Modulation area (at the bottom).

SoundBlender
Minimum System Requirements
Mac OS 7.5; Digidesign Pro Tools PCI or 24 Mix system with one free DSP chip

interesting because it's controlled entirely by *PitchBlender*'s modulation parameters. That makes possible some very unusual patterns. For example, a sawtooth wave used as the modulator creates the standard up/down arpeggio, but a more unusual waveform can yield much less predictable results.

The Pitch Mapper offers a number of non-equal-tempered scales for creating non-Western harmonies from a conventional (equal-tempered) input. When no modulation is present, the Pitch Mapper maps the current input pitch to the nearest note in the selected scale. Chordal arpeggios are also possible with the Pitch Mapper when you use a modulation source. Among the available preset chords are 6th, 7th, and sus4 chords, as well as major, minor, augmented, and diminished triads.

One particularly nice feature of the Pitch Mapper page is the inclusion of Attack and Decay parameters to govern the upward and downward speed of pitch variation from the generated harmonies—similar to portamento. This can be quite expressive if used subtly.

The Delay page controls the amount by which *PitchBlender*'s two independent delay lines delay the input signal. Delay times can be expressed in milliseconds or beats (relative to the current tempo). Panning and Level controls are included for both delay lines, and delay times of up to 700 ms per side are possible.

PitchBlender has two independent multimode filters, each of which can be set to Lowpass, Peak BPF (bandpass filter), Norm BPF, Highpass, or Notch. Both have separate cutoff and Q controls (to control the shape of the filter). The frequency range of the filters spans from 40 Hz to 20 kHz.

The Signal Flow page controls the input level for each channel. It also controls the global Feedback balance between both channels, the Feedback Mix (actually cross-feedback between the channels), and the routing order of the effect blocks in *PitchBlender*.

These routing choices (see **Fig. 2**) are governed by two sliders called Filter and Algorithm. Filter determines where in the signal chain the *PitchBlender* filters appear. The choices are Pre-EFX (filters after input), Pre-EFX+ (the same, but with the filter outputs summed), Post-Pitch (filters at the output of the pitch-shifters, before panning and mixing), Post-Delay (filters at the delay line outputs), Post-EFX (filters at the end of the signal chain), and Loop (filters in a feedback loop).

The Algorithm slider lets you choose one of four global effects algorithms: Loop (creates delayed regenerative effects), Tapped (only the delayed signal is regenerated), Series (the same as Tapped, but pitch level and panning control the input to the delay lines), and Parallel (allows pitch-shifters and delay lines to be used independently).

The Expert page allows you to choose whether delay times are expressed in milliseconds or beats and also provides several parameters for optimizing the audio processing. You can set the minimum and maximum frequencies for the pitch-shifters to optimize the shift quality. The Shift Delay parameter lets you strike a balance between the fastest possible response of the pitch-shift engine and the best shift quality. The SoftClip function serves as a cushion against the digital clipping that occurs when input signal levels get too high. Instead of allowing the signal to distort right away, SoftClip causes a more tolerable "analoglike" distortion. Needless to say, this function is best left on.

MODULATION MADNESS

The Modulation Control Panel area is where things really start to get interesting. *PitchBlender*'s many modulation possibilities aren't obvious; its numerous options are hidden away in menus. Once you peruse the list of sources and destinations, however, you'll be amazed by the program's staggering capabilities.

PitchBlender provides three simultaneous modulation generators for which you can select any of 16 modulation types: Sine, Square, and Triangle Oscillator; Random Numbers; Square, Ramp, Triangle, and Random Triggered; Square and Ramp Toggled; Env. Detector; Gate; Random Square and Linear; Always On; and Always Off. These can be sent to any of the following destinations: Pitch, Pitch Map, Delay, Filter Frequency, Pitch Pan, Delay Pan, Pitch Level, Delay Level, Input Level, Feedback, Mod Rate, or Levels 1, 2, and 3.

In addition to the raw flexibility provided by these extensive routing possibilities, *PitchBlender*'s modulation parameters allow for further modification of the signal. For example, the Sync Mode options and Phase Offset parameter for the LFOs (LFO 2 and 3 can be free-run or synched to 1) provide added control over the final result; so do the Attack and Decay adjustments, which smooth out abrupt modulation changes. A handy Beats/Hertz switch lets you change the display units relative to the master Bpm setting.

You control modulation with a mixer and parameters found in the lower third of the *PitchBlender* window. The layout is largely self-explanatory (with the exception of the pop-up menus, which aren't readily apparent) and is quite simple to navigate. Just choose a modulation source, a destination, and a modulation amount (positive or negative) for one or all of the three modulation generators, and you're off and

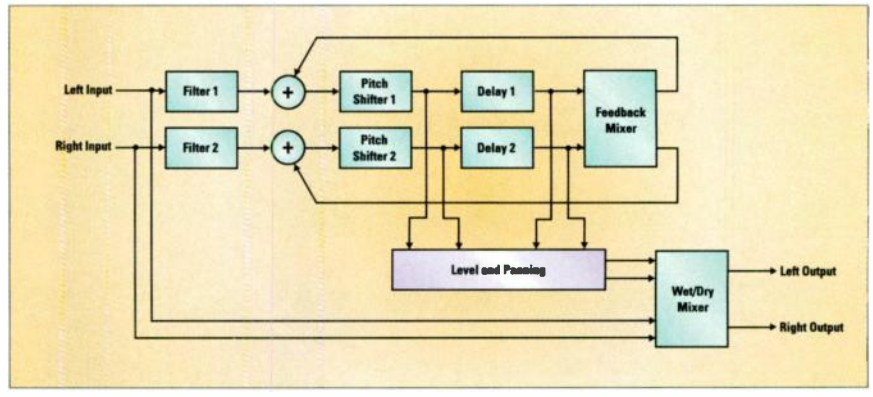

FIG. 2: This diagram shows a typical *PitchBlender* configuration using the basic modules.

For manufacturer information, please see Contact Sheet, p. 171.

running. The only problem is that with complex modulation setups, keeping track of what is modulating what may be difficult. That's because you can see only one set of routings for the three sources at any given time. This is one limitation of working within a plug-in format: you get less onscreen real estate than you would in a stand-alone application. Nevertheless, the creative possibilities are well worth the inconvenience.

SMOOTH OPERATOR

From the moment I began using *PitchBlender*, it proved to be a highly effective tool. Although a great many presets are included with the SoundBlender package, I got the best results by starting from scratch and creating presets for specific situations as they arose. Once I played around and became familiar with the modulation routings, generating interesting effects was easy. Among the patches that I created were some slowly evolving, filtered stereo delays; bizarre, atonal, pitched delays; and a very long, high-feedback panning echo. I also used *PitchBlender* for straight pitch-change effects, which were excellent. In fact, they (not surprisingly) matched those of my Eventide DSP4000 in quality.

The multimode filters offer some particularly interesting possibilities, especially when used with the delays and pitch shifters. Although on close scrutiny the filters exhibit a noticeably digital sheen, they were musical enough to be useful in almost any context that I devised for them. It's possible to crank up the resonance and get fairly convincing "oscillation" out of them (one of my usual litmus tests for filter quality); this works very nicely with the delays.

▼

The program's capabilities are staggering.

At the risk of overstating the case, it's remarkable how powerful *PitchBlender*'s modulation possibilities actually are. This becomes especially evident when you start playing around with triggered modulation from either the sidechain or main audio input. For example, LFOs that are continuously retriggered from an external rhythmic source (via the sidechain) can be used to modulate filter or pitch parameters. I also like the Attack and Decay parameters in the Modulation section; they add another layer of expressiveness that helps create unusual effects (such as using slow attack times to fade in modulations).

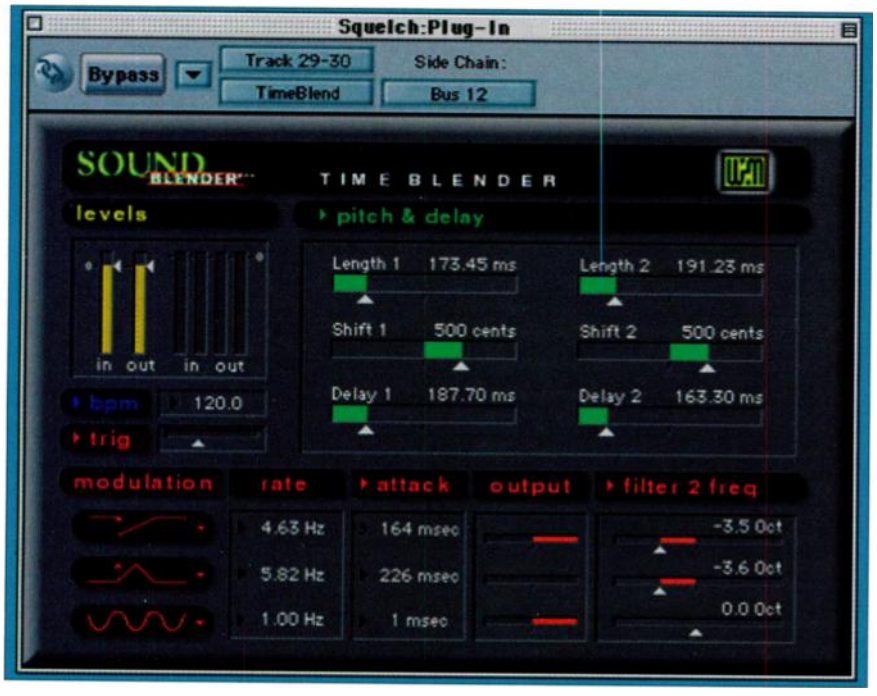

FIG. 3: The *TimeBlender* plug-in closely resembles its *PitchBlender* counterpart.

BACK IN TIME

As I mentioned earlier, the main difference between *PitchBlender* and *TimeBlender* is *TimeBlender*'s substitution of reverse pitch-shifters for the "normal" shifters (see **Fig. 3**). The reverse shifters are laid out as follows: In addition to Shift and Delay controls for each side, *TimeBlender* also features Length sliders, which determine the length of the "sample" that the reverse shifter takes of the incoming signal. It uses this sample for creating the reverse effect. Length values up to 900 ms are possible, along with a ±1-octave pitch-shift range and up to 1,000 ms of delay time. In all other respects, *TimeBlender* is functionally identical to *PitchBlender*.

In actual use, the reverse shifters proved to be substantially different from the normal ones. I found that recreating the same patch in *TimeBlender* that I had previously created in *PitchBlender* often yielded dramatically different results, simply by virtue of the reverse shifters' different sound and response. Combining long Length settings with long delay times also produced quite interesting sounds, especially with slow LFO filter modulation.

At a certain point, I questioned the reasoning behind producing an entirely separate plug-in *(TimeBlender)* that has only one real difference, rather than simply adding a normal/reverse pitch-selector switch to *PitchBlender*. According to Wave Mechanics, programming-related issues governed the two-plug-in decision, and the company is still considering the possibility of integrating them.

SPECIAL BLEND

PitchBlender and *TimeBlender* are two of the best-sounding and most intelligently designed TDM plug-ins available. Once learned, their Modulation sections provide a rich palette of creative possibilities for those seeking to generate unusual effects. Of course, you can produce conventional pitch shifts, delays, and filtered sounds, but the modulation routings really put these plug-ins in a class of their own.

Unlike DUY's *DSPider* or the Eventide DSP4000, the SoundBlender package makes no attempt to be a low-level DSP creation environment—and that's a smart move. The engineers at Wave Mechanics clearly understand the limitations of the plug-in framework and

SOUNDBLENDER

WAVE MECHANICS
SoundBlender 1.05 (Mac) TDM plug-in package
$495
UltraTools 1.01 (Mac/Win NT)
$895

FEATURES ■■■■
EASE OF USE ■■■■
AUDIO QUALITY ■■■■
VALUE ■■■■
1 2 3 4 5

PROS: It's powerful, it's flexible, and it sounds great.
CONS: Only one set of modulation routings is visible at a time. Currently offers no MIDI control.

have developed a program that strikes an excellent balance between ease of use and programming flexibility.

I only wish that the plug-ins offered more onscreen space to display, in one view, the state of all the modulation routings. Indeed, Wave Mechanics' Ken Bogdanowicz says that an alternate version of SoundBlender is being considered; it would have a much larger window area to display more parameters simultaneously. MIDI control is also under discussion.

In my conversation with Wave Mechanics reps, they also revealed the impending release of SoundBlender Plus, which may be available by the time you read this. The Plus upgrade offers an "extended" *PitchBlender* with distortion, ring modulation, downsampling, and bit-quantization capabilities. It also boasts two more filters and a new algorithm called SpaceBlender that has six delay lines, each with its own filter and distortion. This is exciting news, and I look forward to checking out these additions as soon as they're released.

In summary, the SoundBlender package is an essential tool for TDM users who are interested in creating powerful new effects. I highly recommend it.

Peter Freeman *is a bassist, composer, sound designer, and producer in New York. He has worked with Seal, Jon Hassell, John Cale, Nile Rodgers, Shawn Colvin, and other artists.*

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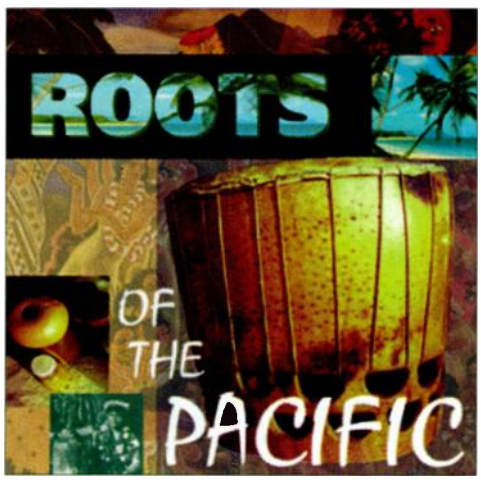
QUICK PICKS

BIG FISH AUDIO

Roots of the Pacific

By Julian Colbeck

This sample CD of sounds, rhythms, and ambiences of the Pacific is clearly a labor of love for its producer, David Morgan Russell. *Roots of the Pacific* (audio CD, $99.95; Akai S1000 CD-ROM, $199.95) is part of Big Fish Audio's *Roots* series, which also includes *Roots of India* and *Roots of South America*. The Pacific collection is huge, beautifully recorded (mainly at Steely Dan man Walter Becker's Hyperbolic Sound studio), and never less than great fun. These are not sounds and sensibilities that just anyone can cook up.



Big Fish Audio's *Roots of the Pacific* provides a panoply of well-recorded ensemble grooves and their individual tracks, as well as percussion and other sounds from Hawaii and other Pacific islands.

Each groove starts with an ensemble recording followed by individual loops of its component parts. This works fine, although I found the main grooves so infectious that I wanted more; individual drum loops tend to be less compelling. Some grooves, such as the Raratonga, come complete with vocal chants, while others are drums only.

Grass Shack Studio

The recordings are totally dry, promoting the somewhat uncomfortable thought of a group of scantily clad Polynesians freezing their tushes off in an air-conditioned studio complex, but that's the right sound for source material like this. For the most part, the recordings are close-miked and clear; the vocals are particularly in-your-face and breathy. Tempos vary enormously, from the normal rock span of 90 to 120 bpm all the way up to the giddy heights of 200+ bpm, and one or two cuts are out of strict tempo entirely.

Standouts range from the aforementioned Raratonga, which features lots of high bongo-type rolls interwoven with chants and grunts; to the superb driving Polynesian loops that bowl along at about 185 bpm; to Ori Tahiti, which I can see as the basis for a massive club hit; to the amusing Samoa Kasala grooves, complete with body slaps. Some of my favorites are in the Fijian collection—electrifying stuff. There are 33 individual grooves, each including several component parts. The grooves vary in length but are generous. There's no count-in and no audio guide, just the grooves, which is fine.

Other sounds featured are 25 individual drum loops and hits. These include stones, gourds, bamboo pipe drums, conch shells, and coconuts, all of which combine to form a definitive sound picture of life on a Pacific island. Standouts here include the Small L'pu (gourd drum), Kaeke (bamboo pipe drum), Pahu Heiau (Temple Drums) with their deep-pitched overtones, and some truly terrifying conch blasts. Different strengths of hit/blow are offered, along with appropriate variations (rolls, flams, short/long shakes, and so on).

Luau's End

I have one minor quibble: a faint clicking rhythm can be heard in the background of one track. You don't have to be a digital audio power user to clean up this material, but you really shouldn't have to.

Two short sections close the disc: "Voices" features a number of sung and spoken chants, words, and phrases, and "Natural Ambiences" includes Hawaiian birds, a rippling stream, and gentle surf. (Finally, we get to emerge blinking into the sunlight.)

Even if you're not a die-hard surfer or an aficionado of Hawaiian/Pacific music, you will certainly appreciate the love and attention to detail that has obviously gone into making this disc. Authentic, honest content is what everyone needs these days, and *Roots of the Pacific* has bags of it. I recommend it highly.

Overall EM Rating (1 through 5): 5

NYR SOUND

Chaosynth 1.0 (Mac/Win)

By Thomas Wells

Given the number of me-too software synthesizers on the market today, it's nice to find something fresh. Not just another subtractive synth, *Chaosynth* (£27, about $40) applies a technique known as cellular automata, which is used in modeling complex natural phenomena, to control a granular synthesizer. The program, created by the respected author, researcher, and composer Eduardo Reck Miranda, generates fascinating and unusual sonic textures in real time and under MIDI control. In addition to real-time playback, the program can write 24-bit, 96 kHz WAV or AIFF files to disk.

MIDI control in *Chaosynth* works both ways: besides responding to MIDI control, *Chaosynth* can save a representation of its output as a MIDI file, which can then be used to trigger anything MIDI you can think of.

Those familiar with granular synthesis will feel right at home with *Chaosynth*, and those without experience in this area will have no trouble getting up to speed quickly.

FIG. 1: *Chaosynth*'s parameters are organized by category into eight screens. The program offers numerous interface elements to control its parameters and also allows real-time MIDI control.

For manufacturer information, please see Contact Sheet, p. 171.

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First Grains

Mastering the control of grain parameters using cellular automata is the real trick in using this program. My first attempts resulted in a sameness of timbres and textures, but after working with the parameters, I could generate unique and fascinating sounds.

Chaosynth's main control surface (see **Fig. 1**) is where you select the desired parameter (in this case, Frequencies) from a row of buttons. You specify up to 64 frequencies (in this case, 32 are shown) from which the cellular-automata algorithm will choose. The algorithm uses the chosen frequencies to control a number of oscillators it selects from a "pool" of waveforms (sine, square, sawtooth, triangle, or noise), thereby generating the spectrum for each individual grain. The frequencies are represented as colored bars, side-by-side, with their values increasing along the *y*-axis. By using your mouse to move around in the window, you can make instantaneous changes to the frequencies that are used for each grain.

The amplitudes of the oscillators are controlled in the Oscillators window, which can also be updated in real time. Other editable parameters include grain size, cellular-automata grid size (which affects the timbre of your sounds), a global envelope control, reverb, filtering, and modulation.

Chaos at Your Fingertips

In addition to using your mouse to "play" *Chaosynth,* you can use real-time MIDI control. A very well-designed user interface makes using MIDI simple: a window under the Setup menu lets you assign the program's parameters to any of 128 MIDI Control Change messages or Pitch Bend. *Chaosynth* really shines under MIDI control, and it offers numerous possibilities for subtle and expressive performance.

What about latency? Depending on the complexity of the patch and the speed of your CPU, it can be an issue. *Chaosynth* is, after all, a software synthesizer. On my 533 MHz Windows PC, the program performed quickly and responsively under real-time control with moderately complex algorithms. On my 400 MHz G3 Mac, performance was also peppy but a bit more problem-prone—especially with complex algorithms and signal processing. The Mac version would often freeze, then recover with no sound output, forcing me to reboot.

In other respects, both versions are essentially identical, except that only the Windows version allows you to store the intriguing-looking animation of cellular-automata development to disk.

Other Options

A handy modulation feature that lets you apply frequency modulation to simple waveforms with the output of the granular-synthesis engine really extends *Chaosynth*'s versatility. Bandpass filtering, stereo outputs, and a decent reverb also lend some interesting effects possibilities to the package.

Included with the program is a generous library of preset sounds, many of which are extremely evocative. The help feature is excellent, and the manual is adequate. Nyr Sound offers a function-restricted demo at its Web site; although the demo has a limit of eight oscillators and will generate mono files only, it still permits saving sounds to disk as well as storing the synthesis parameters themselves.

The author describes the program as useful for electroacoustic musicians, including composers working with film or computer-game soundtracks. Given the iterative nature of the algorithm, a user who fires up *Chaosynth* for the first time might be discouraged by the sameness of many of its sounds. However, delve a little more deeply into the program, and you'll be rewarded with a big variety of sonorities, from huge gongs to drums, and from slow, soft, melodic passagework to some of the best electronic cicadas-on-a-summer-night you'll find anywhere.

Overall EM Rating (1 through 5): 4.5

WAVEMACHINE LABS

Drumagog 1.73 (DirectX)

By Zack Price

The DirectX plug-in *Drumagog* (professional version, $149; standard version, $79) lets you replace recorded drum tracks with a wide variety of drum samples from the included CD-ROM collection. With the pro version you can transfer the CD-ROM samples to hard disk for faster file access and add your own multisamples to the library.

To use *Drumagog,* you first insert it on the proper channel/track or auxiliary bus in your digital audio software. (*Drumagog* works as a mono or stereo plug-in, depending on the type of track or bus insert to which it is assigned.) Next, select the desired sound from the sample collection and play the track. *Drumagog* plays the sampled sounds in real time, using the original recordings to trigger them.

***Drumagog* lets you replace any recorded drum track with one or more samples from its library, and you can adjust a variety of parameters to optimize the process.**

In Control

The process is easy, and no extra tweaking is required most of the time. You can adjust the Sensitivity setting if *Drumagog* is not properly triggered by the audio. In addition, the Resolution control determines how quickly *Drumagog* retriggers from the audio data. With 256-note polyphony, the plug-in can faithfully reproduce any drum pattern, including fast rolls. Furthermore, it lets you tune the drum sounds to the desired pitch by adjusting the sample pitch.

Another useful control is the Filter, which is an equalizer used to filter incoming audio before triggering. For example, if other sounds have bled onto your bass-drum track, you can remove the unwanted audio from that track by selecting a filtering frequency and EQ type (bandpass, highpass, or lowpass). You can select the Solo button to audition the EQ while fine-tuning the settings.

In Stealth mode, all audio passes through unchanged until the sound triggers *Drumagog*. This mode is useful for tracks that contain two different sounds, such as snare drum and hi-hat. With Stealth mode engaged, you can replace the snare drum with the desired sample while simultaneously playing back the original hi-hat sound.

Random Dynamics

The Dynamic and Random Multisamples options are useful for creating realistic-sounding replacement tracks. When the Dynamic Multisamples feature is engaged, *Drumagog* chooses among eight different samples of the same instrument when replacing the audio. These samples were recorded at different volume levels to

capture the tonal characteristics of the instrument at each level. The volume levels in the original track determine which multisample is triggered. Lowering the Input setting causes *Drumagog* to choose replacement sounds with lower volume levels overall.

When the Random Multisamples option is selected, *Drumagog* randomly chooses from three related sets of drum samples, for a total of 24 possible replacement sounds. The result is a very natural sound when the replacement samples are triggered from the original recorded material.

Fade-out

Drumagog does have a couple of minor drawbacks. First, the version I reviewed used only 16-bit samples; it should have 24-bit capability by the time you read this. Also, the sample collection contains no cymbals or ethnic/world percussion. (On the other hand, you do get a wide variety of bass, snare, and tom-tom sounds to choose from.) But, considering that bass and snare drums are usually the only sounds replaced on recordings, the lack of cymbals or other percussion is not a serious deficiency.

Overall, *Drumagog* works remarkably well. If you routinely replace drum tracks with sampled drums, or wish to play other samples triggered by digital audio tracks, you should definitely check out this plug-in package. I think you'll like how it works.

Overall EM Rating (1 through 5): 4

Q UP ARTS

The Holy Grail Grand Piano

By Jeff Burger

A good sampled grand piano is the Holy Grail to many keyboardists and sampling aficionados. Q Up Arts has embraced this quest and has enough confidence in the results to label the effort *The Holy Grail Grand Piano.*

The collection is available in two volumes, which are sold either separately—Platinum ($299) and Silver/Gold ($249)—or as a set ($499). Both discs are available in Akai, Roland, E-mu, and GigaSampler formats, with slight hardware-determined variations. (E-mu also distributes a 16 MB version in a Proteus 2000 ROM.)

Virtual Model Sampling

The architects of this collection developed a process called Virtual Model Sampling

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(V.M.S.), in which a piano is physically disassembled and its various components are sampled. The sampled elements include pedal noise, undampened high notes, hammer strikes and release noises (without strings), and sympathetic string resonance. The documentation also refers to interkey resonance, but Q Up laments that current sampler architecture does not make this possible.

In the sampling sessions for the initial implementation of *The Holy Grail Grand Piano*, Q Up Arts recorded a Kawai 6-foot, 9-inch at various velocities and with multiple combinations of mic pairs. The company says that this particular piano was chosen for its sound rather than its prestige. (Future versions using V.M.S. technology will feature other sought-after pianos.) Q Up used a "Holy Grail tuning" process when it recorded the master samples. This version of well temperament is designed to have more intervals that beat at the same rate, which makes for greater homogeneity across key changes.

Size Matters

The Platinum CD-ROM includes 128 MB banks that bring out more of the original sample qualities, delivering a single sample per note in one Velocity range. There are different banks for three Velocity ranges: pp (Velocity values from 1 to 44), mf (45 to 99), and ff (100 to 127). The pp layer is nice for the mellower side of classical and jazz, while the mf layer is great for all-purpose use. You can also use each as a Velocity layer simultaneously by loading it into three separate samplers and Velocity-switching from the keyboard controller. (*GigaSampler* users can load all three into one unit.)

***The Holy Grail Grand Piano* from Q Up Arts offers nicely recorded and well-programmed sampled piano banks that just might be the prize sought by so many electronic musicians.**

I didn't have the opportunity to try out this heavyweight concept, but there's little doubt that the results are lethal.

The Gold and Silver versions are combined on one CD-ROM. The Gold version has a 128 MB bank with individual samples on each key and crossfading between three Velocity layers. The trade-offs are lower sample rates and shorter samples (thus more reliance on loops). There are also 64 MB banks that trade one, two, and three Velocity layers for sample rates and lengths. The basic presets are pretty bright for my ear (a darker version is also available). Other presets feature various ambiences, envelopes, and links to manipulate various V.M.S. elements via MIDI controllers.

The Silver version distills the sound into 32 MB and 16 MB banks with two Velocity layers. It also incorporates a variety of hits, strums, scrapes, and treated piano effects. All Gold and Silver banks (except the Gold 128) are in equal temperament, because a single sample spans a minor third.

On the whole, I found *The Holy Grail Grand Piano* very flexible, well recorded, and nicely programmed. Although no sampled piano will ever completely replace the real thing, this collection is an effort befitting its name. A single instrument within a genre cannot be all things to all people, but *The Holy Grail Grand Piano* is a great choice for sampler owners—and an auspicious debut for what should be a very interesting series.

Overall EM Rating (1 through 5): 4

DISCOVERY FIRM

From East Europe II—Greek Beats

By Julian Colbeck

When you think of world percussion, Africa, Brazil, China, and Polynesia probably spring to mind. European countries are not generally considered major figures on the ethnic percussion stage, and Greece is perhaps best known for the bouzouki, not percussion. But for all you sound hounds hell-bent on snuffling out every last percussive item from around the globe to spice up your music, I present—okay, Discovery Firm presents—the very last word on Greek percussion. This is a mixed-mode CD ($39.95) containing audio and WAV versions of 50 rhythmic patterns.

The disc's documentation is simply a list of instrument names composed almost

Discovery Firm's *From East Europe II—Greek Beats* includes well-recorded but disorganized and poorly documented loops of Greek rhythms and other styles.

solely of consonants, along with minimal information on tempo and duration. It offers no credits and no notes on the instruments used, and there's simply no excuse for such omissions these days. Come on, Discovery Firm. Put a little more effort into this aspect of your products—it will help.

Greek Rumba?

The recording quality of these loops is fine, but the loops are very poorly presented in a seemingly random mix of styles, sensibilities, and durations. For instance, under the name Hasapiko is a hodgepodge of standard rock and ethnic percussion loops. I think that a sample CD titled *From East Europe II—Greek Beats* ought to stay focused on authentic Greek rhythms.

There are some neat loops, however. I especially liked the bubbling Kamilierikos and Zeibekiko, despite the fact that the samples in this collection are all at different tempos. But do we really need a Greek Tango? Or Slow Rock? Or Rumba?

Mixed Bag

The mixed-mode format of the disc is handy, and the WAV files are named individually, which is helpful. However, Discovery Firm's grab-bag approach does not merit lengthy analysis or tweaking; rather, this is the kind of stuff that you give a quick listen to. If anything jumps out at you, fine—if not, just move on.

The price is right, and Discovery Firm is perfectly capable of recording interesting material. But its products would benefit greatly from some informative (and readable) documentation and a more focused approach.

Overall EM Rating (1 through 5): 2.5

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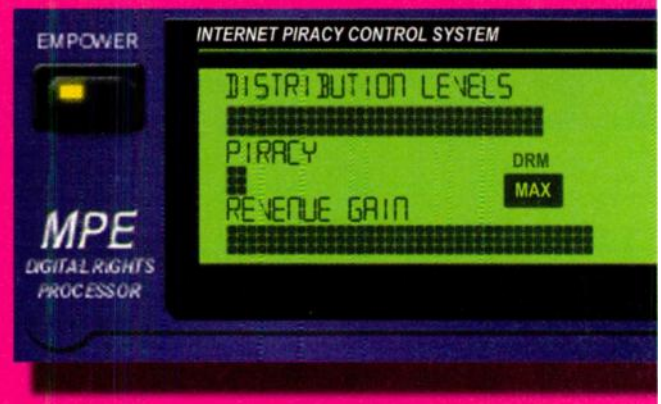

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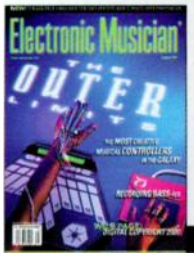

CONTACT SHEET

A GUIDE TO THE COMPANIES AND ORGANIZATIONS MENTIONED IN THIS ISSUE OF ELECTRONIC MUSICIAN

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AKG Acoustics U.S. tel. (615) 360-0499; fax (615) 360-0275; e-mail akgusa@harman.com; Web www.akg-acoustics.com
Demeter Amplification tel. (818) 994-7658; fax (818) 994-0647; e-mail info@demeteramps; Web www.demeteramps.com
Lawson Microphones tel. (615) 269-5542; e-mail lawson47@edge.net; Web www.lawsonmicrophones.com
Ridge Farm/Westwood Audio (distributor) tel. (310) 478-4251; fax (310) 477-0069; e-mail wwmusic@earthlink.net; Web www.ridgefarmstudio.com
Sennheiser Electronic Corp. tel. (860) 434-9190; fax (860) 434-1759; Web www.sennheiserusa.com
Stewart Audio tel. (209) 588-8111; fax (209) 588-8113; e-mail stewartaudio@mlode.com; Web www.stewartaudio.com

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Big Briar, Inc. tel. (800) 948-1990 or (828) 251-0090; fax (828) 254-6233; e-mail info@bigbriar.com; Web www.bigbriar.com
Buchla and Associates tel. (510) 528-4446; fax (510) 526-1955; e-mail buchla@best.com; Web www.buchla.com
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Healing Music.Net tel. (713) 973-2976; e-mail midivox@healingmusic.net or midivox@aol.com; Web www.healingmusic.net
Infernal Devices e-mail info@infernaldevices.com; Web www.infernaldevices.com
Infusion Systems tel. (604) 983-3640; fax (604) 983-3612; e-mail info@infusionsystems.com; Web www.infusionsystems.com
Kellar Bass Systems tel. (650) 941-5567; fax (650) 941-5056; e-mail bkellar@kellarbass.com; Web www.jambass.com
Nearfield Multimedia tel. (310) 518-4277; fax (310) 518-4279; e-mail multimedia@nearfield.com; Web www.multimedia.nearfield.com
Soundbeam/Musiscope (distributor) tel. (813) 581-5306; fax (813) 581-5306; e-mail griffin326@aol.com; Web www.soundbeam.co.uk
Starr Labs tel. (619) 233-6715; fax (619) 233-1231; e-mail harvey@cts.com; Web catalog.com/starrlab
Tactex tel. (250) 480-1132; fax (250) 480-1142; e-mail sales@tactex.com; Web www.tactex.com
Zeta Music Systems, Inc. tel. (800) 622-6434 or (510) 261-1702; fax (510) 261-1708; e-mail info@zetamusic.com; Web www.zetamusic.com

Stand and Deliver
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König & Meyer/Gorg International LLC (distributor) tel. (800) 465-6872; fax (540) 949-4674; e-mail contact@gorginternational.com; Web www.gorginternational.com
Quik Lok/Music Industries Corp. (distributor) tel. (800) 431-6699 or (516) 352-4110; fax (516) 352-0754; e-mail mic@musicindustries.com; Web www.quiklok.com
Ultimate Support Systems (Ultimate Support and König & Meyer) tel. (800) 525-5628 or (970) 493-4488; fax (303) 221-2274; e-mail robins@ultimatesupport.com; Web www.ultimatesupport.com
Yamaha Corporation of America tel. (714) 522-9011; fax (714) 739-2680; e-mail info@yamaha.com; Web www.yamaha.com

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Innovative Quality Systems tel. (323) 888-2982; e-mail sales@iqsys.com; Web www.iqsys.com
Wave Digital Systems tel. (877) 653-0709 or (651) 653-0709; fax (651) 653-0048; e-mail sales@wavedigital.com; Web www.wavedigital.com

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Steinberg North America tel. (818) 678-5100; fax (818) 678-5199; e-mail info@steinberg-na.com; Web www.us.steinberg.net or www.cubase.net
WaveMachine Labs tel. (877) 318-9283 or (847) 514-5168; fax (847) 784-1314; e-mail info@drumagog.com; Web www.drumagog.com
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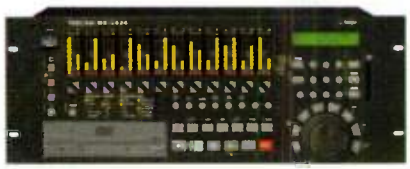
DIGITAL MULTI-TRACK RECORDERS

TASCAM

MX-2424 24-Bit 24-Track Hard Disk Recorder



Co-designed by TASCAM and TimeLine Inc., the MX-2424 is an affordable 24-bit, 24-track hard disk recorder that also has the editing power of a digital audio workstation. A 9GB internal hard drive comes standard as well as a SCSI Wide port that supports external LVD (Low Voltage Drives) hard drives from up to 40 feet away. An optional analog and several digital I/O cards are available so the MX-2424 can be configured to suit your work environment. SMPTE synchronization, Word Clock, MIDI Time Code and MIDI Machine Control are all built in for seamless integration into any studio.

- Records 24 tracks of 24-bit audio at 44.1 or 48 kHz, or 12 tracks at 88.2 or 96 kHz. Up to 24 tracks can be recorded simultaneously using any combination of digital and analog I/O.
- Supplied 9GB internal drive allows 45 minutes of audio across all 24 tracks.
- Wide SCSI port on the back panel allows you to add multiple drives. A front 5-1/2" bay available for installing an additional drive, or an approved DVD-RAM drive for back-up.
- ViewNet MX, a Java-based software suite for Mac and PC offers DAW style editing of audio regions, dedicated system set-up screens that make set-up quicker and easier and track load screens that make virtual track management a snap. Connects to a computer via a standard Ethernet line.
- Can record to Mac (SDII) or PC (.WAV) formatted drives, allowing later export to the computer. The Open TL format allows compatible software to recognize virtual tracks without have to load, reposition and trim each digital file.

Transport Controls-
- Jog/scrub wheel
- MIDI In, Out, and Thru ports are built-in for MIDI Machine Control.

Editing-
- Built-in editing capabilities include cut, copy, paste, split and ripple or overwrite
- 100 levels of undo
- Supports destructive loop recording and non-destructive loop recording which continuously records new takes without erasing the previous version.

Build-In Synchronization-
- TBUS protocol can sample accurately lock 32 machines together for 384 tracks at 96kHz, or 768 tracks at 48kHz.
- Can generate or chase SMPTE timecode or MIDI Time Code.
- Word Clock In, Out, and Thru ports

I/O Options-
- Optional analog and digital cards all provide 24 channels of I/O. There is one slot for analog and one for digital.
- IF-TD24- T/DIF module
- IF-AD24- ADAT Lightpipe module
- IF-AE24- AES/EBU module
- IF- AN24- A-D, D-A I/O module with DB-25 connectors

Software Updates-
- System updates are made available through a front panel Smart Card slot or via computer directly from the TASCAM web site.

DA-78HR Modular Digital Multitrack

The DA-78HR is the first true 24-bit tape-based 8-track modular digital multitrack recorder. Based on the DTRS (Digital Tape Recording System) it provides up to 108 minutes of pristine 24-bit or 16-bit digital audio on a single 120 Hi-8 video tape. Designed for project and commercial recording studios as well as video post and field production, the DA-78HR offers a host of standard features including built-in SMPTE Time Code Reader/Generator, MIDI Time Code synchronization and a digital mixer with pan and level controls. A coaxial S/PDIF digital I/O allows pre-mixed digital bouncing within a single unit, or externally to another recorder or even a DAT or CD recorder. Up to 16 DTRS machines can be synchronized together for simultaneous, sample-accurate control of 128 tracks of digital audio.

Features-
- Selectable 16 bit or 24 bit High Resolution audio
- 24 bit A/D and D/A converters
- >104dB Dynamic range
- 20Hz - 20kHz frequency response ± 5dB
- 1 hr. 48 min. recording time on a single 120 tape
- On-Board SMPTE synchronizer - chase or generate timecode
- On-Board support for MIDI Machine Control
- Internal digital mixer with level and pan for internal bouncing, or for quick mixes
- Track slip from -200 to +7200 samples
- Expandable up to 128 tracks (16 machines)
- Word Sync In/Out/Thru
- Analog output on DB25 balanced or RCA unbalanced
- Digital output on TDIF or 2 channels of S/PDIF

CD RECORDERS & DUPLICATORS

MICROBOARDS

StartREC Digital Audio Editing/ CD Duplication System

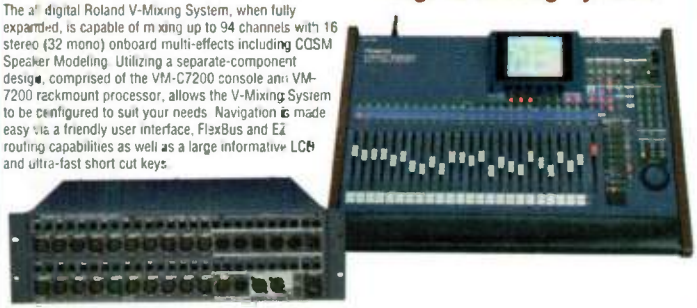
The Microboards StartREC is the first digital audio editing system combined with a multidrive CD recordable duplication system for professionals. Audio is recorded to the internal 6.2 GB IDE hard drive using analog or digital inputs. Sample rate conversion is automatic. Tracks can be edited and sequenced using the StartREC's user friendly interface and up to 4 CDs can be recorded simultaneously. StartREC is the ideal solution for studio recording, mastering, post production or any pro audio environment requiring digital audio editing and short run CD-R duplication.

Features–
- 2X, 4X, or 8X recording speeds
- 6.2GB IDE hard drive
- Editing functions include move, divide, combine or delete audio tracks, add or drop any index or sub index, and create track fade in or fade out
- Coaxial SPDIF or AES/EBU digital input plus optical S/PDIF I/O
- XLR balanced and RCA Line inputs and outputs
- Automatic sample rate conversion from 32 and 48kHz
- Automatic CD Format Detection feature and user friendly interface provide one touch button operation
- Front panel trim pot and LCD display provide accurate input signal and time lapse metering
- SCMS (Serial Copy Management System) is supported, regardless of the source disc copy protection status
- **StartREC Models Include:** ST2000 (2) 8x writers, ST3000 (3) 8x writers and ST4000 (4) 8x writers

DIGITAL MIXERS

Roland

VM Basic 72 Digital Mixing System



The all digital Roland V-Mixing System, when fully expanded, is capable of mixing up to 94 channels with 16 stereo (32 mono) onboard multi-effects including COSM Speaker Modeling. Utilizing a separate-component design, comprised of the VM-C7200 console and VM-7200 rackmount processor, allows the V-Mixing System to be configured to suit your needs. Navigation is made easy via a friendly user interface, FlexBus and EZ routing capabilities as well as a large informative LCD and ultra-fast short cut keys.

Features-
- 94 channels of digital automated mixing (fully expanded)
- Up to 48 channels of ADAT/Tascam T-DIF digital audio I/O with optional expansion boards and interfaces
- Separate console/processor design
- Quiet motorized faders, transport controls, total recall of all parameters including input gain, onboard mixer dynamic automation and scene memory
- 24 fader groups, dual-channel delays, 4-band parametric channel EQ + channel HPF
- FlexBus and "virtual patchbay" for unparalleled routing flexibility
- Up to 16 stereo (or 32 mono) multi-effects processors using optional VS8F-2 Effects Expansion Boards (2 stereo effects processors standard)
- COSM Speaker Modeling and Mic Simulation technology
- 5.1 Surround mixing capabilities
- EZ Routing allows mixer settings to be saved as templates
- Realtime Spectrum Analyzer checks room acoustics in conjunction with noise generator and oscillator
- Digital cables between processor and mixer can be up to 100 meters long - ideal for live sound reinforcement.

Options-
- **VS8F-2 Effects Expansion Board** -- Provides 2 stereo effects processors including COSM Speaker Modeling. Up to 3 additional boards can be user-installed into the VM-7200 processor, for 8 stereo or 16 mono effects per processor.
- **VM-24E I/O Expansion Board** -- Offers 3 R-Bus I/Os on a single board. Each R-Bus I/O provides 8-in/8-out 24-bit digital I/O, totalling 24 I/O per expansion board.
- **DIF-AT Interface Box for ADAT/Tascam** -- Converts signals between R-Bus (VM-24E expansion board required) and ADAT/Tascam T-DIF. Handles 8-in/8-out digital audio. 1/3 rackmount size.
- **VM-24C Cascade Kit** -- Connects two VM-Series processor units. Using two VM-7200 processors cascaded and fully expanded with R-Bus I/O, 94 channels of audio processing are available.

EFFECTS PROCESSING

Lexicon

MPX-500 24-Bit Dual Channel Effects Processor

The MPX 500 is a true stereo 24-bit dual-channel processor and like the MPX100 is powered by Lexicon's proprietary Lexichip and offers dual-channel processing. However, the MPX 500 offers even greater control over effects parameters, has digital inputs and outputs as well as a large graphics display.

- 240 presets with classic, true stereo reverb programs as well as Tremolo, Rotary, Chorus, Flange, Pitch, Detune, 5.5 second Delay and Echo
- Balanced analog and S/PDIF digital I/O
- 4 dedicated front panel knobs allow adjustment of effect parameters. Easy Learn mode allows MIDI patching of front panel controls.
- Tempo-controlled delays lock to Tap or MIDI clock

t.c. electronic

M-One Dual Effects Processor

The M-One allows two reverbs or other effects to be run simultaneously, without compromising sound quality. The intuitive yet sophisticated interface gives you instant control of all vital parameters and allows you to create awesome effects programs quickly and easily.

- 20 incredible TC effects including, Reverb, Chorus, Tremolo, Pitch, Delay and Dynamics
- Analog-style user interface
- 100 Factory/100 User presets
- Dual-Engine design
- 24 bit A/D-D/A converters
- S/PDIF digital I/O, 44.1-48kHz
- Balanced 1/4" Jacks - Dual I/O
- 24 bit internal processing

D-Two Multitap Rhythm Delay

Based on the Classic TC2290 Delay, the D-Two is the first unit that allows rhythm patterns to be tapped in directly or quantized to a specific tempo and subdivision.

- Multitap Rhythm Delay
- Absolute Repeat Control
- Up to 10 seconds of Delay
- 50 Factory/100 User presets
- 24 bit A/D-D/A converters
- S/PDIF digital I/O, 44.1-48kHz
- Balanced 1/4" Jacks - Dual I/O
- 24 bit internal processing

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MICROPHONES

B&H is proud to announce that we are now dealers for RØDE microphones and all other Event products.

RØDE NT-2 Condenser Mic

The RØDE NT2 is a large diaphragm true condenser studio mic that features both cardioid and omnidirectional polar patterns. The NT-2 offers superb sonic detail with a vintage flavor for vocal and instrument miking. Like all RØDE mics the NT-2 is hand-assembled in Australia and is available at a breakthrough price.

Features

- Dual pressure gradient transducer
- Large diaphragm (1") capsule with gold-sputtered membranes
- Low noise, transformerless circuitry
- Omni and cardioid polar patterns
- High pass filter switch
- -10dB pad switch
- 20Hz-20kHz frequency response
- 135dB Max SPL
- Gold plated output connector
- Gold plated internal head pins
- Shockmount, Flight Case, and Pop Filter included

SHURE KSM-32SL Cardioid Condenser Mic

The reviews are raving about Shure's new "classic" microphone. The KSM32 features Class A, transformerless preamplifier circuitry, low self-noise and increased dynamic range, all necessary for critical studio recording. It has a 15 dB attenuation switch for handling high SPLs, making it suitable for a variety of sound sources including vocals, acoustic instruments, ensembles and overhead miking of drums and percussion. For studios, the **KSM32/SL** has a light champagne finish and includes an aluminum carrying case, shock and swivel mounts and a velvet pouch. For live applications, the **KSM32/CG** has a charcoal grey finish and includes a swivel mount and padded zipper bag.

- **Frequency response 20Hz - 20kHz**

AKG C4000B Electret Condenser Mic

This new mic from AKG is a multi polar pattern condenser microphone using a unique electret dual large diaphragm transducer. It is based on the AKG Solid Tube design, except that the tube has been replaced by a transistorized impedance converter preamp. The transformerless output stage offers the C4000B exceptional low frequency response.

FEATURES-

- Electret Dual Large Diaphragm Transducer (1st of its kind)
- Cardioid, hypercardioid & omnidirectional polar patterns
- High Sensitivity
- Extremely low self-noise
- Bass cut filter & Pad switches
- Requires 12, 24 or 48 V phantom power
- Includes H-100 shockmount and wind/pop screen
- **Frequency response 20Hz to 20kHz**

GT Electronics AM-61 Cardioid Tube

The GT Electronics AM61 offers classic tube performance in a fixed cardioid, large diaphragm condenser mic. An outstanding addition to any project studio or large commercial recording facility seeking rich, warm tube sounds and unsurpassed value.

- Groove Tubes military-spec GT5840M vacuum tube preamplifier
- Large-diameter, super-thin 3 micron gold evaporated Mylar diaphragm
- Fixed cardioid polar pattern response
- Switchable -10dB attenuation pad and 80Hz low frequency roll-off filter
- Includes hard-shell case, shock mount, hard mount, 6-pin cable and external power supply
- **Frequency response 20Hz - 20kHz**

• **ALSO AVAILABLE** AM-62 multipattern tube condenser mic

audio-technica. AT4047SV Cardioid Condenser Mic

The AT4047 is the latest 40 Series large diaphragm condenser mic from Audio Technica. It has the low self noise, wide dynamic range and high sound pressure level capacity demanded by recording studios and sound reinforcement professionals.

- Side address cardioid condenser microphone for professional recording and critical applications in broadcast and live sound
- Low self noise, wide dynamic range and high SPL
- Switchable 80Hz Hi Pass Filter and 10dB pad
- **Includes AT8449/SV shockmount**
- **Also Includes a limited edition tweed flight case while supplies last!**

STUDIO MONITORS

VERGENCE A-20 Studio Reference Monitor System

Incorporating a pair of 2-way, acoustic suspension monitors and external, system-specific 250 watt per side control amplifier, the A-20 provides a precise, neutral studio reference monitoring system for project, commercial and post production studios. The A-20's control amplifier adapts to any production environment by offering control over monitoring depth (from near to far field), wall proximity and even input sensitivity while the speakers magnetic shielding allows seamless integration into today's computer based studios.

- Type Modular, self-powered near/mid/far-field monitor
- 48Hz - 20kHz frequency response @ 1M
- Peak Acoustic Output 117dB SPL (100ms pink noise at 1M)
- XLR outputs from power amp to speakers
- Matched impedance output cables included
- -6dB LF Cutoff 40Hz
- 5 position wall proximity control
- 5 position listening proximity control between near, mid and far-field monitoring
- Power, Overload, SPL Output, Line VAC and Output device temperature display.

Amplifier

- Amplifier Power 250W (continuous rms/ch), 400W (100ms peak)
- XLR, TRS input connectors
- Headphone output
- 5-position input sensitivity switch with settings

Speakers

- 2-way acoustic suspension with a 6.5-inch treated paper woofer and a 1-inch aluminum dome tweeter
- Fully magnetically Shielded with an 18-inch recommended working distance

EVENT ELECTRONICS PS-5 Bi-Amplified Project Studio Monitors

The PS-5s are small format, full-range, non-fatiguing project studio monitors that give you the same precise, accurate sound as the highly acclaimed 20/20 series studio monitors. The use of custom driver components, complimentary crossover and bi-amplified power design provides a wide dynamic range with excellent transient response and low intermodulation distortion.

FEATURES-

- 5-1/4 inch magnetically shielded mineral-filled polypropylene cone with 1-inch diameter high-temperature voice coil and damped rubber surround LF Driver
- Magnetically shielded 25mm diameter ferrofluid-cooled natural silk dome neodymium HF Driver
- 70 watt continuous LF and 30 watt continuous HF amplification per side
- XLR-balanced and 1/4-inch (balanced or unbalanced) inputs
- 52Hz-19kHz frequency response ±3dB
- 2.6kHz, active second order crossover
- Built-in RF interference, output current limiting, over temperature, turn-on transient, subsonic filter, internal fuse protection
- Combination Power On/Clip LED indicator
- 5/8" vinyl-laminated MDF cabinet

KRK V-6 Bi-Amplified Near Field Studio Monitors

These bi-amped studio monitors from KRK supply 90 watts of clean power. Their 6-inch woofer & 1-inch silk dome tweeter ensure consistency from top to bottom with crystal clear highs and a solid bass response.

FEATURES-

- 58Hz - 22kHz frequency response
- 1-inch silk dome tweeter and 6-inch long stroke, polyvinyl woofer
- 30 Watt HF & 60 Watt LF amplification
- Magnetically shielded
- Variable system gain +6dB -30dB
- Neutrik XLR/1/4" TRS combo connector

Also Available- V-8

- 1-inch Silk Dome tweeter and 8-inch Woven Kevlar woofer
- 47Hz - 23kHz frequency response
- 60 Watt high frequency and 120 Watt low frequency amplification
- HF adjust +1dB, Flat, -1dB
- LF adjust -3dB at 45, 50 and 65 Hz

Hafler TRM-6 Bi-Amplified Near Field Studio Monitors

Offering honest, consistent sound from top to bottom, the TRM-6 bi-amplified studio monitors are the ideal reference monitors for any recording environment whether tracking, mixing or mastering. Supported by Hafler's legendary amplifier technology that provides a wide and accurate sound field, in width, height and also depth.

FEATURES-

- 33 Watt HF & 50 Watt LF amplification
- 1-inch soft dome tweeter and 6.5-inch polypropylene woofer
- 55Hz - 21kHz Response
- Magnetically Shielded
- Electronically and Acoustically Matched

Also Available- TRM-8

- 1-inch soft dome tweeter and 8-inch polypropylene woofer
- 45Hz - 21kHz frequency response ±2dB
- 75 Watt HF, 150 Watt LF amplification

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COMPUTER BASED DIGITAL AUDIO SYSTEMS

MOTU AUDIO Hard Disk Recording Systems

The MOTU Audio System is a PCI based hard recording solution for the Mac and PC platforms. At the heart of the system is the PCI-324 PCI card that can connect up to three audio interfaces and allows up to 72 channels of simultaneous I/O. Audio interfaces are available with a wide range of I/O configurations including multiple analog I/O with the latest 24-bit A/D/A converters and/or multi channel digital I/O such as ADAT optical and TDIF I/O as well as standard S/PD F and AES/EBU I/O. Each interface can be purchased separately or with a PCI-324 card allowing you to build a system to suit your needs. Includes drivers for all of today's hottest audio software and AudioDesk, multitrack recording and editing software for the Mac.

THEY ALL FEATURE– • Mac OS and Windows compatible • Includes software drivers for compatibility with all of today's popular audio software plus AudioDesk. MOTU's sample-accurate audio workstation software for Mac OS • Host computer determines the number of tracks that the software can record and play simultaneously, as well as the amount of real-time effects processing it can support • Front panels display metering for all inputs and outputs

• **AudioDesk Audio Workstation Software** for Mac OS features 24-bit recording, multi-channel waveform editing, automated virtual mixing, graphic editing of ramp automation, real-time effects plug-ins with 32-bit floating point processing, crossfades, support for third-party audio plug-ins (in the MOTU Audio System and Adobe Premiere formats), background processing of file-based operations, sample-accurate editing and placement of audio, and more

2408 mkII FEATURES– • 7 banks of 8 channel I/O: 1 bank of analog, 3 banks of ADAT optical, 3 banks of Tascam TDIF, plus stereo S/PDIF • Custom VLSI chip for amazing I/O capabilities • • Format conversion between ADAT and DA-88

• 8x 24-bit 1/4" balanced analog I/Os • 24-bit internal data bus for full 24-bit recording via digital inputs • Standard S/PDIF I/O for digital plus an additional S/PDIF I/O for the main mix • Sample-accurate synchronization with ADATs and DA88s via an ADAT SYNC IN and RS422

1224 FEATURES– • 24-bit analog audio interface • State-of-the-art 24-bit A/D/A • Simultaneously record and play back 8 channels of balanced (TRS) +4 dB audio • 24-bit balanced +4 XLR main outputs • Stereo AES/EBU digital I/O • Word clock in/out • Dynamic range of 116 dB (A-weighted) • Front panel displays six-segment metering for all inputs and outputs • Headphone jack with volume knob

308 Features– • 8 channels of coaxial S/PDIF using 4 RCA input and 4 RCA output connectors • 8 channels of optical S/PDIF using 4 toslink input and 4 toslink output connectors • 8 channels of AES/EBU using 4 XLR male and 4 XLR female connectors • Word Clock I/O allows the 308 to synchronize with digital audio environments

24i Features– • 24 high quality, 24-bit analog inputs • Balanced 1/4" analog outputs • Optical and coaxial S/PDIF outputs • Front panel headphone output with level control • Word Clock I/O • Connect up to three 24i rack I/Os to a PCI-324 audio card for a total of 72 inputs and six outs

digidesign Digital Audio Workstation For Mac And PC

A Division of Avid Technology, Inc

A completely integrated digital recording, mixing and editing environment for the Mac and PC, the DIGI-001 offers a 24-bit multi I/O breakout interface along with Pro Tools LE software— based on Digidesign's world renowned ProTools software. The DIGI-001 interface features 18 simultaneous I/Os made up of 8 analog inputs and outputs— two of the inputs are full featured mic preamps with phantom power, and digital I/O including standard S/PDIF as well as an ADAT optical interface that can also be used as a S/PDIF I/O. ProTools LE supports 24 tracks of 16 or 24-bit audio and 128 MIDI tracks and also features RealTime AudioSuite (RTAS) effects plug-ins. For ease of use, MIDI and audio are editable within the same environment and all mixing parameters including effects processing can be fully automated.

FEATURES–
- 18 simultaneous, 24-bit ins and outs with support for 44.1 and 48 kHz sample rates
- 20Hz - 22kHz freq. response ± 0.5 dB
- 2 channel, XLR mic/1/4" line inputs with -26 dB pad, 48v phantom power, gain knob, and HP Filter at 60Hz
- 6 ch. line inputs (1/4") TRS balanced/ unbalanced w/ software controlled gain
- +4dB balanced 1/4-inch Main outputs
- Balanced 1/4" monitor outs with front panel gain knob
- 1/4-inch unbalanced line outputs channels 3-8
- Headphone output with independent gain control knob
- 2 channel S/PDIF coaxial digital I/O
- 8 channel ADAT optical I/O can also be used as 2 channel optical S/PDIF

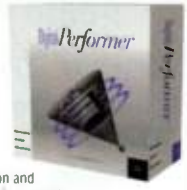
Pro Tools LE
- Supports 24 tracks of 16 or 24-bit audio and 128 sequenced MIDI tracks
- Sample-accurate simultaneous editing of audio & MIDI
- Real-time digital mixing capabilities include recall of all mixing parameters, support for edit and mix groups and complete automation of all volume, panning, mutes and plug-ins
- Route and mix outboard gear in realtime
- MP3 and RealAudio G2 file support (Mac)
- Two plug-in platforms offer multiple options for effects processing— Real-Time AudioSuite (RTAS) is a host-based architecture that allows an effect to change and be dynamically automated in realtime as the audio plays back. —AudioSuite is a file-based format, that renders a new file with the processed sound.
- Bundled RTAS plug-ins include 1 and 4-band EQ, Dynamics II- compressor, limiter, gate and expander/gate, Mod Delay - short, slap, medium, and long delays with modulation capabilities for chorus or flange effects and dither. AudioSuite plug-ins include Time Compression/Expansion, Pitch Shift, Normalize, Reverse

MIDI Functions
- MIDI functions include graphic controller editing, piano roll display, up to 128 MIDI tracks and edit ng options like quantization, transpose, split notes, change velocity and change duration.
- MIDI data can be edited on the fly

SOFTWARE

Also available with MOTU's award-winning Digital Performer audio sequencer software package

Digital Performer 2.7 MIDI/AUDIO Software for Mac



Digital Performer is an integrated multitrack digital audio and MIDI sequencing program packed with advanced tools for a wide variety of audio applications. Sample accurate editing, loop based audio capture, realtime DSP effects and the best MIDI timing/resolution available insures unlimited creative potential.

FEATURES-
- Includes over 50 real-time MIDI and audio effects plug-ins • POLAR window - which provides Interactive audio loop recording • 24-bit recording and editing • 32-bit native effects processing - incredible sounding EQ and other FX • 64-bit MasterWorks Limiter and Multiband Compressor plug-ins included • Sample-accurate - the most reliable waveform editing and tightest sync you can get • Samplers window - drag & drop samples between your Mac and your Sampler • PureDSP stereo pitch-shifting and time-stretching • Unlimited audio tracks, real-time editing, full automation and remote control • QuickTime digital video support

NEW FEATURES-
- Full Plug-In FX automation and increased 3rd party Plug-in support
- Drum Editor
- **Adjustable Display Resolution** from 2 to 10,000 PPQ. Tick values up to four decimal places can be set allowing 1000 times greater editing resolution. For example, if you are used to editing MIDI data at 480 PPQ, you can set your edit resolution to 480,000 for 1000 times more precision.
- **MIDI Time Stamping** (MTS) which exists in MOTU's rack-mountable USB MIDI interfaces, delivers MIDI data from Digital Performer to MIDI devices as accurately as a third of a millisecond for every single MIDI event.

TC WORKS SPARK 1.5 2-Track Editing For Mac

ULTIMATE SOFTWARE MACHINES

Spark is professional 2-track audio editing software for the Power Macintosh that provides fast access to files and powerful processing tools. Supports files up to 24-bit/96kHz and has batch processing, VST plug-in support, as well as MP3 file export built-in. Audio can be extracted from a Quicktime movie, edited and then exported along with the video to a new file. Bundled with Adaptec's Toast so you can burn your audio directly to CD.

- Browser View- File database, audio editor and play list all in one easy to use display with movable border lines- Eliminates the need for surfing several windows to access and edit files
- Wave Editor- Perform off-line editing, processing, and create markers and non-destructive regions
- Supports AIFF, Sound Designer, .WAV and QuickTime file formats.
- DSP Processing Includes- Normalize, Reverse, Fades, Crossfades, and Sample Rate conversion and realtime Time Stretching
- VST Plug-In compatible
- Supports file swapping with most major samplers and any sampler that supports SMDI • Batch Processing
- Bundled with Adaptec's Toast Pro you can burn your audio on CD
- Extract audio from a quicktime movie for editing and then export the audio along with the video into a new file
- **SPARK 1.5** supports MP3 audio authoring for the web directly from the file menu

AMM-1 Microphone Modeler

ANTARES

The AMM-1 Microphone Modeler uses patented technology to create precise digital models of a wide variety of microphones, from historical classics to modern exotics and even industry-standard workhorses. Simply tell the Microphone Modeler what microphone you are actually using and what microphone you'd like it to sound like. It's as simple as that. Available as a plug-in for the TDM and MAS environments, with DirectX and Mac VST not far behind.

FEATURES–
- Proprietary DSP-based acoustic modeling allows any reasonable quality microphone to sound like any of a wide variety of high-end studio mics • Models reproduce the effects of windscreens, low-cut filters, pattern-dependent frequency response and proximity effects • Create hybrid mics that combine the bass response of one mic with the treble response of another
- Add a model of classic tube saturation distortion • Use during mixdown to change the mic on an already recorded track • Incredibly simple to use - simply select the mic you're using and the mic you want it to sound like • Includes an extensive collection of digital models of historical classics, modern exotics, and industry-standard workhorses • Additional models can be downloaded from the Antares web site

WAVES Pro-FX Bundle Plug-ins For Mac or PC

The latest Bundle from Waves has some of the coolest sound design plug-ins available for the Mac and Windows platforms.

SuperTap - Six taps of mono or true stereo delay (up to Six seconds) • Global LFO modulation • 2 feedback modes • Q10-style filtering for each tap • rotation (stereo panning) • Delays are adjustable in milliseconds and note values • Tap out delay times or patterns using the Tap Pad

MetaFlanger - Vintage tape-flanging, phaser-emulation, and special effects • True dual-delay flanging sounds • Wet signal include filters so you can flange or phase just part of the signal • Factory presets of vintage emulations (Mutron, MXR, Itchycoo Park) and more

MondoMod - AM, FM, and Rotation (stereo panning) modulators • Gentle wandering guitar solo panning or bizarre destructive effects • Single LFO drives all modulators with independent phase offsets between the modulator signals.

UltraPitch - Formant-corrected pitch shifter with 6-voices • Excellent gender-bending • Independent stereo panning and delay • Animator delay-randomizer. Set the pitchshift by musical intervals (with 5 cent resolution) • Manual formant mapping as well as presets that perfectly match instrumental formant responses • Creates huge and thick stereo chorusing, doubling, parallel harmonies, excellent vocal slap/spread effects, and much more

Enigma - Mysterious and innovative, Enigma combines a complex notch filter, short delay feedback loops and modulation to create distinctive sound design effects.

Doppler - Developed for post, film sound and game designers. Provides realtime doppler effects with auto and manual triggering modes, full control of air damping, panning pitch, path curve, gain, start/stop points and reverb tail.

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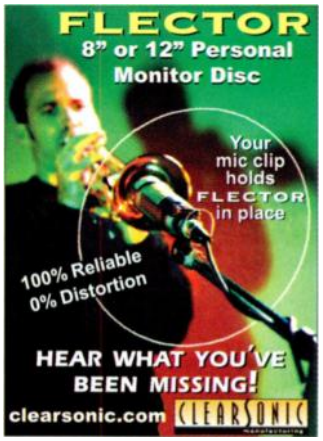

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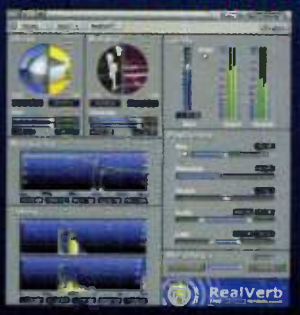

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FINAL MIX

By Larry the O

The Best of Times or the Worst of Times?

The fraternity of recording engineers used to be a pretty rarefied club consisting of those men (hardly any women, alas) who were dedicated enough to break in as a studio "gofer" and stick with it until, if they had talent and applied themselves, they became well-trained and seasoned professionals. Today, recording is much more democratic: almost anyone can put a small studio together and record in their own home.

The proliferation of the professional personal studio (or project studio) is a mixed blessing, with some things gained and some lost. Some aspects cut both ways. For instance, consider the project studio's relatively isolated working environment.

In the days when serious recording couldn't be done at home, people learning the craft of audio engineering did so under the tutelage of experienced senior engineers in a commercial studio. Well-developed techniques of miking, recording, and mixing were passed on through observation and instruction. Systems of organization, documentation, and procedures were impressed on the newbie as much as professional conduct and client-handling tricks.

In contrast, most project-studio practitioners work largely on their own. The down side is the number of "engineers" who can edit in Pro Tools all day long but know only about the one or two microphones they own and even then know only how to use them for guitar and vocal overdubs and perhaps for drums. Don't ask most of them to record a woodwind quartet, and don't expect them to keep their composure when a piece of equipment dies while a client is present.

On the other hand, working on one's own fosters individualistic approaches that can become one's stock-in-trade, as well as a deep mastery of the tools that are present in that studio.

Working in a traditional studio means operating as part of a team, which entails both cooperation and collaboration. New artistic and technical challenges are met by the collective application of several or all of the studio staff's brains. It also entails a degree of compromise, whereas the project studio offers the possibility of realizing an artistic or commercial vision in pure, undiluted form.

The old way requires entry to the recording world in relatively menial jobs, fetching coffee and the like. Slowly, aspiring engineers work their way up to second engineer and then, after thoroughly learning the whole studio and participating in many sessions, graduate to being a first engineer. Sometimes this last step means waiting until one of the established engineers moves on, leaving an opening. In contrast, the project studio is hands-on from the get-go and requires users to do everything themselves, including troubleshooting problems that arise.

So, is one environment better than another? That's a tough call. In the end, I think we're better off with the way things are now because it is possible to have the best of both worlds, but getting the best of the "old" world today requires some definite and directed effort. As much information as one can glean from magazines and online interaction, a good deal of recording knowledge, especially that involving microphones, rooms, and speakers, can really only happen "in the flesh." Getting this sort of knowledge, along with the benefits of collaboration, requires that project-studio practitioners get out of their studios and into those of others—and get others into their own.

This can mean more involvement with one's peers, but it seems to me much more difficult today to create situations where one can learn from people who are much more experienced. One way is to try and get jobs assisting more experienced engineers, but the fact is that those are hard connections to make.

Times have certainly changed, but it is not clear that they have changed for the better . . . or for the worse.

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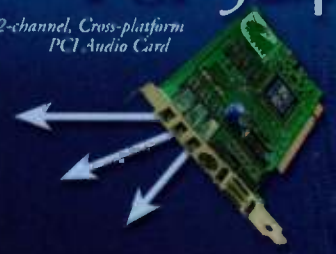

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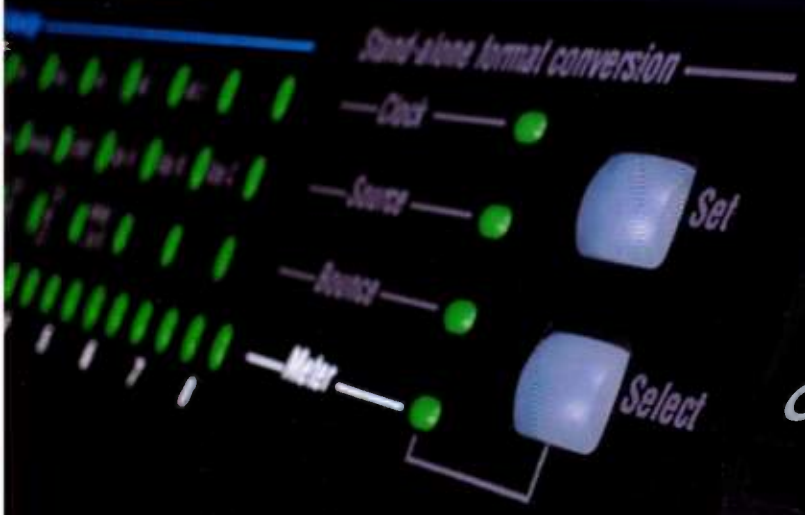

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