MS-DOS 5.0 • Hard-Disk Recording Primer • Reviews of Peavey DPM-2 and 6 More

Electronic Musician

U. S. $3.50/Canada $4.50
December 1991

DIGITAL UNION

MIDI Sequencing and Digital Audio Recording

Microphone Buyer's Guide

135 Models Compared

•

Season of Dreams

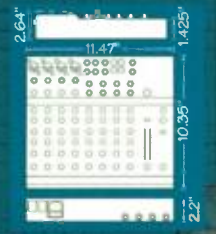
Holiday Wish Lists from the Pros

12
0 71896 47104 5

NEW! MicroSeries 1202

Mackie design and manufacturing technology creates a $399 mixer without compromises! In the past, small mixer specifications and quality dropped in direct proportion to price, making lower cost models unacceptable for serious recording, broadcast or sound reinforcement.

But with the **MicroSeries 1202**, you get the same high performance electronics and rugged all-steel construction as its famous big brother, the CR-1604. The result is a rare combination of performance and reliability in a small, very affordable mixer.



From the noise and distortion specs, you'd think it was a big studio console. After all, it has discrete mic preamps, +28dBu balanced output drivers, and a 90dB working S/N ratio.

The **MicroSeries 1202**'s footprint is under one square foot, yet it packs an amazing total of 20 inputs, all designed to work with any level, from instrument level, to semi-pro –10, to professional +4 levels. With performance equal to the proven CR-1604, the rack-mountable **MicroSeries 1202** excells in applications where other small mixers can't measure up:

Mini recording mixer
Broadcast remotes
8-track monitor mixer
AUX inputs for a bigger console
Headphone or cue mix
Compact keyboard mixer
Small church or school systems
Impedance/level converter

N°3 IN A SERIES

PRO SPECS FEATURES & PERFORMANCE IN A COMPACT, RELIABLE PACKAGE.

THE NEW MICROSERIES 1202 FROM MACKIE.

Four +48V phantom-powered mic preamps. Like the CR-1604, the new 1202's preamps are designed to handle screaming vocals or close-miked drums without overload — yet can capture the subtle nuances of delicate strings or woodwinds with the extraordinary fidelity of the best studio mic preamps. . . Specs like these have never before been available on a $399 mixer: –129 dBm E.I.N., 0.005% THD, +14dBu max input.

4 stereo channels w/separate L/R inputs (along with 4 mic & 4 mono lines, 20 inputs total!)

Trim matches any signal, including instrument levels, –10 semi-pro and +4 pro gear.

Two AUX sends with plenty of gain for special effects and center detent at unity gain.

EQ at musically useful frequencies: 80Hz (more real thump than 100) and 12.5kHz (more sizzle than 10k).

Inside: Less than **0.025%** THD 20-20kHz; **90dB** S/N ratio (ref +4dBu), **108dB** dynamic range.

UnityPlus channel gain controls minimize noise, maximize headroom. 20dB gain above unity reduces need to constantly re-adjust trims during performance.

No wall wart! Like the CR-1604, our new MicroSeries 1202 has an internal power supply.

Rugged and reliable...all-steel, heavy-duty construction; double-sided, through-hole-plated fiberglass circuit boards for maximum durability and full electronic protection for input/output circuitry from power surges, static discharges, misuse and impedance mis-match.

AUX Outputs for stage monitoring, effects, recording, 22dBu max out.

Stereo AUX Returns. Separate left and right inputs & 20 dB gain for effects, tape playback, extra line inputs, etc.

Bal./unbal. mono line inputs

"Phono" style **tape input and output** connectors for recording and playback.

Lurking in the shadows: The MicroSeries 1202's big brother, the **CR-1604** 16-channel Mic/Line Mixer. Road and studio-proven by professional musicians, producers, sound contractors and broadcasters worldwide and rave reviewed by major pro audio publications. Naturally, the new 1202 has the same great sound, specifications and performance.

Main Outs. TRS output drives balanced or unbalanced inputs. Max bal out =+28dB, unbal.=+22dB.

3-Year Warranty

Stereo AUX returns have enough gain to work with all levels, are ultra quiet with super-high headroom.

Tape monitor switch brings tape inputs up in AUX 2 so you have level control.

12-segment LED VU meters. Via Ch. Metering button, display reads main output levels, mic input levels, or line input levels for far more accuracy and detail than mere overload LED's.

Same long-life, contamination-resistant **sealed rotary potentiometers** as CR-1604.

High output headphone amp drives headphones to max level.

Made in Woodinville, WA, USA.

Channel Inserts provide both uninterruped and interrupted direct outputs as well as pre-fader & post-fader effect loop channel patching for equalizers, compressors, limiters etc.

MicroSeries 1202 12-Channel Mic/Line Mixer – Suggested Retail $399

MACKIE

MACKIE DESIGNS INC • 16130 WOODINVILLE-REDMOND ROAD NE, N°2 • WOODINVILLE WA 98072 • U.S.A. • 1-800-258-6883

WRH

ELECTRIFY YOUR MUSIC

Based on A.R.T.'s revolutionary new VLSI, the Multiverb Alpha is a whole new beginning in digital effects processing.

- 6 simultaneous effects
- 20 kHz bandwidth
- New A.S.I.C. 24 bit integration
- Over 50 effects to choose from
- Better than 90dB S/N ratio
- 200 memory locations
- Multifunction rotary encoder
- Studio sampler - auto, manual and midi triggering
- Over 2 octaves of pitch transposing
- Fully programmable mix, level and parameters
- Stereo inputs and outputs
- DC 9V power output jack for powering foot pedals
- 24 types of reverb
- Over 20 types of delay
- Gated and reverse reverbs
- Programmable equalizer
- Leslies and multi-tap delays
- Stereo chorus and flanging

- Stereo panning and imaging and more!
- Exclusive Midi Data Monitor — see the Midi data stream

The Multiverb Alpha offers a level of sound quality that is stunning. The increased power of the new 24 bit A.S.I.C. system allows for incredible amounts of processing resolution. Reverbs sparkle, chorusing is lush, dense and full.

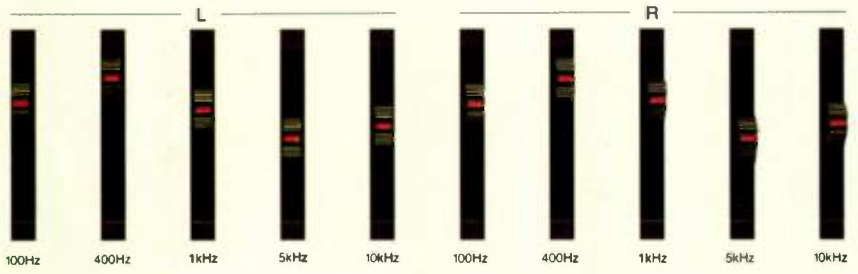
The X-15 Ultrafoot offers realtime control of all midi products but with the Alpha you may do incredible dive bomb pitch changes, sweep solos side to side in realtime and bend notes with your feet! Control up to eight effects at one time. The creative power is electric!

ART

THE SOUND OF PERFECTION

APPLIED RESEARCH & TECHNOLOGY, INC., 215 Tremont Street, Rochester, NY 14608, (716) 436-2720, Telex: 4949793 ARTROC, FAX (716) 436-3942

WRH



The MT120 with 5-band EQ. Creative freedom. And a bit more.

Quite a bit more. Like getting a rock solid bottom end from the kick drum. Like bringing more brilliance to a cymbal. Like making a dull guitar track scream. All from a four track cassette recorder with an integrated mixer and a 5-band graphic equalizer. When you go in to your local dealer, don't ask for the MT120. Demand it.

YAMAHA®

Electronic Musician

AN ACT III PUBLICATION

DECEMBER 1991 VOL. 7, NO. 12

features

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departments

Cover: Photo by Rob Cardin. Special thanks to George Petersen.

Digital Dreams

ANNE HAMERSKY

This holiday season, your recording wishes may come true.

For many electronic musicians, the "stuff of which dreams are made" often involves new gear, particularly that of the digital variety. But until recently, some of the most sought-after pieces of digital gear have eluded our grasp: digital recording equipment. At the recent AES (Audio Engineering Society) convention, there were strong hints that this holiday season may see the dream of affordable digital recording gear fulfilled (see our AES report in "What's New" on p. 17).

Not surprisingly, DAT (digital audio tape) recorders and 2-track hard-disk recording systems were abundant. Tascam, for example, showed a $999 portable DAT with digital I/O from their parent company, TEAC, and several new companies threw their hats into the hard-disk recording arena.

But as nice as these 2-track systems may be, most musicians dream about a digital replacement for their multitrack cassette or reel-to-reel recorder. Well, wishes do come true: The stars of this show were relatively affordable (or at least less expensive) digital multitrack recording systems in a variety of formats.

Computer-based multitrack systems with multiple simultaneous inputs and outputs, the most pricey of the available formats, were shown by Spectral Synthesis and Micro Technology Unlimited on the PC, Digidesign on the Mac, and Hybrid Arts on the Atari. In the stand-alone hard-disk recorder category, Roland showed their DM-80. Finally, and most impressively, Alesis showed a working model of their ADAT 8-track digital tape recorder. Priced under $4,000, this engineering marvel squeezes approximately 40 minutes of recording time onto standard S-VHS 120 videotape.

Though most of these systems had been shown before, their combined appearance made a powerful statement about the evolving nature of multitrack recording. Impeccable audio quality, noise-free tapes, and unlimited track-bouncing no longer are limited to high-end professional gear. Thanks to Alesis' ADAT, in particular, professional-quality digital-recording equipment at a home-studio price is here.

Less expensive digital multitrack systems also fulfill another wish high on the list of many electronic musicians: a fully integrated system that combines MIDI and digital audio. MIDI sequencing programs have had a dramatic impact on the way music is produced, but the editing ease and power these programs provide has been unavailable to traditionally recorded material. Now that sequencing programs that integrate MIDI and digital audio are available and more are on the way, all elements of a recording can be controlled and extensively manipulated from a single environment. It's a powerful union that is bound to become the standard for years to come, which is why we covered the subject in this month's cover story, "When Worlds Collide" (p. 44).

Of course, not everyone includes digital recording gear on their holiday wish list. So just for the heck of it, we asked a number of professional musicians and industry personalities what they'd like for the holidays. You can find their answers in "Season of Dreams" on p. 70. Have a joyous holiday season.

On an unrelated note, I'm proud to announce that **EM**'s June 1991 cover received an Ozzie Award for excellence in magazine design. Congratulations to hard-working art director Andrew Faulkner and his staff.

Bob O'Donnell

Electronic Musician

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Studio 5

The Intelligent MIDI Interface/Processor/Synchronizer/Patchbay

- Intelligent Macintosh MIDI Interface/Processor/Synchronizer/Patchbay
- Supports 240 MIDI channels
- Built-in 16 MHz 68000 microprocessor and 64K RAM for speedy processing
- 128 Patches and unlimited virtual instruments and controllers
- 15 independent MIDI INs and OUTs
- Digital patch number display with program change buttons
- Audio input creates MIDI trigger
- Separate Audio IN, SMPTE IN, and SMPTE OUT
- Two footswitch inputs and one continuous controller input
- Reads all formats of SMPTE and converts to MIDI Time Code or "direct time lock"
- Writes all formats of SMPTE including 29.97 non-drop
- Two thru switches for using peripherals without changing cables
- Internal power supply and detachable power cord
- OMS Software included for studio integration with Opcode Software such as Vision and Galaxy

OPCODE

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GUILT TAX

Your "Guilt Tax" editorial ("Front Page," October 1991) is a perfect example of the mixed blessing of the First Amendment. You are entitled to state your opinion, however uninformed and misleading it may be.

The proposed legislation does not place a tax on anything. A tax is a levy to pay for the operation of the government. The royalty assessed on digital recorders and blank tape will go to the copyright owners, not the government.

Home recording is not clearly already legal. What the Supreme Court's Betamax opinion really held was that off-the-air video taping for time shifting of regular commercial television broadcasts was not an infringement. The movie companies could not prove any harm to their copyrights. The music industry can prove the loss of millions of dollars due to home copying of audio recordings, most of which is not off-the-air.

The Audio Home Recording Act gives consumers the right to make analog copies for private, non-commercial use, without any royalties due. Your readers will benefit. They are (or aspire to be) the professional musicians, songwriters, and recording artists who will receive a share of the royalties.

Geoffrey Hull, Professor
Recording Industry
Management Department
Murfreesboro, TN

Geoffrey—Though you bring up some excellent points, you fail to address the fundamental problem with the proposed Home Recording Legislation: its presumption of guilt. Clearly, illegal home taping is a problem (though independent studies have found it isn't nearly as bad as record companies claim). But to be prosecuted and charged without recourse is completely unjustified. If there were an equitable solution that benefitted all affected musicians, I would reconsider my opinion. As it stands, I believe the proposed legislation is grossly unfair and will, in fact, hurt more EM *readers than it helps. The proposed royalty, which because it's collected and distributed by the U.S. government can accurately be called a tax, will simply line the already-gilded pockets of major record companies.—Bob O'D*

DJ ZEN

Jeez...it's not enough being a radio DJ steeped in trivia enough to know answers to most zen questions. Questions like what is the sound of one hand clapping? How does one pinch smoke? If a tree falls in a forest, etc.

Now Rudy Trubitt's September 1991 "Computer Musician" column had to ask what is the memory of a trombone? Thank God CCRMA's Perry Cook provided the answer.

Good thing EM's available to us radio-production types. It's what keeps me ahead of the competition.

Alan Peterson
New Milford, CT

AMIGA ACCURACY

In your "Guide to Notation Software" (September 1991), I noted some apparent errors in your description of the *Deluxe Music Construction Set* (Amiga version) data.

First, to my knowledge, there are only two Amiga versions: v.1.0, which was copy-protected, and the version I have, the 1.3, which you call 1.2.

You credit the Amiga version with supporting 48 staves, but eight is the known maximum for the versions our Amiga group is familiar with. And you forgot to note that mouse input is possible from the note palette.

I don't know of any other versions for the Amiga, although that didn't stop at least one vendor from advertising a v.2.0 over a year ago until I sicked the state consumer-protection office on them.

Gary Goldberg
Silver Spring, MD.

Gary—According to Electronic Arts product specialist Michael Prince, the production team for the Amiga platform of Deluxe Music Construction Set *did not render an official upgrade number on the software. However, Prince confirms the current version is considered 1.2 by the manufacturer. Regarding the maximum staves figure, the correct number is eight.—Mike Molenda*

DOUBLE TROUBLE

How does Bob O'Donnell find the time to be the editor of EM and star in the hit TV show *Northern Exposure* as Dr. Fleischman? Or were they just separated at birth....

Teddy Rasch
Los Angeles, CA

LACKING A NICHE

It was with great dismay and shock that I read your article "The Fundamentals of MIDI Mixing" (September 1991).

I had read a review in your August 1990 issue about a rack-mount MIDI mixer called the Niche that you gave a 10, which does exactly what this article talks about, MIDI mixing. Yet there was no mention of the Niche in the article.

Ray Williams
Willowdale, Ontario

Ray—I didn't mean to dis your favorite piece of gear. As the article's title stated, it was an introduction to the subject, not a buyer's guide. Few products were named, and then only as illustrations of specific points, entirely without endorsement or comparison. The Niche, in not being mentioned, was in good company with the majority of audio mixers, sequencers, synthesizers, effects units controllers, and other products that can be used in MIDI mixing.—Dan Phillips

GORDON STUDER

The Top 500

Play the D4 with its onboard trigger inputs.

Alesis drum machines are famous for their sounds. The HR-16's natural acoustic drums are still the standard for transparent rhythm tracks. The punchy aggressive samples of the HR16:B redefine how to make rhythm tracks burn. The SR-16 is an instant hit with its sampled reverb and ambience techniques.

Now you can have all this and more with the new **Alesis D4 Drum Sound Module.** There's an incredible 500 sounds in all. Right at your fingertips.

The D4's sounds are unparalleled for their realism. For example, when you hit a D4 sound harder, the tone *and* pitch change just like a real drum, thanks to the D4's Enhanced Dynamic Articulation.™ Plus, stereo reverb and ambience are built into many of the samples so you can keep your mind on the beat.

Using the D4 is a breeze with its large data entry knob and dedicated buttons for all major functions. There's even a touch-sensitive preview button and headphone output for instant gratification... and latenight drumset programming.

Play the D4 with MIDI software or hardware

The D4's 21 user definable drum-sets are accessible via MIDI or through the 12 onboard audio trigger inputs. You can even replace a wimpy drum sound on tape. Which you'll want to do if it didn't come from a D4. No rocket science here. Just pure honest incredible sound. The only reason to buy a drum sound module.

Everybody wants a hit. The D4 has 500 of them right now. At your Alesis dealer.

12 audio trigger-to-MIDI inputs are built in for drum triggers, pads, or tape.

ALESIS THE TOP 500 DRUM SOUNDS

THIS WEEK	LAST WEEK	WKS ON CHART	TITLE / ARTIST	DRUM PRODUCTION
1	2	208	HONEST SNARE / HR-16	ALL WOOD-BRASS RIM
2	NEW ▶		STUDIO TOM / BRAND NEW D4	16" MAPLE TOM w/VERB
3	NEW ▶		BIG "O" / BRAND NEW D4	DOUBLE HEAD KICK w/VERB
4	5	52	RIM SHOT ROOM / SR-16	BRASS PICCOLO w/VERB
5	10	156	BIG FOOT / HR-16:B	SINGLE HEAD 26" MAPLE
6	NEW ▶		SLAM / BRAND NEW D4	POWER TOM w/VERB
7	23	156	COMBO SNARE / HR-16:B	PICCOLO PLUS WOOD
8	NEW ▶		BIG BALLAD / BRAND NEW D4	WOOD SNARE w/BIG VERB
9	NEW ▶		FAT CITY / BRAND NEW D4	SUPER FAT SNARE
			CLOSE TO OPEN	ARTICULATED HI HAT

THIS WEEK	LAST WEEK	WKS ON CHART	TITLE / ARTIST	
302	NEW ▶		RAW HIDE / BRAND NEW D4	CUSTOM SN
303	450	52	HI ROOM TOM / HR-16	10" MAPLE
304	NEW ▶		WET HALF / BRAND NEW D4	HALF OPEN HAT
305	327	52	RIM 2 CENTER / SR-16	ARTICU
306	123	208	[illegible]	DOUBLE HEAD KIC
307	223	15(		
308	401	5		
309	NEW			
310	175	1		
311	NEW			
312	211			

ALESIS STUDIO ELECTRONICS

LOS ANGELES:
Alesis Corporation 3630 Holdrege Avenue
Los Angeles, California 90016

LONDON:
Alesis Corporation 17 Letchworth Point
Letchworth, Hertfordshire SG6 1ND

SOUND CHOICES

A system of digital effects processors that adds spectacular sonic enhancement to your performance or production.

Lexicon's LXP Series digital multi-effects processors combine Dynamic MIDI® effects automation, spectacular effects, 128 user memories, and of course, the legendary Lexicon Sound. Add Lexicon's MRC MIDI Remote Controller, and you have a multi-effects system with an unprecedented range of control. The newest member, the LXP-15, enhances the series even further.

The LXP-15: Simply Brilliant
You don't need a photographic memory or a degree in computer science to get the most from the LXP-15. It was designed to bring its incredible range of effects to everyone. The LXP-15's effects programs include pitch-shifting, stereo delays, gate, plate, and Lexicon's renowned reverb. Best of all, the LXP-15 makes it fast and easy to let them work for you.

For performance freedom without MIDI, the LXP-15 has external inputs for use with most foot switches or pedals. These inputs can be patched to any of the LXP-15's effects parameters. You can even use them together with Dynamic MIDI for superb effects control.

The LXP-1: Small But Mighty
The half-rack LXP-1 gives you access to Lexicon's repertoire of renowned digital reverberation programs, and delay, gate, and chorus programs as well. All via simple controls that let you adjust two parameters for each effects program. The LXP-1 is the essential, fundamental component of the LXP Series.

The LXP-5: Sensational Sound
The LXP-5 complements the LXP-1 with an additional 64 preset effects, including pitch-shift over three octaves, dramatic stereo delay, flanging, chorusing, and a wide array of reverb too. You can access every effect's parameters from the LXP-5's front panel, for a breathtaking spectrum of control. And combine this versatile processor with the LXP-1, and you fill a single rack space with incredible power and performance.

MRC: MIDI Mission Control
The LXP-1 and LXP-5 are formidable in their own right. But add Lexicon's MRC MIDI Remote Controller, and you have a commanding ensemble of networked effects. The MRC also simplifies programming and control of all your MIDI gear, up to 16 MIDI devices simultaneously.

The LXP-1, LXP-5, LXP-15, and MRC are powerful tools for the producer, engineer, or musician. You can't help but make the right choice.

For more information about the LXP Series, call us at (617) 736-0300, FAX (617) 891-0340, or write Lexicon Inc., 100 Beaver St., Waltham, MA 02154.

lexicon
The Art and Science of Sound

A DESIGNER'S VIEW

After reading Roger Linn's "Back Page" (September 1991), I agree that manufacturers usually fall severely short of creating *user-friendly* electronic instruments.

I was surprised that he didn't mention the profession that is devoted to the design of user-friendly products: industrial design. As a practicing industrial designer, it is my job to create product designs that mutually benefit both consumer and manufacturer. Most engineers have a hard time looking at the big picture of a product when they spend their time tracing electrans through circuits. The great strength of an industrial designer is his or her ability to organize the many requirements of engineering, manufacturing, and marketing into a comprehensive design solution that is simple, logical, and beautiful. Electronic instrument manufacturers, take note!

J. Joel Pilger
Atlanta, GA

FEAR OF FLYING CABINETS

I have always thought of EM as a high-quality publication. Therefore I feel I must point out that some information presented in the "Putting Your Sound System in its Place" (July 1991) is so incomplete that it's dangerous. As an audio engineer, I am familiar with flying cabinets above the audience to achieve proper dispersion of mid and high frequencies. However, as a rigger, I am also familiar with the absolute need to do this safely.

Mr. Schierman doesn't give nearly enough information for an inexperienced reader to safely raise P.A. cabinets, which weigh up to several hundred pounds.

Scaffolding, while an inexpensive alternative method, is unstable if not set up properly (i.e., without proper bracing on uneven surfaces, overloaded, or having damaged parts). One local sound company in my area set up scaffolding improperly last year and had several Meyer MSL 3-sized cabinets fall on concert goers, severely injuring several people. How is a reader to know there is a danger like this if the article does not mention the hazards?

Mr. Schierman mentions using approved rigging straps, but approved by who? The club owner? The salesman at the hardware store? Rigging hardware that is safe under some conditions will be unsafe under others. If you load a piece of hardware the wrong way, or overload it, it could fail and hurt someone. The proper way to handle rigging is to hire an experienced rigger whose first concern is *safely*.

Tim Melton
Tempe, AZ

Tim—Thanks for your input. Indeed, safe scaffolding and rigging are of critical importance. In large venues, it's best to hire union gaffers from the International Alliance of Theatrical Stage Employees (IATSE). Those who have a small gig and can't afford professional riggers can start with JBL's Technical Notes Vol.1, Number 14, *"Basic Principals for Suspending Loudspeaker Systems," free from JBL Professional, 8500 Balboa Blvd., PO Box 2200, Northridge, CA 91329. At the end of JBL's publication is a list of further references. But amateurs are better off placing their speakers on* terra firma.*— Steve O.*

NOT A TYPO

Your August 1991 issue had a feature that helped make sense of the chaotic world of computer sequences. However, I was a bit confused when you referred to the September 1990 "Computer Musician." Is that a typo, a sister magazine, or has there been a name change I wasn't aware of? And how can I obtain a copy of this issue?

Sep Sekhavat
Providence, RI

Sep—EM's monthly "Computer Musician" column, which debuted in the September 1990 issue you mention, covers computer issues for musicians. This month's column discusses MS-DOS 5.0 for PC compatibles and how it can help music software.

Back issues of EM are available through Mix Bookshelf, tel. (800) 233-9604 or (510) 653-3307.—Anne-Marie P.

PEANUT GALLERY

I find EM's DIY projects and modifications the most useful part of the magazine. Although I rarely build something, I read the electronic problems. I constantly refer to back issues, where an article may have been no use to me at first but one or two years later answered a question.

Todd Marsden
Royersford, PA

I subscribed a few months ago and I'm glad I did. Keep up the good work. As a beginner, I get a lot out of your blend of beginner-/advanced-level approaches—even if the magazine does seem a bit schizo now and then.

Alan Murdock
Tokyo, Japan

READERS HELPING READERS

Does anyone know what became of the Synthophone MIDI sax? I wrote to their U.S. address in Boston, and the letter was returned marked "addressee unknown." A subsequent letter to their address in Switzerland was not answered.

I tried the instrument at the 1989 Summer NAMM show and was very impressed. I like it better than other MIDI wind instruments, especially because I could use the saxophone technique I already had and did not have to learn to play all over again.

Ray Rideout
San Diego, CA

Ray—Softwind Instrument's Synthophone ($3,450, including shipping and U.S. taxes) is alive and honking. Manufacturer Martin Horni suggests interested buyers contact him at Softwind Instruments, Münstergasse 52, 3011 Bern, Switzerland; tel. (011) 41-31-222820; fax (011) 41-31-7511548. Martin also invites everyone to stop by Softwind's booth at this year's Winter NAMM show.—Anne-Marie P.

ERROR LOG

October 1991, "Studio Toys: The EM Guide to Digital Effects Processors," p. 45: The correct price for the ART DR-X is $629, not $129. Too bad.

October 1991, "What's New," p. 12: The Korg 01/W has 6 MB of ROM-based sounds, not 8 MB. ●

A few important words about the new A-T 40 Series:

AT4049
Omnidirectional
Capacitor

AT4051
Cardioid
Capacitor

AT4053
Hypercardioid
Capacitor

Tony Bongiovi
Power Station

"The 4051 is a great mike, especially for rock. It sounds fat and you can bang away at it with a lot of level without a pad...for a rock studio like the Power Station that's important. When you put it on horns it has a nice clean sound and it holds the dynamics well...it's just an excellent sounding mike."

David Cook
Dreamland Studios

"...real nice top end and a warm bottom end...very versatile. I didn't have to pile on a lot of EQ to capture the air in the studio...very present, very natural sounding mikes."

Milan Bogdon
Masterfonics

"The S/N ratio is superior to some of the other mikes we used. They're bright and clean so we don't have to push the EQ. Superb mike...great for vocals, overheads, snare, toms, electric and acoustic guitar...it seems to work well wherever we put it."

Jeff Baxter
Producer/Artist

"If I'm not getting what I want from another microphone...I've been putting up the 4051 and it nearly always does the job."

Mack Emerman
Criteria Studio

"The response is very flat...it holds the natural tonal qualities even at high sound pressure levels."

Now it's your turn!

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THE PROTEUS™ MASTER PERFORMANCE SYSTEM OFFERS YOU SUPERIOR QUALITY SOUNDS AS WELL AS THE ABILITY TO CONTROL YOUR ENTIRE MIDI SYSTEM. MORE MUSICAL POWER IS AT FINGERTIP COMMAND IN THE MASTER PERFORMANCE SYSTEM PLUS ORCHESTRAL EXPANSION.

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family of electronic musical instruments *(not to mention a few adoring fans)*. Individually, each brings superb sounds, immense versatility and supreme ease of use to the realization of your musical concepts. Combine them and you've created a system of unprecedented range and scope.

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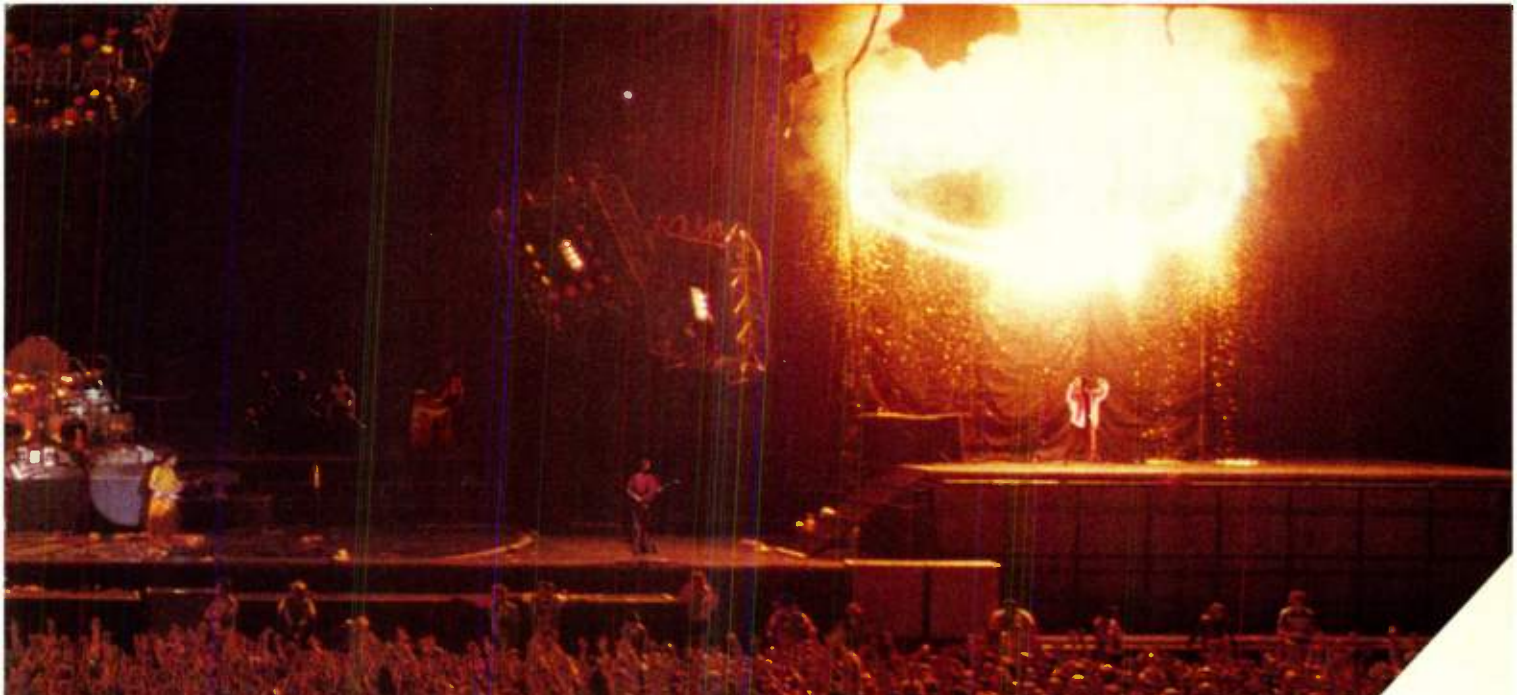
MAKE H

Start with the Proteus™ Master Performance System. This 5-octave pressure and velocity sensitive keyboard offers fabulous 16-bit sampled sounds and a host of powerful MIDI controller features like Quick Keys and Performance Maps. Plus, integrated professional quality digital effects (sure everyone has 'em, but not with this quality).

Then, let your ears delight to the Proteus line of 16-bit multi-timbral sound modules. Each provides a vast collection of exceptional sounds, 32-voice polyphony and extensive sound editing capabilities. Choose Proteus/1



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PROTEUS/1 OFFERS YOU A WIDE SELECTION OF POP AND ROCK SOUNDS.
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Procussion™ (with more than 1000 drum and percussion sounds). In 1992, we'll offer Proteus/3 (World), a gathering of truly unique and unusual sounds from around the globe (from the Bull Roarer and Spirit Catcher to the ever-popular Midjwidz).

A WHOLE WORLD OF SOUNDS WILL BE IN YOUR HANDS WITH OUR UNIQUE NEW PROTEUS/3 MODULE (COMING IN 1992)

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CUBASE TASTE TEST

Make no mistake. Cubase for the Macintosh™ is the 'freshest' Desktop MIDI Recording System currently available.

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Last year, Steinberg/Jones made a money back offer on the Atari ST™ Cubase; if one was not satisfied after 30 days, it could be returned. This campaign ran for seven months and not one program was returned. Hence, we are so confident that you too will love Cubase, we are making the same offer.

Take the taste test, **"Buy it, Boot it, Use it, Love it or your money back!"**....Cubase, the freshest Sequencer available.

*This guarantee is valid through participating dealers only. Please verify prior to purchase. A full refund, less 10% handling and restocking charge, will be remitted upon receipt of the complete (including both installs) Cubase software package in undamaged condition and within the 30 day period. This offer expires on December 31, 1991.

Steinberg JONES

17700 Raymer Street, Suite 1001
Northridge, California 91325
818-993-4091 FAX: 818-701-7452

Report from the 1991 Audio Engineering Society Convention

Digital multitrack recording systems arrive with a vengeance.

In years past, the AES convention was a rather crusty affair, where the golden ears of the pro-audio world would argue the merits of six-figure recording consoles and twenty-year-old microphones. With the blistering pace of technological change and the corresponding decrease in equipment prices, however, it's taken on an entirely new feeling. The primary focus has shifted away from high-end professional recording studios toward the home and project studio markets. Of course, expensive, high-quality equipment still commands a great deal of attention, but each year, new, less-expensive gear grabs a larger share for itself.

This year's show, held Oct. 5-8 in the New York Hilton and Towers, was no exception. Many manufacturers showed low-end recording gear, software, and accessories that in previous years may not have been deemed appropriate for AES. Even more telling, however, the most exciting new products were on the lower end of the price spectrum (though not exactly cheap).

The biggest development at the show was the proliferation of digital multitrack recording systems. Whether your recording preferences lean toward tape, computer-based systems, or stand-alone systems, this year's show had something to offer.

DIGITAL AUDIO RECORDING

Without question, the most exciting piece of gear on display, and the most representative of the move toward more affordable gear, was the Alesis (tel. [213] 467-8000) **ADAT 8-Track Digital Audio Recorder** ($3,995). First shown at the January 1991 NAMM show, this machine may well tear down the remaining barriers separating home and professional studios. Alesis originally promised to release it before the end of the year, and it appears they are on schedule: A pair of working units played in sync and recorded at numerous demos for appreciative audiences. ADAT offers up to 40 minutes of digital audio (at 48 kHz) on an S-VHS 120 videotape. The system uses 16-bit linear A/D and D/A conversion with variable sampling rates from 42 to 50 kHz, and it offers +4 dBu balanced connections (with a 56-pin ELCO connector), -10 dBV unbalanced ins and outs (using 1/4-inch phone jacks), and a proprietary 8-channel, optical digital output. The optional BRC (Big Remote Controller; $1,995) controls up to sixteen units, sync-locked with better than single-sample accuracy, and reads and writes MTC and SMPTE time code. (The stock remote controller requires a tape track for time code.) An AES/EBU digital I/O option is expected soon.

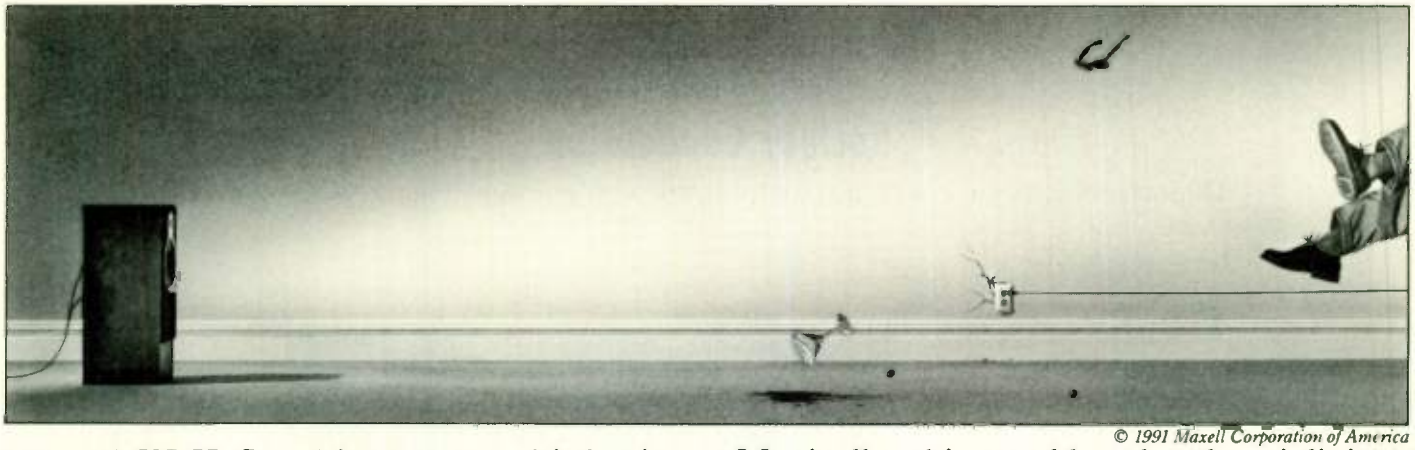
Alesis ADAT 8-Track Digital Audio Tape Recorder

Roland showed the **DM-80 Hard Disk Recorder**, available in 4- and 8-track configurations (DM-80-4 $6,995; DM-80-8 $9,995). The rack-mount DM-80-4, which features a built-in, 24-bit digital mixer with 2-stage EQ, pan, and level controls, comes with a built-in 100 MB hard disk and a remote controller. The 4-track system includes four analog inputs, stereo mix outputs, and individual track outputs, all using 1/4-inch, balanced connectors. Two separate SCSI ports are included, one to connect up to six external drives, and one for 4 mm data (DDS) DAT or 8 mm (Exabyte) videotape backup. Basic recording operations are tape-recorder-like, and the song-construction environment is similar to a sequencer. In addition to both MIDI and SMPTE time code support, the DM-80 has a video sync input. The manufacturer also offers optional remote controller (DM-80-R $1,895) and fader (DM-80-F $1,295) units and *Track Manager System* controller/editing software ($650) for the Macintosh. An expansion kit is planned that upgrades the 4-track version to eight tracks.

Korg is shipping the **SoundLink** ($35,000), an 8-track, random-access, hard-disk audio recorder/editor with an automated digital mixer and onboard digital EQ and effects processing. The recorder includes a 670 MB hard disk that provides 110 track-minutes of recording time at 48 kHz, expandable to more than nine hours with the addition of five hard disks. The unit also incorporates a 16-track MIDI sequencer and has LTC and VITC time code inputs, 8 mm streaming-tape backup, and external machine control. SoundLink offers balanced analog XLR ins and outs as well as AES/EBU and S/PDIF digital I/O.

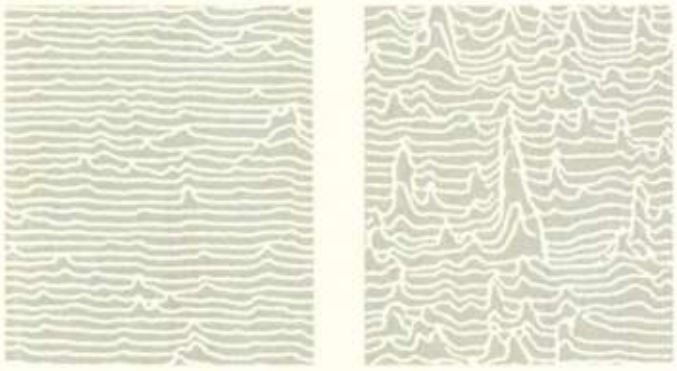
Hybrid Arts showed **ADAP IV** ($15,000-$20,000 depending on hard-disk drives), its Atari-based, 4-track hard-disk recording and editing system. Essentially an upgraded ADAP II, the new system provides non-destructive audio recording and editing integrated with the sequencing functions of Hybrid's *SMPTE Track Gold*. ADAP IV consists of a 4 MB Atari ST/STe CPU; a 4-channel converter unit that includes 16-bit, 64-times oversampling A/D and 18-bit, 8-times oversampling D/A; a signal-processor module; a

THE SCIENCE BEHIND MAX



Maxell XLII-S achieves new highs in Maximum Output Levels, offers wider dynamic range, along with significant reductions in AC Bias Noise and Modulation Noise. This is an all-new Maxell audiotape formulation capable of blowing you away like never before.

We started from scratch, creating



Smooth Side. Rough Side.
Maxell dual-surface base-film reduces tape jitter.

XLII-S from the base-film up. In fact, the base-film is unlike anyone else's and our patent on it is pending.

We call it "dual-surface base-film." One side is smooth, the other rough. The smooth side provides the sound and the rough side provides a stable, non-sticky ride through the tape deck's transport mechanism with the least possible tape jitter.

Excessive tape jitter causes phase deviation which results in echo "shading." Musically, this would make the violinists in a symphony orchestra sound as though they were strolling around the stage instead of sitting still. You don't want gypsy violinists wandering through your symphony.

A powerful reason for trying Maxell XLII-S.

The standard magnetic coating on nearly all audiotapes today consists of gamma ferric oxide particles.

But standard wasn't what we were shooting for when we developed XLII-S. Instead, we harnessed a higher energy magnetic particle we call Black Magnetite. It has 13% greater magnetic power and is a major contributor to the outstanding MOL of this new tape.

Many tapes' magnetic particles go on in a snarl.

Another is the superior dispersion technique we employ in placing the Black Magnetite particles onto the tape.

ELL'S BLOW-AWAY SOUND.

During manufacture, some tapes are run through a magnetic field and the magnetic particles adhere to the film in a willy-nilly, helter-skelter pattern—similar to the arrangement you'd find on the end of a magnet if you dunked it into a bowl of metal filings.

IEC Tape Specifications				
Tape Selector Position				IEC II High (CrO2)
			Unit	XLII-S 100
Physical Properties	Backing Material			Dual Surface Tensilized Polyester Base Film
	Tape Width		mm	3.81
	Coating Thickness		μm	4.5
	Total Thickness		μm	11.0
	Yield Strength		N	5.5
	Breaking Strength		N	10.5
Magnetic Properties	Magnetic Material		—	Black Magnetite
	Coercivity		kA/m (Oe)	58(720)
	Retentivity		mT(G)	190(1900)
	Squareness		—	0.90
Electro-acoustic Properties	Optimum Bias		dB	+1.0
	Sensitivity	315 Hz	dB	+0.5
		6,300 Hz	dB	+1.5
		12,500 Hz	dB	+3.0
		16,000 Hz	dB	+4.5
	Output Uniformity at 315 Hz		dB	0.3
	Output Uniformity at 8 kHz		VU	0.4
	Dynamic Range	315 Hz	dB	65.5
		10 khZ	dB	57.5
	MOL (Maximum Output Level)	315 Hz	dB	+6.0
		10,000 Hz	dB	-2.0
	AC Bias Noise		dB	-59.5
	Erasing Effect		dB	70
	Print Through		dB	51

All features and specifications are subject to change [illegible] (Specifications are measured with [illegible] Tape U564W in accordance with [illegible])

The XLII-S Performance Story.

At Maxell, we use a unique and complex process called "multi-orientation." Simply stated, it allows us to place smaller, Black Magnetite particles onto the tape in greater density, in near perfect alignment. The result is a smoother, more uniform coating which produces less AC Bias Noise.

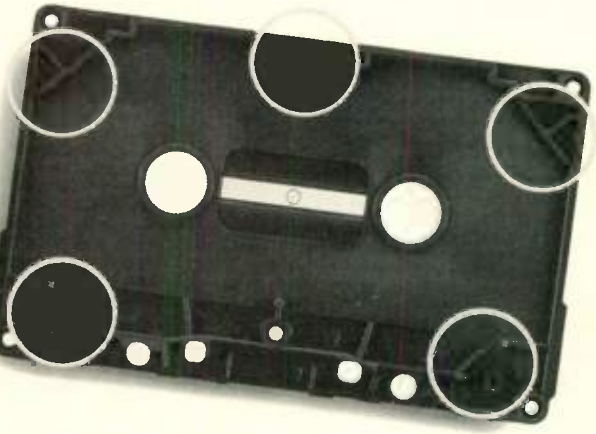
Finally, there's a newly engineered cassette shell that doesn't merely *house* the tape. It *contributes* to the tape's outstanding performance.

Maxell's "multi-orientation" technology sets the particles straight.

Through the use of a new composite material—a blend of ceramic and polymer resins—we created a *high resonance-damping cassette shell*. More rigid and weightier than standard cassettes, it reduces modulation noise and helps maintain phase accuracy. Also, by making the window smaller, we were able to improve the cassette's overall structural integrity, building in five support points instead of the standard three.

All in all, we think you'll find that Maxell XLII-S is the finest High Bias audio cassette available today.

Make it your first choice for program material that demands the highest standards of performance. Buying anything less is like knowingly setting out to take your music to the min.



XLII-S vibration-damping cassette shell has five support points for increased rigidity and durability.

TAKE YOUR MUSIC TO THE MAX.

MIDI interface; and a SMPTE Chase Lock board. It supports a variety of SMPTE time code formats and audio sampling rates, and AES/EBU and S/PDIF digital I/O are included. A MIDI-equipped remote editor controls most recording and editing functions and includes a scrub wheel.

Micro Technology Unlimited (tel. [919] 870-0344) showed version 2.0 of its **MicroSound hard-disk recorder/editor** ($2,690-$3,890) for PC compatibles with an AT-style bus. The basic system hardware consists of a 56001-based DSP board and the MicroSound I/O module (available with unbalanced analog, balanced analog, and AES/EBU plus S/PDIF digital I/O). MicroSound can be expanded into a 4-track system with the addition of optional expansion boards ($1,650-$1,850). Another optional board ($495) adds digital I/O to the analog systems. The company's *Windows 3.0*-based *MicroEditor* software provides graphic zone and waveform-editing, and the new version allows simultaneous stereo recording and playback from a single disk. Two additional software programs also are available: *PCSound* ($250) is a MicroSound-compatible version of *C-Sound* synthesis software that includes *MicroTools*, a DSP package that offers time compression/expansion, pitch transposition, noise suppression, filtering, and sample rate conversion. *MicroTools* ($200) also is available separately.

Steinberg/Jones gave an advance peek at **Topaz MT** ($16,000), a real-time stereo digital audio editing hardware/software package for the Macintosh that is scheduled for U.S. release in February 1992. The Mac provides the user interface, while the Steinberg hardware provides 8-times oversampling analog and AES/EBU digital I/O; storage, using a magneto-optical drive (the system can handle up to six MO and Winchester drives); and DSP functions for real-time editing and effects processing. Other features include 32, 44.1, and 48 kHz sampling rates; sample-rate conversion; 5-band parametric EQ; time compression; and transposition. The program is *MIDI Manager* and System 7-compatible. An optional MLTC 1 time code synchronizer ($1,450) provides SMPTE time code support.

Sonic Solutions (tel. [415] 394-8100) also showed a new Mac-based disk recording system. The **SonicStation** ($4,995) is a lower-cost version of the company's Sonic System hard-disk recorder/editor plug-in board and software package. Like the original version, SonicStation offers real-time, non-destructive edits, crossfades, and level adjustments. The system also includes stereo digital inputs and outputs but is capable of real-time playback and mixing of eight to twelve channels off a single hard disk. An optional A/D/A converter ($995) also is available.


Tascam 464 Portastudio

The most interesting twist in hard-disk recording systems was the Mac-based **SoftSplice Digital Audio Editor** ($3,995 to $4,695) from newcomer Digital Expressions (tel. [206] 389-9895). Instead of using a NuBus card like all the existing systems, SoftSplice does all of its digital audio recording and processing in an external SCSI device that holds both the DSP board and a hard disk (either 340 or 760 MB). As a result, it can be used with any Macintosh, including the SE/30 or even the Classic. The system is capable of 4-track mixing and playback, with real-time crossfades and EQ, and can sync to SMPTE through MIDI Time Code. Graphic waveform editing and EDL-style editing are available in the software, as are MIDI-controllable automated faders. AES/EBU and S/PDIF stereo digital I/O are provided on the box; A/D/A conversion must be provided by a DAT recorder or separate converters.

ANALOG RECORDERS

The latest edition to Tascam's line of Portastudios is the **464 4-track cassette recorder/mixer** ($899). Modeled after the 424 and 488, the 464's gray wedge chassis includes four XLR inputs with trim controls and 3-band, sweepable-mid EQ, and two stereo inputs with 2-band shelving EQ. The 464 also includes two mono effects sends and two stereo returns.

SYNTHS AND SAMPLERS

E-mu Systems (tel. [408] 438-1921) demonstrated its **Emulator III Expander** ($7,995), expected to ship in early 1992. Available as a stand-alone sampler or E-III expander module, the E-IIIx comes with 8 MB of sample RAM, expandable to 32 MB; Sigma-Delta A/D converters with 64-times oversampling (at 44.1 and 48 kHz); 18-bit DACs for each of the eight programmable, polyphonic outputs; and aux sends and returns on each output for adding external effects processors. Sixteen-bit DSP functions include pitch conversion, EQ, delay, compression, gain change, and cut-and-paste editing. The unit includes AES/EBU digital I/O and a SCSI port.

The Yamaha booth showcased a long-anticipated development: digital outputs on synthesizers. The company announced that it would produce a **retrofit offering digital outputs for the SY99** (approximately $1,000-$2,000). Targeted for an April release, the retrofit would give the instrument two stereo AES/EBU digital outputs (or, optionally, two Yamaha Y2 format DIN connectors) and a word clock input for synching up with other digital equipment or house sync.

SOFTWARE

Steinberg/Jones (tel. [818] 993-4161) demonstrated ***Cubase Audio*** for the Macintosh ($795), which combines Steinberg's *Cubase* sequencer with onscreen digital audio recording and non-destructive editing. The program uses Digidesign Audiomedia, Sound Tools, or Pro Tools recording hardware, controlling from two to 64 audio tracks (as many as the hardware can handle). It also can play back through SampleCell. The program is *MIDI Manager*-compatible and System 7-savvy, communicating via Apple Events with Steinberg's ***Time Bandit*** time compression/expansion utility ($495).

On the low end of the price spectrum, MIDI Land (tel. [714] 595-0708) released ***Final Cut*** ($99.95), a **16-track sequencer** for IBM PC-compatibles that offers 192 ppqn resolution, a MIDI data filter (for recording), and piano-roll

Jam with the best.

No matter what kind of music you make, you make better music playing with better musicians. That's why you owe it to yourself to sample the ENSONIQ EPS-16 PLUS Digital Sampling Workstation.

The EPS-16 PLUS is your ticket to an incredible library of over 1000 sounds. Sounds that have been developed exclusively for ENSONIQ by some of the best in the business.

The extensive library for the EPS-16 PLUS numbers over 1000 sounds — and new collections are being released every month.

and David Hentschel, and musicians like bassist Marcus Miller, jazz organist Joey DeFrancesco, drummer John Robinson, and vocalist Maurice White.

To help bring their expertise to your music, the EPS-16 PLUS is available as a keyboard or a rack-mount unit. Both feature 16-bit fidelity, 24-bit dynamic effects, and a 16-track sequencer with recording and editing features geared towards musicians. And both are available in Turbo configurations with expanded RAM, our FLASHBANK™ memory, and SCSI interface to give you all the power and versatility you need.

The EPS-16 PLUS Digital Sampling Workstation.

Jam with an EPS-16 PLUS, and you can make music with pianos sampled from Chick Corea's Mad Hatter Studio, guitars by Paul Jackson, Jr. and synth programs by Jason Miles. You can benefit from the talents of respected producers like Nile Rodgers

The EPS-16 PLUS Rack-mount.

So take your music to the next level and jam with the best. The ENSONIQ EPS-16 PLUS. For the dealer nearest you, call 1-800-553-5151.

The SD-1 Music Production Synthesizer — Advanced synthesis, 16-bit output circuitry, 24-bit dynamic effects, and a 24-track sequencer. Truly, the next generation in integrated music production synths.

The SQ-R PLUS Synthesizer Module — The great sound of the SQ-1 PLUS in a single-space rack-mount .

The SQ-1 PLUS Personal Music Studio — Advanced synthesis, 24-bit dynamic effects, and a 16-track sequencer make this the low-cost MIDI studio with the high-quality sound.

The SQ-2 Personal Music Studio — A 76-key synth with great sounds, 24-bit dynamic effects, and a 16-track sequencer. The perfect choice when 61 keys just aren't enough.

Please send me the FREE ENSONIQ Guide to Choosing a Synth vs. a Sampler.

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graphic editing. You can separately quantize note durations and attack times and can apply dynamics compression, limiting, and expansion. The program supports Standard MIDI Files, MTC, and Song Position Pointer. In addition, the company showed the **PCD-401 sound board** ($389), a combination MPU-401-compatible MIDI interface and a 16-voice, 8-part multitimbral, 16-bit PCM playback card with stereo outputs. The board offers 124 preset sounds and one drum kit with 30 percussion sounds. The PCD-401 can be controlled directly from *Final Cut*.

MIDI HARDWARE

The most-physically striking award goes to a working prototype of the Peavey **DPM C8 master keyboard controller** (expected list $1,999.99; tel. [601] 483-5365). The 88-key weighted keyboard provides eight programmable zones/layers and comes with many control features, including two banks of two programmable sliders each; a pitch wheel and two mod wheels, one of which is spring-loaded; two CV-pedal inputs, four footswitch inputs, two merging MIDI Ins with programmable MIDI filters, and four independent MIDI Outs. But the most obvious new feature is a large, programmable X-Y-Z touchpad controller (developed by Intelligent Music) that can be programmed to trigger a variety of MIDI events individually or simultaneously. The DPM C8's built-in, 3.5-inch, PC-DOS-compatible, floppy disk drive writes and sends C8 presets and SysEx bulk dump information for the C8 and external devices.

While we're in Peaveyland, the **MIDI-BASE** MIDI bass guitar controller (price to be announced) arms a Peavey B-90-style electric bass with a fret-sensing system and a quad, bridge-mounted MIDI pickup. You can control a variety of MIDI functions, including program changes, pitch transposition, and patch-editing, from the bass. The unit holds 32 programs in internal memory and sports a digital program and parameter-value display. The bass guitar connects via 9-pin Neutrik cable (carrying MIDI, bass audio, and AC power) with a 1U rack-mount interface box. Regular bass sound is provided by active pickups and electronics developed for Peavey's Dyna-Bass electric bass.

It may look odd, but SynchroVoice's **MidiVox** ($1,595; tel. [201] 483-7416) is the newest seeker after the Grail of **voice-to-MIDI conversion**. MidiVox looks like a soft neck brace (the kind of cervical collar worn by those with neck injuries), but it's equipped with biosensors that pick up vocal chord movement and accurately convert it, preserving subtle vocal inflections and emphases, to MIDI note and controller data.

Opcode Systems (tel. [415] 369-8131) released the **Studio 5 MIDI interface/processor/synchronizer/15 × 15 patch bay** ($1,295). The unit includes a Motorola 68000 processor that handles such tasks as data filtering, channelizing, note-range splitting, and velocity and control-value modification. Battery-backed RAM storage holds up to 128 routing and processing setups. The synchronizer converts SMPTE time code to MTC, provides jam sync, will "flywheel" (remain locked despite dropouts or other SMPTE errors), and is compatible with DTL (Direct Time Lock) and DTLe sync. The unit comes bundled with *OMS* and works with the *OMS* Studio Setup document for enhanced MIDI-system configuration. When used with Studio 5- or MIDI Time Piece-compatible software, the

When You're Buying A Microphone, Who Should You Listen To?

Easy. Just listen to your favorite performers. Chances are, they're using Shure SM57's and SM58's.

In fact, the SM57 and SM58 are used by more professional musicians than any other, from Toledo to Tokyo. With their legendary sound and proven reliability, it's no wonder.

So listen up. You'll find you're in good company with the Shure SM57 and SM58. Call 1-800-25-SHURE. The Sound Of The Professionals®...Worldwide.

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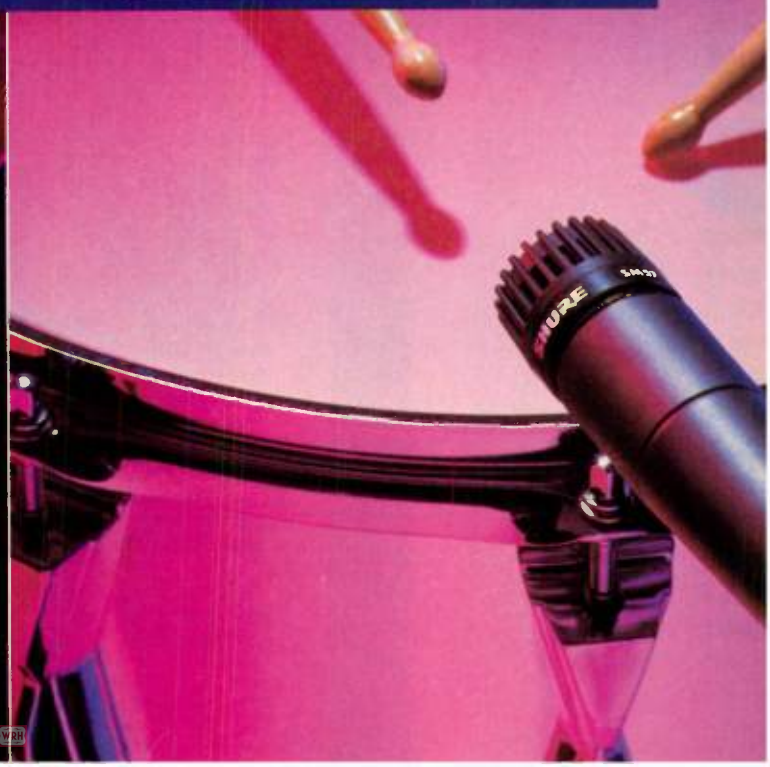

It will take you over 300 years to play every sound.

- 32-bit internal precision, into 18-bit output DACs.
- 4 SIMM sockets for user sample RAM up to 64 Mb.
- Up to 3 configurable filters or effects per voice, movable in real time.
- 6 polyphonic audio outputs, configured as 4 separate outputs plus a stereo master pair.
- Separate outs double as insert points, allowing external effects to be used and returned to the master stereo output pair.
- Over 100 sound programs, in ROM, including piano, drums, waveforms, transient attacks and synthetic timbres.
- Room for over 100 user-created sounds.
- 16-bit linear sample format.
- Sends on 3 MIDI channels.
- 24-voice polyphony.
- Up to 4 oscillators per voice, for "fat" timbres without using up voices.
- 16-channel multitimbral.
- 3.5", 1.4 M DOS-compatible disk drive.
- SCSI port for connection to hard disks and optical media (CD ROM).
- Optional audio input board for stereo sampling of analog or direct digital sources (R-DAT, etc.).

Specifications subject to change without notice.

At one new sound per second, 24 hours a day, it would take over 300 years to outgrow the new Kurzweil K2000. That's how powerful it is. The K2000 features a totally new approach to creating sound called VAST™ (Variable Architecture Synthesis Technology). It's like having the entire history of synthesis under one control panel — from analog subtractive programming to several types of digital synthesis.

But no programming is necessary to enjoy the K2000's vast stockpile of onboard sounds: 8 megabytes worth of striking new 16-bit soundfiles. Beyond this, the K2000 can accept MIDI sample dump files from other machines. And there's even an option that lets you sample your own sounds. Its sonic potential is infinitely expandable.

There's also an onboard multi-effects processor that can produce up to four simultaneous effects. External signal processors can be patched right into the K2000, too.

Add a 61-note velocity/aftertouch sensitive keyboard with master controller features, a big 240x64 backlit graphic display for programming ease, immediate support from the top names in music software, and you've got all the synthesis power you'll need for a long time to come...the next 300 years, at least. So there's no time to lose. Visit your Kurzweil dealer for a glimpse at the future of synthesis — the K2000.

KURZWEIL
Music Systems

Kurzweil is a product line of Young Chang America, Inc.

WRH

JBL 4200 Series Studio Monitors

Studio 5's fifteen ports can be independently addressed, providing 240 MIDI channels.

JLCooper (tel. [213] 306-4131) introduced the **MLA-1 and MLA-10 MIDI Line Amplifiers** (panel-mount MLA-1, $299.95; 1U rack-mount MLA-10, $499.95), which permit MIDI cable runs over 1,000 feet. Each MLA unit provides eight independent MIDI lines configured as four inputs and four outputs. The devices convert the MIDI signal to a balanced, high-speed digital protocol that can travel over common twisted-pair wire and is reconverted by another MLA on the other end.

Also from JLCooper, the **CS-10 Control Station** ($1,295) provides a hardware user interface for Digidesign's Pro Tools recording hardware and *ProDECK* and *ProEDIT* software. The CS-10 combines transport-control, macro, and jog/scrub wheel functions (as in the company's CS-1, reviewed in the November 1991 **EM**) with eight 100 mm faders for controlling automated mixing functions in *ProDECK* and six programmable, rotary potentiometers for manipulating DSP functions. The parameter-control knobs can be automated, including control of external sends to route signals for additional processing.

SIGNAL PROCESSING

Ensoniq (tel. [215] 647-3930) entered the signal-processing fray with its first dedicated effects device, the **DP/4 Parallel Effects Processor** ($1,395), which uses four custom 24-bit DSP chips. The unit has four independent inputs and outputs and can be configured as four monophonic processors (each performing four effects functions); as two pairs of stereo processors; or as a single, 4-processor chain (running up to sixteen algorithms simultaneously). The DP/4 has a total of 33 effects algorithms. Signal routing between effects processors can be serial, parallel, or feedback, and the output channels can be submixed onboard. Every parameter of an effect can be modulated by any one of 137 controllers, including footswitches, CV pedal, key velocity, and MIDI controllers. Even the processor configurations can be changed through MIDI. All input and output volumes are accessed by dedicated knobs, and parameters are controlled via a large data-entry knob. The audio inputs and outputs are 1/4-inch phone jacks.

MONITOR SPEAKERS

JBL (tel. [818] 893-8411) showed the **4200 Series**, a line of **2-way studio monitors** with a pot-belly. The **4206** ($395/pr.) and **4208** ($525/pr.) feature an injection-molded, sculptured baffle that directs the short-wavelength reflections (say, off a console top) away from the listening position, eliminating a source of distortion. The transducers are positioned such that the low-, mid-, and high-frequency portions arrive together at the optimal listening point (at console-top height, three to five feet away).

Look for more on DAT recorders, synchronizers, and signal processors next month. ●

Wafer-Scale Integration

By Gary Hall

Chip designers always are searching for ways to fit more circuitry onto an IC. As time passes, circuit geometries get smaller and smaller. A few years ago, IC "fab" houses struggled to make circuits with dimensions of 2 microns (a millionth of an inch). Now, sub-micron topologies are common. But there still are design ideas that call for circuits far too complex to fit on a chip, now or in the foreseeable future.

As digital circuits get smaller, some people are trying to make them bigger.

So why not just make really large chips? I mean *really* large, like inches across. Well, it has been tried. Over the last several years, designers have experimented with a concept, *wafer-scale integration,* to make ICs that are gigantic by normal standards. To understand the ideas behind wafer-scale integration, you need to know something about how ICs are made.

The process of manufacturing integrated circuits begins with a silicon *wafer,* a disc of crystalline silicon about five inches in diameter. The silicon disc must be perfectly flat and extremely pure. Using photoetching and deposition techniques, the manufacturer puts different material on top of the disc in the complex patterns that represent the circuit design.

The silicon disc is divided up into many small squares, each of which receives a duplicate of a single chip design. When the deposition process is complete, the wafer is cut apart, using a very fine and precise saw, to yield a handful of complete ICs.

What prevents a designer from using the whole wafer to create a single circuit? In theory, nothing, but the process of making chips is not perfect. Even with the best controls, minute impurities contaminate the silicon wafer, and motes of dust get embedded into the layers of conductors and semiconductors. At sub-micron levels, an ordinary speck of dust is like an asteroid.

The manufacturer tests each "die" from the wafer to determine if it is a functional part. The ones that don't make the cut are thrown away. The percentage of good dies is called the "yield."

Since a manufacturer can't count on getting a working chip from every die, a designer doesn't have much hope that a chip the size of a whole wafer will work. The strategy, then, is to come up with ways of using wafer-scale devices that only partially work.

The most common approach is to use wafer-scale integration for circuits that involve many repetitions of one subcircuit, such as a memory cell. When the wafer is finished, it is tested to determine which parts work. The information is turned into a "map" that can be used to avoid the bad sections.

Another type of circuit that involves a lot of redundancy is the neural network (see the January 1991 "Computer Musician"). A neural network uses a large number of simple processors connected such that the network can "learn" how to produce a desired response. There is considerable interest in neural networks as a way to solve problems that are difficult to program conventionally.

For most practical purposes, the problem with neural networks is that complexity is traded off against speed. Complex neural nets can be imple-

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mented in software but generally are slow in their learning process. A hardware neural network tends to become extremely large, because each "neuron" is a moderately complex circuit in its own right. A typical neural net uses dozens or hundreds of neurons.

But neural networks have a property that makes them a good candidate for wafer-scale integration. If a neural net has "dead" or impaired nodes, it doesn't stop, as a normal computer would. It just becomes less efficient. The learning process and the process of solving problems based on what the network learns still can proceed; they just become slower.

The strategy is to come up with ways of using wafer-scale devices that only partially work.

Hitachi has shown a neural-network processor, based on wafer-scale integration, that uses as many as eight individual wafers, with a total of 1,152 neurons. In operation, the neural network processor performs as many as 2.3 billion individual operations per second.

The Hitachi processor is intended to connect to a general-purpose computer workstation as a "back-end" processor. The programmer or operator uses the computer to set up problems and feed inputs to the neural processor. "Learning" input for a typical problem might consist of a database of stimuli and the results these produced. Hitachi believes their neural processor can be expanded by reducing the complexity of individual neurons and increasing the efficiency with which wafer real estate is utilized.

As computing becomes increasingly complex, designers will find more and more uses for wafer-scale designs. In addition, as skill in fabrication grows, these "mega-chips" eventually will find their way into the electronic musician's life.

Former **EM** *technical editor* **Gary Hall** *currently plies his trade at Sonic Solutions, a manufacturer of Macintosh-based digital audio products. He has been designing, modifying, and using digital audio effects for more than ten years.*

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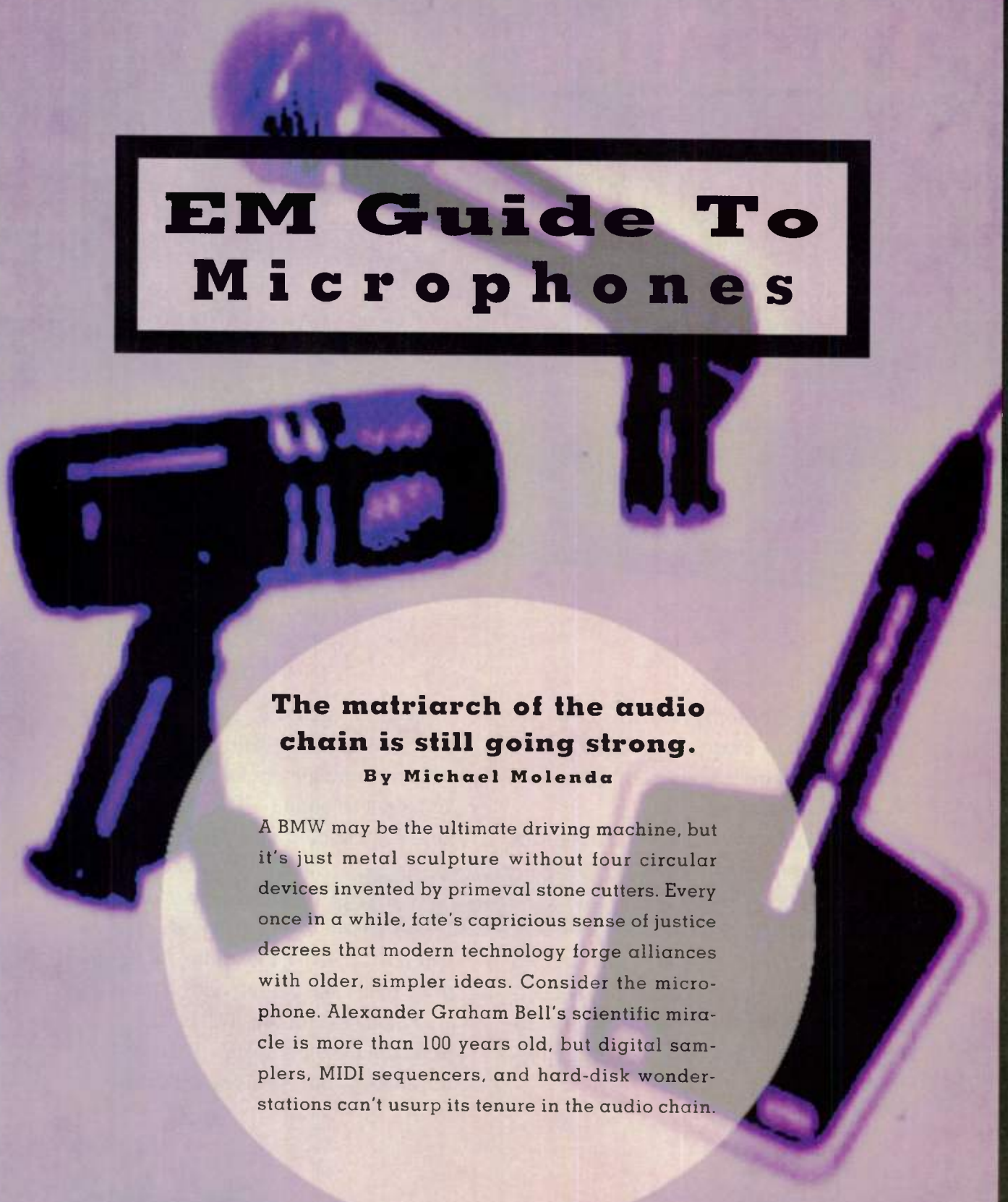
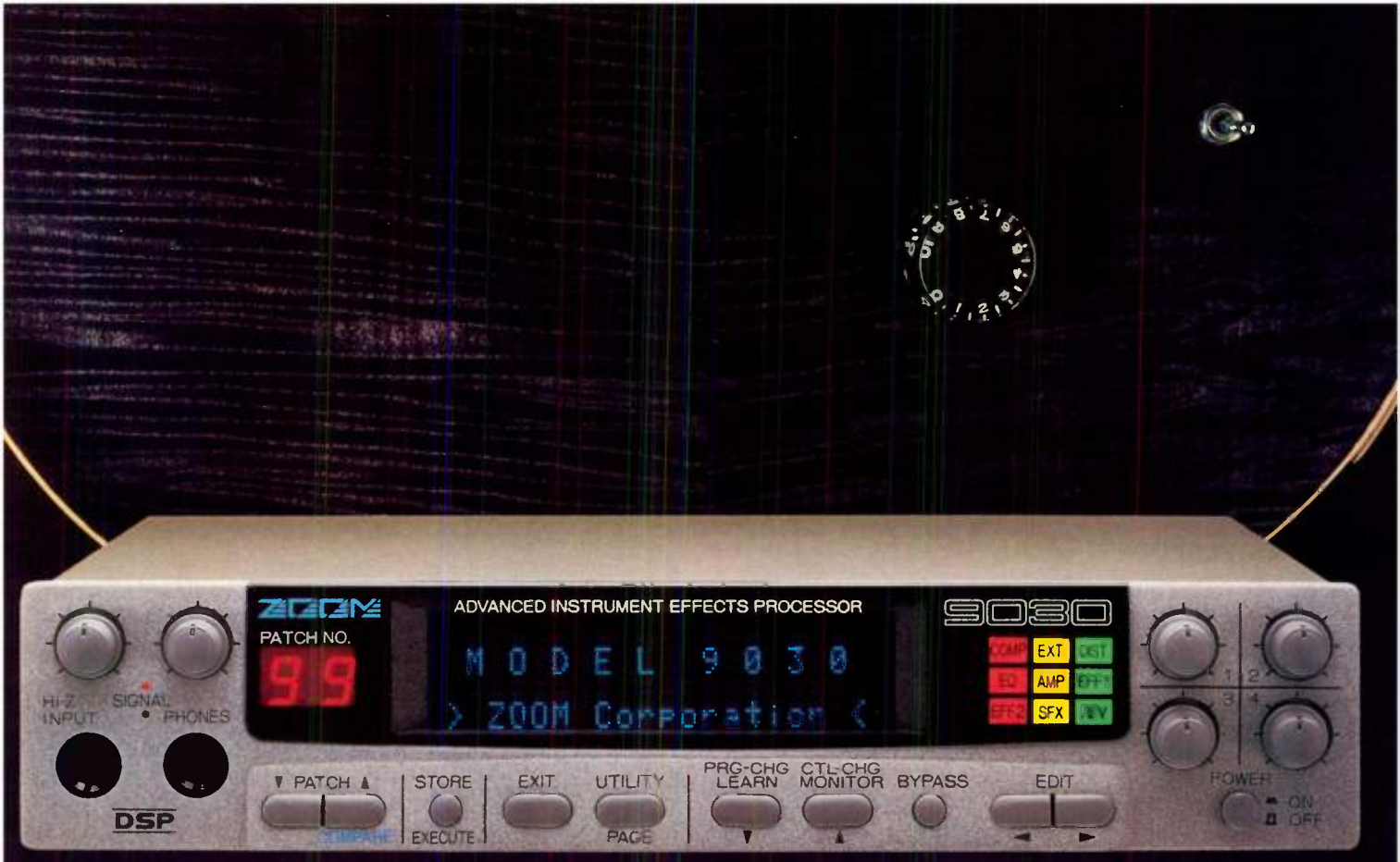


EM Guide To Microphones

The matriarch of the audio chain is still going strong.

By Michael Molenda

A BMW may be the ultimate driving machine, but it's just metal sculpture without four circular devices invented by primeval stone cutters. Every once in a while, fate's capricious sense of justice decrees that modern technology forge alliances with older, simpler ideas. Consider the microphone. Alexander Graham Bell's scientific miracle is more than 100 years old, but digital samplers, MIDI sequencers, and hard-disk wonderstations can't usurp its tenure in the audio chain.



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LASTING POWER

In a field where products come and go as often as Madonna changes hairstyles, it's remarkable to find two keyboards that continue to perform as industry top sellers year after year. The Kawai K4 and KIII Digital Synthesizers.

Frankly, we aren't surprised. There are good reasons why the K4 and KIII have been so popular with musicians and why they continue to be. First of all, they offer the kinds of sounds most in demand. Both are highly flexible in sound programming, easily updatable with tons of new sound programs that show off that flexibility, and best of all, sensibly priced.

Just take a quick look at the specs: KIII: 16 Voice Digital Synth, Multi-Timbral, Multi-Layering, 256 Waves, Digital FX, Velocity and Aftertouch, Retail Price $895.00. K4: 16 Bit, 16 Voice Digital Synth, 256 DC and PCM Waves, Multi-Sampled, Multi-Timbral, Multi-Layering, Resonant Filter, Digital Drums, Digital FX, Velocity and Aftertouch, Release Velocity, Analog, Acoustic and Digital Sounds, Retail Price $1445.00. Both units are also available in rack-mount form as the K4R and KIIIR.

But great specs are only part of the answer. The bottom line on the continued success of the K4 and KIII is something thousands of musicians already know: THEY PERFORM — consistently, professionally and reliably. And while they don't try to be the flavor of the moment, they do provide an unbelievably rich arsenal of sounds to complement setups from the most miniscule to the most fully blown. Get some lasting power out of your keyboards — add a K4 or a KIII to your set up. Better yet, a K4 *and* a KIII.

KAWAI

Digital Magic.

Kawai Professional Products Group, 2055 E. University Drive, Compton, CA 90220, (213) 631-1771. Kawai Canada Music Ltd., 6400 Shawson Dr. Unit #1, Mississauga, Ont., Canada L5T1L8.
Prices shown are suggested retail.

A major reason for such tenacity is that vocalists are not equipped with an AES/EBU digital port. Unlike the myriad sounds that are recordable direct-to-digital via a sampler, reproducing the human voice requires a microphone to transform airborne sound waves into electrical signals. It's simple: If you need a singer, you need a microphone. Even today's excellent sample libraries originally required microphones to translate nature (or industry) to disk or DAT. And while great samples abound, great players need microphones to capture the individual nuances of drumstick to snare head, plectrum to string, or lips to reed.

AKG's C451EB condenser microphone is a modular design that accepts interchangeable capsules.

CHART WAVES

Despite its importance in the audio hierarchy, many musicians remain mystified about microphone applications. The MIDI revolution's de-emphasis of acoustic sound bore a generation of musicians who can't place a microphone in front of an instrument and get a good sound on tape (or through a sound system). A combination of unstudied microphone selection and less-than-optimum placement often results in poor acoustic reproduction. A mic that excels in reproducing a kick drum is probably a bad choice for recording mandolin, and the extreme accuracy of a testing/calibration mic won't do much to help a hard-rock vocal track cut through a mix. Choosing the correct microphone is an essential step in defining your sound. While this buyer's guide is not a microphone primer, we attempt to inform you by charting the suggested applications and working parameters (frequency range, etc.) of popular models (see pp. 34-36). We've deliberately charted models that cost no more than $875 to keep pricing within a reasonable home studio budget .

OPERATING PRINCIPLES

The fidelity and versatility of a microphone is determined, in part, by the method it uses to convert acoustic sounds into electrical energy (see "From The Top: Microphones Made Easy" in the November 1991 **EM**).

Dynamic microphones are the most common, due to their affordability and rugged dependability. A flexible diaphragm attached to a wire coil is buffeted by sound waves, causing the coil to move back and forth within the field of a magnet. The motion of the coil across the magnet produces a small current that is an electrical representation of a sound wave. Dynamics are favored in live sound applications because they can handle relatively extreme sound levels and have a decent chance of surviving an accidental drop-kick across the stage. They also remain the classic guitar-amp microphone (stick that SM57 an inch away from the speaker cone) and a favorite of many rock vocalists.

Audio-Technica's ATM61HE is a member of the rugged dynamic family.

Ribbon microphones work like dynamics, except a thin metal strip (ribbon) takes the place of the wire coil. Ribbons characteristically offer warm tones and excellent transient response, making them ideal for vocal applications.

continued on p. 38

EM GUIDE TO MICROPHONES

Manufacturer/ Model	Operating Principle	Polar Pattern(s)	Frequency Response	Maximum SPL (dB)	Suggested Applications	Price	Notes
AKG C406	condenser	hypercardioid	20 Hz-20 kHz	121	guitar cabinets, piano, strings	$229	A, B, C, E, I
AKG C408	condenser	hypercardioid	80 Hz-20 kHz	131	drums, percussion	$229	A, B, C, E, I
AKG C409	condenser	hypercardioid	20 Hz-20 kHz	121	wind instruments	$229	A, B, C, E, I
AKG C410	condenser	hypercardioid	20 Hz-20 kHz	121	vocals	$249	A, B, C, E, H
AKG C451EB	condenser	cardioid, hypercardioid, omnidirectional	20 Hz-20 kHz	120	general purpose	$529	A, E, G (polar patterns/pads) L (75 Hz, 150 Hz)
AKG C460B	condenser	cardioid, hypercardioid, omnidirectional	20 Hz-20 kHz	144	general purpose	$599	A, E, G (polar patterns), L (75 Hz, 150 Hz), M (-10 dB)
AKG C525S	condenser	hypercardioid	50 Hz-20 kHz	133	guitar cabinets, vocals	$219	A, B, D
AKG C535EB	condenser	cardioid	20 Hz-20 kHz	144	cymbals, general instrumental, vocals	$369	A, L (100 Hz, 500 Hz), M (-14 dB)
AKG C562BL	condenser	hemispherical	20 Hz-20 kHz	130	general purpose	$469	A, C, E, K
AKG C567	condenser	omnidirectional	20 Hz- 20 kHz	132	acoustic guitar, piano, vocals	$279	A, C, E, I
AKG C747comb	condenser	hypercardioid	30 Hz-18 kHz	133	acoustic instruments, snare drum	$449	A, C, E, F, I
AKG C1000S	condenser	cardioid, hypercardioid	50 Hz-20 kHz	137	vocals	$359	A, B, D, E
AKG D12E	dynamic	cardioid	30 Hz-15 kHz	128	bass, kick drum	$439	
AKG D90S	dynamic	cardioid	70 Hz-18 kHz	128	vocals	$159	
AKG D95S	dynamic	hypercardioid	70 Hz-18 kHz	128	toms, vocals	$169	
AKG D112	dynamic	cardioid	20 Hz-17 kHz	168	bass, kick drum, toms	$249	
AKG D125E	dynamic	cardioid	60 Hz-15 kHz	128	percussion, horns, snare	$199	
AKG D310	dynamic	cardioid	60 Hz-18 kHz	128	congas, saxophone, vocals	$159	
AKG D321	dynamic	hypercardioid	40 Hz-20 kHz	128	vocals	$239	
AKG D330NR	dynamic	hypercardioid	50 Hz-20 kHz	128	horns, flute, vocals	$259	
Audio-Technica AT825	condenser	stereo	30 Hz-20 kHz	126	general purpose	$665	A, B, C, E, J L (3 dB @ 100 Hz)
Audio-Technica AT4031	condenser	cardioid	30 Hz-20 kHz	145	cymbals, guitar, hi-hat, vocals	$330	A, E, L (3 dB @ 80 Hz)
Audio-Technica AT4051	condenser	cardioid	20 Hz-20 kHz	143	acoustic guitar, brass, choir, cymbals, hi-hat, organ, vocals	$610	A, G (hypercardioid, omni), L (3 dB @ 80 Hz)
Audio-Technica ATM25	dynamic	hypercardioid	30 Hz-15 kHz	151	bass, kick drum, piano, toms	$250	
Audio-Technica ATM31	condenser	cardioid	60 Hz-20 kHz	125	general purpose	$180	B, D
Audio-Technica ATM33R	condenser	cardioid	30 Hz-20 kHz	141	general purpose	$260	A, E
Audio-Technica ATM35	condenser	cardioid	30 Hz-20 kHz	145	horns, saxophone	$280	A, B, C, D, E, F, L (3 dB @100 Hz) G (hypercardioid, omni, subcardioid-$38 each),
Audio-Technica ATM41HE	dynamic	hypercardioid	50 Hz-17 kHz	150	vocals	$208	
Audio-Technica ATM61HE	dynamic	hypercardioid	50 Hz-18 kHz	150	vocals	$250	
Audio-Technica ATW-1031-M73	condenser	cardioid	60 Hz-15 kHz	135	vocals	$790	A, B, D, E, H, L (3 dB @ 100 Hz)
Audio-Technica PRO 25	dynamic	hypercardioid	30 Hz-12 kHz	150	bass, kick drum, piano, toms	$139	
Audio-Technica PRO 37R	condenser	cardioid	30 Hz-15 kHz	141	cymbals, guitar, hi-hat, vocals	$159	A, E
Audix 300xb	dynamic	cardioid	50 Hz-18 kHz	144	general purpose	$165	
Audix C-1	condenser	cardioid	30 Hz-20 kHz	128	acoustic instruments, cymbals	$139	B, C, D, E
Audix D-1	dynamic	hypercardioid	38 Hz-17 kHz	144	percussion, snare	$229	
Audix D-2	dynamic	hypercardioid	38 Hz-17 kHz	144	kick drum, percussion	$229	
Audix D-3	dynamic	hypercardioid	35 Hz-17 kHz	144	percussion, snare	$329	
Audix D-4	dynamic	hypercardioid	35 Hz-17 kHz	144	kick drum, percussion	$329	
Audix OM-3xb	dynamic	hypercardioid	38 Hz-21 kHz	144	vocals	$279	
Audix OM-7	dynamic	hypercardioid	40 Hz-18 kHz	144	vocals	$359	
Audix SCX-One	condenser	cardioid, hypercardioid, omnidirectional	20 Hz-20 kHz	130	acoustic instruments, sampling, vocals	$699 (includes one capsule)	A, G (cardioid, hypercardioid, omni, omni with presence boost—$400 each), M (optional — 10 dB screw-on type)
Audix ST-2	condenser	dual cardioid	40 Hz-20 kHz	124	sampling, stereo recording	$119	B, C, D, E, J
Audix UEM-81c	condenser	cardioid	20 Hz-20 kHz	128	cymbals, hi-hat	$129	B, C, D, E, G (shotgun—$200), L (3 dB @120 Hz)
Beyer M69 TG	dynamic	hypercardioid	50 Hz-16 kHz	120	general purpose	$269	
Beyer M88 TG	dynamic	hypercardioid	30 Hz-20 kHz	120	general purpose	$419	
Beyer M130	ribbon	bidirectional	40 Hz-18 kHz	110	general purpose studio	$529	
Beyer M160	ribbon	hypercardioid	40 Hz-18 kHz	110	general purpose studio	$499	
Beyer M201	dynamic	hypercardioid	40 Hz-18 kHz	116	floor tom, cymbals	$299	
Beyer M260	ribbon	hypercardioid	50 Hz-18 kHz	110	general purpose studio	$369	
Beyer M300	dynamic	cardioid	50 Hz-15 kHz	110	vocals	$219	
Beyer M380	dynamic	bidirectional	15 Hz-20 kHz	140	kick drum	$299	
Beyer M420	dynamic	hypercardioid	100 Hz-15 kHz	116	toms	$229	
Beyer M422	dynamic	supercardioid	100 Hz-12 kHz	116	hi-hat, snare	$159	
Beyer M500 TG	ribbon	hypercardioid	40 Hz-18 kHz	110	vocals	$399	
Beyer M700	dynamic	hypercardioid	40 Hz-16 kHz	116	vocals	$329	
Beyer MC713	condenser	cardioid	40 Hz-20 kHz	116	cymbals	$654	A, L, M

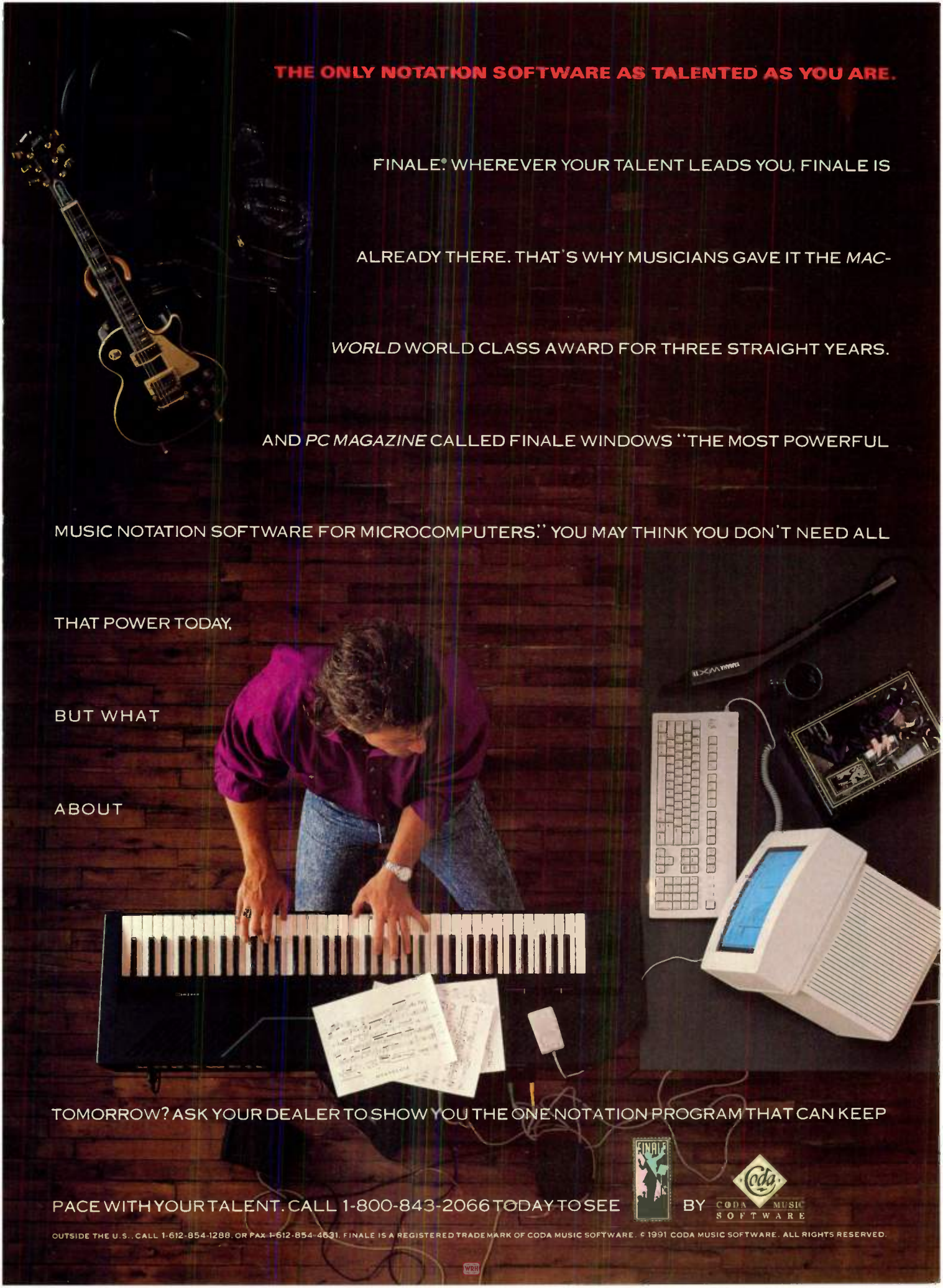
KEY: A=phantom power required B=can be battery powered C= includes cable D=includes on/off switch E=includes external windscreen F= includes shock mount M=includes internal pad

Manufacturer/ Model	Operating Principle	Polar Pattern(s)	Frequency Response	Maximum SPL (dB)	Suggested Applications	Price	Notes
Beyer MC734 TG	condenser	cardioid	20 Hz-20 kHz	120	vocals	$869	A, L
Beyer MCE81 TG	electret condenser	cardioid	50 Hz-18 kHz	116	vocals	$369	
Beyer TGX 180	dynamic	hypercardioid	40 Hz- 16 kHz	140	vocals	$169	
Beyer TGX 280	dynamic	hypercardioid	30 Hz-16 kHz	120	general purpose instrumental	$219	
Beyer TGX 480	dynamic	hypercardioid	40 Hz-18 kHz	140	vocals	$279	
Beyer TGX 580	dynamic	hypercardioid	30 Hz-18 kHz	120	general purpose instrumental	$359	
Countryman Isomax 2	condenser	choice of bidirectional, cardioid, hyper-cardioid, omnidirectional	20 Hz-20 kHz	150	general purpose mini microphone	$219	A, B, C, E, I
Countryman Isomax Headset	condenser	hypercardioid	20 Hz-20 kHz	150	vocals	$254	A, B, C, D, E, H
Crown CM-200A	condenser	cardioid	80 Hz-15 kHz	150	general purpose	$209	A, E
Crown PZM-6F	condenser	hemispherical	20 Hz-20 kHz	150	general purpose	$349	A, C, E, K
Crown PZM-30F	condenser	hemispherical	20 Hz-20 kHz	150	general purpose	$349	A, K
Crown Sound Grabber	condenser	hemispherical	50 Hz-16 kHz	120	general purpose	$99	B, C, K
CTI Audio Equitek II	electret condenser	bidirectional, cardioid, omnidirectional	10 Hz-18 kHz	148	general purpose	$669	A, B, D, F, L (6 dB/octave), M (-20 dB)
Electro-Voice N/D757A	dynamic	supercardioid	25 Hz-22 kHz	n/a	general purpose	$346	L (3 dB @ 100 Hz)
Electro-Voice N/D857	dynamic	supercardioid	25 Hz-22 kHz	n/a	general purpose	$472	L (3 dB @ 80 Hz)
Electro-Voice RE20	dynamic	cardioid	45 Hz-18 kHz	n/a	kick drum, guitar cabinets, vocals	$552	L (3 dB @ 150 Hz)
Electro-Voice RE27N/D	dynamic	cardioid	45 Hz-20 kHz	n/a	general purpose	$625	L (3 dB @ 150, 500 Hz)
Electro-Voice RE38N/D	dynamic	cardioid	25 Hz- 20 kHz	n/a	general purpose	$460	L (16 position selectable)
Fostex M20RP	ribbon	M/S stereo	40 Hz-18 kHz	130	drums, piano, choir	$695	
Fostex M77RP	ribbon	cardioid	40 Hz-18 kHz	130	acoustic bass, bass cabinet, cello	$460	
Fostex M85RP	ribbon	bidirectional	50 Hz-12 kHz	130	nature recording, vocals	$395	
Fostex M88RP	ribbon	bidirectional	40 Hz-18 kHz	130	guitar, piano, vocals	$650	
Fostex M501	dynamic	cardioid	70 Hz-16 kHz	120	vocals	$75	
Milab D37	dynamic	cardioid	50 Hz-20 kHz	n/a	general purpose	$330	E
Milab DC93B	condenser	cardioid	40 Hz-20 kHz	118	brass, cymbals, piano, strings, vocals	$795	A, E
Milab LSR-2000	condenser	cardioid	40 Hz-20 kHz	143	vocals	$675	A, E, L (18 dB @ 80 Hz), M (-10 dB)
Milab MP-30	condenser	hemispherical	40 Hz-20 kHz	110	studio instrumental	$385	A, K
Milab VM-44	condenser	cardioid	40 Hz-20 kHz	140	cymbals, drums, percussion, piano	$615	A, E, G, M (-12 dB)
Peavey PEL 25	electret condenser	cardioid	50 Hz-15 kHz	124	acoustic guitar	$219	A, B, D, E, I
Peavey PSM 1	electret condenser	cardioid	50 Hz-20 kHz	127	ensembles, kick drum, piano	$249	A, C
Peavey PV	dynamic	cardioid	50 Hz-14 kHz	145	general purpose	$99	C, D
Peavey PVM 38	dynamic	cardioid	50 Hz-18 kHz	145	general purpose	$199	C, E
Peavey PVM 45	dynamic	hypercardioid	40 Hz-16 kHz	145	general purpose instrumental, snare, toms	$199	C, E
Peavey PVM 380N	dynamic	cardioid	50 Hz-16 kHz	145	general purpose	$199	C, E
Peavey PVM 480	electret condenser	cardioid	40 Hz-20 kHz	128	piano, sampling, vocals	$219	A, C, E
Peavey PVM 520TN	dynamic	cardioid	45 Hz-19 kHz	145	brass, kick drum, piano, reeds, toms, vocals	$299	C, E
Peavey PVM 535N	dynamic	cardioid	40 Hz-16 kHz	145	general purpose	$229	C, E
Peavey PVM 580TN	dynamic	hypercardioid	50 Hz-18 kHz	145	general purpose	$219	C, E
Peavey PVR 1	electret condenser	omnidirectional	40 Hz-20 kHz	128	general purpose, sampling	$199	A
Ramsa WM-S1	electret condenser	cardioid	50 Hz-18 kHz	148	cymbals, hi-hat, stringed instruments	$210	E, I
Ramsa WM-S2	electret condenser	cardioid	120 Hz-15 kHz	138	brass, percussion	$170	E, I
Ramsa WM-S5	electret condenser	cardioid	70 Hz-16 kHz	158	brass, percussion, snare, toms	$280	E, I
Ramsa WM-S10	electret condenser	cardioid	120 Hz-15 kHz	138	flute, harmonica, vocals	$220	E, H, I
Sennheiser Bf 530	dynamic	supercardioid	40 Hz-16 kHz	140	vocals	$395	L (adjustable basket)
Sennheiser MD 409	dynamic	cardioid	50 Hz- 15 kHz	140	kick drum, snare, toms, vocals	$295	
Sennheiser MD 421	dynamic	cardioid	30 Hz-17 kHz	140	drums, vocals	$469	L (5-position selectable)
Sennheiser MD 422	dynamic	cardioid	30 Hz-17 kHz	140	broadcast voice, drums, vocals	$569	L (5-position selectable)
Sennheiser MD 431	dynamic	supercardioid	40 Hz-16 kHz	140	vocals	$479	
Sennheiser MD 441	dynamic	supercardioid	30 Hz-20 kHz	140	general purpose	$629	L (5-position selectable)
Sennheiser MD 518	dynamic	cardioid	50 Hz-16 kHz	140	guitar, saxophone, toms, vocals	$229	
Sennheiser MKE 48	condenser	cardioid	40 Hz-20 kHz	n/a	vocals	$439	A, H
Sennheiser MKE 2002	condenser	omnidirectional	40 Hz-20 kHz	n/a	sampling, binaural recording	$689	B, J
Sennheiser MKE 4032	condenser	supercardioid	70 Hz-20 kHz	140	vocals	$639	A, B, M (-10 dB)
Shure 849LC	condenser	cardioid	40 Hz-16 kHz	131	general instrumental	$183	A, B, D
Shure 869LC	condenser	cardioid	70 Hz-16 kHz	137	vocals	$183	A, B, D
Shure Beta 57	dynamic	supercardioid	50 Hz-16 kHz	n/a	drums, guitar cabinets, horns, percussion	$258	
Shure Beta 58	dynamic	supercardioid	50 Hz-16 kHz	n/a	vocals	$266	
Shure SM57LC	dynamic	cardioid	40 Hz-15 kHz	n/a	drums, instrument cabinets, percussion	$141	

G= accepts interchangeable capsules H=headset type I=miniature model J=stereo microphone K=pressure zone type L=includes internal roll-off

MICROPHONES (continued)

Manufacturer/ Model	Operating Principle	Polar Pattern(s)	Frequency Response	Maximum SPL (dB)	Suggested Applications	Price	Notes
Shure SM58LC	dynamic	cardioid	50 Hz-15 kHz	n/a	vocals	$181	
Shure SM81LC	condenser	cardioid	20 Hz-20 kHz	138	acoustic instruments, choir, cymbals	$410	A, E, L (6 dB @ 100 Hz; 18 dB @ 80 Hz), M (-10 dB)
Shure SM85LC	condenser	cardioid	50 Hz-15 kHz	134	vocals	$305	A
Shure SM87LC	condenser	supercardioid	50 Hz-18 kHz	134	vocals	$329	A
Shure SM94LC	condenser	cardioid	40 Hz-16 kHz	135	general instrumental, sampling	$260	A, B
Shure SM96LC	condenser	cardioid	70 Hz-16 kHz	140	vocals	$260	A, B
Shure SM98	condenser	cardioid	40 Hz-20 kHz	145	acoustic instruments, drums, horns	$250	A, B
Sony C-535P	condenser	cardioid	30 Hz-16 kHz	138	drums, horns	$495	A, M (-10 dB)
Sony C-536P	condenser	cardioid	30 Hz-16 kHz	138	drums, horns	$405	A, M (-10 dB)
Sony ECM-23FII	electret condenser	cardioid	20 Hz-20 kHz	130	drums, horns	$105	B, C, L (12 dB @100 Hz), M (-8 dB)
Sony F-720	dynamic	cardioid	50 Hz-11 kHz	n/a	vocals	$145	D
Sony F-730	dynamic	supercardioid	50 Hz-11 kHz	n/a	vocals	$145	D
TOA HY-3	condenser	cardioid	70 Hz-20 kHz	122	vocals	$398	A, B, D, E, 273 each), H G (communication, female, male-$273 each)
TOA J-1	dynamic	cardioid	30 Hz-18 kHz	n/a	general purpose	$184	B, C, D, E, L (200 Hz)
TOA J-2	dynamic	cardioid	40 Hz-18 kHz	n/a	drums, guitar cabinets	$233	B, C, D, E
TOA J-3	dynamic	cardioid	50 Hz-18 kHz	n/a	bass, drums, guitar, vocals	$233	B, C, D, E
TOA K-1	condenser	cardioid	30 Hz-20 kHz	115	general purpose	$184	A, B, C, D, E, L (100 Hz)
TOA K-2	condenser	cardioid	30 Hz-20 kHz	115	general purpose instrumental	$296	A, B, C, D, E
TOA K-3	condenser	cardioid	60 Hz-20 kHz	n/a	vocals	$296	A, B, C, D, E
TOA K-4	condenser	cardioid	20 Hz-20 kHz	130	general purpose	$504	A, C, D, E, G (female, male-$273 each)
TOA KY	condenser	cardioid	20 Hz-20 kHz	130	general purpose	$598	A, C, D, E, F, G (communication, female, male-$273 each)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 (continued from p. 33)

Beyer's M500TG is evidence that technology has toughened the once-frail ribbon microphone.

With a few exceptions—such as some of the Fostex and Beyer designs—ribbon mics tend to be more fragile than dynamic types and seldom venture outside the controlled environment of the recording studio.

Condenser microphones (sometimes referred to as capacitor mics) utilize a metal-coated diaphragm mounted over a conductive back plate. When sound waves vibrate the diaphragm, the distance it moves from the back plate induces a fluctuating voltage that "photographs" the sound wave. The power of the condenser's signal is weaker than that of a dynamic microphone, so an internal amplifier is employed to boost signal level. Some condensers offer onboard frequency tailoring (roll-off) and attenuation (padding). Since the diaphragm is not connected to a moving coil, the reduced mass allows a quick response to varying sonic textures. Condensers are equally sweet as vocal, brass, or "room" mics, and are popular for certain guitar timbres. (The off-axis miking sound popularized by modern funksters often is accomplished with a condenser positioned 45 to 60 degrees off-center from a Marshall speaker cabinet.)

Electret condensers are specialized condenser types utilizing a unique diaphragm that retains a static charge. Electret technology is relatively inexpensive and the components can be made very small to accommodate extreme close-miking situations.

Both true condensers and electret types require some sort of power supply, either in the form of an onboard battery or an external "phantom" source. The name for the latter comes from the fact that the operating voltage from the mixing console or outboard power supply travels down the same 3-pin XLR cable that carries the mic signal. There is no additional power cable, hence the term "phantom."

POLAR PATTERNS

How a microphone responds to directional sounds is charted with a polar graph. *Bidirectional* microphones pick up sounds in a figure-8 pattern: sensitive on the front and back of the microphone and less-sensitive on the sides. This pattern often is used to record two vocalists who wish to face each other while singing. A *cardioid* pattern is heart shaped, picking optimum sound from the front and rejecting sound from the sides and rear. Cardioids are popular in recording, since they minimize sound leakage. *Hypercardioid* and *supercardioid* microphones are more directional, offering high rejection of sound from the sides, and

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are favored in live sound situations to decrease monitor/instrument leakage and feedback. *Omnidirectional* microphones draw sound equally from all directions. Although sound leakage can be a problem in uncontrolled environments (concert stage, field recording, etc.), omnis typically offer smoother frequency response than directional microphones.

FREQUENCY RESPONSE

Modern technology makes it possible to manufacture microphones with nearly flat frequency response throughout the entire audio range. However, certain deviations from flat response are welcome and manufacturers deliberately tailor frequency response to specific applications. For instance, vocal microphones often exhibit a presence peak in the 5 to 8 kHz range to enhance intelligibility. And the warmth attributed to ribbon microphones is partially due to a characteristic low-frequency rise around 200 Hz. Since space would not allow inclusion of graphs illustrating the actual ranges of frequency response, we've charted the working range of each microphone.

MAXIMUM SOUND-PRESSURE LEVEL

Microphones are like the Marines: Whatever the hardship, excellence is mandatory. A microphone is expected to deliver pristine and accurate sound reproduction, even when pummeled by screaming vocalists (who often swallow the windscreen), 45-caliber snare shots, or rampaging guitar amplifiers at full volume. These relatively extreme situations may generate an input sound-pressure level (SPL) beyond the threshold of pain. If the microphone can't take the heat, it overloads. Generally, it pays to match the input level to the application. If you're close-miking excitable drummers, a maximum SPL rating of 140 to 150 dB is recommended.

SUGGESTED APPLICATIONS

These suggestions are offered by the manufacturers. Use this listing as a basic guide and dare to experiment. While it's true some microphones are tailored to specific applications, the acid test remains the quality of sound. Train yourself to listen critically to the sound each microphone produces. If a vocal microphone adds the right sizzle to a tamborine, or clarifies the timbre of

LIST OF MANUFACTURERS

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Audio-Technica U.S., Inc.
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Stow, OH 44224
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Audix Corp.
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Beyer Dynamic Inc.
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Crown International
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Elkhart, IN 46517
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CTI Audio
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Box 120
Conneaut, OH 44030
tel. (800) 762-9266

Electro-Voice Inc.
600 Cecil St.
Buchanan, MI 49107
tel. (616) 695-6831

Fostex Corp. of America
15431 Blackburn Ave.
Norwalk, CA 90650
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Peavey Electronics
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Meridian, MS 39301
tel. (601) 484-4256

Sennheiser Electronic Corp.
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PO Box 987
Old Lyme, CT 06371
tel. (203) 434-9190

Shure Brothers, Inc.
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Evanston, IL 60602-3696
tel. (708) 866-2200

Sony Professional Audio
3 Paragon Dr.
Montvale, NJ 07652
tel. (201) 358-4196

TOA Electronics Inc.
601 Gateway Blvd., #300
South San Francisco, CA 94080
tel. (415) 588-2538

flabby congas, it's doing the job. Also take into account the overall sonic environment. Recording a cello that needs to cut through a rock guitar track may require using a different microphone than one used to record the same instrument in a string quartet.

IT'S BACK!

Since pop culture is cyclical, it's no surprise acoustic music is hip again. The popular reemergence of folk, bluegrass, and other acoustic genres has reaffirmed the microphone's status in home and studio recording. The synthesizer, sampler, and MIDI sequencer are not the creative masters of this movement, but the pristine sonics attained through the technology of electronic music remain the standard. Good miking requires practice and patience. You can't haphazardly position any microphone in front of a mandolin and automatically access a great mandolin sound. Using microphones is more difficult, but hopefully more rewarding, than depressing patch buttons. Our chart can help you determine the advantages and/or limitations of a particular microphone. After that, it's up to your ears and imagination. And remember, until human throats evolve digital outputs, any time spent developing microphone chops is not wasted.

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WHEN WORLDS COLLIDE

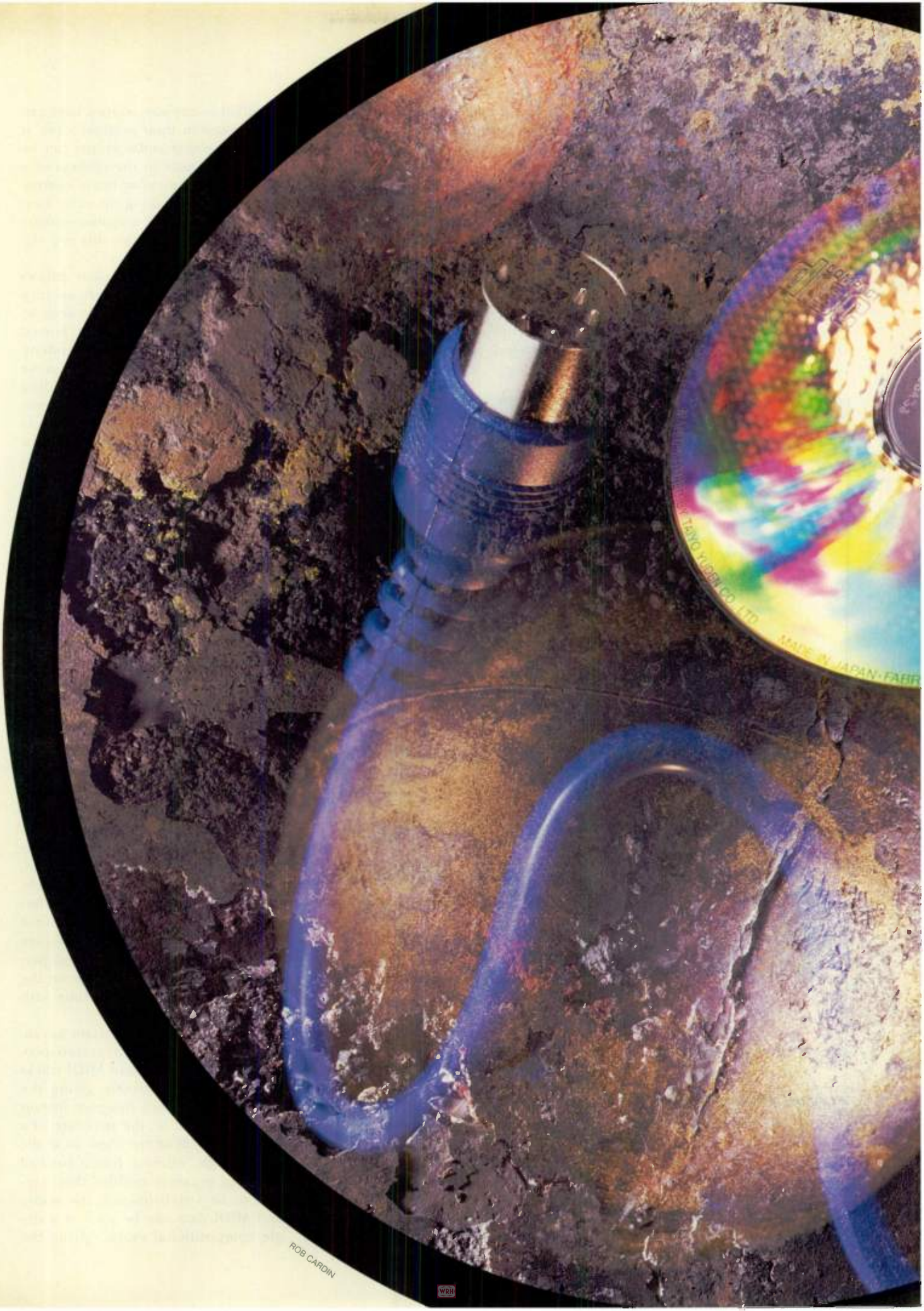
Integrating MIDI and Digital Audio

By Dennis Miller & Paul Lehrman

Whether you call it a marriage, a collaboration, or just a meeting of the minds, the integration of MIDI and digital audio is one of the hottest topics in the music industry today. It's also one of the most significant technological developments for musicians in recent memory. The ever-increasing power of desktop computers, combined with the advent of inexpensive, dedicated sound hardware that can be added to the computer, has resulted in a much closer pairing of these two worlds of sound manipulation. As software appears that brings it all together, an enormous realm of creative possibilities is opening up.

MIDI musicians long have recognized that certain types of musical expression—saxophone solos, acoustic guitar vamps, and vocal lines, to choose a few examples—are difficult, if not impossible, to achieve with MIDI instruments. Many computer musicians address this by incorporating analog audio into MIDI-based projects, putting up with the problems of synching their sequencers to a conventional, external tape recorder.

For the home recordist resigned to synching a MIDI sequencer with analog tape, the idea of using digital audio in the same context, much less under the control of MIDI, has been considered a pipe dream. Until recently, combining MIDI and digital audio required kludged setups and/or extremely expensive hardware. Digital tape-recording systems, from early Sony PCM-F1 recorders to DAT and professional reel-to-reel 2-track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formats, don't easily lend themselves to the use of either FSK sync or SMPTE time code, which MIDI sequencers require. Multitrack digital tape decks have been completely out of line with the budgets of home or project studios (although new models from Yamaha and Alesis may soon change this).

WHAT'S IT GOOD FOR?

There are numerous practical advantages to putting MIDI sequencing and digital audio recording under the control of a common front-end. MIDI composers are used to cutting and pasting musical events as easily as paragraphs in a word processor, and the tools for doing so have become highly sophisticated and friendly. Extending that metaphor to blocks of digital audio is a major boon, especially when the software doesn't actually change the data, but (as most integrated programs do) simply manipulates "pointers" that serve as indexes to the data. That way, the operation is fast (only minuscule amounts of data are being dealt with), and the audio files are not modified in any way, so they later can be accessed in their original form. It also means that audio events can be used many times in the context of a single composition, or many compositions, without taking up extra storage space. Given the megabyte-hungry nature of digital audio, this is a significant consideration.

The sequencer metaphor allows audio tracks to be broken up into individual phrases (again non-destructively, using pointers) and moved around and replicated independently of each other. This even can be done on individual notes, providing the ability to quantize audio events. For example, rhythm or effects tracks recorded out of time can be broken down into individual "hits," with each hit locked to the beats of a sequence. Files also can be processed and mixed non-destructively in the same way that MIDI tracks can be faded, panned, or processed, using Velocity and controller commands within the sequenced data.

Hard-disk audio systems, unlike most samplers, can start playing a sound file in the middle. Thus, editing and auditioning audio tracks is as easy as working with sequenced data; there's no need to repeatedly go back to the beginning of a sampled phrase in order to work with it. In addition, hard-disk systems, like sequencers, can slave to time code, so if the speed of a master tape (audio or video) changes, the audio stays in sync with the MIDI data. One disadvantage of this, however, is that when the time-code speed changes, audio tracks, unlike MIDI sequences, change pitch. Although no manufacturer has announced this feature yet, it's not impossible for systems in the future to recognize off-speed code and perform a real-time pitch change on the digital audio to keep it in tune with the MIDI tracks.

Perhaps the most important advantage is conceptual. Integrated programs display audio and MIDI tracks simultaneously onscreen, giving the composer or sound designer instant visual feedback on the structure of a piece, either as an overview, or at the microscopic editing level. Instead of being separate entities that happen to be synchronized, the audio and MIDI data can be seen as a single compositional entity, giving the

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This is of inestimable value in many musical and audio contexts. Consider the applications in rap music, with its reliance on lots of samples, and dance music, which requires multiple remixes and reorganization of both electronic and acoustic material. With conventional pop and rock, MIDI-digital audio integration helps provide seamless fusion of different elements. For video and film production, dialog, effects, and music must be coordinated and mixed, while computer-based multimedia production ties sound (including music) to graphics, either on an external medium or generated by the same computer. In these and other, non-musical, events, the MIDI-digital audio connection can be used to great advantage.

From another angle, many recording and mixing engineers finally have realized that MIDI makes an excellent protocol for studio automation, and with the plethora of MIDI-controllable mixing and processing hardware now available, a sequencer of some kind can be an ideal controller for many aspects of real-time sound manipulation. The post-production community has realized that controlling synthesizers and samplers by synching a MIDI sequencer to time code on a videotape is an excellent way to lay in sound effects and ambience tracks. Expanding that capability to disk-based audio is a logical next step.

Finally, experimental musicians working in universities or other non-commercial studio environments are thrilled at the prospect of working with complex and infinitely variable digital sound "objects" as flexibly as they work with the more-restricted parameters of MIDI.

DEVELOPING SOLUTIONS

The dreamed-of integration of digital audio and MIDI is being realized from several directions at once. Sequencing software now is available that adds audio recording and editing to MIDI number-crunching, and hard-disk recording systems are integrating MIDI recording, playback, and manipulation tools. In addition, more esoteric systems, outside of the music industry mainstream, are combining the two technologies in

SPEED KILLS

Without some tricky engineering, most general-purpose computers are not fast enough to handle the high-speed transmission needed to keep samples moving off a hard disk at a suitable audio rate. Stereo, 16-bit audio, sampled at 44.1 kHz, requires a whopping 1.4 million bits per second, while multitrack systems require even greater rates. One way to speed up operation is to use a computer's Direct Memory Access (DMA) channels, which allow a computer's peripherals to communicate directly among themselves rather than passing data through the CPU.

A more efficient, but costly, solution is to add an independent digital audio bus to the host computer to handle these communications. Spectral Synthesis's FlyBy bus card is at the heart of all the company's hardware and is solely dedicated to this task. "If the SynthEngine Sampler wants to get data off the disk," explains Mark Doegnes, "it doesn't have to ask the CPU and wait while the CPU loads and unloads the accumulator. Instead, it directly transfers samples to the DSP board via DMA. If the Digital Studio wants to record the Sampler, playing in real time onto a couple of its tracks, the FlyBy transfers the audio completely independent of the computer." Spectral's approach results in accelerated communication among all the devices in their systems, including external and internal MIDI sequencers and hardware.

Similar capabilities will be provided by Digidesign's System Accelerator card when it's released late in 1991. The System Accelerator combines a dedicated SCSI controller with a 68030 processor, and it will be required when expanding a Pro Tools system to eight tracks or more.

unusual and potentially revolutionary new ways.

From a hardware standpoint, the key to integrating MIDI and digital audio has been the development of sound-recording and sound-generating hardware placed inside the computer that is handling the MIDI data. MIDI data is relatively simple for a computer to deal with. Its bandwidth over sixteen channels of data is limited to 31,250 bits per second, which is trivial for a computer whose CPU is ticking at several million clock cycles per second. Audio, however, is much more demanding, and bandwidths in excess of 1.5 million bits per second are possible with just two tracks.

Therefore, audio often is produced by a plug-in card that can handle all the sound-generating calculations itself and be addressed by the computer over a relatively slow data bus, thus taking a great burden off of the computer's central processsing unit (CPU). The major differences between the various products available, besides the platforms they are designed for, have to do with the method and speed of data transfer and the audio quality, in terms of sampling rate (which controls frequency response) and word length (which determines dynamic range).

LOW-RES SOUND

The growth of multimedia computing (which we'll discuss more later) has engendered a veritable explosion of low-resolution, medium-fidelity sound cards for IBM PCs and compatibles (see the August 1991 "Computer Musician"). These 8-bit, multipurpose audio cards often combine several distinct applications, such as hard-disk recording, text-to-speech conversion, and direct synthesis. While many musicians look down on them, some of these cards are close to professional-quality tools and add a lot to otherwise sonically unimpressive games and multimedia presentations.

The growth of multimedia computing has engendered an explosion of PC-compatible sound cards.

The Sound Blaster Pro from Brown-Wagh Publishing, for example, offers 8-bit stereo recording and playback from disk at sample rates up to 44.1 kHz, stereo FM synthesis using a chip set made by Yamaha, an optional MIDI interface, CD-ROM support, and mixing capabilities for all of the card's internal sound sources. The software bundled with the card provides no direct way of triggering audio and MIDI simultaneously, but that capability can be added to other programs by using software drivers available from third parties.

In fact, one measure of this and similar boards' success is the large number of developers who are writing applications for them. Two major IBM music software companies, Voyetra Technologies and Turtle Beach Systems, have created software optimized for the Sound Blaster. Voyetra's *Sequencer*

Plus Jr. is bundled with every Sound Blaster, and other versions of *Sequencer Plus* can access the card's FM chip directly. Voyetra also offers software developers a complete set of routines for incorporating the Sound Blaster into their own applications. (Singing spreadsheets, anyone?) Turtle Beach offers support for the Sound Blaster in its *SampleVision* wave-editing software, which lets you use the card to preview samples edited for either the Sound Blaster or an external sampler. The company also announced *Recording Studio Pro,* a complete graphic editing environment for Sound Blaster files.

Even with the enhanced specs of the Sound Blaster Pro, Voyetra president Carmine Bonano believes new applications will be needed before musicians flock to the 8-bit cards. "For example," he observes, "there's no reason the Sound Blaster Pro couldn't serve as the engine for a disk-based sampler. All we need is the proper software."

The Macintosh in some ways is even more audio-friendly than the IBM, and many of the features IBM users add with sound cards are built into the Mac.

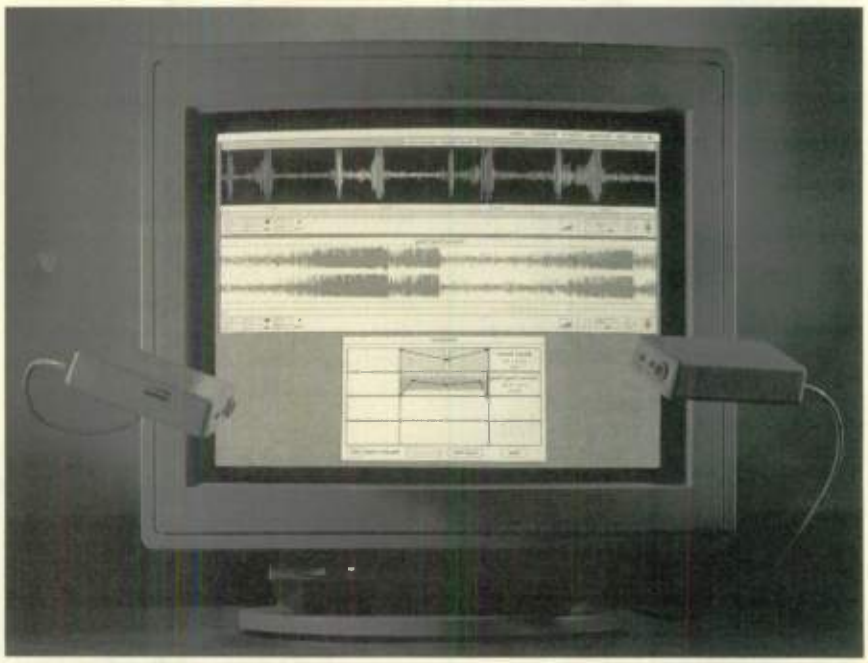
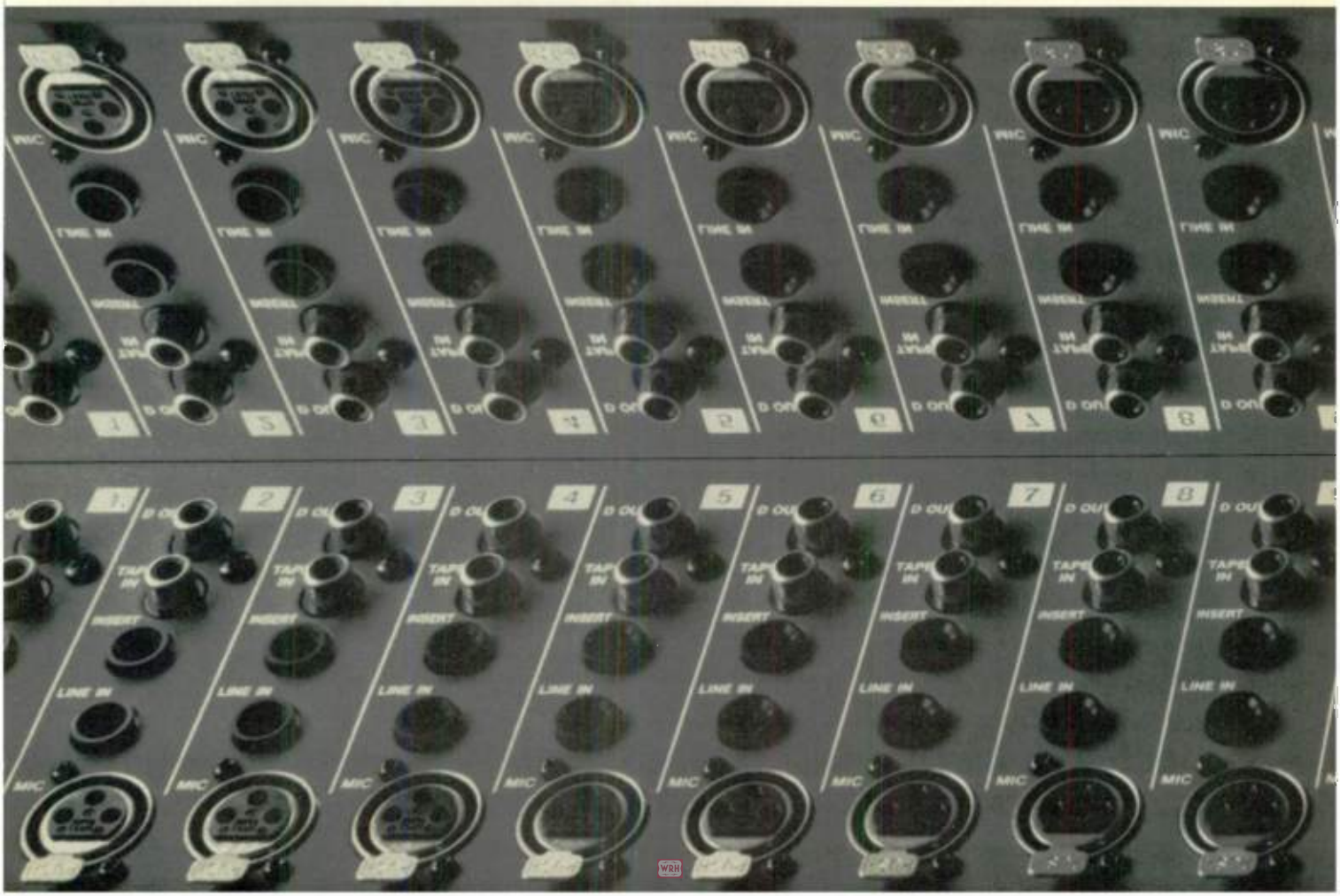


FIG. 1: Farallon's MacRecorder digitizes audio with 8-bit resolution, at sample rates up to 22 kHz. The accompanying Sound Edit software offers a comprehensive set of DSP functions in a graphic environment.

Newer Macs such as the IIsi and LC come equipped with a sound-input device—a microphone and audio digitizer—that can record sound into RAM or directly to hard disk. For older Macs, inexpensive devices such as Farallon's



MacRecorder (Fig. 1), provide the same sound-recording capabilities. With the right software, mono or stereo sample playback at rates up to 22 kHz is a simple proposition. For a long time, the length of an 8-bit sound file one could address using Macintosh software was limited to how much audio would fit into the computer's RAM, but newer Macintoshes equipped with Systems 6.0.7 or 7.0 can record and play sound directly to disk without any additional hardware, allowing sounds to be virtually unlimited in length.

Software for working with 8-bit audio on the Mac now is available. Farallon's *Sound Edit* program includes a comprehensive set of DSP functions in an intuitive graphic environment. Software hooks for accessing 8-bit audio are provided in popular multimedia programs such as *HyperCard* and Macromind *Director*. Adding MIDI capabilities to these programs is simple: Products such as EarLevel Engineering's *HyperMIDI* or Opcode's *MIDIPlay* can be used with *HyperCard*, and the newest version of *Director* (3.0) will talk

WHAT DOES IT TAKE?

What does it take to get started in the digital audio game? That depends largely on which platform you have or want to get. There are clear advantages to IBMs and Macs, as well as Ataris.

On the IBM side, an "MPC" computer, which follows the minimal configuration outlined by Microsoft for multimedia use, consists of an IBM-compatible with a 10 MHz or faster 80286 or 80386 processor; 2 MB of RAM; standard or enhanced VGA graphics; an audio card (8- or 16-bit); a 30 MB hard disk; and a CD-ROM drive. Practically speaking, if you plan to work with 16-bit sound, you'll need a much larger drive and a faster processor.

Macintosh users will want an SE/30 or Mac II series with at least 2 MB of RAM (4 MB or more would be preferable); appropriate audio hardware, which may be unnecessary if you're planning to stay in the 8-bit world; and a hard disk (40 MB for 8-bit audio, and 80 MB or larger for 16-bit).

When shopping for a hard drive, there are several things to keep in mind. First is access time. To handle 16-bit digital audio playback and recording, a 28 ms or better access time is required. This speed is needed to keep the samples flying off the disk fast enough for sound to be continuous. If possible, listen to the drive's noise level. A noisy motor, while not a serious problem in a large office environment, can be distracting in a quiet home studio. Perhaps most serious, check to see if the drive does periodic recalibration. This is a diagnostic routine that some drives use to check if all their platters are in sync. It can result in a momentary loss of data transmission from the disk and, in the case of audio playback, can result in an undesirable short hiccup.

A few companies have developed drives specifically for the audio market. Eltekon, DynaTek Automation, and Frontera Electronics, for example, produce rack-mount drives that can be used with the major computer types and directly support several stand-alone samplers that have SCSI ports. Microtech International also offers drives for different platforms and markets them to the audio and music industries.

Digidesign recently announced a magneto-optical drive, the Pro Store, that is fast enough to function with their audio hardware as a real-time playback (although not recording) device. MO drives use removable media that are not terribly expensive, and they can be a viable option if you have large storage needs. Also worth considering are removable drives, available from several manufacturers, which are fast enough for digital audio and come in 44 and 88 megabyte formats.

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to Apple's *MIDI Manager* system software and can be used in conjunction with most Macintosh sequencers. The imminent release of *QuickTime*, an extension to Systems 6.0.7 and 7.0 that provides time-based hooks for visual and audio events (see the November 1991 "Computer Musician"), promises even more integration. Passport's new *AudioTrax*, discussed later, provides a true integrated platform that allows simultaneous recording and manipulation of low-resolution digital audio and MIDI.

HIGH RES

While 8-bit audio is acceptable for mass-market sound products, 16-bit hardware is more appealing to the professional musician. Its advantage is quality: It can sound as good as a CD or professional digital tape deck. Its disadvantages are that its storage requirements are far greater than for 8-bit sound (at least twice as large, four times larger if you use a high sampling rate, and eight times for stereo); its demands on hard-disk performance are greater; and the hardware is expensive, although it's getting cheaper.

On the Mac side, Digidesign's Audiomedia card is gaining popularity among mid-level production facilities. A younger cousin of Sound Tools, the most prevalent hard-disk recording and editing system on the Mac, Audiomedia offers nearly the same audio performance at about one-third the price. Audiomedia lacks some of the flexibility, particularly in interfacing with other equipment, of the older system. Both Audiomedia and Sound Tools can be used in a MIDI environment in a number of ways: with *Q-Sheet*, a time code-oriented sequencer that can trigger both MIDI and audio events; with *Deck*, a 4-track digital "ministudio" that can record, import, and play back Standard MIDI Files; and with *Studio Vision*, a full-featured sequencer with a host of audio-editing capabilities. This and other programs will be discussed more in detail later on.

Digidesign's new Pro Tools, now available in a 4-track version and soon in 8-, 12-, or 16-track versions (just keep adding cards), boasts a particularly thorough MIDI implementation. It combines elements of Sound Tools and *Deck* into its own software, *ProEdit* and *ProDeck*. MIDI shows up in many parts of the system: Sequenced MIDI data can be recorded, viewed, edited, and played back directly within the programs, audio "regions" of any size can be defined in a MIDI file and scheduled in the playlist, and incoming MIDI data can be used to manipulate the system's real-time effects section, providing sweepable filters, modulated chorusing, etc.

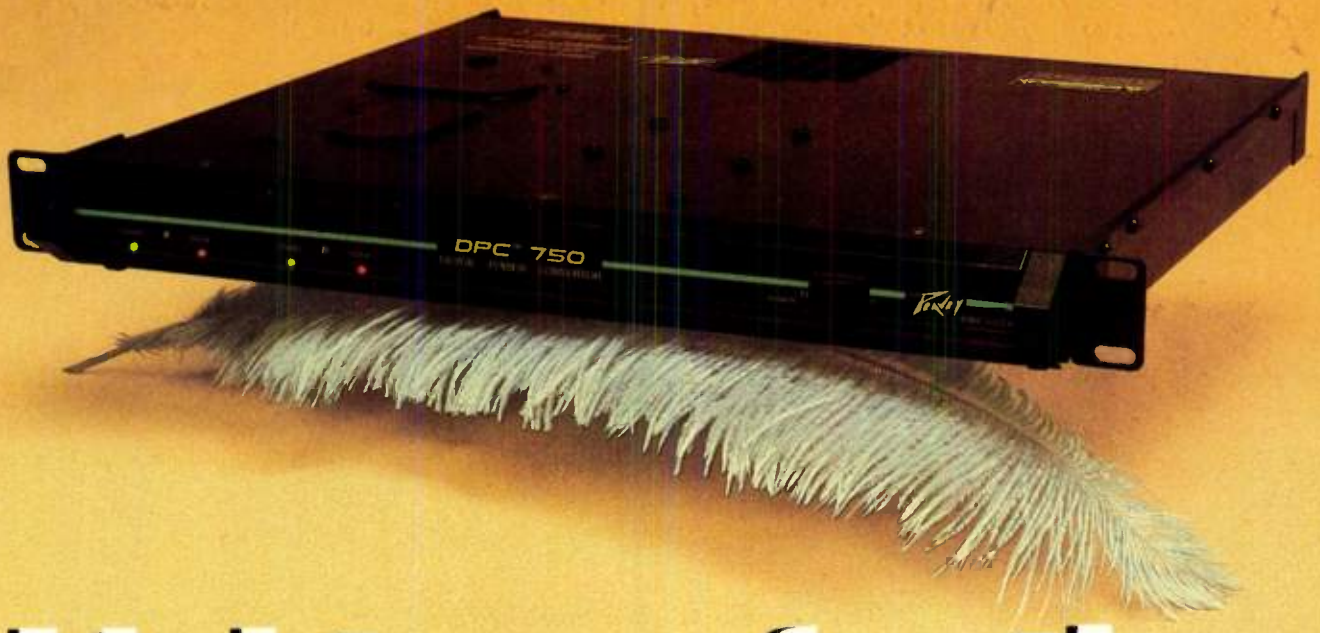
Despite this level of MIDI implementation, Pro Tools co-designer Josh Rosen still believes the user will want a sequencer on hand for more sophisticated editing of MIDI data. "I view Pro Tools as an audio and MIDI layout program in which the user will pull together the various source materials he uses to make music," he says. "If the end-user is only comfortable with MIDI, an integrated program like *Studio Vision* might be a better option. But if digital audio is their primary interest, Pro Tools will be the right choice."

There are plenty of other hard-disk recording systems for the Mac (from companies such as Sonic Solutions, Digital Audio Labs, and Symetrix) that are geared to the higher-end production environment, but most of these systems lack any MIDI capabilities, at least so far.

On the IBM side, there are a number of companies making high-fidelity hardware and offering different degrees of integration with MIDI. Turtle Beach Systems' 56K allows the user to specify a MIDI Note-on command (or a mouse click or SMPTE time) to trigger any audio event in a playlist. Under the control of an external sequencer or controller, a whole evening's worth of audio events can be compiled into a single list. The user also can insert MIDI Note-on commands into the playlist to trigger external MIDI hardware.

MTU's MicroSound AT, a new entry in the IBM market, uses a technique called "disk-layering" to mix a large number of segments from up to twenty soundfiles. Microsound can use MIDI to trigger playback, and it also has MIDI-triggered recording. Using a second MIDI card, a sequencer running under *Windows* can be used to control the system. When Multimedia Extensions (MME) compatibility is added in the coming months, that extra

DPC/750



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Spectral Synthesis's *Digital Studio*, a multitrack system with a sequencer-style interface, contains a MIDI-controllable mixer in which up to sixteen tracks can be manipulated independently by Continuous Controller data. The software allows as many as seven Spectral applications to communicate among themselves. For example, the *MIDI File Player* program can read a file off the disk and send it to up to six other Spectral applications.

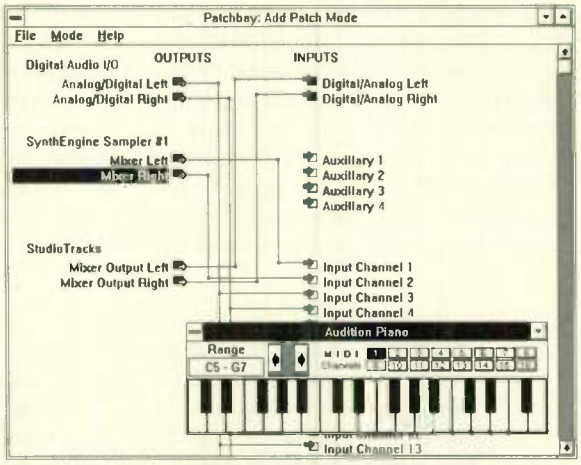

FIG. 2: Spectral Synthesis' Digital Studio multitrack system allows as many as seven Spectral applications to communicate among themselves. Patchbay links the various inputs and outputs of the different applications.

The same data also can be sent to external MIDI gear. A program called *Patchbay* is used to link the various digital audio inputs and outputs of the different applications (see **Fig. 2**). Spectral's software takes advantage of *Windows'* Dynamic Link Library (DLL) capabilities, which allow different programs to share code resources.

An interesting new integrated hardware system is Turtle Beach's MultiSound sound card, due this month. For under $1,000, MultiSound offers many of the features of the company's 56K hard-disk recording system. In addition, the card includes a ROM sample player based on E-mu's Proteus/1, with 4 MB of 16-bit samples accessible over MIDI (internally or externally) and 16-channel, 32-voice polyphonic capability. A stand-alone application called *Wave* offers additional sound-editing features for the recorded audio. Roy Smith, Turtle Beach's president, is confident that users of less-expensive cards will prefer the sound of a 16-bit card. "People today are used to CD-quality sound," he says. "We expect to see a progression up to higher-end cards as people realize they can have that same sound quality from their computer."

For Atari users, Hybrid Arts offers Digital Master. This affordable, 16-bit system is based on technology found in the company's ADAP II series. MIDI is most prominent in the system's disk-based sampler, which functions in many ways like a stand-alone sampler but allows the user to set up an entire disk full of files for playback from a MIDI keyboard. Digital filtering, individually programmable ADSRs, and sophisticated time-compression/expansion are among the most prominent features of the 8-voice-polyphonic sampler. Any file can be assigned a unique MIDI note number for triggering, so live playback of sound files is easy to manage.

In the near future, Steinberg/Jones expects to release Topaz MT for the Atari. This multitrack system will record on magneto-optical or hard disk and work in conjunction with the Steinberg's *Cubase* sequencer.

INTEGRATED SOFTWARE

As discussed earlier, while hard-disk systems offer varying degrees of MIDI capabilities, none yet have the MIDI-editing features of even a mid-level sequencer. One obvious solution, therefore, is to add digital audio capabilities to a sequencer. Opcode's *Studio Vision* for the Mac (reviewed in the February 1991 **EM**) is the first such product to appear, and several others are about to follow.

Studio Vision, originally designed for use with Digidesign's Sound Tools or Audiomedia hardware, allows the user to record, view, edit, and play back two channels of digital audio with the flexibility of virtual MIDI tracks (see **Fig. 3** on p. 59). The newest version will be compatible with Pro Tools and will handle up to sixteen channels of audio. It combines all of the features of Opcode's high-end *Vision* sequencer (reviewed in the August 1989 issue), with a new layer of options built around the audio hardware. A wide range of non-destructive audio-editing capabilities, including cutting, past-

ing, merging, mixing, panning, sliding, gating, and quantizing are available. *Studio Vision* stores audio files in Digidesign *Sound Designer II* format, so it's easy to manipulate data further using that program or Passport's *Alchemy*. A "hot link" is provided in *Studio Vision* that automatically opens *Sound Designer*, with a specified file loaded and ready to edit.

Mark of the Unicorn also has been developing an integrated MIDI/audio sequencer, *Digital Performer*, due for imminent release. Like *Studio Vision*, *Digital Performer* lets you edit digital audio within a sequencer (*Performer*), which also includes music-notation display and editing. The program will

NEW PLATFORMS

While we in the music industry are focused on commercially available hardware and software running on common platforms, there is much musical research and development going on outside our immediate line of vision. Much of this activity is centered around academic and government institutions, and it often involves custom hardware or computers not readily available to musicians. Products developed in this sphere occasionally find their way into the marketplace, either when an existing corporation purchases or licenses the technology, or when the developers themselves form a startup company to bring the fruits of their labor to the public.

An example of the former is Max, a programming language conceived at the French government research facility IRCAM and developed into commercial form by Opcode Systems. When first released, Max worked primarily in the MIDI world, but software drivers developed at CNMAT, a research center based at the University of California at Berkeley, are bringing digital audio into the picture. CNMAT's drivers give the user direct access to the DSP chips found on audio boards such as Digidesign's Audiomedia and Studer Dyaxis' Excellerator, and permit links between MIDI and audio. For example, a patch might use a MIDI Foot Controller (Controller 4) message to determine what type of synthesis algorithm is to be used by the DSP. Another patch might scan an incoming audio signal for a specific frequency, and when that frequency appears, send out a MIDI Start command to trigger a sequence.

An example of the second path to the market is a company whose product evolved from research at the University of Illinois. Symbolic Sound of Champaign, Illinois, has developed a Mac-based, real-time, direct software-synthesis system called Kyma (reviewed in the September 1991 issue). The system couples up to eight custom boards, equipped with Motorola DSP 56001 chips, with an object-oriented software interface. The user builds sounds by linking together graphic "objects" that represent the actual DSP code needed to compute samples. Any form of MIDI data can be represented as an object, which allows MIDI to play a role in real-time sound-creation.

Although the NeXT machine, with its built-in 56001 chip, has great capabilities for digital audio, there is no software available for it that will integrate MIDI with audio. On the other hand, Silicon Graphics, a company known for its state-of-the-art, UNIX-based graphics workstations, has put a 56001 chip into its new, lower-cost IRIS Indigo computers (see the October 1991 "What's New" column) and has hired MIDI guru Roger Powell to head up their audio group, no doubt to encourage music developers to take the platform seriously. While it's still far from clear which manufacturers (if any) will be moving their products over to the platform, the machine's processing power and the multitasking nature of its operating system may give developers the opportunity to rethink the way in which MIDI, digital audio, and graphics can interact.

provide an unlimited number of virtual audio tracks for cutting and pasting and allow you to move audio and MIDI with ease, even while a file is playing. A Tracks Overview screen displays a zoomed-out picture of all events in a project and lets the user quickly arrange large blocks of material. In most cases, identical commands are used for working with different types of data. Product specialist Daniel Rose explains, "We spent a tremendous amount of time developing *Digital Performer* with the hope that the end-user will find it clear and intuitive. As new hardware appears on the market, we expect the program to evolve and offer even greater capabilities."

An integrated-audio version of *Cubase,* Steinberg/Jones' well-established sequencer for the Atari and Mac, is being developed for the Mac. *Cubase Mac Audio* will support both the 2-track Sound Tools/Audiomedia and multitrack Pro Tools hardware.

Passport Designs is taking a budget-conscious approach. *AudioTrax* is available for the Mac and will be released for the IBM next year. This program gives Passport's entry-level sequencer, *Trax,* the ability to handle two channels of 8-bit, 22 kHz audio data on hard disk. You can cut, copy, and paste AIFF files recorded using the Mac's sound input device, MacRecorder, or even Sound Tools or Audiomedia (if you first convert the files to the low-res format), on the same screen as MIDI data (see **Fig. 4** below). The product has a number of distinct advantages over those using 16-bit audio: It requires little or no additional hardware, its storage requirements for digital audio are far smaller than any of the professional formats, and its price ($299) is low enough to attract a large number of Macintosh users who might otherwise be reluctant to get involved with adding digital audio capabilities to their music. While the sound quality is not equal to 16-bit boards, Passport feels it will be more than sufficient for a wide range of uses, especially voice-overs and sound effects, but also as a replacement for low-end cassette ministudios.

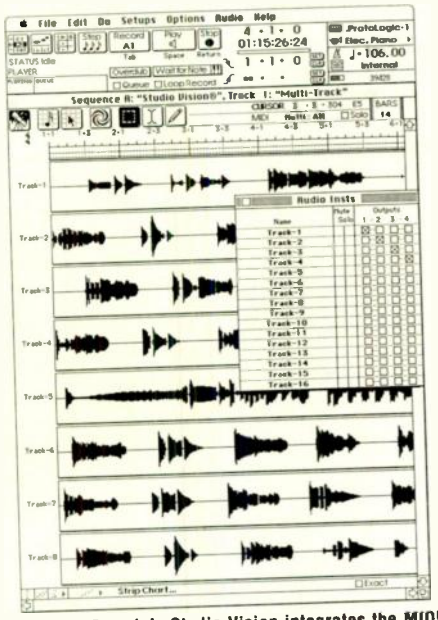

FIG. 3: Opcode's Studio Vision integrates the MIDI sequencing features of Vision with the ability to record, view, edit, and play multiple channels of 16-bit digital audio.

MULTIMEDIA

By the time you read this, Microsoft will have officially released its long-awaited Multimedia Extensions (MME) to *Windows 3.0.* By establishing standards for the use of MIDI and digital audio

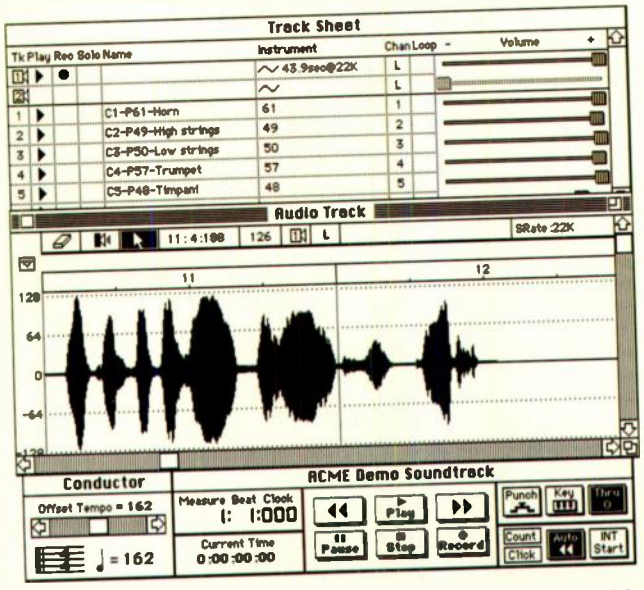

FIG. 4: AudioTrax combines Passport's Trax sequencer with a 2-track hard-disk recorder that can handle 8-bit, 22 kHz digital audio.

on computers running under *Windows*, MME will greatly simplify the job of the application developer who wants to control music hardware or use sound in a program. Not only has Microsoft defined the specifications for a multimedia-ready PC (MPC), it has provided developers with the tools to make their products work together under *Windows*. (Earlier versions of *Windows 3.0* provided limited sound function calls, and

continued on p. 122

DIGITAL AUDIO PRODUCTS FOR THE AMIGA

If you're interested in digital audio for multimedia or other low-fidelity applications for the Amiga, you can start with any of several 8-bit digital samplers, including the Michtron Amas ($199.95), RAM Scan Microspace's Audio Engineer Plus ($349), SunRize Industries' Perfect Sound 3 ($99.95), Datel Computers' Pro Stereo Sound Sampler ($99.95), and the Oxxi Soundmaster ($199.95).

In the middle lies the AD1012 12-bit sampling board ($495), with Studio 16 editing software from SunRize Industries. SunRize's system uses an AD2105 DSP chip and allows recording directly to hard disk. It offers adjustable lowpass filters, and the built-in SMPTE time code reader enables easy synchronization of digital audio to videotape. Since the AD1012 is monophonic, two boards are required for stereo. Studio 16 includes an ARexx port for interfacing with other Amiga software, cut/copy/paste, real-time delay effects, and graphic EQ. Bars&Pipes users can trigger the AD1012 as a MIDI channel, allowing sequencing of vocals or guitar with other MIDI instruments.

Expected soon from SunRize Industries, the high-end AD1016 16-bit sampling board ($2,000) includes all the features of the AD1012 12-bit board but uses a Motorola DSP56001 chip. It adds digital in and out ports that can be configured as AES/EBU or S/PDIF, stereo record and playback, and MIDI In and Out.

Another high-end entry is the AudioLink ($1,295) by Beta Unlimited, a 16-bit stereo sampling board that comes with an external stereo analog-to-digital converter box and sample-editing software. Features include sixteen voices (eight in stereo), sixteen outputs, and direct-to-DAT transfers. The AudioLink comes with 1 MB of onboard RAM, expandable to 16 MB.

Because the Amiga is a multitasking computer, you can run most digital audio systems concurrently with most MIDI sequencers. Unfortunately, no Amiga program allows you to edit the audio tracks from within the sequencer, as you can on Opcode Systems' Studio Vision and Passport Designs' AudioTrax for the Macintosh.

In order to take full advantage of Amiga multitasking with integrated MIDI and digital audio, you can use a sequencer and digitizing system that support ARexx, the Amiga's inter-applications communications command language (see the October 1991 "Computer Musician"). With ARexx, you can trigger synched playback from within the sequencer. To date, the most completely integrated Amiga system of this type is The Blue Ribbon SoundWorks' Bars&Pipes Professional sequencer (reviewed in the September 1991 EM), combined with the SunRize Studio 16 software and AD1012 or AD1016 hardware. This partnership doesn't integrate MIDI and digital audio to the same degree as Studio Vision—you still have to edit audio and MIDI in separate windows—but you can use Studio 16 windows within the Bars&Pipes environment, so both are onscreen simultaneously. You also can mix Studio 16 audio levels from Bars&Pipes' Mix Maestro virtual mixer screen. It's a big step in the right direction.—*Otto von Ruggins*

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TIPS

How to Juggle Music and Musicians

BY MICHAEL MOLENDA

Chances are, if you're sitting in a cafe and overhear two tortured souls complaining about being misunderstood, they're probably record producers. Few people can accurately define what a producer does or what it takes to produce a record. And yet, producers are routinely villified as dictatorial egotists who sacrifice art on the altar of commerce. They also are worshipped for making hit records. That's the problem, and the mythology, of record production.

Producers are not magicians, miracle workers, or musical despots. Basically, a producer is entrusted with translating an artist's vision to tape with clarity and (hopefully) commercial promise. Accomplishing this "simple" task involves juggling the responsibilities of a musical director, recording engineer, pop historian, psychiatrist, budget supervisor, time-management expert, legal counsel,

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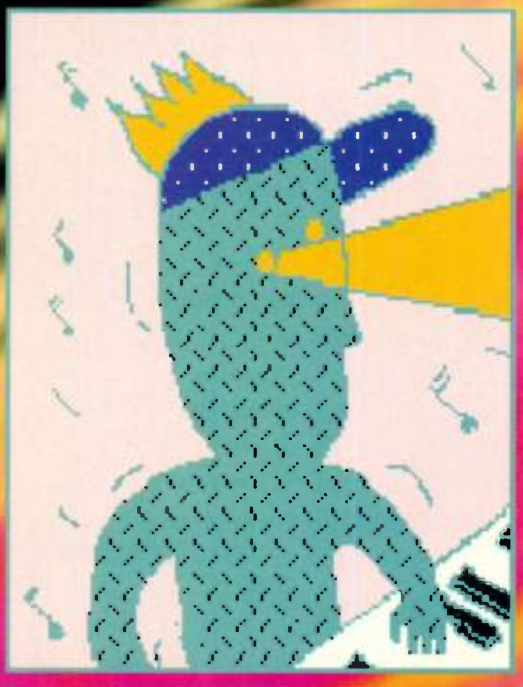

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dramatist, politician, and detective. It also helps to have a whippet-quick mind and the lung capacity to scream over the din of two guitars, an electric bass, and drums.

As with most careers, certain tenets haunt those who seek the producer's chair. Foremost of these are that you probably won't make any money, and yet you'll spend long hours swimming in someone else's creative juices. When self-fulfillment is the sole reward, you'd better enjoy what you do and who you do it with. The production process can energize one's love affair with music, or drop the psyche into an abyss.

The pressures inherent in working in a creative field make the development of a creative and practical methodology essential to maintaining sanity. Every producer has a system (or ideology) for getting an artist's best work on tape *and* a "defense plan" for surviving the process. While production is a subjective discipline, I've discovered some aspects of the job that occur often enough to be considered a helpful curriculum. Hopefully, you can use some of them as a foundation for constructing a personal style. The majority of these insights are slanted toward pop music production, but the basic ideals adapt to any genre.

THE SURVIVAL PROFILE

Multitasking is great for computers but rough on humans. Record production is a multitasking nightmare, intensified by something computers ignore: ego. A producer's responsibility to document an artist's strengths often exposes a few blemishes. It is not easy or enjoyable to rescue a volatile mind from an artistic death wish. Artists often are too emotionally shackled to their work to be objective, or even rational, about editing arrangements. Surviving the producer/artist relationship requires the producer to exhibit confidence and the ability to justify every creative decision. Unsubstantiated opinions are lethal. (The parental rationale of "because I said so" won't win a creative debate.)

In addition, the producer must be sensitive enough to withstand a barrage of emotions from the artist, while maintaining the distance necessary to retain control. Also, you won't have much of a personal life during a project. The production process is similar to directing a film or stage play. Pulling together all the creative and technical elements that comprise a successful production devours one's time and brain cells. And forget about sleep: Recording sessions *never* end.

CHEMISTRY

When you discover an artist you'd consider producing, try to clear all hidden agendas and concentrate on "chemistry." Are you really excited about the artist, or do you just think they have a good chance of getting a record deal? Unfortunately, many producers forget about creative chemistry and accept jobs they hate because of the *career potential*. This is a mistake. First, the primary rule of working in the music business is: Things never turn out as promised. Producing an act that's courted by record labels doesn't guarantee you'll produce them if they get signed. (Matt Wallace, producer of Faith No More and The Replacements, watched several of his projects get deals before a label offered him a chance.) Second, these projects typically end with the producer drowning in frustration and unable to do a good job. In the end, the quality and personality of your work is what determines success.

Your career is better served if your productions exhibit creativity, energy, and sensitivity. Few people rise above hack craftsmanship when producing artists that don't excite them. Remember, a typical recording project means spending weeks in close creative corners with an act. If enthusiasm wanes, so will your ideas. Spend time at a prospective client's rehearsals to study if your work habits are compatible. Schedule an informal lunch meeting to discuss career goals and artistic concerns. Don't limit yourself to music topics. I collect tons of insights by asking about favorite movies, books, paintings, and clothing stores.

Only after you've learned something about the person behind the instrument should you commit to a project. Making a great record often takes a combination of genius, luck, and chemistry. If you can't guarantee the first two ingredients, pour a healthy dose of the last one.

THE BUDGET BUGABOO

When the casual chats are finished, it's time to schedule a budget meeting. This is your first opportunity to

separate fact from fiction. Most musicians overestimate their readiness to enter the recording studio and underestimate the costs. At this juncture, the producer becomes a fiscal detective. It's especially important with self-financed artists to ferret out a realistic budget that ensures a project's completion. There's nothing worse than a production that self-destructs before it's mixed.

Setting a comfortable budget figure also determines the parameters and dynamics of the recording process. Serious major-label demos typically must sound as good as current hits. A professional studio and engineer is a given, but rehearsal time and tape costs also increase. Many labels won't consider a production demo with less than "half a side" (one half of a record or five to seven songs), which can push the budget toward the $1,000 to $5,000 mark.

Recording an artist in a well-designed home studio can dramatically reduce costs, and it also helps if the artist or producer has access to free recording time in a pro studio. Obviously, the musical nature of the artist affects recording costs, too. (Heavy metal projects typically burn more studio time than acoustic folk productions.)

However, there is no such thing as a "cheap" demo, and a smart producer insists that an artist acknowledge financial realities. Put *everything* on paper: producer's fee, studio time, tape costs, equipment rentals, rehearsal studio rentals, and even the batteries for the guitarist's wah-wah pedal. When the artist approves a written budget, you are one step closer to securing a production deal.

PAPER CHAINS

In the music business, no deal is a deal until it's in writing. Get into the habit of signing production agreements with your clients. Although it is advisable to have a lawyer prepare a standard contract, these documents can be as simple as a list of the producer's services and the client's responsibilities. Be sure to clarify who owns the master tape, what the producer's compensation is should the act sign a major label recording contract, and the duration of the agreement. Leave nothing to chance. Any promise worth a handshake is worth chiseling in stone.

Some producers work for an hourly rate, just like recording engineers. Others negotiate a flat project fee. More complicated compensation agreements are necessary when a producer asks for a percentage of an artist's record deal. A producer may "spec" (work for no salary upfront) his or her time in exchange for a healthy chunk of the artist's advance payment from the record company. If the producer cannot secure a deal within a specified period, the artist is freed from the responsibility of production costs. Some producers hedge their bet by requesting a cash advance against a lower percentage of the artist's deal.

The recent Tara Kemp (creator of a Top-Ten dance record) debacle, in which alleged broken promises resulted in a blizzard of lawsuits, proves some producers remain innocent of the ramifications of undocumented agreements. I'll list some: no pay, reduced pay, loss of sound-recording copyright, loss of artist to more renowned producer, and loss of royalties.

Although some clients may bristle at a producer getting "corporate," the majority of artists are happy to have a formal road map of the producer's responsibilities and compensation. Strive to complete the business aspects of a production relationship early, so musical work can progress without distractions. But under no circumstances should you begin recording without a signed production agreement.

PRE-PRODUCTION

Pre-production is where most projects succeed or fail. Comprehensive pre-production binds a project to a stone foundation; poor pre-production strands the artist on a bridge of rice paper. Unfortunately, planning is a discipline few musicians seem willing to master no matter how many books, magazine articles, instructional videos, and music seminars build monuments to its importance. So guess who gets to enlighten the masses?

Pre-production is where most aspects of a recording project are defined. This is where the songs to be recorded are chosen, song arrangements developed, the band rehearsed, musical parts auditioned, recording plans adopted, and problems solved. Nothing should be left to chance when the musicians are in the recording studio, as time is money. Don't assume anything. Force the songwriters to make chord charts and lyric sheets. I've produced several

bands where only one member knew the proper chord structure of a song. (You haven't truly experienced life until you work with a band where one guitarist is playing a B, the other a Bm, the bassist is hammering an F, and the keyboardist a Cmaj7.) Also, after ten years of working with stars, pros, and inspired hopefuls, a session this fall marked the first time a band provided lyric sheets without my asking. (The band XTender deserves to get famous if only for being so prepared.)

AURAL CONCEPT

Pre-production also is where a producer develops a stylistic foundation for an artist. Some producers call this "The Box." The box represents the definitive identity of the production, an outline of the artist's creative and commercial strengths. These plans are essential to maintain a production's cohesiveness. For example, the box for my band Soul Poets is: folk/rock style; male/female duet vocals; acoustic guitar foundation; keyboards limited to piano, organ, and strings; lush background vocals; aggressive rhythm section.

Not every song follows this plan to the letter, but every production is based upon these elements. We would never do a ska song or layer an orchestra of heavy metal guitars. The box keeps us honest. It is easy for some artists to follow several stylistic trends simultaneously. It is extremely difficult to interest record labels in a production where one song is hard rock, another reggae, and yet another blues. Think no one is silly enough to produce tapes with these stylistic gumbos? I receive a few every week.

Conceptualizing the personality of a record usually is done either by song or by sound. Neither domain is exclusive, and a producer must be musically conversant in both to be successful, but often one or the other best enhances an artist's work.

Song-oriented producers, such as Richard Perry or Mike Chapman, take an active role in streamlining an artist's songwriting before any tracks are recorded. They may assist with melody lines, or even suggest lyric changes. The main point is that the song is developed to its highest level. A consistent ideology in contemporary hit records is that you just can't ruin a great song.

The sound-oriented producer often becomes a "member" of the band, since the aural component of the work is elevated in importance. Phil Spector's "Wall of Sound" is the classic example of sonic production. Obviously, if the producer takes this approach with an artist, he or she better have something to offer. It's a dangerous methodology, but if something novel develops, you'll probably get famous.

TRACKING

If life were fair, thorough pre-production would ensure easy success in the recording studio. After all, the songs have been stripped to their roots and reconstructed, and the musicians rehearsed until performances are involuntary reflexes. Unfortunately, many things happen in the studio, and some of them are bad. An artist can freeze up when the "record" button is depressed (who could know?), equipment malfunctions can sap enthusiasm, poor headphone mixes can sabotage musical interaction, and the list goes on.

It's the producer's responsibility to purify the recording environment, cleansing it of all technological and psychological obstacles that prevent the artist from delivering inspired performances. Much of this is accomplished by choosing the right studio. Nurturing a creative environment requires more than a well-maintained studio and a good engineer. Many artists are uncomfortable in clinical state-of-the-art facilities, so an upscale 24-track studio may be inappropriate. Some artists can't function in *any* studio. I've hired mobile recording trucks to work in an artist's home. Why go to all this trouble? Because how an artist relates to the recording environment has a major effect on their performance.

The Sextants, a San Francisco rock band courted by several major labels, recorded demos in the city's finest studios. None of these tapes displayed the energy of the band's live shows, so the labels withheld contract offers. However, the young band often admitted being intimidated by the huge professional studios in which they recorded. Apparently no one was listening. My production partner, Neal Brighton, and I brought the band to our 16-track facility and gave them the run of the place. We downplayed the importance

of producing "the all-important demo that gets the deal," let them record live (the way they rehearsed), and just committed to having fun.

The difference in the band's studio performance was amazing. All their passion was translated to tape. Two demo tapes later, The Sextants signed with Imago Records. Some people still can't believe we made better tapes on our Tascam MS16 16-track deck than those recorded at world-class, 24-track studios. It wasn't the equipment. It was the environment. A good producer never lets technology impede creativity.

MIXING

Mixing can be the most pleasurable aspect of producing records. Rediscovering a song by piecing together the sonic jigsaw puzzle of tape tracks and effects invigorates both the intellect and the heart. However, mixing also is a detail-oriented task that can be incredibly stressful. A record, and a mind, can be lost if pummeled with the diverse opinions of five musicians, their spouses, roadies, and engineers. The best mixing advice for producers has nothing to do with musicality or electronics. It's simply this: Ban the band. A producer must mix in peace.

This doesn't mean a producer hands the artist a finished mix, collects payment, and walks into the sunset. The artist always should comment on a mix and request appropriate changes. After all, it's the artist's record too. However, this process should occur *after* the producer has finished a complete, almost perfect, "test" mix. There's a reason for invoking private mixing rights.

Common musical psychology conceives the mixing process as a collection of segmented entities: Get the drums sounding good by themselves, then work on the bass tone, then the guitar tone, and so on. Most musicians with limited studio experience view mixing in this manner. Nothing could be more false. While the sound components are indeed separated by individual tape tracks, the final stereo mix is (hopefully) a harmonious blend. The sound of the drums cannot be separated from the roar of the guitars. I've watched engineers spend hours dialing in a great vocal sound, then change it when the voice is referenced with the instrumental mix. No instrument is an island; tonalities can enhance or fight each other. It is important the producer negotiate these sonic land mines without an artist insisting upon a tone that may be incongruous with the stereo mix.

When an artist is forced to assimilate a mix as a "finished" song, rather than a collection of individual instruments, their criticisms become much more appropriate. They may want to raise or lower instruments in the mix but will seldom ask to spend fifteen minutes agonizing over something like a ride cymbal tone (typically on a part that occurs only during the bridge and is shrouded by the big bad guitar chords slashing down on the same quarter-note accents).

THE FINAL CUT

A comprehensive guide to record production would take volumes. This article is, by necessity, a brief overview of a complicated process. However, I've tried to cover points that constantly surface when I teach production seminars, talk with other producers, or sit in on industry panel discussions.

Most musicians have excellent technical chops by the time they decide to become producers, but few realize the producer deals more with people than with digital effects processors or samplers. It's the human factor that sends shivers down the spine when you hear a great record, not the snare sound. Technology provides the sonic tools to enhance an inspired music performance, it does not create the performance.

All this may sound like common sense, or even an overstatement of the obvious. But I still meet producers who disregard the artist, and I continue to hear complaints from musicians who have suffered with insensitive producers. The image of the producer as a musical dictator is perpetuated by these unfortunate instances. This perception engenders mistrust between people who are supposed to be on the same team. Great records are collaborative efforts.

I'd like to see Phil Spector make "River Deep, Mountain High" without Tina Turner.

After 157 nervous breakdowns in a 10-year production career, **EM** *assistant editor* **Michael Molenda** *has been documented in* An American Rock History *(Borderline Press, Great Britain).*

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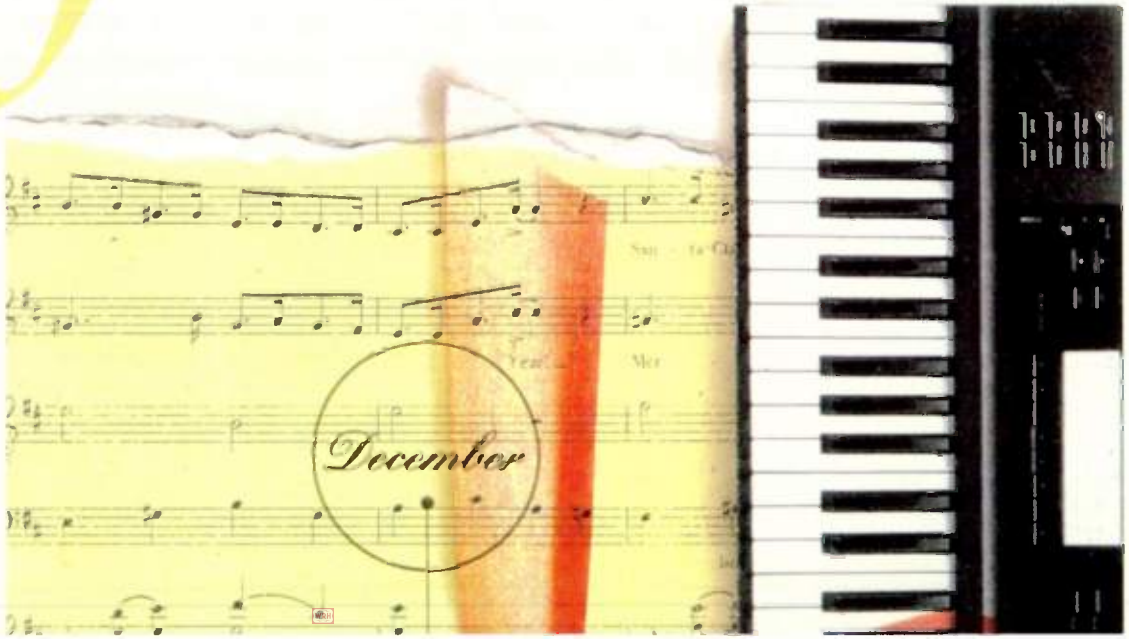
A Season of Dreams

By Anne-Marie Praetzel

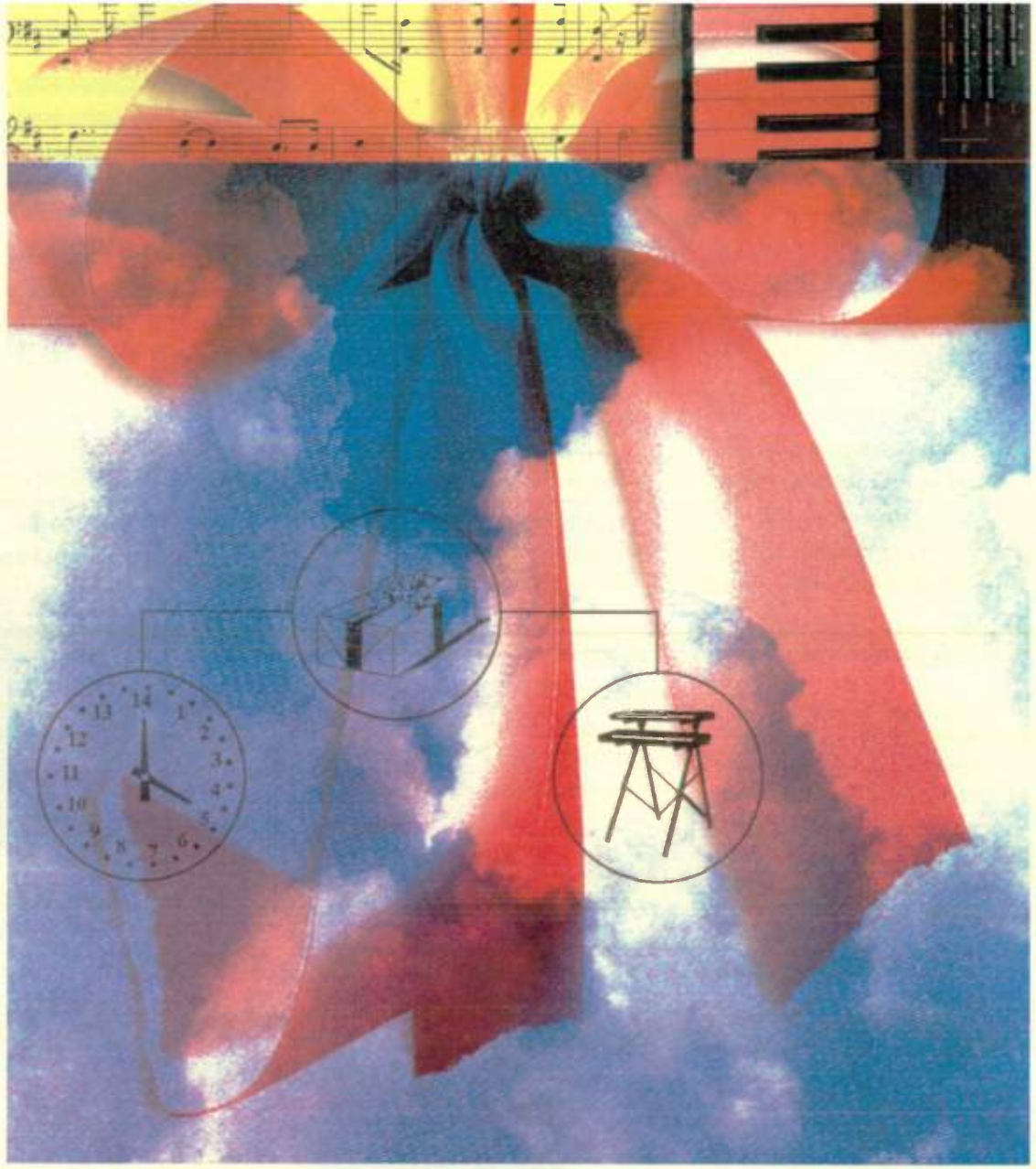
What do pros and visionaries whisper to Santa?



If you could have anything you wanted this holiday season, what would it be? A sparkling pro DAT machine, a digital audio workstation, the newest sequencing software?

The holidays inspire even the most jaded to dream, to create endless lists of what we need to make our lives complete: fame, fortune, the finest equipment money can buy.

But what if you already have it all? In the following pages we steal a peek at some prominent musicians' holiday wish lists, and their desires reach far beyond the latest MIDI gadgets. Here's hoping all your dreams come true.



LAURA TARRISH

A Season of Dreams

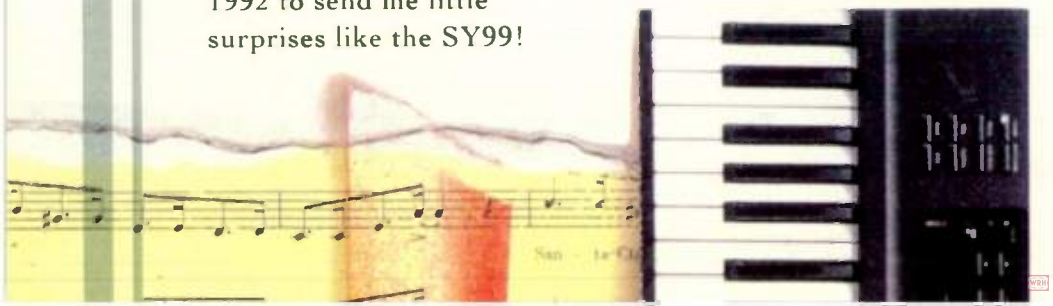
WISHLIST

Chick Corea *Consummate electronic keyboardist, recording artist, and leader of Elektric Band*

I'm asking Santa for an 8 series BMW, a glow-in-the-dark Frisbee, and that Yamaha will continue in 1992 to send me little surprises like the SY99!

Pat Metheny *Electronic guitarist extraordinaire, he was among the first to use the Synclavier guitar*

Another 64 voices of poly for the Synclav and 64 MB of RAM.



Jerry Harrison *Independent recording artist and keyboard player with the Talking Heads*

My first wish is for more adventurous radio stations. It's sad that in the U.S., where there has been more access to the airways than anywhere else, there isn't greater variety. I miss the early days of FM, when people took chances and stations had real personalities. Wishing for even more inventive and responsive ways to make music seems unimportant when the opportunities for exposure keep shrinking. I also think ticket prices are too high, so high that nobody will take a chance on hearing music that they don't already know.

Bob Moog *Prominent electronic musical instrument designer and creator of some of the first commercial synthesizers*

I don't want any equipment for Christmas. In fact, I'd like to get rid of much of the gear I've accumulated over the years but no longer use. What I *would* like is about a year of free time to really get to know some of the wonderful software applications I've recently acquired, in particular, Opcode's *Max*, Midisoft's new *Studio for Windows*, and Borland's C++.

Branford Marsalis
Accomplished jazz saxophonist and closet MIDI freak

I'd like a Synclavier and the ability to get away with robbing a bank so I can buy it. I'd also like to be Axl Rose for a day, and to catch the winning touchdown for the Saints when they win this year's Super Bowl.

Mark Isham
Grammy-winning composer and trumpet player

Global sanity, a Lotus Super 7, and a 28-hour day.

Wendy Carlos *Recording artist, film composer, premier electronic musician*

A time machine. Which brand? Too bad there aren't any decent ones out there. I've got all these projects going on, and the tools I've got to do them are wonderful. Now I just need something that gives me the time I need to do them.

David Torn *Experimental composer, recording artist, and guitarist*

The conceptual retraction of MIDI, which seems to have helped in spawning "The Mid-Seventies Disco Age, Part II: the Eighties," which might further be subtitled, "Providing the music industry's lowest-common-denominator-obsessed corporate honchos with all kindsa styles, feels, sounds, and samples that may be repeated and recycled endlessly and formulaically (amen), so that they might be marketed more safely, easily, and with a sharp eye toward the fiscal bottom line, thereby protecting said honchos' frightened little buttocks on their awe-inspiring (yet secure!) climbing of the corporate ladder to penultimate mediocrity, and ensuring that their mediocre children (and their children's mediocre children) will never be deprived of the latest in video home entertainment systems." Not that I object to MIDI, mind you (I'll use *any* tool that music requires); I jes had to get all that off my chest. (And, well, yeah, my kids have Nintendo, too, but, hey...)

That a few more people will pay a lot more attention to the first two words of this over-used phrase: "The Art of Music." And I'd liketa hear more musicians expressing a little "piss and vinegar" in their music.

I want Miles and Jimi and my grandma back.

EM *editorial assistant* **Anne-Marie Praetzel** *plans to vacation in Antarctica for the holidays.*

Microsoft DOS 5.0

By Constantine Peters

The latest system software for the PC is an improved taskmaster with a long memory.

LINDSEY LOCH

After a gig, do you and your friends gather around the old PC and discuss assembly language routines to determine the optimal disk interleave? Or while duplicating a file, do you open up your C compiler and write a faster copy command? Neither do I. If you're like most musicians, you're more concerned with making music than with system internals. And when it comes to low-level nasties such as the operating system, there's one overriding principle: If it ain't broke, don't fix it!

With that in mind, why bother with MS-DOS 5.0, especially in light of the problems in DOS 4.0? After all, DOS 3.3 works just fine, even though the occasional "OUT OF MEMORY" or "BUFFERS FULL" message interrupts the recording or editing of long sequences. So what if I have to save and quit my notation package every time I want to spend ten seconds in a patch librarian? Who cares if I can recover accidentally deleted files, open a buffer for frequently used files, and navigate around files and subdirectories graphically with the new system? Things are working well enough for me to get by.

If getting by isn't good enough, then an upgrade to 5.0 is for you.

THROUGH THE 640K BARRIER

While the "complete" installation of MS-DOS 5.0 requires 512 KB and almost 3 MB of hard-disk space, the spartan MIDIot still clinging to a dual-floppy drive system with 256 KB can upgrade to a "minimal" installation. But such a low-end installation would bypass all the major benefits offered by DOS 5.0.

The most significant benefit of DOS 5.0 is its ability to reduce the dreaded RAM cram plaguing DOS users for years. With a well-tuned installation, in combination with task-swapping, you can enjoy larger sequencing and editing buffers and the ability to do more things at once. Keep in mind, however, that your applications must be capable of using extended or expanded memory.

The latest DOS takes advantage of extended memory (beyond the 640 KB barrier) in two ways. First, the HIMEM driver allows 80286, 80386, and 80486 machines to load the DOS kernel into the High Memory Area (HMA), using low memory pointers to address the A20 address line. Second, on 80386 or 80486 machines, the EMM386 memory manger lets you load memory-resident programs (TSRs) and device drivers such as ANSI.SYS into the unassigned memory space between 640 KB and 1 MB known as "upper memory blocks" (UMBs; see **Fig. 1**). Also, DOS 5.0 eliminates the need to load RAM-consuming products such as SHARE.EXE to read disk partitions over 32 MB.

Before DOS 5.0, I had around 575 KB of user memory free, which allowed me to record up to 27,500 MIDI events in my sequencer. Now, my 612 KB system gives me 32,000 events to play with and has significantly increased the size of the Undo buffer, so I can recover from even bigger mistakes. This bonus buffer is overkill for me, which is why I opted to use this extra memory to take advantage of 5.0's *DOSShell*.

DOSSHELL

Essentially, the *DOSShell* provides a graphic means of navigating and controlling the DOS operating system. Although it gobbles up the 40 KB I gained from tweaking my CONFIG.SYS file, the task-swapping feature lets me eliminate three TSR programs and the

pain of quitting one program to run another. However, the system does not multitask: Once you swap out the sequencer for, say, a librarian, the sequencer is unable to record, play, edit, or operate in any fashion until you swap back to it.

Furthermore, unlike task-swapping in Microsoft *Windows 3.0*, you are unable to cut-and-paste information between applications by means of a clipboard/buffer. Nor are you able to take advantage of dynamic data exchanges or links if you choose *DOSShell* over *Windows*. Finally, *Windows 3.0* takes up less RAM than *DOSShell* (with task-swapping turned on) and is faster at swapping tasks. Nevertheless, for those who don't plan to install *Windows, DOSShell's* task-swapping is far better than continually saving and quitting to get to other applications, and it makes moving, copying, and finding files *almost* as easy as a Mac.

COMPATIBILITY

Having said all of this, the remaining question is, "Will your applications work under MS-DOS 5.0?" This question should be rephrased, "How do you make them work under 5.0?" To date, all of the major MIDI sequencers and notation programs boast 5.0 compatibility. I've found only a couple of common problems in this regard. One problem becomes evident when some MIDI applications attempt to use the first 64 KB memory segment. This produces a Packed File Corrupt message, which wouldn't be so disastrous had Microsoft put the solution somewhere in the 668-page *User's Guide*. Unfortunately, the solution is only briefly mentioned on p. 41 of the 55-page *Installation Guide*, which simply tells you to prefix your program call with LOADFIX. For instance, to use Twelve Tone Systems' popular *Cakewalk Professional* sequencer, type "c:\> loadfix cakepro."

The other common problem arises with software that interrogates the computer about which version of DOS is running. Many applications are looking for version numbers between 3.0 and 4.0. Unfortunately, the number 5 does not fall into this range. The problem is often resolved during the upgrade process for the programs themselves. And for new MIDI applications that run into "wrong version..." problems, the answer can be found in the User's Guide under "SETVER."

BUT WAIT...

There's more. While DOS 5.0 may look the same, with its ignominious C> prompt, when you enter the command HELP, you'll discover a radical departure from the past. Not only has online help been added, but it has been extended to each command.

The new DOS adds several other nice touches. If you type EDIT, instead of EDLIN, you'll enjoy a mouse-sensitive editor that "knows" how to cut, copy, and paste. Better yet, take a ride with QBasic, a professional, run-time Quick Basic that replaces the kludgy "Gee-Whiz" Basic. To top it off, you get an Undelete function.

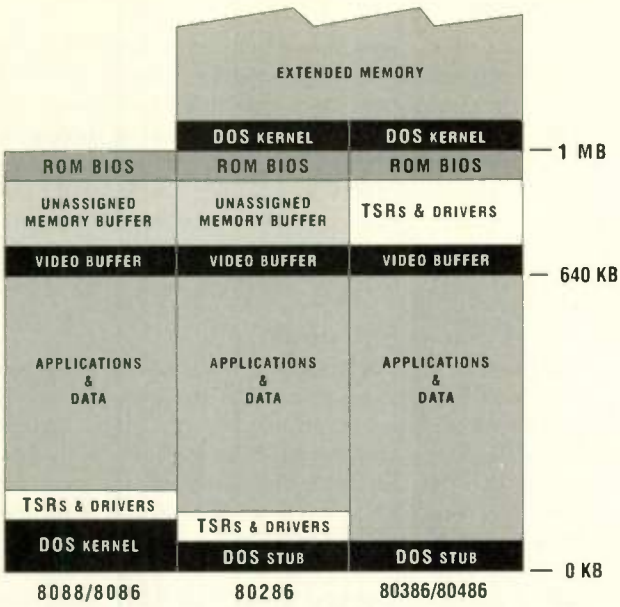


FIG. 1: DOS 5.0 lets 80286-, 80386-, and 80486-based machines load the DOS kernel into the High Memory Area above 1 MB. On 80386- and 80486-based machines, TSRs and device drivers can be loaded into the upper memory blocks between 640 KB and 1 MB.

SHOULD YOU UPGRADE?

As you can tell, I'm pretty high on the new operating system. It successfully reduces the time it takes to keep things running, giving me more time to perform and record music. However, you also must consider the time you spend in your operating system versus your MIDI application.

The easiest and least-expensive upgrade path is Microsoft's MS-DOS 5.0 upgrade package, which I've found for as low as $39. This Microsoft product offers the complete DOS 5.0, with relatively painless upgrading from your current operating system. The only part I found to be time-consuming was my self-enforced hard-disk backup before installation. The only undocumented part was the need to format two diskettes labeled "UNINSTALL" before proceeding with the upgrade process. (The computer prompts you for this disk; without it, you would have to terminate the installation.)

Unquestionably, MS-DOS 5.0 is worth the investment. If you own an 80286, 80386, or 80486 computer with at least 1 MB of RAM, you definitely should upgrade. The additional memory for your MIDI applications and the ability to switch between applications make it too useful to pass up. Even if you're a PC or XT hold-out, you may find the sluggishness of the mouse-sensititve editor, Undelete, and *DOSShell* outweighed by the eons it takes to open and close applications. In either case, DOS 5.0 is the best version of MS-DOS to date and deserves serious consideration.

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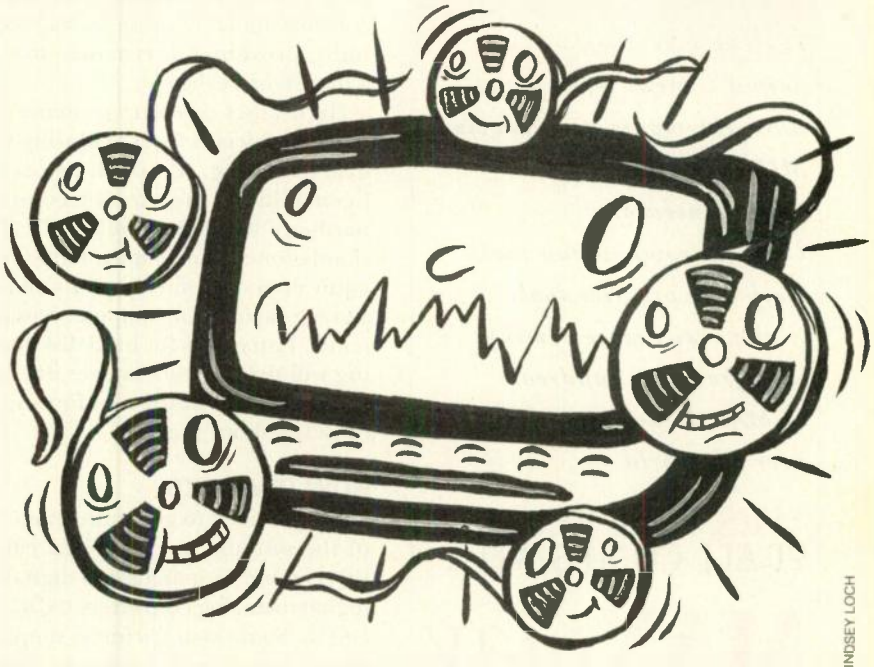
Hard-Disk Recording

By Dan Phillips

The marriage of sound and computer brings new flexibility to audio recording and editing.



LINDSEY LOCH

Ah, the ongoing, glorious revolution of recording technology. The compact disc raised the consumer's expectations of audio fidelity; DAT and its cousins have done the same for the musical community. Many have praised digital audio for removing the extraneous clicks, pops, and hiss from our recordings, and rightly so. But recordists who extoll its virtues solely in terms of improved fidelity miss the point.

Digital audio involves converting sound into a list of numbers (albeit a long list) using a device called an *analog-to-digital converter* (ADC). The list of numbers representing a sound can be stored on a computer's hard disk or other recording media as a file in the same way as any other computer-based information. This sound file can be edited and modified at will, providing extraordinary ease and flexibility of audio editing. To hear the sounds again, the system sends the list of numbers through a device called a *digital-to-analog converter* (DAC), which changes the numbers back into sound waves that you hear as music. (For more on the basics of digital audio, see "The Legend of Digital Audio" in the October 1990 **EM**.)

The process of storing and editing sound on a computer hard disk is called *hard-disk recording*. Hard-disk recording is to tape recording as the word processor is to the typewriter. This analogy points out one of the most important aspects of hard-disk recording: how it facilitates and improves the process of sound editing.

With tape, complex splices require extensive use of razors and adhesive tape; with hard-disk recording, they are as simple as cutting and pasting in a word processor. Edits that are nearly impossible with tape, such as switching around verse 1 and verse 2 on a single track of a multitrack recording, are a piece of cake in a disk-based system.

There are two types of hard-disk recording systems: stand-alone units (which provide a completely self-contained recording environment) and computer-based systems (which essentially are add-ons to personal computers). Stand-alone systems have the virtues of simplicity; they are easy to set up and (generally) have quick-to-use, dedicated user interfaces (see **Fig. 1**). Most offer controls similar to those of traditional studio equipment: buttons for play, record, stop, and other transport functions; shuttle wheels for locating edit points; and sliders for mixing.

As of this writing, complete stand-alone hard-disk recording systems are available from below $5,000 up to the mid six figures. Hard-disk recording may be many things, but cheap is not one of them.

Computer-based systems are available for most platforms but generally require the more-powerful models. (CD-quality recording takes considerable high-speed computing power.) You'll need *at least* a Macintosh SE/30, a 286-based MS-DOS compatible, an Atari Mega ST, or a Commodore Amiga 2000. However, these don't guarantee zippy performance; most manufacturers recommend buying the most powerful computer you can afford.

Computer add-on systems include a combination of software and hardware (expansion cards and/or external devices) and tend to provide more elegant, graphical user-interfaces than stand-alone units. The costs of computer-based systems are comparable to those of stand-alone units, when you figure in the cost of the computer and hard disks.

The distinction between stand-alone and computer-based systems can be rather fine, and the industry seems

intent on closing this gap. Some stand-alone recorders also include software to use a Macintosh as a "front end," providing a graphical user interface. On the computer-based side, some manufacturers offer add-on hardware with transport, editing, and mixing controls similar to those on stand-alone units, providing alternatives to using a mouse or keyboard.

High costs discourage many electronic musicians from exploring hard-disk recording. Although prices have been falling, the cost of computer hardware limits the rate of fall. (Even stand-alone systems must embody the equivalent computer power and mass-storage capacity of computer-based systems.) Entry costs for hard-disk recording will drop as time moves on, but it should remain in the mid four figures for a few more years.

HOW IT WORKS

First, you need to get audio in and out of the system. As mentioned earlier, this is done with analog-to-digital and digital-to-analog converters (ADCs and DACs). Some manufacturers simply use digital inputs and outputs to transfer audio signals in their digital form (a list of numbers) between a DAT or other digital tape machines (which have their own converters) and the hard-disk recorder. This type of system not only allows you to get audio into and out of the computer, it offers a convenient way to back up and store the enormous files created when working with digital audio. Most hard-disk recording systems operate at the CD-standard 44.1 kHz sampling rate and 16-bit resolution, with some offering DAT-compatible 48 kHz or memory-saving lower rates.

If the system uses its own ADCs and DACs, there are many design considerations that can affect audio quality. Not all "CD-quality" systems sound the same. Some manufacturers offer a choice between medium- and high-quality input and output, all at 44.1 kHz, with 16-bit resolution. This is an area where you (generally) get what you pay for. Before you invest in a hard-disk recording system, it's best to listen and compare. These systems have very high fidelity, especially when compared to mid-range analog recorders, but there are substantial differences between converters. The more you listen, the more apparent the differences become, and it's never too early to begin educating your ears.

It's possible to get confused between hard-disk-equipped samplers and hard-disk recording. Both are capable of audio input and output and (usually) of processing the sound in the digital domain. Samplers specialize in shorter sound segments, which can be played polyphonically and transposed in pitch. Sounds being sent into a sampler are digitized and stored in RAM (Random Access Memory). From there, the sound can be edited, played, and transferred to a hard disk or other storage medium for long-term storage. In order to use them again, the sounds must be transferred from the hard disk back into RAM. My sampler may have an 80 MB hard disk, but it only can record and play back sounds that fit into its 2 MB of RAM (a little over twenty monophonic seconds at near-CD quality).

On the other hand, hard-disk systems record and play back by constantly streaming data to and from the disk directly, using a small RAM buffer just to maintain a constant data rate. This allows them to record much longer chunks of audio—enough audio for an entire song, for instance, or even a whole album (depending on the size of the hard disk). For a more detailed description of hard-disk recording technology, see "Going Tapeless" in the October 1990 **EM**.

FIG. 1: The Roland DM-80 offers a complete stand-alone system for 4- or 8-track hard-disk recording.

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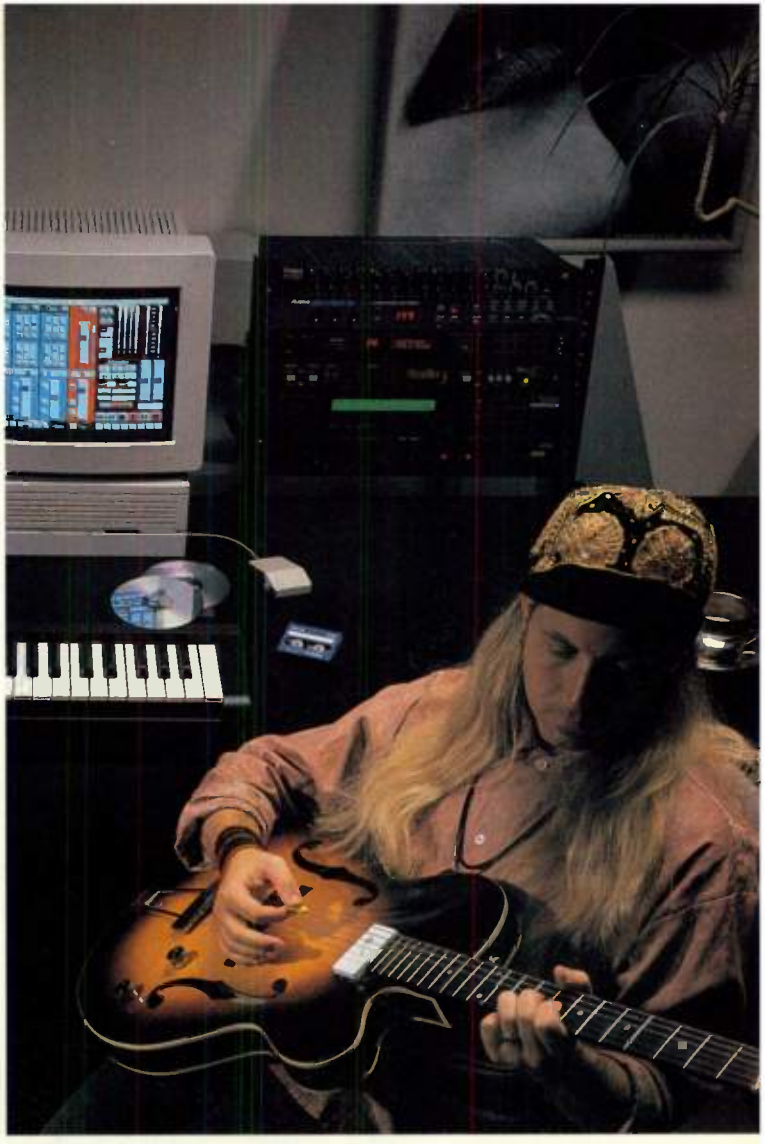
STORAGE AND BACKUP

The next ingredient is the hard disk itself (or other mass-storage medium such as a magneto-optical disk, which I'll explain later). The more massive, the better. Sixteen-bit, 44.1 kHz audio eats up 88.2 kilobytes per track per second, or about 10.6 megabytes per stereo minute. A 160 MB drive is good for less than sixteen minutes; cut *that* in half for 4-track operation. These figures are worst-case estimates; in multitrack work, one normally doesn't have continuous audio on every track (and silence doesn't take up disk space). However, it does give you some idea of the voraciousness of the medium. Mid-sized drives may be sufficient for casual users or multimedia applications, but it's best to get the biggest drive possible (e.g., 300 MB or more). To get the full benefits of hard-disk recording, you'll want several pieces active at one time, with plenty of room left over for alternate takes, experimental edits, and so on.

The biggest disadvantage of hard disks as a recording medium is that they are not removable. Along with large storage media comes the need for backup. When your 300+ MB drive is full (and it will be quickly), all of that data must go somewhere before you can record another song. Backing up also provides vital insurance against the day your hard disk decides to crash (which it often does just as you're finishing that all-important project). Floppy disks are not a good solution; you might need hundreds for a single song. (I can just see the glazed, weary eyes staring at a dialog box requesting, "Please insert disk #172 now.")

The most cost-efficient backup systems are probably those that dump the contents of your hard disk to a DAT tape, which can hold about 1.2 gigabytes (1,200 megabytes). SCSI DATs, designed as data-storage peripherals rather than sound recorders, may be used by any system that includes support for SCSI hard drives. (SCSI, or Small Computer System Interface, is the most prevalent standard for connecting mass-storage devices to personal computers.)

Some systems also can back up directly to an audio DAT, which can serve as a high-fidelity mastering deck, as well. Complete backup requires storage of



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all audio *and* editing information. Audio DAT backup systems are able to store and retrieve this editing information using the digital inputs and outputs of the DAT machine.

Removable hard-disk cartridges also are popular because they serve as both backup and editing media. These cartridges generally hold either 45 MB (a little over four minutes of stereo) or 90 MB, so there are limits to their utility. Also, the cartridges only can be played on the hard-disk system itself; you still need a 2-track tape machine to record the final product.

An alternative to hard drives—and an aid to backup—is the removable *magneto-optical* disk. These CD-sized disks hold 300 MB per side and can be removed like floppies, but otherwise act almost like hard disks. The drives themselves are expensive, currently in the $3,000 to $5,000 range, and a single disk costs about $200. Magneto-optical drives are much faster than tape backup; for a new song, just pop in another disk. Right now, only a few systems are capable of recording to magneto-optical, but their numbers are growing.

DIGITAL ON A BUDGET

Professional hard-disk recording systems can set you back from thousands to tens of thousands of dollars, but there are some less expensive options for applications that can tolerate low audio fidelity. Several companies (such as Passport Designs with their *AudioTrax* for the Macintosh; see "When Worlds Collide" on p. 44) have announced systems that integrate MIDI sequencing and 8-bit recording at low sampling rates for only a few hundred dollars. Since these systems use low-resolution audio data, they also take up less hard-disk space for their files. You can probably get away without the expense of high-speed computers, large hard drives, and tape backup.

Eight-bit systems are fun, useful in the appropriate contexts, and full of sophisticated features, but they don't begin to approach the fidelity of 16-bit audio, or even analog cassettes, and are unsuited for general recording. However, for simple multimedia presentations, or for use as an audio "scratch pad" within a sequencer, they should be quite sufficient. Eight-bit systems also have proven helpful for speech-oriented applications, and they provide an excellent way to learn the principles of random-access audio at low cost.

Atari, Amiga, and Macintosh computers have 8-bit sound output built-in. Some of the new models also include low-resolution sound input. As this trend progresses, we should see CD-quality, stereo sound emerge as a common feature, at least on higher-end computers.

HOW MANY TRACKS?

The concept of tracks in a hard-disk recording system is somewhat different than that found on multitrack tape. Audio tape has a certain number of physical tracks, laid out as stripes on the tape, and each track has its own input and output. This does not apply to hard-disks, which can put the audio data anywhere on the disk and thus can record any number of separate "tracks." However, simultaneous playback and recording is another matter. One way to define tracks in a hard-disk system is by the number of audio channels that can play at one time.

Disks only can transfer a certain amount of information in a given time, which translates into two to four simultaneous "tracks" per disk for most systems (some higher-end systems manage to do more). Many multitrack systems get around this barrier by using a dedi-

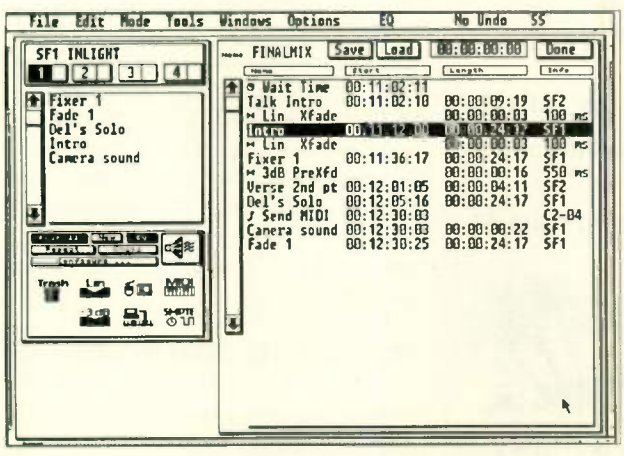

FIG. 2: Playlist-style editing lets users describe audio blocks with text names.

cated, separate hard disk for every four output tracks.

Some systems may have fewer outputs than the number of tracks they can accommodate—a 4-track recorder with only stereo connections, for instance. In this case, the tracks are kept discrete on the disk, allowing you to record and edit them separately. They then are mixed down to stereo inside the computer and sent to the outputs.

Some systems claim to have many more "tracks" than inputs and outputs, or even more tracks than they can play simultaneously. This is somewhat like using a 256-track MIDI sequencer with a 16- or 32-voice sound module. The computer can represent many tracks on the screen, with various pieces of audio at different points on each track. As long as the editor does not try to play more channels of sound than the system can deliver at any one time, everything is fine. For example, these "virtual" tracks can be used to assemble a final performance out of various takes.

EDITING

Editing is the *raison d'être* of hard-disk recording. Tape recorders must play sections of a piece back in a linear fashion (1, 2, 3, 4, 5), but a hard drive doesn't care where the data is. It can play audio segments in any order, such as 4, 2, 5, 5, 1, by jumping from one part of the disk to another. These jumps are quick, and a little bit of RAM memory acts as a buffer so that no audible break occurs. The speed at which a disk can locate and jump to a new piece of data is known as its *access time.* Most recording systems require a drive with access time of 28 milliseconds (ms) or less.

A hard-disk system "splices" bits of audio together by simply reading from a different place on the disk, instead of actually rearranging the sound file itself. Other types of editing, such as mixing, transposing, and so on, also can be performed and the result saved as a different file. Since the original recording remains intact, this is known as *non-destructive* editing. This type of editing is easy to undo and redo. Since you can make changes quickly and without fear of destroying the original material, you can afford to experiment more.

To make the splice point smooth and less detectable, hard-disk recorders can fade down the audio quickly, before the splice point, while simultaneously fading up the audio at the beginning of the next segment. This type of transition is known as a *crossfade*, similar to the crossfade loops found on most samplers.

For each track of audio with a crossfade, two tracks play simultaneously during the period of transition. This can create a situation that calls for more audio channels at one moment than the system can deliver. To get around this problem, many systems create their crossfades ahead of time and plug them back in at the appropriate places as small, independent segments of audio. This makes crossfading easier, but the system must recalculate the crossfade each time a splice changes, which requires considerable time.

PLAYLIST VS. GRAPHIC EDITING

One useful technique is to record a song in one pass and then mark off certain sections as "Verse 1," "Bridge 2," "Chorus 1," and so on. Depending on

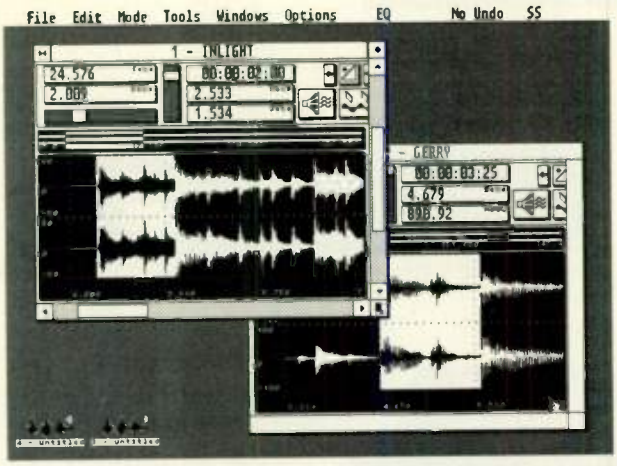

FIG. 3: Graphic editing lets users see the time relationships between different audio elements.

the particular software, these sections may appear as entries in a text list, or as graphic blocks (see Figs. 2 and 3.) You are then free to rearrange these blocks in any order, or copy them so that they play more than once.

Multitrack systems also let you do this kind of editing separately for each track. You can (for instance) copy the background vocals between verses 1 and 2, or shift the guitar track a few milliseconds ahead of the beat. Assembly tracks, in which multiple takes are recorded and phrases taken from each to produce a single "best of" performance, also become easier.

If you're synchronizing to film, video, or audio tape, you usually can synchronize individual sections of digital audio on the disk to specific points on tape using SMPTE time code. (For more on SMPTE sync, see "Secrets of Synchronization" in the July 1991 EM and "Decoding SMPTE" in the April 1991 EM.) This technique is extremely useful for sound-effects editing. You can keep a huge library of long, high-fidelity sounds on a hard disk, shifting their start times around effortlessly.

Destructive editing (rewriting the actual data on disk) also has a place in hard-disk recording. Numerous small-scale edits, such as cutting out a small cough or smoothing out an inadvertent click, may overload a system's random-access capability. When this happens, the system must go in and write new data so that the final product can be played as a continuous segment. Avoid destructive editing when possible, as it is time consuming and greatly reduces the flexibility of hard-disk editing.

Some problems need to be resolved before digital recording becomes the solution for everyone. Entry costs are still high (though much lower than a few years ago), and backup can be time-consuming. Still, the editing control it provides can be a dream come true, opening realms of sound creativity. With its steady drop in cost and concurrent increase in capability, hard-disk recording is here to stay.

Dan Phillips *is a product specialist for Korg R & D and an exceptionally hard-working author.*

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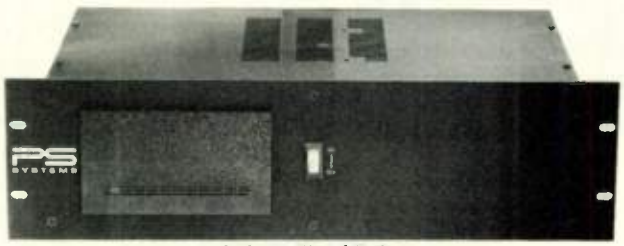

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Reviews

Peavey DPM-2 Synthesizer

By Greg Rule

A manufacturing maestro progresses deeper into the synth market.

Peavey Electronics, whose DPM-3^{se} keyboard quickly became a significant competitor on the synth scene, recently released a scaled-down, lower-cost version, the DPM-2 Digital Phase Modulation Synthesizer. The DPM-2 offers 16-part multitimbral operation and 16-note polyphony, along with an unweighted, 5-octave, velocity-sensitive keyboard. The new synth costs just $1,299, but don't let the price mislead you; this is a good-sounding, extremely easy-to-use instrument with solid features.

PETER DIGGS

The Peavey DPM-2 combines good sounds, an onboard effects processor, and programming simplicity.

A relatively small, but heavy machine, the DPM-2 measures approximately 36 × 15 × 4 inches and weighs about 32 pounds. On the front panel, you'll find an 80-character, backlit display with six corresponding "soft" buttons; pitch and modulation wheels; data and volume sliders; and twenty function/editing buttons.

The DPM-2 is stuffed with 4 MB of ROM-based, 16-bit samples (sampled at 38.4 kHz). With 300 user-editable program locations in battery-backed RAM, you'll have more than enough room for modified factory and custom patches. Two hundred additional programs can be accessed via a RAM or ROM memory card. Unfortunately, no new waveforms can be accessed from the memory cards, only new patch configurations. Furthermore, unlike the DPM-3^{se}, you can't load your own samples via MIDI Sample Dump. Peavey has hinted this feature could be included in a future upgrade, but I'm not holding my breath

In addition, the DPM-2 offers onboard digital signal processing and alternate tuning tables. The tuning tables include Mean C, Just major, Just minor, and two user-programmable scales. The latter are Just tables that let you offset the scale by a programmable amount. Incidentally, you can create equal-tempered microtunings by using the keyboard as a modulation source, permitting, for example, 17- and 19-tone scales.

For connections to the outside world, the DPM-2 provides 1/4-inch left and right audio outputs, one of which is a stereo output; MIDI In, Out, and Thru jacks; and a programmable, 1/4-inch footswitch connector. There is no dedicated headphone jack, but you can plug a pair of headphones into the stereo audio output. (The signal isn't nearly as hot as I'd like, though.) The DPM-2's underside panel contains a small, removable panel for easy access to the operating system ROMs.

DSP REFRESHER

For those unfamiliar with the DSP (digital signal processing) chips used in DPM-series keyboards, here's a crash course. Unlike most synthesizers, which rely on fixed, proprietary VLSI chips to generate sound, the DPM's "general-purpose" Motorola 56001 chips are capable of performing numerous types of synthesis and sound-modeling functions. The DPM-3^{se} employs three such DSP chips while the DPM-2 contains—you guessed it—two chips, hence the name.

In theory, an operating system software update could transform the DPM into a completely different machine. Peavey claims that this system "will end the cycle of obsolescence." So far, the

company hasn't delivered the proposed op system upgrades to the marketplace.

PROGRAMS AND VOICE ALLOCATION

A DPM-2 program can consist of a Single sound or a Combi (or combination) sound. Combis, as the name implies, are sounds that are either layered, split (up to three times across the keyboard), or velocity-switched. Surprisingly, all three of these functions can be used simultaneously within a Combi program. For example, you could have a velocity-switched bass guitar from C1 to C2 and a piano/string layer from C#2 to C5. (However, remember that layering consumes more polyphony than a Single patch.)

The DPM-2, while limited to sixteen notes at a time, offers an "intelligent" means of dynamic voice allocation. When all sixteen voices are in use and a seventeenth is triggered, the DPM-2 deletes the "least useful" voice (the one nearest to the end of its decay cycle). This is in contrast with keyboards that simply steal the first note that was played in the group. Another nice touch is the inclusion of a real-time voice display. While the synth is being played, via the keyboard or MIDI, a series of flashing dots appear on the LCD, showing how many of the sixteen voices are in use.

WAVEFORMS

If you like the sounds of the DPM-3^{se}, you're bound to enjoy the DPM-2 sounds. The instruments are, on the whole, crisp and vibrant, thanks in no small part to the 16-bit internal samples and onboard digital effects.

There are a total of 104 waveforms in ROM, which can be edited and stored to any of the 300 program locations. Guitar waveforms include fingerbass, pick bass, fretless, slap, acoustic bass, four synth basses, acoustic guitar, three electric guitars, and guitar loop. Among the collection of keyboards are grand piano, four electric pianos, EP loop, harpsichord, pipe organ, full B3, jazz B3, and percussive organ. Peavey also remembered the synth waveforms: Sine, triangle, sawtooth, square, pulse waves, digital waves, loops, and five "special" waves are furnished. The synth also supplies mallet instruments, human voices, breath, steam, bottle, and lightning effects. Overall, Peavey has assembled a pretty impressive collection of waveforms, especially for an instrument in this price range, and there are few clinkers in the bunch.

DRUM KITS

While not offering an end-all collection of drum and percussion samples, Peavey gets no major complaints from my ears. The palette of samples includes five kicks, four snares, side stick, two toms, electronic tom, open hat, closed hat, crash, ride, reverse cymbal, and a variety of ethnic instruments such as kalimba, gamelan, taiko, and timbali. If Peavey upgrades the DPM-2 to accept new waveforms, I hope we'll get such presently lacking percussion sounds as ride-cymbal bell, china cymbal, pedalled hi-hat, and conga slap.

The DPM-2 allows ten drum kits to be edited and stored under the Global menu. Each kit can comprise up to 32

samples from any of the DPM-2's onboard waveforms, percussive or otherwise. You can create custom drum kits with specific instrument tunings, key assignments, decay times, pan assignments, and volume mixes.

Although the process of editing drum kits is extremely easy, Peavey could have gone the extra mile by making the keyboard "live" while editing. In other words, when it comes to designating a high and a low pitch or selecting a note number, you simply could tap the appropriate key and the note would appear in the display. As it stands, you must enter all commands via the data slider or the increment/decrement buttons. Given the open-architecture of the DPM-2, it is possible that this, and many other enhancements, could appear in future software updates.

GETTING AROUND

Peavey earns several bonus points in the user-interface department. Like the DPM-3^{SE}, getting around on the DPM-2 is a breeze, thanks to a logically laid-out menu- and page-oriented system. When not in Play mode, there are four basic menus to choose from: Edit, MIDI, Global, and Copy. Each has its own, dedicated front-panel selection button. To further simplify matters, you'll find Copy, Compare, and Exit buttons close by.

Once inside a menu, choices appear on the display and can be selected via a corresponding front-panel "soft" button. In most cases, there are more choices in a menu than can be displayed on a single screen, so the Inc/Dec buttons allow you to flip

Product Summary

PRODUCT:
Peavey DPM-2 Synthesizer
PRICE:
$1,299
MANUFACTURER:
Peavey Electronics
711 A St.
Meridian, MS 39302
tel. (601) 483-5365

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

through the extra pages of that menu. If you get lost or want to leave a menu, the Exit button will take you back to Play mode. Compared to many other synthesizers, this is an easy system to master.

EDITING

Finding your way around the Edit menu is a relatively painless process. One touch of the Edit button opens the door to nineteen pages of editing parameters, each accessible via the Inc/Dec or numeric-entry buttons. When programming new sounds, you can initialize the factory presets and start from scratch, or edit a preexisting program. When starting from ground zero, you first choose a sample as the sound source. From there, the sample can be tuned and then modulated by an envelope, an LFO, and the keyboard. The Compare button comes in handy when you tweak parameters, letting you A/B audition the modified patch with the original.

When programming amplitude envelopes, the DPM-2 provides 4-point control, with individual Level and Rate pages for each. Pitch and filter envelopes, on the other hand, adhere to a 5-point level and 4-point time format. For LFO programming, there are five waveforms to choose from—triangle, sawtooth, ramp, square, and random—with further control over frequency, amount, delay, wheel-controlled LFO rate, and wheel depth (amount of modulation).

If you want to program a split, layer, or velocity-switch, link your Single patch to as many as three others to create a Combi.

Power programmers may be disappointed to learn that the DPM-2 has only one oscillator per voice, creating some pretty lean timbres at times. But don't write the synth off as a wimp: The onboard effects processor, while not a substitute for a second oscillator, can turn a weak sound into a hairy monster.

EFFECTS

Speaking of effects, the DPM-2's signal processor provides seven Single effects patches (reverb, delay, chorus, EQ, gate, distortion, and exciter) and 32 Combination patches, including reverb/chorus, distortion/exciter, and delay/EQ. The Combination patches can be routed in series, parallel, or

dual. Each DPM-2 program can have its own effects patch, but in Multi mode, only one effects patch can be used.

The smooth reverbs (plate, room, and hall) and delays are particularly outstanding. Delay times can be programmed independently for the right and left outputs.

MIDI

Although not a MIDI powerhouse, the DPM-2 does have a few goodies up its digital sleeves. Most notably, there are four Multi patches (*à la* DPM-3^{se}) that allow each voice to respond to its own MIDI channel. Of course, the barrier of sixteen simultaneous voices still applies, but Peavey has equipped the unit with an overflow function that allows multiple DPMs to be cascaded together for additional polyphony. Setting up a Multi patch is as easy as entering the MIDI menu: You simply select the Multi number (1 to 4), designate which voice is assigned to which MIDI channel, and set its volume.

The bad news here is that in Multi mode you cannot preview individual programs as you scroll through them. As a result, in order to audition sounds, you have to repeatedly switch between Multi mode and Play mode. Another disappointment is that the DPM-2 transmits on just one MIDI channel at a time, making it a poor candidate for use as a master controller.

Other MIDI functions include a MIDI filtering mode (allowing SysEx, Volume, Program Change, Sustain Pedal, Pitch Bend, and Mod Wheel messages to be filtered on input or output) and a program change map that allows DPM-2 programs to respond to specific incoming program-change numbers. Surprisingly, there is no MIDI implementation chart in the DPM-2's owner's manual. While this may be of little interest to first-time synthesists, others are sure to miss it.

MISSING IN ACTION

What doesn't the DPM-2 have? Two big no-shows are a disk drive and an internal sequencer, common features on most integrated machines. However, adding a disk drive to the DPM-2 would have upped the retail price several notches. As the folks at Peavey no doubt would relate, if you want a built-in disk drive, buy a DPM-3^{se}. As for the sequencer though, stay tuned: At press time, the company planned to show a 16-track DPM-2 sequencing upgrade package at the 1991 Audio Engineering Society Convention in October. According to a Peavey spokesperson, the new sequencing software ROMs will plug into two empty sockets on the synth's main circuit board.

While the disk drive and sequencer are understandable omissions, the DPM-2's lack of aftertouch is not. Any synthesizer retailing for over a thousand dollars should have this feature. After all, aftertouch is no longer a luxury for most keyboardists, but a necessity. The inability to add new waveforms also is unfortunate.

WRAP IT UP

Is the DPM-2 for you? Well, at $1,299,

it certainly is a good value. The 4 MB of internal 16-bit samples sound impressive overall. As for user-friendliness, the DPM-2 is a piece-of-cake to operate.

If you like the sounds and features of the DPM-2 but already have a keyboard controller, you should consider Peavey's DPM-V2 rack-mount synth. At $799, it contains all the DPM-2 features except the keyboard.

The omissions I mentioned earlier may encourage potential buyers to thoroughly check out the slightly higher-priced competition (such as Ensoniq's SQ-2, Kawai's K4, Roland's D-20, or Yamaha's SY55) before settling on the DPM-2. But the DPM-2 is a well-rounded, easy-to-use synthesizer that price-conscious shoppers shouldn't overlook. If there are software upgrades on the horizon—at present, we only have promises—there's no telling what this machine will be capable of doing next year.

Greg Rule *is a San Francisco-based freelance writer who frequently finds himself in a state of MIDI hell by day and acoustic nirvana by night. One of his most challenging moments while writing this review was getting the DPM-2 out of the blasted shipping container.*

Cheetah MD16 Drum Machine

By Michael McFall

Innovative software features set this one apart from the pack.

"Here we go again," I mumbled as I read the spec sheet, "another drum machine featuring 'high-quality' 16-bit samples." Indeed, Cheetah's new MD16 drum machine sports 41 16-bit samples in its internal memory, all sampled at 44.1 kHz and of uniformly excellent sound quality. But the MD16 is not just another drum machine.

For the most part, the samples comprise traditional drum and percussion sounds, including five kick drums, six snares, five toms, four hi-hats, three cymbals, and seventeen hand percussion sounds (bells, bongos, timbales, whistles, handclaps, and the like, along with one of my favorites, the singular and aptly named "acid flik"). Rounding out the sample complement is a very funky bass guitar.

At first, I didn't think the machine had a lot of sounds, but I soon discovered that fourteen variations can be programmed for each of the MD16's 64 Pad setups (Cheetah refers to these setups as "Pads," although there actually are just sixteen physical "pads"), giving it plenty of onboard sounds. If you want to play with different samples, up to 200 more can be added via optional ROM cartridges. And here's the thing I like: Any sound can be played from within any pattern at any time.

My estimation shot up several notches. "Nice sounds, but I'll bet you can't

do much with them," I said, pulling on my reviewer's cloak of skepticism. However, as I began to uncover some of the MD16's extensive and innovative editing and sound-manipulation tools, my initial reservations gave way to reluctant admiration and curiosity. So I got down to the serious business of checking out the high-performance engine hiding under the MD16's family-sedan hood.

The MD16's front panel consists of a 2-line LCD display (which is not backlit), multi-function buttons from which you can access the eleven menus that control 142 parameters(!), up/down buttons for altering parameters, and sequencer-type play, record, and start/stop buttons. Using the sixteen velocity-sensitive pads—the real pads—you can select among 32 levels of velocity, and all 127 velocity levels can be accessed via MIDI, albeit in 32 steps. Samples are assignable on four levels, so you can have 64 independent Pad setups for dispensing your percussive wizardry.

Pads on levels 1, 2, and 3 (Pad numbers 1 to 48) are single-sound setups, while Pads on level 4 (Pad numbers 49 to 64) are multi-sound setups. Three different sounds can be assigned to each multi-sound Pad setup, and all sound/Pad parameters, including velocity-crossfading between sounds, are independently programmable for each of the three sounds. An additional 64 Pads can reside in memory, providing a total of 128 instantly available Pad setups.

The MD16's circular, rubberized pads respond and feel as good as—and perhaps better than—those on most other drum machines. All 64 Pad setups also can be accessed from a MIDI keyboard controller, if you have one. When used with a MIDI percussion controller, such as the drumKAT or Octapad, Pads 1 to 40 can be rotated in blocks of eight, allowing access to five "kits" of sounds with the press of a footswitch. Incidentally, the MD16's footswitch also can be programmed to perform start/stop, Pattern Trigger, and Swap All Pads, or to start the next chained song.

On the back panel, you'll find five stereo, 1/4-inch audio output jacks; a ROM Port for accessing cartridge-based samples; MIDI In/Out/Thru ports; Tape In/Out jacks; and a Start/Stop footswitch jack.

SOUND MANIPULATION

The MD16 is 8-note polyphonic, and sounds can be routed through eight separately assignable voice outputs (four stereo, 1/4-inch jacks) and a stereo mix output. (Note that you need five stereo Y-adapters to make full use of the MD16's stereo output jacks.) Each voice output can be turned on or off in the stereo mix.

All individual voice outputs are monophonic, which means they can play only one sound at a time; playing a second sound through the same voice output cuts off the first sound. This is useful for hi-hats, where the closed hi-hat normally cuts off the open hi-hat, but to avoid cutting off a sound that is struck rapidly in succession (the "machine-gun" effect), you must assign the sound to use more than one voice output. The default setting allows all sounds except hi-hats to use up to eight outputs. Of course, you can assign more than one sound to the same voice output as long as the two sounds are not played simultaneously.

It's relatively easy to program useful variations of the MD16's onboard sounds and come up with sounds that bear little, if any, resemblance to the original sample. You can specify the tuning of each sound (+1 octave to -6 octaves in Microtune mode, and ±1 octave, in semitone increments, in Chromatic Tune mode) and can play sounds in reverse, or play them first in one direction, followed by the same sound played in reverse.

Selecting Auto Pitch causes a sound's pitch to increase or decrease automatically while the sound is playing, at one of eight user-selectable rates of change. This is a powerful editing tool that can be used to program realistic and exaggerated drum decays as well as intriguing sound effects, such as fade-in and -out effects. Sound length is programmable in sixteen steps, and one of eight preset volume envelopes can be assigned to each Pad.

Sounds can be placed at fifteen pan positions from left to right across the stereo field. One interesting panning option routes the sounds such that as a sound assigned to multiple outputs is retriggered, the MD16 reroutes the sound successively through each assigned output. For instance, if you assign a sound to outputs 1, 2, 4, and 6, the first time you trigger the sound it goes to output 1, the next time to output 2, then output 4, output 6, and back to output 1. If the outputs are assigned to different pan positions, this creates a sound that appears to move at random around the stereo field with each successive hit. It's an impressive feature that effortlessly endows sounds with the illusion of depth.

Auto Pan is a similar feature, allowing a sound to pan dynamically from left to right each time it is triggered. For example, a tom with a long decay might begin with its attack appearing at the left side of the stereo field and "move" to the right as it sustains. The rate of movement is programmable in eight steps.

Roll Pan permits the sound to move to a new pan position when the same sound is repeated while it is already playing. Thus a tom roll can automatically "move" across the stereo image with each successive hit. The pan-position step rate also is programmable. Opposite Pan allows a sound programmed into a pattern to have its pan position automatically moved to the opposite side of the stereo field for every user-specified occurrence of the sound (every other hit, every fourth hit, etc.).

The sense of space and movement can be further enhanced by combining pan effects with the MD16's onboard echo. Two echo banks allow each Pad to have echo or flam effects. Repeat rate, decay rate, and number of repeats are programmable, and the rate can be synchronized to MIDI clocks so you can set the echo to repeat

PETER DIGGS

Cheetah's MD16 drum machine offers 41 16-bit samples, four assignable stereo outputs, and extensive sound-manipulation capabilities.

in time with the music.

A Chromatic Pad function allows any sound to be tuned and spread out across all sixteen Pads on its Pad level, without losing the regular Pad setups. This is useful for developing tuned-percussion parts and entering bass lines. Unfortunately, bass lines generally cover more than the 16-note range possible using the MD16's sixteen Pads. (I was told that sounds can be spread out over all 64 Pads, but I was unable to do this.)

Sounds can be "humanized" by linking a sound's start point and/or pitch to the volume at which it is played. You could, for example, soften the sound's attack or shorten its decay at lower volumes, detune the pitch at higher volumes, or play volume-dependent tunings over a 2-octave range. You even can randomize the change in volume level and link the new volume to start point and/or pitch, or you can randomize all of the parameters—start point, pitch, and volume—independently. Of course, using these parameters also "humanizes" a pattern so that it plays differently each time.

LAYING IT DOWN

The MD16 has 254 user-programmable patterns, including 54 factory patterns, many of which are interesting and usable. Patterns can be copied, deleted, appended, or merged; for example, drum fills can be mixed into another pattern at whatever timing position you desire. Using Pad Fill, the MD16 automatically repeats a Pad at the selected quantization rate.

Level 3 Pads can be used to trigger up to sixteen patterns, and you can velocity-shift between playing the Pad normally and triggering the assigned pattern. Triggered patterns can be set to play continuously or for a predetermined number of repeats.

The MD16 allows real-time pattern-recording: In Tape mode, the unit records like a tape recorder. In Cycle mode, selecting Mix combines new events with those already in a pattern, while selecting Overwrite brings up a special mode in which the MD16 mixes new entries with those already in a pattern until the pattern has played through twice without a new Pad entry. The next Pad entry clears the entire pattern and then restarts the recording from scratch, or you can simply

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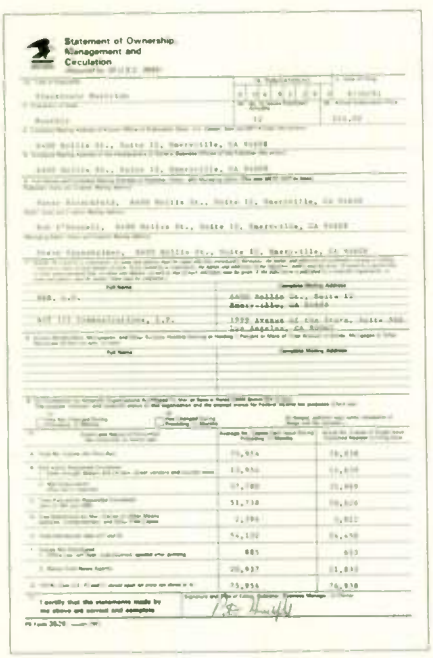
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stop the pattern to exit and save. This can be a real time-saver (no pun intended).

Step-time recording also is possible, with the added advantage that the pattern continues playing, and your edits can be heard immediately. All sound parameters can be edited separately for one event, or for groups of events, so the playback of sounds recorded in a pattern can be completely different from their Pad settings. Events can be moved in time, copied, inserted, and deleted, and groups of events can be rotated and quantized, or you can select Opposite Pan for every nth event (where n is between 1 and 16).

Tempo is variable from 20 to 240 bpm, with 96 ppqn (96 MIDI clocks per bar) internal resolution for patterns. Playback timing for all, or selected, events can be shifted by a specified amount, or the timing can be randomized so events play first behind the beat, then ahead of the beat by a specified increment (from sixteenth notes to 384th notes). The time taken to cycle the timing shifts also can be set from one to 64 beats.

Tempo Swing is a timing-shift parameter that allows you to set the ratio of "swing" from 1:1 to 1:6 or 6:1. Solo Sample allows you to "solo" a sound—hear a selected sound individually—during recording or playback.

Songs can be programmed by building a list of patterns (up to 127 steps) and the number of times each pattern repeats. Changing tempos during a song is handled by programming a tempo track, which consists of a start tempo followed by any number of new tempo steps. Each step is made up of a new tempo value, a timing position where the new tempo takes effect, and a rate-of-change value that specifies an immediate tempo change, or one that occurs gradually over several bars.

Up to twenty songs can be chained together for performance, and you can program an automatic delay and/or count-in between songs. In addition, a timing cue point can be programmed so that pressing the Play button plays the patterns or songs from any point.

The MD16 can run from its internal clock, sync to an external MIDI device such as a sequencer, or sync to the tape-sync signal from a tape recorder. It also can merge incoming MIDI commands with those it generates. The unit sends and receives most MIDI commands, including Song Position Pointers, Patch/Song Select, Start/Stop/Continue, and MIDI Note-on/off. It also responds to MIDI Volume messages, a feature not found on most other drum machines.

Patterns, songs, Pad setups, and other internal settings can be saved directly to tape, or to an external computer or sequencer via MIDI SysEx dump.

TO BUY OR NOT TO BUY

The first criteria for assessing any drum machine is sound, and the MD16's sounds are excellent. Whatever style you're into, whether it's rap, hip-hop, funk, house, rock, pop, country, or Latin, you'll find something to accommodate your taste. The unit also provides special effects; I came up with lots of the off-the-wall sound variations that fairly screamed "movie soundtrack." This illustrates what I like most about the MD16: It provides you with the tools to shape basic sounds to fit your unique ideas. If you're a composer, taming and tailoring sound is what it's all about.

Onboard reverb, or more sounds sampled with reverb, would have been nice. That, combined with the marvelous panning and sound-editing options, would make an absolutely killer sound machine. Remember, though, there are 200 more ROM-cartridge samples I haven't played with yet. All my dreams could be true already. Besides, you always can add reverb using the independent outputs and your favorite outboard effects processor.

Product Summary

PRODUCT:
Cheetah MD16 Drum Machine
PRICE:
$589
DISTRIBUTOR:
Jessico
11230 Grandview Ave.
PO Box 2034
Wheaton, MD 20902
tel. (301) 949-9314

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

● CHEETAH MD16

At first glance, I was skeptical that a machine with such an unprepossessing exterior (it is clunky-looking) could have so much to offer. As it turns out, looks can be deceiving. Having so many sounds onboard, each one customizable by the user, combined with an extensive set of software features, some of which aren't found on any other drum machine—at any price—makes this a strong contender in the drum-machine sweepstakes.

Michael McFall *is former editor of* Rhythm *magazine and present owner of VDO Productions, specializing in instructional videos for music. His latest releases feature drummers Doane Perry and Joe Porcaro.*

Akai EWI 3000/3000m Wind Controller

By Tim Tully with Paul McCandless

Akai's improved wind controller lets horn players blow the MIDI bop.

After a three-year hiatus, Akai has fired its second shot at bringing electronic music to wind players. The Electronic Wind Instrument, a.k.a. the EWI, is back.

The new EWI consists of two pieces: the thing you blow into and finger (the 3000) and a specially designed analog synthesizer module (the 3000m). The module contains MIDI In and Out ports and connects to the controller via a custom cable. The 3000 is an attractive and sturdy-feeling, elongated box of metal and plastic. A set of nonmoving, chrome-plated rings and bars are arranged like woodwind keys along one side. Opposite those, a set of chrome rollers under the left thumb give the EWI a 7-octave range, and two bend plates above and below the right thumb-rest provide pitch bend. At one end is a slotted, rubbery mouthpiece that resembles an extra-large and chewy Chiclet with an opening along the top edge. Hook the 3000 to the 3000m with the supplied cable, blow into the Chiclet, and move your fingers on and off the rings and bars to

produce pitched, synthesized sounds in an electronic simulacrum of playing an acoustic wind instrument.

CONTROLLER

The EWI 3000 has a few new features. Where the EWI 2000 did not allow air to flow through it, which forced you to let air escape between your lips and the mouthpiece, the new model has an air-escape tube. Unfortunately, the 3000 vents so little air we had to resort to the leaky-gasket routine anyhow. And we found no reference in the manual for adjusting the air flow. While double-reed players normally need to exhale regularly—and may feel comfortable with this situation on the EWI—sax/clarinet players may find it distracting.

Akai significantly improved the mouthpiece. The opening sits horizontally in your mouth, feeling much more familiar than the 2000's nipple-like device. It also feels more substantial than the soft original and responds well to a good bite, which is what the manual recommends for producing vibrato.

Because the keys respond electrically to touch and do not move, you must keep your fingers completely off keys you don't want down or you get wrong notes. This was fairly bothersome on the 2000, where the slightest brush of a key would trigger it. A small pot on the 3000 allows you to adjust the amount of touch the keys need to trigger a note. After setting it up, we had much less trouble with false notes. Players of open-hole instruments normally keep their fingers well off open holes and will feel more at home with the EWI than sax players, who usually rest their fingers lightly on open keys. To ameliorate the situation, Akai offers a snap-on finger-rest, the EWI-FR ($29.95), that provides three spring-loaded keys for each hand.

Touching the rail along the right side of the octave rollers with your left thumb activates the instrument's portamento ("glide"), a fairly easy technique to learn. To bend the pitch of any note, roll your right thumb up or down onto the instrument's bend plates. The amount of bend this creates is programmable from a quarter-tone up to a minor third in either direction.

While the bend plates are straightforward, the implementation of vibrato

is idiosyncratic, to say the least. Biting the EWI 2000 mouthpiece produced an LFO-driven vibrato. You could only control its depth and speed by setting these parameters in the synth program. After some experimentation, we determined the new setup is different. However, it's still not analogous to acoustic instruments, where biting bends the pitch up and relaxing bends it down. Biting the EWI 3000 mouthpiece produces a full half-cycle of vibrato; that is, the pitch bends up, then automatically returns back into tune. Releasing the bite produces the other half-cycle: It drives the pitch flat, then immediately back to normal. By editing the synth module, you can set the depth of the bend, but not the rate of change. If you want to control vibrato speed and depth in real time as you play, you must use the bend plates.

DAN ESCOBAR

The keys on Akai's EWI 3000 wind controller don't move, responding to touch. The 3000m analog synth module (below) is monophonic.

In general, it's easy to get used to the controller. It's responsive enough to make double-tonguing and R&B-style flutter-tonguing easy. Slurring from one octave to another has been difficult on most wind controllers. Their response is typically so fast they generate false notes if all your fingers don't move at exactly the same time. The new EWI is fairly forgiving of human timing, however. With a bit of practice, we managed to get smooth slurs across octaves.

THE 3000M SYNTHESIZER MODULE

The synthesizer consists of two independent, analog, 2-oscillator "sources," mixed with a single line amplifier (for a total of four oscillators). Each oscillator can generate sawtooth, triangle, and pulse waves. In each source, Oscillator A can be both synched to, and modulated by, the frequency of Oscillator B. When combined, the oscillators share an LFO, digitally controlled analog filter (DCF), and digitally controlled analog amplifier (DCA). The filter has a resonance control and A/B balance, and its envelope depth can be modulated by Velocity. Both the amplifier and filter can be programmed to respond to either an ADSR envelope generator, or to breath pressure. You even can set up one source to be controlled by the ADSR envelope and the other by breath, allowing you to program some complex expressiveness. For example, you can have the EG trigger a fast-decaying, percussive sound from Source 1 that gets louder with velocity and set Source 2 to respond only to breath, to simulate certain acoustic wind-instrument responses.

In general, you can elicit a good range of breath-driven expressiveness from the sounds that come with the EWI 3000m. The module sounds very much the classic, "brappy" analog synth, complete with lowpass filters and hard sync between oscillators. Because breath intensity can control DCF and DCA levels, pulse width, filter resonance, and oscillator balance, you have breath control over more sound parameters than most synths allow. Even better, the range of the breath control over each parameter feels and sounds quite wide, so you can play from *ppp* to *fff*, from dull to bright, and so on.

While there's good control, the variation from one sound to the next didn't impress us. Nevertheless, in light of all the different synth technologies we've grown used to since the heyday of analog synthesis—FM, additive, L/A, and so on—this is probably spoiled-brat hindsight.

The EWI synth is monophonic, but you can play chords with it if you connect it to another MIDI instrument. You can set up sixteen two- to four-note chord patterns in the 3000m, then assign any pattern to any note in the chromatic scale. Each note in a pat-

tern can be set from -12 to +12 half-steps. When you play a pitch to which the pattern is assigned, the EWI plays the note you finger and your second MIDI instrument plays the notes in the pattern, offset as programmed from the note you play. This way, you can set the EWI so that, for instance, every G# you play produces a third-inversion G#m9 chord. The application that immediately comes to mind is to set the instrument up to play the chords of a diatonic scale, allowing a wind player to comp like a pianist. The voicings remain fixed until you reprogram them—and they sometimes get a little monotonous—but you get more than simple parallel harmonies, and certainly more polyphony than a sax.

The synth also gives you two modes designed particularly for wind instruments. In Single mode, a sound's envelope won't trigger when you play legato, only when you tongue. This gives you a good range of expression. Multi mode simply lacks this differentiation: The envelopes trigger each time you finger a new note, letting you play a fast line without having to tongue each note and still get clean triggering.

The Transpose function lets you transpose the entire instrument, not just an individual patch, in a way familiar to horn players. In the same way a trumpet is in B flat, an alto sax is in E flat, and so forth, if you put the EWI into any key, the LCD reads out the name of the key: C, C#, and so on.

Product Summary

PRODUCT:
EWI 3000 Electronic Wind Instrument and EWI 3000m sound module

PRICE:
$1,400

MANUFACTURER:
Akai/International Music Co.
1316 E. Lancaster
Fort Worth, TX 76102
tel. (800) 433-5627
or (817) 336-5114

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

● EWI 3000

Despite the small, 16-character LCD, the synth's architecture is straightforward. Nine real hardware buttons provide solid visual orientation for their associated editing pages. Anyone familiar with analog synthesis can get up to speed pretty quickly editing the 3000m.

MIDI AND THE OUTSIDE WORLD

If you run a MIDI cable from the EWI 3000m to another MIDI instrument, you can, of course, play that instrument with the EWI controller. While other MIDI wind controllers have this power, the 3000 has an edge. Playing a MIDI instrument that hasn't been designed specifically for wind control requires tedious setup at best and can be profoundly frustrating at worst.

The 3000m module sounds very much the classic, "brappy" analog synth, complete with hard sync between oscillators.

If, however, you at least defeat the envelope generators of an instrument and have it blast out its sounds full-bore at the presence of a MIDI Note-on message, the EWI can help. Route the audio out of the second instrument into the EWI's mono external input, and the second instrument's sound will be modulated by the EWI's DCA and DCF and hence, your breath. This gives you the same kind of dynamic breath control over an external signal as you have over the EWI's DCO A. Because of the relation to dynamic control, this function is typically more appropriate for a sampler than a synth. For one thing, samplers' dynamic controls tend to be less complex; for another, simply loading and mapping a patch's worth of samples, then blowing them with the EWI would *save* you programming time rather than add it to your schedule.

While the above scenario is great for live performance and recording to tape, it's no help when sequencing. In fact, MIDI recording in general is not the EWI's strength. The 3000m features a MIDI In port that lets you play it from a sequencer or other MIDI device. But if you want to play a second instrument with a sequence performed on the EWI, the EWI's external input is no help: You must program the second axe to respond to the breath-derived controller data you record with the EWI. This requires, at least, a learning curve and investment of time.

In addition, to play back a sequence on the 3000m, you must disconnect the cable connecting the 3000 and 3000m. Sequencing usually means repeatedly recording and playing back, so this can be a serious hindrance. We also experienced an unusual number of stuck notes when we played the EWI back from the sequencer, which forced us to turn the instrument off and on again in order to get back to work.

It's easy to blame this on MIDI as well as on the EWI. MIDI was designed to start and stop notes with Note-on and Note-off messages, not by Breath or other Continuous Controllers. To get the expressiveness a player wants from a MIDI wind instrument, however, necessitates using Breath, Aftertouch, or some other controller to trigger notes continuously from zero to maximum volume. If you don't get the Breath Control back to zero at the end of each note, or if you stop sequencer playback before it sends a controller value of zero, stuck notes can occur. While this is understandable, it doesn't help when you're recording. It also happened more often with the 3000 than with other wind controllers we have used, including the original EWI.

MANUAL

There is no nice way to say this. The two manuals—one for the 3000 and one for the 3000m—are abominable. They constitute as uninformative an example of Japanese "translated" into English as I recall, and I still recall the Casio CZ-101.

In most cases, selling equipment accompanied by a manual that confuses and inconveniences customers is understandable in the face of a great market demand; people will buy VCRs anyhow. Where a product is new and a demand needs to be established, one can only wonder why Akai fails to take this small step to draw English-speaking horn players to the EWI.

If you get a hold of a new EWI,

before you develop an embolism over the enclosed manuals, learn the analog synthesis and MIDI from other sources. Especially if you're unfamiliar with electronic music, it could easily mean the difference between frustration and a rewarding expansion of your musical toolkit.

CONCLUSION

The extent to which the EWI gives you a wind-player's interface to electronic music depends on what you know, what you own, what you can dope out on your own, and what you want.

The worst news is undoubtedly on the last front. If you want something that feels exactly like a sax, clarinet, oboe, or whatever your main axe is, forget it. The EWI is its own instrument, with its own learning curve, as well it should be. However, to whatever extent you know woodwind fingerings and how to produce tones with your breath, that curve will flatten out—up to a point. Beyond that, you're still learning a new instrument. I felt it significantly easier, for example, to get comfortable on the EWI than I did when first learning soprano sax with experience only on alto.

The more important issue is the other end of the spectrum. How far can you take the instrument? Listen to Michael Brecker play the original EWI and you'll discover that in the right hands, it fires off simply awe-inspiring solos. But if you want to either experience an electronic version of a saxophone's immediate, speech-like expressiveness, or make your axe snarl, sneer, laugh, and cry—if you want to *preach*—you should probably stick to the brass and leave the silicon alone.

On the other hand, if you want to expand your tonal palette and learn some new techniques and concepts, or if the electronic side of things intrigues you enough to shell out $1,400 for a piece of that action, the EWI could be your ticket.

Tim Tully *is a MIDI consultant and multimedia composer in the San Francisco Bay Area. He once again knows the joy and pain of playing tenor in a little-known R&B band.* **Paul McCandless** *has played oboe for Oregon for 21 years and also plays English horn, bass clarinet, soprano sax, sopranino, Lyricon, and WX7. At present, he is recording a solo album with Windham Hill.*

Oberheim Drummer and Strummer

By David Crigger

Oberheim brings drum licks to the non-drummer and guitar riffs to the keyboardist.

On rare occasions, new products arrive that actually do something new. Most are variations of last year's model, sometimes better or less expensive, but rarely new. Not that I'm complaining; comparing today's products with those available five years ago leaves little to gripe about. Still, it is exciting to see someone introduce a true innovation.

Drummer and Strummer, the latest members of Oberheim's Perf/X (performance expansion) series of modules, provides new solutions to old problems. Drummer makes it unnecessary for musicians to learn to play drums in order to program drum parts, and Strummer makes great guitar samples actually sound like guitars, rather than plucky keyboard parts.

Strummer and Drummer are small, primarily plastic, tabletop units (half-rack modules would increase costs) that are identical to the rest of the Perf/X line. Like other Perf-X modules, Drummer features nine front panel buttons, a two-character LED display, and eight LED indicators. The rear panel includes MIDI In and Out jacks, four 1/4-inch footswitch jacks that accept normally open or normally closed momentary switches, and a power-connector jack. Neither unit produces sound; they either create, or modify, MIDI data. The front panel is pretty spartan, but so is the $200 list price.

DRUMMER OVERVIEW

When it comes to programming drum parts, the drum machine's (or sequencer's) flaw is they know nothing about playing drums. Factor in the typical musician sans drum chops, and the result often is a less-than-rewarding drum-programming experience.

Drummer approaches drum programming in a completely different

way, since the unit basically knows how to play the drums. The programmer simply gives Drummer the same kind of instructions songwriters and arrangers often give real drummers: time signature, style of music, whether to follow the bass pattern with the kick drum, whether to follow dynamics, and when to play fills. The programmer doesn't even need to create drum fills; Drummer knows what to play.

Since Drummer only *creates* MIDI information, the first thing needed for operation is a MIDI sound source containing drum sounds (any drum machine, sampler, synthesizer, or sample-playback module). Although programming a drum kit is easy, Oberheim makes it even easier by preprogramming thirteen of the sixteen available kits to match many of the popular sound sources. A kit consists of sixteen sounds: bass drum, snare drum, click (cross-stick), open and closed hi-hat, three toms, crash and ride cymbals, tambourine, cowbell, shaker, bongo (or conga), snare enhancement (claps, noise burst, etc.), and open snare (or timbale). You may want to use different sounds at different times, which is why it features sixteen kits. (The preprogrammed kits can be overwritten and then restored later.) You can select one kit for all presets, or allow each preset to use its own kit.

Drummer starts with 100 patterns in about ten basic styles (the actual number depends on your interpretation of "style"). Each pattern varies in length from eight to dozens of bars. However, these patterns don't continuously loop like a drum machine; Drummer selects and plays portions of the pattern at different times, depending on a number of programmable parameters.

The first such parameter is Time Signature. There are seven choices: 2/2, 3/4, 4/4, 6/8, 9/8, 12/8, and SG (representing 4/4 with swing 16ths). For each pattern, the Time Signature settings affect not only the meter but the style of the pattern (which often results in different notes or pattern parts being played).

The next parameter is Rhythm (or Feel). There are 100 different Rhythm settings, and each includes many instructions for varying basic patterns. Rhythm settings can change bass drum parts, adjust the relative volume of the backbeat, add sixteenth-note variations to hi-hat and cymbal parts, and add "jazziness" (occasional extra bass drum notes, snare drum "ghost" notes, and open hi-hat notes).

The Other Percussion setting randomly (depending on the style chosen) adds one of five instruments to whatever else is going on. The choices include closed hi-hat (which adds more activity to the existing hi-hat part), open hi-hat, ride cymbal, tambourine, and shaker.

If you take these parameters, plus some others I haven't touched on yet, and tweak them just the way you want, you have a Preset. There are 100 Presets, which can be strung into Songs.

WHERE YOU LEAD

Some of Drummer's most exciting features are interactive. At the basic level, four footswitch jacks allow users to start and stop, mute (for breaks in the music during which Drummer plays silently), add random percussion fills, and cue fill-ins. The four Follow modes are considerably more advanced, taking their cues from an incoming keyboard part (entering via a merging MIDI In on a separate MIDI channel from the outgoing drum parts) that is analyzed as it passes through Drummer.

In Auto-Start, Drummer waits to play until the first note is played on the keyboard. Accessing the Fill feature instructs Drummer to look for performance

Given basic arrangement information, Drummer creates continuously changing drum patterns that can follow and interact with a keyboard part.

Strummer turns keyboard chords into correctly voiced guitar chords, including multiple styles and variable parameters.

"holes" (rests or sustained chords) in which to get busy. As soon as you start playing more, Drummer cools it and plays more sparsely.

Velocity is simple: You play soft, Drummer plays soft; you play loud, Drummer plays loud. Actually it only seems simple. Drummer doesn't just change its velocities, it actually changes what it plays. Depending on the style, snares evolve into cross sticks, and parts become simpler or simply drop out altogether.

Last is Bass, in which any note played on the keyboard below middle C is doubled by the bass (kick) drum. This is a great idea, except Drummer generates its own bass-drum note on beat one of each bar, causing a bass-drum flam every time the same figure is played on the keyboard. Although admirably designed to track the downbeat, its implementation renders the Bass feature unusable for serious work. Any Follow feature can be enabled or disabled in each preset, while footswitch functions are always active.

A DIFFERENT DRUM

Drummer's first thirteen patterns are available for user rhythms, composed by either adding to or deleting from an existing pattern, or by starting from scratch. (Memory can be expanded with an off-the-shelf RAM chip, adding 87 more user pattern locations.)

When recording, you are not limited to the sixteen notes that make up a kit, though you are limited to patterns that are two bars in length. It's important to note that user-recorded parts are constant (as on a conventional drum machine) and not mixed up, like those found in Drummer's preprogrammed patterns.

Each of Drummer's sixteen Songs consists of sixteen Parts. Each Part is characterized by which Preset it contains, the number of bars it plays, and how often it plays a fill (every fourth, eighth, sixteenth, 24th, or 32nd bar; at the end of the part; or not at all). Therefore, during the course of a song, Drummer can become quite interactive in some sections by changing kits and tempos (tempo settings are stored as part of each preset). But unlike most drum machines, Drummer uses the last bar of each section of the song to gradually change from one tempo to another. I wish there were a way to "vamp" a part indefinitely, then use one of the footswitches to cue Drummer to proceed to the next part of the song.

HARD TO BEAT

Drummer's MIDI functions are a mixed bag. The unit sends its rhythm data on one MIDI channel, receives program changes on another, and accepts incoming Velocity data and other MIDI events for Follow features on a third channel. Drummer won't respond to MIDI Song Position Pointer or Song Select messages, but it understands Program Changes and can dump memory data via SysEx. It also can receive or transmit MIDI Clocks.

Overall, I think Drummer is a great alternative to programming drum parts. It knows enough about popular drum styles to do an admirable job in virtually any commercial setting. Drummer would be much easier to use if the manual were more musically specific about how the various rhythms interact with the patterns. As it is, you're on your own, matching patterns and rhythms by trial and error.

If you don't play drums, and you aren't comfortable programming drum parts or don't like spending the time to do it, this Drummer is hard to beat.

STRUMMER OVERVIEW

Ever since the pitch bend wheel appeared, keyboardists have imitated guitar solos, first with analog synth

sounds and later with guitar samples. But what about rhythm parts? Only through great amounts of study and significant technique can a chordal keyboard performance resemble one that originated on guitar. And without a realistic guitar technique, even the best guitar sounds (sample or patch) sound pretty dumb when chorded on a keyboard.

Strummer takes chords played on a keyboard and remaps them to sound as if they were played on guitar. (The concept is reminiscent of James Chandler's *KeyFrets* program, which was published as a Commodore 64 DIY project in the August 1988 **EM**.) Inserted between a Master keyboard's MIDI Out and a sound source's MIDI In, Strummer's 33 parameters interpret your playing. The sum of these settings is saved as a preset, of which 64 are stored in ROM (32 user-definable presets can be saved in battery-backed RAM). The unit's functions are controlled using its nine front panel buttons and four optional footswitches.

PRESETS AND PARAMETERS

To illustrate Strummer's basic func-

Product Summary

PRODUCT:
Drummer interactive drum-pattern sequencer; Strummer keyboard-to-guitar chord converter

PRICE:
Drummer $199
Strummer $199

MANUFACTURER:
Oberheim
13345 Saticoy St.
N. Hollywood, CA 91605
tel. (800) 765-4629
or (818) 503-0631

DRUMMER

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

STRUMMER

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

tion, let's look at factory preset 1, Folk Guitar. Play a simple three-note triad, and you'll hear a 6-string guitar strum, voiced as a folk guitarist might perform it, using the first five frets of the guitar and arpeggiated perfectly. With this preset, any chord played anywhere on the keyboard is played as an open chord, transposed, and revoiced to fit on the first five frets. Single notes are passed through unaffected, while chords of two notes or more are revoiced and "strummed." There is a certain amount of delay involved as Strummer decides whether you're playing a single note or a chord, but this can be minimized by tailoring the Chord Detect parameter to match your playing style.

Preset 2, Rock Guitar, creates barre chords, where the bottom note played on the keyboard is placed on the guitar's low E string. The remaining notes are transposed only if that's required to make them reachable from the basic fretboard position.

Preset 8 (One-Note Barre Chords) makes use of the Chord Capture and Chord Velocity functions. With Chord Capture, each time a chord is played on the keyboard it is "captured" (after being processed by Strummer's other parameters). Thereafter, playing single notes produces the captured chord, with the single note as the root, until another chord is played and captured. The Chord Velocity parameter affects the number of notes Strummer includes in each chord (one to six). Play hard, and it strums all the strings; play softer, and you'll only catch a few.

There are many other adjustable parameters at work in these presets. Strum Rate can be fixed at any rate in a wide, 99-step range, and Strum Velocity determines whether velocity affects Strum Rate. Strum Direction determines up- or downstrokes (when off, all strums are downstrokes). Strum Mute creates an effect similar to palm-muting guitar strings. Both Strum Direction and Strum Mute can be controlled by a Keyboard Split parameter, or by whether a chord is played above or below an adjustable velocity threshold. Chords can be limited to fewer than six strings using the Chord Low Strings and High Strings parameters, while Chord Sustain automatically sustains each chord until a new chord is played.

Strummer has numerous transposi-