

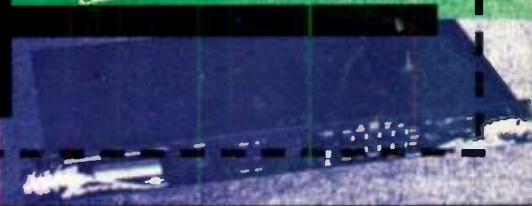
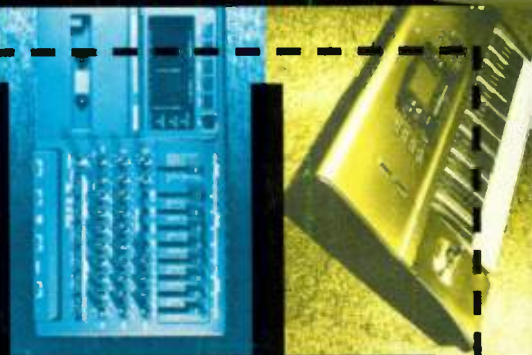
Electronic Musician

U. S. \$3.50/Canada \$4.50

January 1992

BUY THE RIGHT GEAR

**Working through the
Equipment Maze**



Untapped Resources

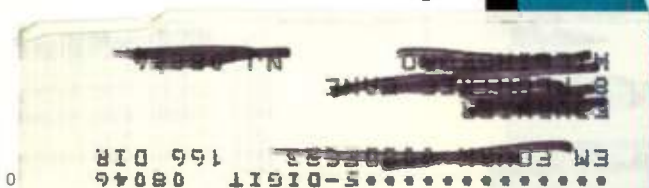
*Getting Grants and
Funding for Music*

Shifting Gear

*Pitch-Shifting
Applications*

In the Groove

The Art of DJ Mixing



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**

excels in applications where other small mixers can't measure up:

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Broadcast remotes

8-track monitor mixer
AUX inputs for a bigger console
Headphone or cue mix
Compact keyboard mixer
Small church or school systems
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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).

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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.

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

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

N°3
IN A
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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.

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World Radio History

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 K111 Digital Synthesizers.

Frankly, we aren't surprised. There are good reasons why the K4 and K111 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: K111: 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 K111R.

But great specs are only part of the answer. The bottom line on the continued success of the K4 and K111 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 K111 to your set up. Better yet, a K4 *and* a K111.

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.

Electronic Musician

AN ACT III PUBLICATION
JANUARY 1992 VOL. 8, NO. 1

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Cover: Photos by Ron Miller. Special thanks to Korg, Ensoniq, Tascam, Fostex, ART, and Zoom.



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Buying Equipment

There's more to making new purchases than initially meets the eye.

Though few people think about it, the process of buying electronic music gear has an important impact on your music-making. Besides the obvious—determining what gear you will own and use—the process inevitably offers a valuable educational experience.

Before you buy, you need to determine what you need, what you want, and what's available. As you research the market, you'll encounter the philosophical differences in approach between everything-but-the-kitchen-sink-type products and those with a more specific purpose. You'll learn how various products work and how different pieces of gear perform different types of tasks. And you'll discover more about the gear you already own—both its overlooked benefits and hidden shortcomings. Thorough SysEx implementations, Standard MIDI File support, and other "extras" become a lot more important as your system starts to grow.

You'll probably also need to learn more about how pieces of your system fit together and what additional accessories you'll need to make them work better (or at all!). Reality and Murphy's Law dictate that interfacing issues, compatibility problems, and other related dilemmas grow exponentially with linear increases in the size of your rig. After making a purchase, you may find yourself learning the hard way about some previously overlooked aspects of the electronic music-making process. Of course, none of this is particularly bad. The more you learn about these types of issues, the better you'll understand your existing gear ("Oh, so *that's* what that function is for..."). Besides, if you're like most electronic musicians, you'll enjoy doing a bit of research and learning more about how all this stuff works.

As exciting as the prospect of buying new gear may be, however, a question remains: How do you best approach it? How do you ensure that you're buying the right gear, from the right place, at the right price? There are no easy answers, of course, but this month's cover story ("Working Through the Maze" on p. 38) offers a few guidelines on how to make the most of the sometimes-confusing buying process. It addresses components systems vs. all-in-one products, new vs. used gear, storefront vs. mail order, and more.

Of the many issues that arise during a purchase, most musicians worry about price. But buying the wrong gear from the wrong place will cause more long-term frustration than any but the grossest price discrepancies. Where you buy your gear greatly affects the success of your purchase. Keep in mind that you will undoubtedly need some type of additional information or support after the purchase has been made. A store or mail-order operation with a well-informed sales force helps ensure you get the right gear for your needs and the most value from that equipment.

This leads to the delicate question of the value of service. Volumes have been written on the subject, but it all boils down to this: If you go to a music store, you should expect to work with someone knowledgeable who will help you make the wisest purchase. If the store provides that level of service, they deserve to charge more for their expertise. If they don't provide it, look elsewhere or buy mail order.

Given the proper preparation, equipment shopping can and should be an enjoyable experience. Don't let anyone make it otherwise.



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Bob O'Donnell



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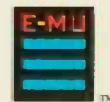


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DOWN BY LAW

I wanted to get into the music business, but I couldn't pass the bar.

Michael Molenda's article about music lawyers was well written, informative, and very sad ("Legal Beagles: How Lawyers Hunt Record Deals," November 1991). It points out one of the big problems in American industry: Having a lawyer decide who gets shopped and who doesn't is like going to the doctor and having a lawyer tell the surgeon where to operate.

Law school has nothing to do with what is entertaining or artistic. Have you ever read a contract? It's boring and repetitious (like a lot of the music coming out of major labels lately). The expression "entertainment lawyer" has to be a major oxymoron.

Why is America getting beat in industry on so many fronts? Because our companies used to be run by people with love and creativity for the business they were in. Now they are run by lawyers.

Dan Radlauer
Los Angeles, CA

Dan—Unfortunately, the rebels with the passion and guts to bust the "moon/june/swoon" tyranny of Tin Pan Alley were doomed as soon as the cash registers started to ring. When pop music became big business, the soldiers of industry became lords of the castle. However, some label executives and lawyers are sincere music lovers who happily promote acts they believe in. Today's musicians shouldn't allow themselves to be

poisoned by harsh business realities. We just have to be smarter, braver, and more creative rebels.—Michael M.

NOT IN EM

I write this letter in response to Jim Black's letter (October 1991 "Letters"). Jim spoke for those readers who enjoy interviews as opposed to those of us who enjoy useful articles. Am I saying we are strictly against interview articles? Not really. That's why we buy *Rolling Stone*, *Musician*, and other such magazines. They satisfy our need for entertainment news, while **EM** provides the tools to help us grow both musically and technically.

Knowing how a particular artist uses a \$10,000 effects processor (which, by the way, is more than I paid for my home studio and automobile combined) will not help me improve the sound or usefulness of my \$500 Quadraverb. An article that clearly explains compression or pitch shifting, however, will.

No, let's not turn **EM** into ET (*Entertainment Tonight*). Continue to make **EM** a uniquely informative and resourceful magazine, and maybe someday others will be reading entertainment news about us...but not in **EM**.

Derek Franklin
Indianapolis, IN

I read that someone wished there were interviews in your magazine. Please, no! If I want to read what my favorite pop star uses, there is always *Keyboard* magazine. They just did about twelve pages on what Greg Phillinganes used on tour with Eric Clapton. So I guess when old Slow Hand calls me I'll know what gear I need to take, eh?

On a more serious note, I have always wondered why, when the people who contribute your articles have Internet electronic mail addresses, they don't include them? Many of your writers are CompuServe subscribers, I'm sure, and thus can be reached through Internet mail. Equally as many, I would assume, have Internet access through a college system. So how about it people? When

you contact **EM** or contribute an article, include your Internet E-mail address so we can contact you. Also, many times we would like to contact the author of an article without waiting three months for a hand-written letter to filter through channels to that person.

I also ask that readers who have the appropriate modem access to E-mail me at my Internet address. I will compile a list of readers who can be reached through Internet E-mail and send it out to those who reply. Those of you with modems, drop me a line and let's get some sort of working directory compiled.

Eddie Anthony
Cleveland, OH
Internet address:
aa588@cleveland.
freenet.edu

*Eddie—Thanks for the efforts. Though few of our writers are on CompuServe or the Internet, several can be reached on the PAN network, where **EM** has its own SIG. PAN also offers mail service to and from the Internet. Simply add @pan.com to the PAN address. **EM**, for example, can be reached at emeditorial@pan.com.—Bob O'D.*

PRE-VISION VISIONARIES

In reference to the "EM Guide to Sequencing Software" (August 1991), the article states that "Other solutions comprise software tools, such as graphic (onscreen) faders introduced in Opcode's *Vision* and quickly copied by virtually every major manufacturer." This is a strong statement to make about "every major manufacturer." Just to be accurate, I checked with Opcode. They informed me *Vision* was first shown at Winter NAMM 1989.

My problem with your article is this: Our company, C-Lab Software, introduced *Notator 1.1* with many new features including something we call the "Realtime MIDI Generator," a collection of up to 64 on-screen Graphic Faders, at the Frankfurt Music Messe 1988. This was almost a year before Opcode introduced *Vision*.

I am not saying C-Lab was the first to

● LETTERS

do so, but we certainly showed the RMG publicly long before Opcode's *Vision*.

Mikhail Graham
Nevada City, CA

Mikhail—Thanks for setting us straight.—Bob O'D.

OCR FOR MUSIC

I use *Personal Composer, System 2*. Unfortunately, this software was not included in your "Buyer's Guide to Notation Software" (September 1991), although it has serviced me quite well these past couple of years.

I am writing to inquire if you are aware of any software that accepts scanned scores as MIDI data for MIDI playback. I am considering the purchase of a hand-held scanner, should it be possible to use this as a tool to input scores for playback. Please let me know if this technology exists, and if so, who manufactures it.

Richard Holley
Flushing, NY

Richard—Softelligence's Personal Composer wasn't in the September 1991 "EM Guide to Notation Software" because we covered it in the August 1991 "EM Guide to Sequencing Software." Admittedly, most recent-vintage notation programs include at least rudimentary sequencers, and some sequencers offer simple notation. But with a few exceptions, the programs primarily are optimized for one application or the other, so when we planned the two articles, we decided not to include the same programs in both. It was a debatable decision, and some folks weren't happy about it (see the November 1991 "Letters"), but we think our approach was reasonable.

I understand several software companies are developing software that scans scores and converts them into MIDI data, but it may take awhile. Optical character recognition (OCR) software for written English—let alone music—is difficult to program, and even state-of-the-art programs often are less reliable than manufacturer's ads lead you to believe. OCR software that understands music notation and saves it as a Standard MIDI File is a terrific idea, and I think there would be a sizable demand for it, but it's going to take a lot of tough pro-

gramming.—Steve O.

THE WORKING MUSICIAN

You should include more articles and info, maybe even a monthly column, aimed directly at MIDI-enhanced, working, part-time (week-end warrior) bands. I bet many of your readers are in a position similar to mine: I'm far from wealthy, and the investment I've currently got (over \$8,000) into synth, sequencer, P.A., and other equipment is far too much for just a hobby. Unless I want to get a divorce and lose the house, I have to make a definite return—some significant profit—on the investment I've made in performing music. We need articles on topics such as which live instruments to have in a band; union membership; and what else, besides insurance, can be done to protect against equipment robbery, particularly late at night, when a band is loading out of gigs.

I realize you might not want to address some of these topics because of legal considerations. But there are

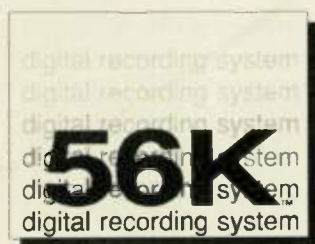
Hey Glenn, what do you do with your 56K?

Glenn Meadows is the president of Masterfonics Inc. in Nashville, Tennessee. His mastering credits, 350 of which have achieved Gold/Platinum status, include: Alabama, Hank Williams Jr., Dan Fogelberg, and Reba McEntire. Recent 56K projects include: Steely Dan Gold Extended/MCA, Reba McEntire/MCA, and Sawyer Brown Curb/Capitol. He has been mastering since 1973.

"The 56K has made my life much easier. In an effort to find a digital mastering system suitable to my needs, I evaluated several other systems on different platforms. The 56K proved significantly easier to use and faster to learn, as well as very quick to do the type of edits I normally did with analog tape.

The playlist in SoundStage is the most intuitive I have seen. I use it daily for quickly changing the song order on compact discs, as well as reassembling songs for different required mixes. What used to be done in a day with tape can now be done in minutes with the 56K.

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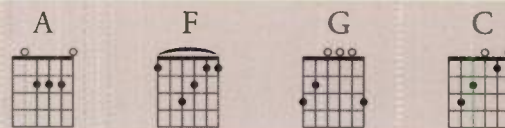
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World Radio History

● LETTERS

many concerns for us working MIDI-bands that are practical as well as technical. If you want our true love, help us with topics like these!

Broadway Jack
Chicago, IL

Broadway Jack—We couldn't agree with you more. That's why, starting next month in the February issue, we'll feature a new column entitled "Working Musician." It will address many issues that you and other readers have raised. The primary focus will be real-world problems and questions fac-

ing performing musicians and those trying to make a living (or at least pay off their equipment bills) with electronic musical instruments. We'll cover things like copy-right, monitor systems, contracts, and deciding when to use a professional studio. Let us know what you think.—Bob O'D.

TURN IT DOWN

As a musician, I want to protect my hearing. Do you have any suggestions for what we can do to get the volume at concerts turned down? I

know I can use earplugs, but that affects the sound, and it shouldn't be necessary to use them.

There isn't anything wrong with having the volume somewhat high, but it shouldn't be so loud that you need to worry about your hearing being permanently damaged. With the awareness of what loud music can do, I don't understand why this is still a problem.

Gary Griffaw
St. Louis, MO

Response from David Schwartz, editor-in-chief of Mix magazine and advisor to the House Ear Institute, a non-profit hearing research organization: Until live sound-reinforcement companies either decide to take the responsibility or are legislated into reasonable sound-level limits, it's up to people like yourself to cry foul when you experience an abusive sound environment. I suggest when you are in such a situation, find out who is in charge of sound and write them about your feelings. Encourage others to write them. They ultimately are in business to please the audience; if the audience is not happy, their business is in jeopardy. Use your power.

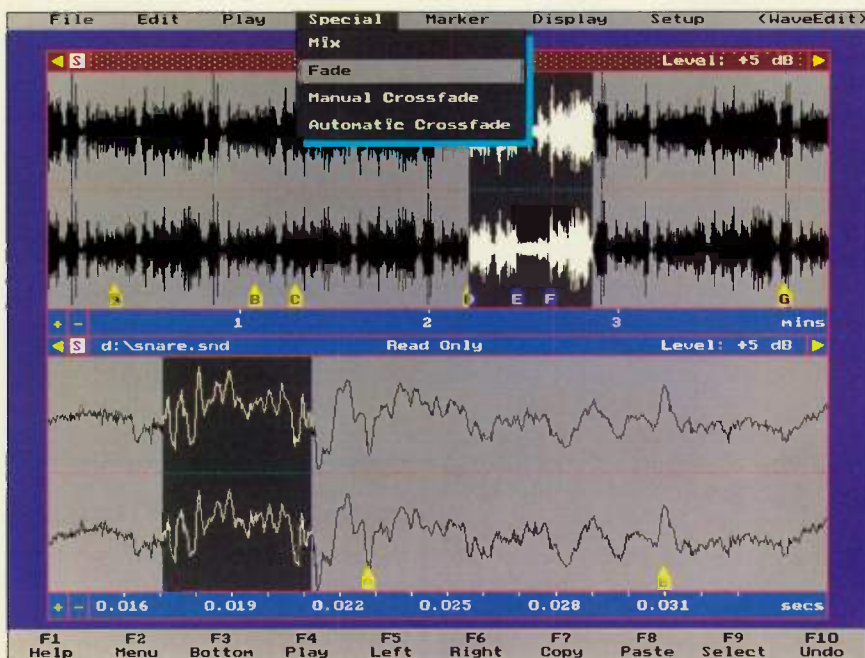
(For a more in-depth discussion of this topic, see David Schwartz's "Back Page" editorial in the July 1991 issue of EM.—Anne-Marie P.)

ERROR LOG

November 1991, "Letters," p. 11: The response to Charles Siu's "Tascam Troubles" letter was incomplete. Using an external 48-volt phantom power supply with Tascam's 688 MIDiStudio requires a minor modification to the 688's input section. Contact the Tascam service department, tel. (213) 726-0303, for details.

November 1991, "Legal Beagles" sidebar: "The Top Ten Lawyer Hunting Grounds," p. 83: Volunteer Lawyers for the Arts in New York does not shop demo tapes to record companies. They are a referral service that operates a hotline for legal questions (tel. [212] 977-9271). None of the organizations listed in the sidebar shop tapes.

Correspondence should be addressed to Letters, Electronic Musician, 6400 Hollis St. #12, Emeryville, CA 94608. Please include your full name and address. Letters may be edited for space and clarity.



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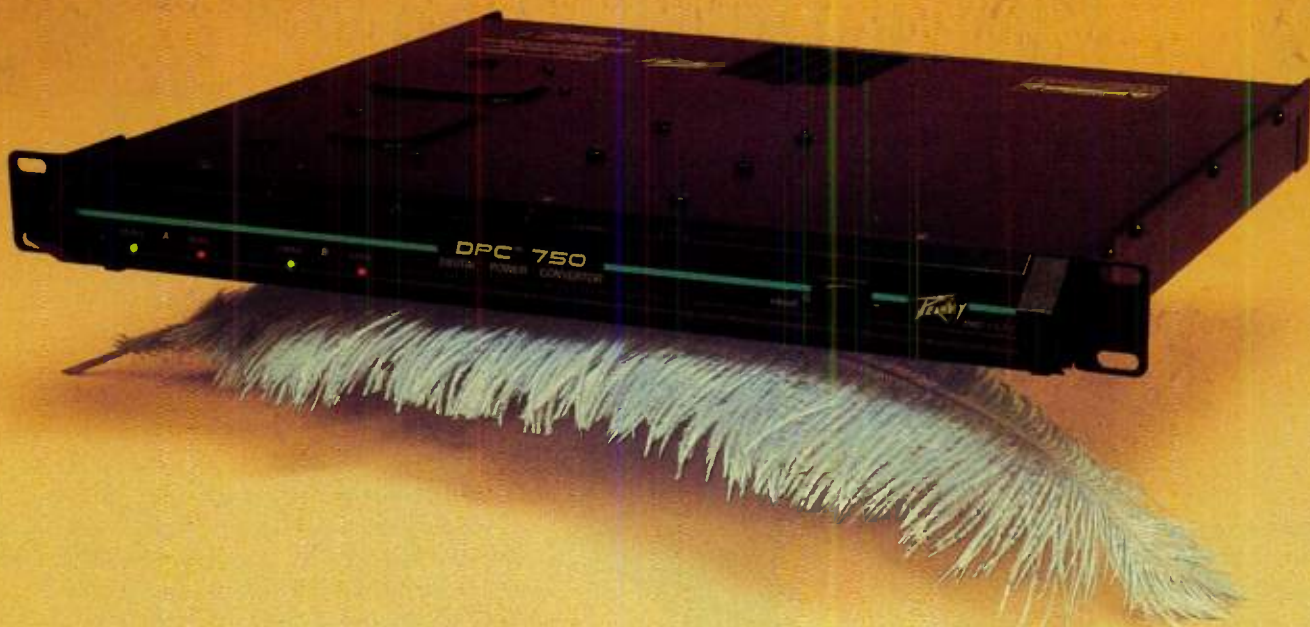
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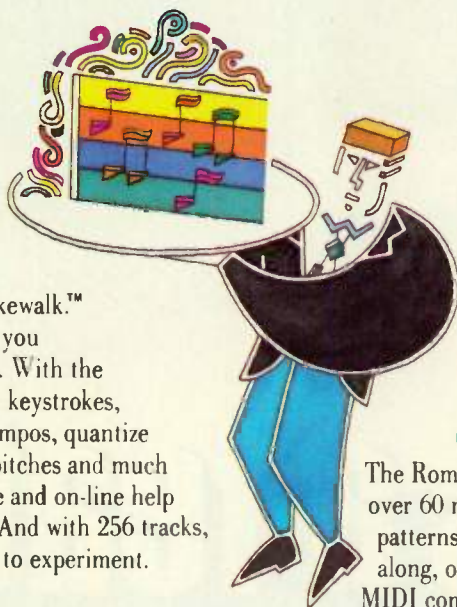
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We greet 1992 with more wares from the 1991 AES convention and a selection of those that didn't reach the show.



Sony PCM-2300 DAT Recorder

DAT RECORDERS

As noted last issue, this year's Audio Engineering Society convention mostly focused on various forms of digital audio recording. While hard disk-based systems received considerable attention, the somewhat more humble, but tremendously useful pro digital audio tape machines also made a strong showing at the convention.

Sony (tel. [201] 930-6432) announced the **TCD-D10 PRO II** portable DAT (\$3,300; approximately \$400 for TCD-D10 PK pro upgrade kit), which adds several important features to its predecessor, the TCD-D10 PRO. These include absolute time recording for ease in editing and a new graphic display that includes 20-segment digital peak-level meters, and tape time/clock, battery, sampling frequency, and caution indicators. Even more interesting is the new **PCM-2300** professional DAT recorder (\$1,590). The 2300 offers 1-bit A/D and D/A converters; selectable 32, 44.1, and 48 kHz sampling rates; analog and digital I/O; absolute-time recording; and the ability to record subcodes separately. A remote control is included.

At the Otari booth, two new DAT recorders were on display. The high-end **DTR-90** (\$8,495) is a 4-head ma-

chine designed to be used in conjunction with its companion Editor (\$3,695). The Editor can control two DTR-90s simultaneously for assembly editing in a manner similar to video-editing systems. An optional plug-in board for the DTR-90, the Edit Memory PC Board (price not available) allows digital audio to be read into a RAM buffer for non-destructive preview edits. Once edit points are marked, the Editor automatically rewinds the tape and precisely punches in and out at the edit points. The low-end **DTR-7** (\$1,895) offers basic operations without time-code.

Fostex's **PD-2 portable DAT recorder** (\$10,950) is a 4-head portable DAT that supports SMPTE time code in both the new IEC standard and Fostex's proprietary standard. Intended primarily for film and television location recording, it features an internal time-code generator that also can jam sync to any external sync reference.

The least expensive DAT at the show was the **TEAC DA-P20 portable** (\$999), which will be distributed by Tascam (tel. [213] 726-0303). The DA-P20 includes balanced XLR analog and S/PDIF digital inputs and RCA unbalanced analog and S/PDIF digital outputs, 16-bit linear converters, and the

ability to display absolute time. The supplied rechargeable battery pack allows two hours of recording time.

ANALOG RECORDING

Yamaha displayed the **MT-120** (\$520; tel. [714] 522-9011), the latest in its line of 4-track cassette recorder/mixers. Features include dbx noise reduction; a 2-channel, 5-band graphic EQ; one aux send, with sliders rather than rotary pots; panning; monitor faders; a single master fader; and four 15-segment level LEDs (the track 1 and 2 displays double as L/R master meters). The transport can operate at either 1 $\frac{1}{2}$ or 3 $\frac{1}{2}$ ips. The unit has a footswitch jack for remote-controlled punches and a jack for the optional RCM-1 Remote Controller (price to be announced), which provides basic transport controls. The mic/line inputs, headphone out, aux send, and aux returns use $\frac{1}{4}$ -inch phone jacks; all other audio outputs are RCA jacks. Yamaha claims a frequency response of 40 Hz to 18 kHz (± 3 dB) at 3 $\frac{1}{2}$ ips and 40 Hz to 13 kHz at 1 $\frac{1}{2}$ ips, 1% THD at 315 Hz (dbx on, -10 dB record level), and 85 dB signal-to-noise ratio (dbx on).

According to Ampex (tel. [415] 367-3888), its **499 Grand Master Gold analog mastering tape** offers extremely low noise and distortion, high output, and the "widest dynamic range of any analog mastering tape," even at and beyond +9.0 dB operating levels. Ampex 499, which appears to be a potentially strong competitor to 3M's popular 996 tape, is available in $\frac{1}{4}$ -inch and larger widths.

TRANSDUCERS

Westlake Audio unveiled its first powered reference monitor, the **BBPM-4** (\$1,985/ea.; tel. [805] 499-3686), a biamped, phase-coherent system based on dual 4-inch woofers and a $\frac{1}{2}$ -inch dome tweeter. Each cabinet has an electronics section with an active

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Other SansAmp Purchasers:

Living Colour, Def Leppard, KISS, Metallica, Larry Oakes (Bad Company), Robert Quine (Lou Reed), Paul Pesco (Madonna, Steve Winwood), Doug Wimbish (Jeff Beck, Mick Jagger), Rik Emmett (Triumph), Chris Currell (Michael Jackson), Ray Gomez (Stanley Clark), Jeff Campbell (Sting).



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WHAT'S NEW

crossover, a 150W (peak) amp for low frequencies, and a 66W amp for highs. The input connectors are balanced XLR, phone, and RCA jacks. The 8 x 15 x 12 1/2-inch speakers are scheduled to ship this month.

Beyerdynamic (tel. [516] 935-8000) displayed the MCE 52 and MCE 53 miniature condenser mics (\$399.95 each, with preamp), which can handle up to 152 dB SPL for close-miking musical instruments. The size of the mics and spring-loaded mounting clips facilitate low-profile mounting to percussion, brass, and woodwind instruments. The manufacturer claims a frequency range of 35 Hz to 20 kHz.

SIGNAL PROCESSING

Sabine (tel. [904] 371-3829), manufacturer of the FBX M Feedback Eliminator, is preparing to release an improved model, the FBX 900 (\$600). The new model attacks feedback problems with nine programmable, parametric filters instead of the earlier model's six filters. The filter center points can be set anywhere from 60 to 15k Hz, and the filter width is 1/10 octave, giving much more precise attenuation of problem frequencies than the FBX M. Balanced XLR and unbalanced, 1/4-inch inputs and outputs are provided. Barrier strips and a balanced-line transformer are optional.

T.C. Electronic's (tel. [805] 373-1828) M5000 Digital Audio Mainframe (\$3,999) is an expandable true stereo audio effects processor with analog and digital I/O. The base unit can be expanded with an additional two channels of I/O, an extra processing card, a disk drive, and optional memory cards. Available effects for the M5000 include reverb, sampling, pitch shift, chorus, and flanging.

The Rane ME 60 Stereo micro-Graphic Equalizer (\$649; tel. [206] 355-6000) is a 2-channel, 1/3-octave graphic EQ with adjustable high (over 3 kHz) and low (under 250 Hz) band-limiting filters on each channel. The constant-bandwidth filters are designed to minimize the boost/cut interaction between filters that plagues many graphic EQs. A passive bypass and channel volume pots complete the main controls. Rear-panel inputs and outputs are electrically balanced XLR and 1/4-inch, TRS stereo jacks (which accept unbalanced, 1/4-inch, mono plugs), and unbalanced RCA jacks.

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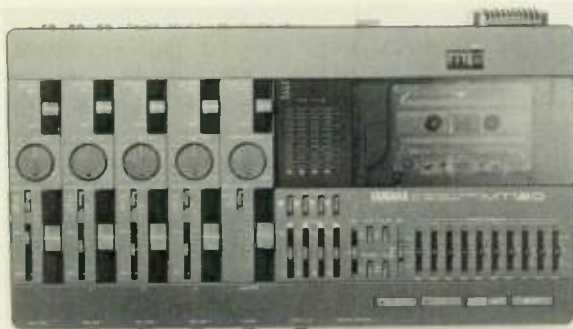
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Yamaha MT120 Multitrack Cassette Deck

MACHINE SYNC

Tascam showed a prototype of the **MMC-100 MIDI Machine Control Interface Unit** (no price yet). The unit is designed to translate MIDI Machine Control messages (which have not yet been officially ratified) into transport control functions to which Tascam recorders equipped with an Accessory II connector can respond. For example, your sequencer program could tell your 238, 644, 688, TSR-8, MSR-16, or MSR-24 to record, rewind, or autolocate. The MMC-100 also will incorporate a SMPTE generator and be capable of performing SMPTE/MTC conversion. The company also showed the **ATS-500 Synchronizer** (\$799), which is essentially a MIDHzER without the MIDI and transport functions. The unit includes a SMPTE reader/generator that can be synced to an external video signal and can jam sync. In addition, the half-rack device offers control over any two Tascam recorders with controllable transports (see list above). With the addition of the IF-500 (\$550), the ATS-500 has the ability to control any parallel interface video or audio tape recorder.

TimeLine Micro Lynx (\$2,495; tel. [619] 727-3300) controls up to three audio/video transports (a third transport requires an optional expansion card, \$850) simultaneously with MIDI sync. In addition to reading and writing SMPTE time code and MTC and providing jam sync, Micro Lynx has a computer control port with a Mac interface. The key-



TimeLine Micro Lynx Synchronizer

board (which is included) offers transport controls, keypad input, function keys, and editing capabilities. It permits direct entry and calculation of time-code numbers and lets you store and recall operations and select a master for group audio/video operations. Optional cards include either of two digital

audio clock generators (\$375 and \$550) for synchronizing to Digidesign's Pro Tools, an NTSC or PAL sync generator (\$200), and a VITC reader (price not available).

CONTROLLERS

JLCooper displayed the **CS-10 Control Station** (\$1,295; tel. [310] 306-4131), which provides a hardware user interface for Digidesign's Pro Tools recording hardware and *ProDECK*, *ProEDIT*, *Q-Sheet*, and *Sound Designer* 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.

WHAT ELSE IS NEW?

While we were covering the AES convention, the new-product release stack grew like Jack's beanstalk. (So far, we haven't sighted any giants, though....)

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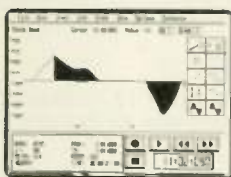
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● WHAT'S NEW

First, we'll catch up on an assortment of items that had to make way for the show report. Next month, we'll delve into the myriad products announced since AES.

MODIFICATIONS

Encore Electronics is offering the **JP8MK** (\$275), a MIDI retrofit for the Roland Jupiter-8. A plug-in daughter card replaces the existing ROMs, and its twelve wires are soldered to the processor board. Two MIDI jacks mount on the back panel. The modified JP-8 operates on two selectable MIDI channels and responds to a 5-octave MIDI note range; scalable Pitch Bend (with no modification to voice or bender boards); MIDI Program Change, with 128 patches (numbers 0 to 127), including two banks that are accessible from the front panel; MIDI Volume (Controller 7); Expression Pedal (Controller 11), mapped to Filter Cut-off; and Portamento On/Off (Controller 65). The software has an extensive SysEx implementation.

Encore Electronics

30 Glenhill Ct.

Danville, CA 94526

tel. (510) 820-7551

MUSIC FONTS

German font-designer ergo sum has released **Susato** (\$199), a Petrucci-compatible, Type 1 PostScript font for Coda's *Finale*. In addition to traditional European music characters, ergo sum offers a character set of accordion registers and a variety of German and English keyboard-layout options.

ergo sum computer GmbH

Sternwaldstraße 6a

D-7800 Freiburg, Germany

tel. 49-761-7044 44-10



ergo sum Susato music font

COMPUTER PERIPHERALS

Articulate Systems launched **Voice Impact Pro** (\$299), which adds the 8-bit sound digitizing capabilities of the Mac LC and IIsi to a Macintosh Plus, SE, Classic, or II-series computer. The system includes a digital signal processor, unidirectional microphone, and digital compression (MACE). The externally clocked, asynchronous serial device is interrupt-driven and has a RAM buffer, letting you record 8-bit mono digital audio while the Mac works on other tasks. It requires 2 MB RAM, a hard disk, and System 6.x or 7.0. Voice Impact Pro ships with *SoundWave*, an application that provides sound-editing functions, including handling multiple windows, adding effects to samples, and mixing and filtering samples. It also comes bundled with *Voice Record 2.0* software (also available separately, with *SoundWave*, for \$79), which enables the user to record, edit, and manage sounds in one integrated window. The program can be accessed from a DA, or directly from virtually any Mac application that supports the sound-input features in System 6.0.7 and above, including System 7.0.

Articulate Systems

600 West Cummings Pk.,

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tel. (617) 935-5656

ORGANIZATIONS

The formation of the Professional Composers of America, a non-profit organization, was announced by director Doug Wood. The PCA's goals are to increase public awareness of composers' contributions to America's music culture; to provide a forum for dialog among commercial composers, manufacturers, and software developers; and to lobby government and performing rights societies on behalf of composers. A primary concern is the education of composers about such issues as mechanical and synchronization licenses, how performing rights organizations work, and work-for-hire laws. Membership (\$10/yr.) is open to any composer who has been paid for writing music.

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- 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.).

At one new sound per second, 24 hours a day, it would take over 300 years to out-grow 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.

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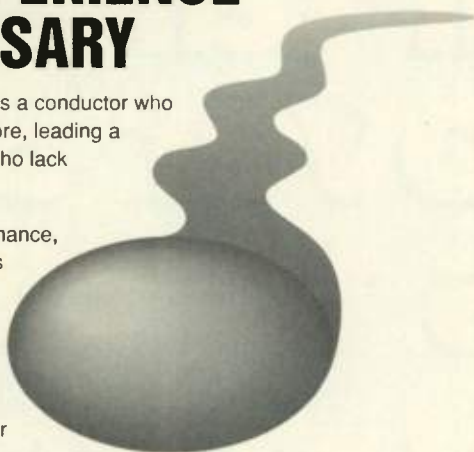
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SOFTWARE

Next Phase Enterprises released *Next Phase MIDI Ear Trainer 1.5* (\$49.95, plus \$5 s/h), a self-paced, interactive ear-training program for IBM PC-compatible computers. The program consists of a series of drills that teach you to recognize melodic and harmonic intervals, chord types, chord voicings, and scale types. It uses your MIDI instrument to play the exercises. You respond using either the MIDI instrument or the computer keyboard. *MIDI Ear Trainer* records your previous score, tracks your progress, and lets you select an area of concentration and level of difficulty. It runs on IBM XT, AT, or compatible computers with 640 KB of memory, PC- or MS-DOS 3.0 or later, and an MPU-401-compatible interface. A MIDI instrument is required. Next Phase offers support for an optional color display and Microsoft-compatible mouse.

Next Phase Enterprises
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Natick, MA 01760
tel. (508) 651-2580

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REV UP

Twelve Tone Systems' **Supplemental Driver Disk** (free to registered *Cakewalk* owners; tel. [800] 234-1171 or [617] 273-4437) for PC-based *Cakewalk 4.0* and *Cakewalk Professional 4.0* sequencers now includes a driver for Sound Blaster and Ad Lib FM sound cards. The new driver includes a library of 128 General MIDI patches that automatically download to the card and a utility for loading additional patches. The Sound Blaster driver supports the card's MIDI option so the sequencer can access external MIDI instruments and the onboard sounds simultaneously...NewTek (tel. [800] 843-8934 or [913] 354-1146) announced a Video Toaster for the IBM PS/2 and PC-compatibles, available in the first quarter of 1992. **The Toaster PC Workstation** (\$4,995; upgrades from regular Toaster available, price to be announced), includes an onboard, dedicated Amiga CPU and interfaces directly with MS-Windows-equipped PCs. The software is compatible with images from many popular PC graphics programs. A Macintosh-compatible Toaster, which can read popular Mac graphic formats, also is available for \$4,995 (with the same upgrade policy), and an OS/2 version is under development. ●

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A Potpourri for 1992

It's back to the future with 3-D displays, optical PC boards, and silicon ants.

By Gary Hall

Each month, we take an in-depth look at one particular area of emerging technology. For a change of pace this month, I'll give you quick "capsule-takes" on three developments that have important implications.

GETTING DOWN IN 3-D

Dimension Technologies, Inc. (DTI), of Rochester, New York, has introduced the first commercial computer display that can show true 3-dimensional images without requiring special glasses. The screen size is 12 x 10 inches, and screens currently are available for

IBM PCs and compatibles. Macintosh versions are expected soon.

These remarkable displays are based on active-matrix, liquid-crystal displays, which are much faster than the conventional LCDs musicians have become accustomed to seeing on synths and effects processors.

DTI exploits this speed to multiplex two images on the same display, one for the right eye and one for the left. The screen shows the image for one eye for $\frac{1}{30}$ of a second before switching to the image for the other eye. Just as with film and video, our eyes combine the flickering images so that we see just a single, continuous picture.

But the real key is keeping the two images separate so that each eye sees only the picture intended for it. To achieve this, the DTI design draws on another, more familiar property of

LCD displays. If you've been using instruments with LCD alphanumeric and graphic displays, you've become accustomed to adjusting the "contrast" control so you can read the display from your normal position. This is actually a viewing-angle control.

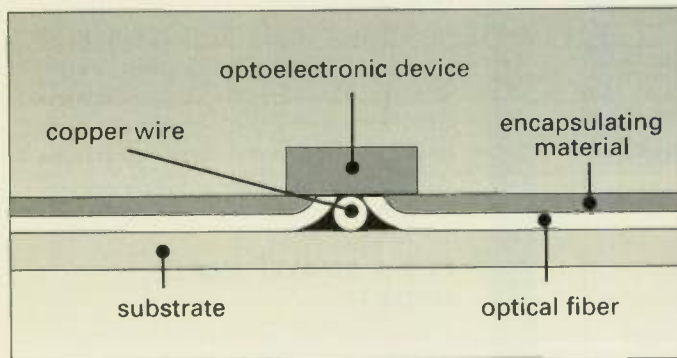
The 3-D LCD display combines two separate color LCDs that are set for different viewing angles. Viewed from the proper position, about 30 inches from the screen, the difference in angle between left and right eye is enough to ensure each eye sees only the image intended for it. The 3-dimensional image is visible from a "sweet-spot" about 2½ to 3 inches wide. There are several such spots in an arc in front of the screen so more than one person can view the image with the full effect.

3-D displays suggest powerful applications for computers and especially for interactive entertainment. It may be awhile before you see them on your favorite laptop, however. The current price of a 3-dimensional, flat-panel-color display is about \$10,000.

UNDERGROUND OPTICS

Some of the applications and benefits of optoelectronics and optical storage are familiar: MIDI interfaces use optical isolators to ensure freedom from electrical interference, and the world of music has never been the same since the introduction of the laser-read compact disc. For several years, engineers have been excited about the possibilities of using optical fibers to carry digital information at ultra-high bandwidths. (See "The Local Area Network: MIDI's Next Step?" in the November 1989 EM.)

For the most part, these efforts have focused on optical fiber as a means of conveying information from one com-



Now optical fibers can be embedded in a printed circuit board. Small copper wires are used to push the optical conductor to the surface wherever connections are needed.

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● TECH PAGE

puter, instrument, or peripheral device to another. But recently, a technique was introduced that lets engineers embed tiny optical conductors into a printed circuit board.

The benefits of optical fiber for data communications over large distances are well-known. When especially high data rates are needed, electrical connections using standard conductors suffer from problems caused by signal reflections and interference from outside sources. Optical connections are virtually immune to both.

The severity of these problems is a function of frequency and distance. The further you want to go, the more slowly you have to transmit information. MIDI uses a data rate of 31,500 bits per second (bps), and at these frequencies there isn't much of a problem. Things can start to get hairy when transmitting digital audio, with its data rate of 750.00 bps per channel.

These days, however, engineers are looking at data rates of hundreds of millions of bps for high-performance computing and communications. At these frequencies, even a few inches of wire or trace on a printed circuit board can introduce intolerable degradation of information, and engineers are excited about the possibilities of designing boards using optical conductors. But the experts are divided on when this technology will see commercial application, with estimates ranging from eighteen months to several years.

IT'S A SMALL, SMALL UPDATE

Shortly after my column on micro- and nanotechnology went to press, I spotted a remarkable item on the wire service. A patent has been granted for a "silicon ant" small enough to handle individual cells. This amazing creation has its own motor, powered by acoustic vibrations, and it potentially could be steered by a computer or human operator. Now all we need is microscopic video cameras to give virtual reality a whole new twist.

That's all for now. See you next month.

Former EM technical editor Gary Hall is realizing how easy he had it in the publishing game, now that he's support manager for high-end audio workstations at Sonic Solutions in San Francisco.

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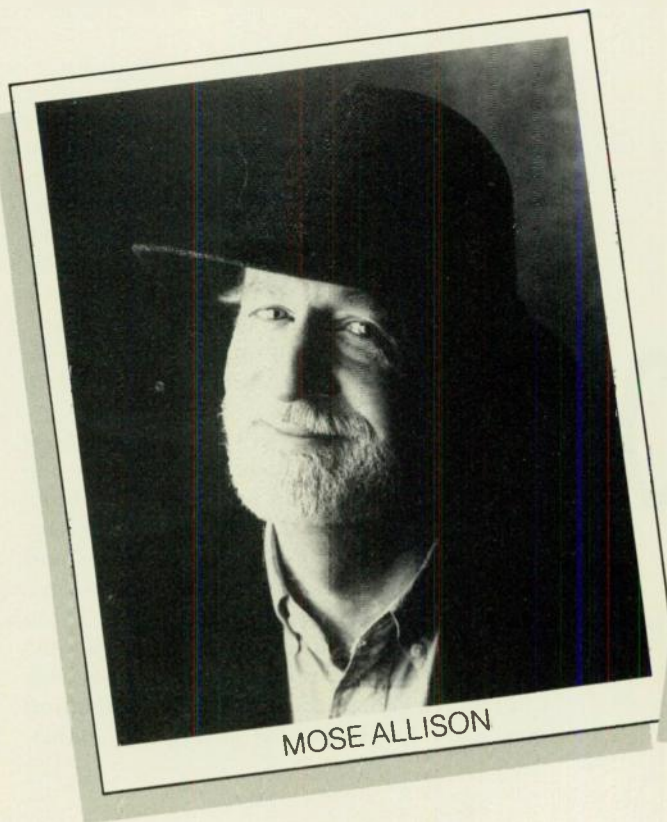
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Foundation grants open doors for savvy musicians.

MONEY

A familiar scenario: A musician works two jobs to earn the money to buy the equipment to make the demos that collect the rejection letters that trigger the determination that starts the process all over again. Unfortunately, most musicians believe this is the singular path to artistic fulfillment. There is another way.

Thousands of private foundations and government agencies provide funding for artists. Of these, the National Endowment for the Arts (NEA) is the most visible. However, its travails have convinced many musicians that foundation funding is unattainable or only supportive of certain types of expression (see sidebar, "The Endangered Arts Grant"). The fact is, funding exists for virtually every artistic statement. There even are people employed to help artists acquire a foundation's support.

for

However, there is a catch. Foundations operate to meet their founders' goals, not the ambitions of the musician. A foundation's goal may be as broad as improving a community's quality of life,

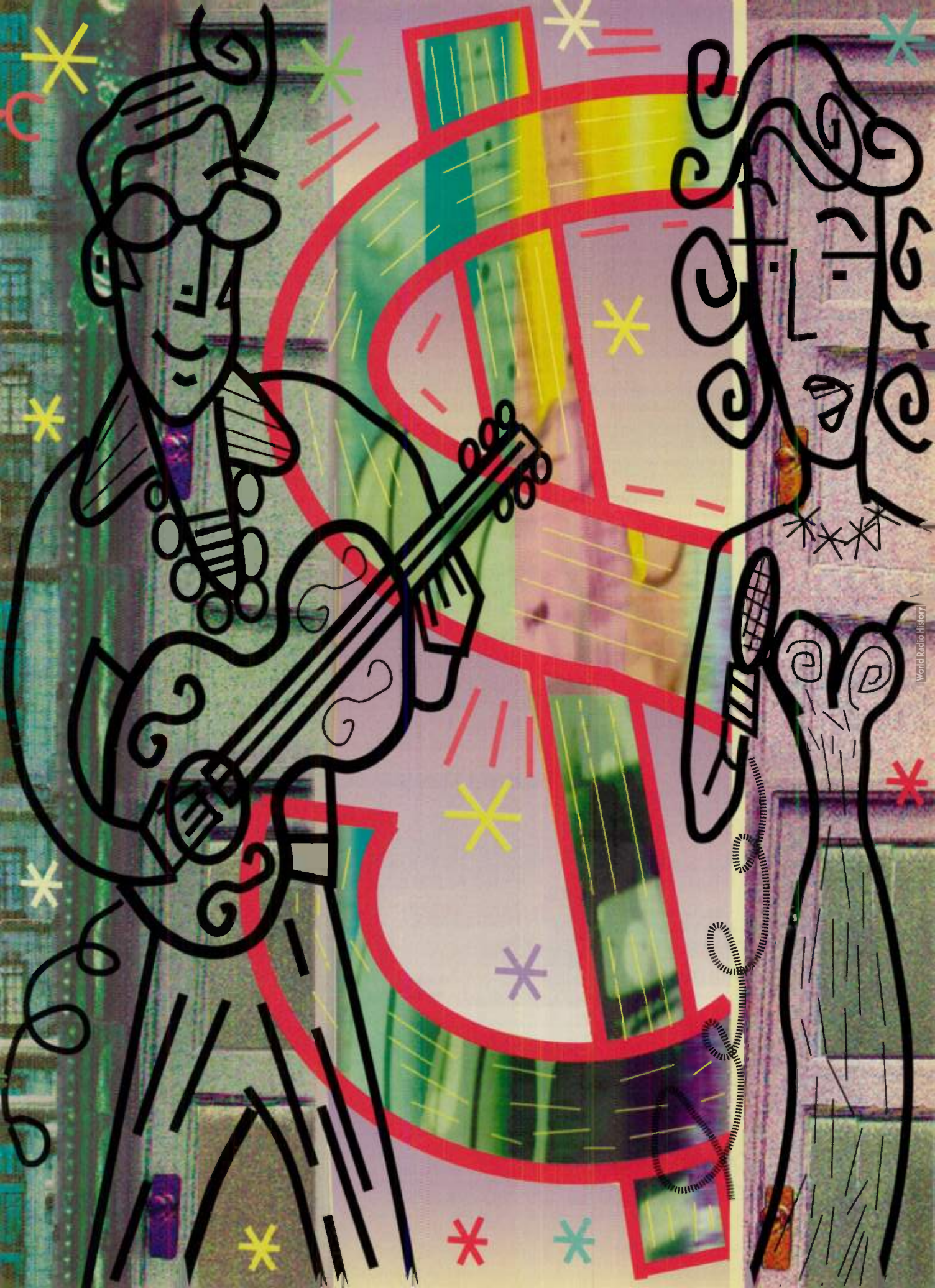
or as specific as encouraging modern composers to write more music for the accordion. If your artistic goals match the goals of a private foundation or government agency, you may easily qualify for financial support.

This doesn't mean foundations subsidize attempts to climb the pop charts. Musicians seeking huge commercial success will be frustrated by the machinations and returns of the funding process.

However, if your music is too eccentric for even the most adventurous independent label, or your ideas are too outrageous to embrace commercial outlets, a foundation may be the perfect partner to support your art.

MUSIC

By Stephen Dick



GOING NONPROFIT

Foundation support won't buy a home on Easy Street, or even provide enough capital to jettison your day job. Although some funding pays living expenses during the creative process, most support covers specific expenses of a project undertaken by an established nonprofit organization. Eligibility for most funding is dependent on nonprofit status, but don't let the term scare you. It simply means your goals are something other than making a profit. Perhaps your art celebrates your community and heritage but is not mainstream enough to garner commercial appeal. A suitable nonprofit project can be anything that brings your work to the general public: live performances, lecture/demonstrations, sound installations, multimedia presentations, records, films, or videos.

The first issue to consider is whether to start your own nonprofit corporation or seek fiscal sponsorship from an already-established nonprofit organization. In general, self-incorporation serves long-term goals, such as bringing Moldavian music to rural New Mexico

or nurturing a chamber ballet or theater company. Fiscal sponsorship is appropriate for singular projects that support or enhance the focus of an existing organization.

The cost of setting up a nonprofit corporation depends on where you live and the availability of free professional services. You are required to create articles of incorporation (company "bylaws"), select a board of directors, and complete forms securing nonprofit status with state and federal tax departments.

You'll discover that procuring the money and filing documents is easier than establishing a board of directors. The ideal board includes professionals, such as accountants and attorneys, who can contribute services and money (by fundraising or personal contribution). The board must be rational and focused in its responsibility to achieve the organization's long-term goals. Because most artists are uncomfortable with creating a board of directors to oversee projects, they make the mistake of asking friends and other artists to join the board. Since a board's job is

to raise funds and maintain corporate affairs in a business-like manner, the people you jam with may not be the best choice for board members. The survival of a nonprofit corporation often depends on the commitment and tenacity of its board. A collection of friendly, well-meaning deadwood invites failure.

FISCAL SPONSORSHIP

After researching the work involved in setting up a nonprofit organization, many artists seek fiscal sponsorship. In many ways, fiscal sponsorship is an ideal arrangement for artists new to the nonprofit world. A fiscal sponsor is an organization that "lends" its nonprofit status and reputation to an outside project for funding purposes. A sponsor often takes ten percent of the money donated to the artist for this service.

Sponsoring organizations are highly sensitive about jeopardizing their fiscal status when they enter a relationship with an artist. One flaky artist can severely damage an organization's reputation, making it harder to secure funding for their own projects. An organization will demand detailed information about you and your project before agreeing to be your fiscal sponsor. Also, your project must adhere to the goals and scope of the sponsoring organization. A sculpture gallery probably is a bad choice to sponsor your outdoor reggae festival.

Generally, any established nonprofit organization involved in the arts can act as a fiscal sponsor. Organizations in larger communities generally follow a broad mandate to bring more arts to the community. These organizations regularly enter into fiscal sponsorship agreements with artists. Other possible fiscal sponsors include dance companies, art galleries, performance spaces, and theatrical organizations.

THE BUSINESS PLAN

Starting a nonprofit corporation or choosing a fiscal supporter paves the way for potential funding. Actually procuring the money requires a business plan that defines your goals, such as a series of concerts, creation of a sound installation, or teaching school kids to sing the blues.

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● GRANTS

ness plan specifies costs and parameters of a proposed project. How much is the auditorium rental? What are the advertising costs? How much labor can be secured for free, and how much must be budgeted for salaries? Do you need permission to use certain facilities or copyrighted materials? An effective plan chronologically lists both what you need to do and have.

In addition, a well-defined business plan forces you to be honest about your

abilities and goals. Potential funders quickly spot gaps between current levels of experience and grandiose ideals. This is one arena where it may not pay to think big. If your performance experience is limited to local club gigs, funders are unlikely to assume the next step is a world concert tour. They're more likely to underwrite advertising costs for a performance in a concert hall slightly larger than your last venue.

FUNDING INFORMATION

Several resources are available for those seeking foundation grants or other arts funding.

The **National Endowment for the Arts** is still a major funding source.

National Endowment for
the Arts
Music Program, Room 702
Nancy Hanks Center
1100 Pennsylvania Ave., NW
Washington, D.C. 20506
tel. (202) 682-5445

The **Foundation Center** is an independent, national service organization that provides information on private philanthropy. Apart from reference collections maintained in New York City, San Francisco, Washington D.C., and Cleveland, the center operates cooperative libraries throughout the U.S. and overseas.

The Foundation Center
79 Fifth Ave.
New York, NY 10003
tel. (800) 424-9836

Specialized directories list state and regional arts agencies and provide a wealth of information on contacts and resources. Published annually, the directories are expensive but usually can be found in the music section of your local library.

Stern's Performing Arts
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33 West 60th St.
New York, NY 10023
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Some of it is already in your pocket. You've probably never considered yourself a walking Rockefeller Foundation, but look back over the years and determine how much you spend annually on music. Now decide how much of these expenditures can be routed into

the project you want funded. This personal contribution should equal the absolute minimum project cost. If the funds required are significantly greater, reassess your project or secure more funding.

The next platform for additional funding is your family and friends. Remember, your nonprofit status makes contributions tax deductible. Also, seek donations of services. Many professional organizations exist to provide needed services to nonprofit organizations at no charge or for a nominal

THE ENDANGERED ARTS GRANT

Although the nonprofit world is isolated from the commercial marketplace, nonprofit funding depends on healthy commerce. Corporate giving often reflects corporate profits, and the benevolence of private foundations fluctuates with their investment portfolios. Federal arts funding is under constant threat of budgetary cutbacks.

Corporate and private funders usually react to a tight economy in one of two ways: They narrow their focus to projects they've previously funded, or they seek the most effective use of available funds. The latter scenario offers start-up organizations an advantage over established competitors. A new project costing a few hundred dollars may have a better chance at funding than established projects requiring large sums. For example, funding a single work by a choreographer is more "cost effective" than the continued subsidy of a large dance company's production budget.

The reaction of government funding to the economy is less clear. The recent flap over National Endowment for the Arts funding of performance artists invoked the bureaucrat's greatest fear: adverse publicity. This situation, more than economic health, apparently prompted several government agencies to entwine arts funding with the goals of cultural or ethnic groups within the community they serve.

As support funds dwindle, less money reaches fewer projects. Challenging and non-mainstream projects often are victimized by this funding climate. Hopefully, when the economy rebounds, we'll all be too busy producing artistic works to bother with "who deserves the money" issues. Until then, it's important to understand the goals and limitations of potential funders if you want their support.

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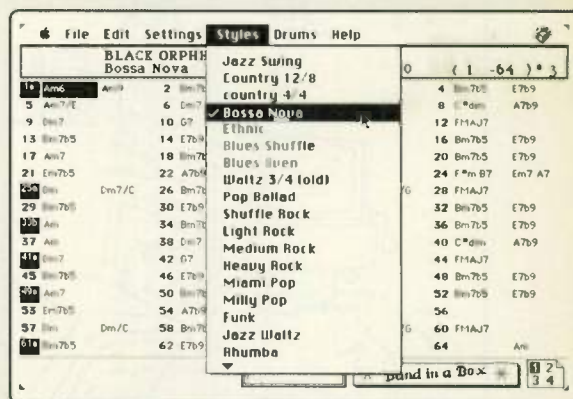
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● GRANTS

fee. Contact your local bar association to find attorneys in your area who provide pro bono services to artists. Other professionals, such as accountants, lighting designers, graphic artists, conductors, arrangers, and choreographers often support interesting projects with free labor.

THE MONEY HUNT

Now for the fun part: finding other people's money. Research libraries throughout the U.S. and overseas provide valuable information for artists

seeking financial support. These libraries are staffed with knowledgeable people who are extremely helpful with grant applications. A healthy amount of research should uncover foundations that fund your type of project. Then it's just a matter of matching your goals to those of potential funders. Don't consider this hours of tedious library research, because it's really a treasure hunt.

Comprehensive research is important. Foundations frequently complain about administering funding requests

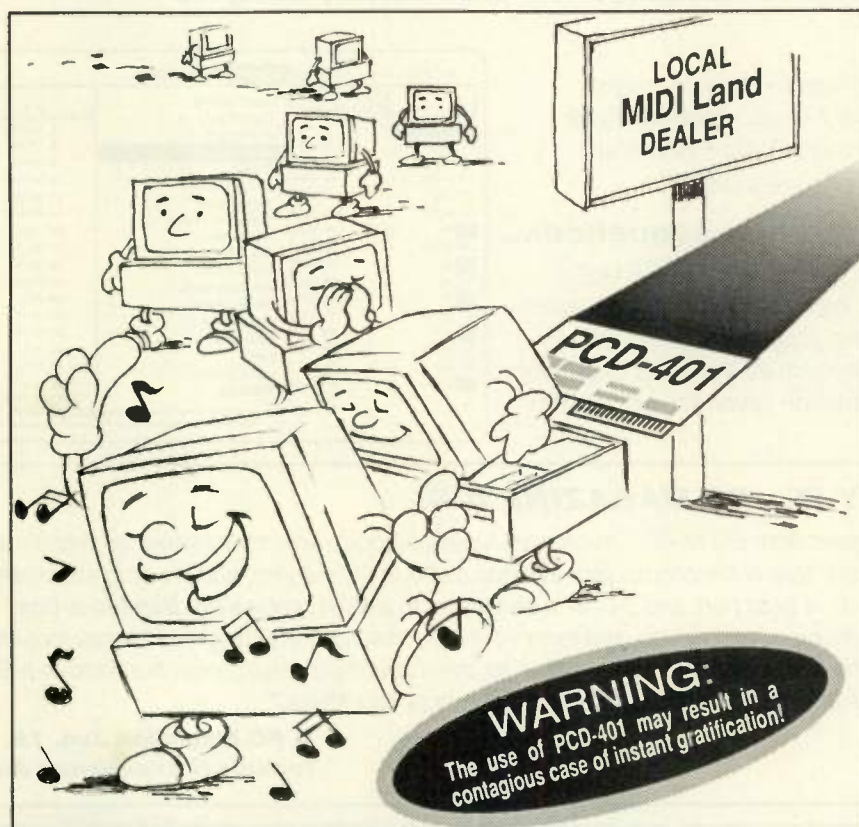
for projects outside the scope of their organizations. Funders, both private and public, have the decidedly non-commercial desire to make the world a better place. Every foundation has its own idea of how to accomplish this. Don't try to convince an organization dedicated to bringing symphonic music to inner city school children that they need to promote gamelan music in the bayou. Success is unlikely if you blindly approach foundations for support they do not provide. Some limit gifts to a specific area or segment of the population, or support only certain types of art. Many funders want to pay for equipment, while others prefer underwriting artist salaries. Don't forget to compute foundation application and funding deadlines into your business plan. It's useless pursuing a funder for advertising money that you wouldn't receive until after the show.

DON'T GIVE UP

It is not considered unprofessional to confirm the details of a particular grant application. Don't be afraid to call a foundation and inquire if they still fund your type of project. Be sure your application information remains accurate. Ask if they provide guideline forms and if they review applications prior to formal submission. For the most part, funders are quite helpful. They exist to donate money. Some larger foundations offer seminars that teach applicants how to submit a successful grant application. But even without direct foundation assistance, enough guidelines are available through government agencies, foundation libraries, fiscal sponsors, and organizations such as The Grantsmanship Center (see sidebar "Funding Information") to ensure a good chance of acquiring funding.

However, frustration and blind alleys are as common in the nonprofit world as in the commercial music market. Each of my successful grant applications is over-balanced by ten "regrets" letters. Fortunately, the successful grants have provided funds for everything from hall rental to musicians' salaries. I've been paid for composing the music I want to play, and no funder has ever told me what music that should be.

Stephen Dick, a composer, guitarist, and writer living in Los Angeles, does the best he can with what he's got.



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Transforms a quiet PC into a powerful music workstation with a 16-bit, CD quality music sound source and a MPU-401 compatible MIDI interface.

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*This guarantee is valid through participating dealers only. Please verify prior to purchase. A full refund, less 10% handling and resending charge, will be provided upon receipt of the complete (including both install & Cubase software package) in undamaged condition and within the 30 day period. This offer is extended to March 31, 1992.

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Cubase



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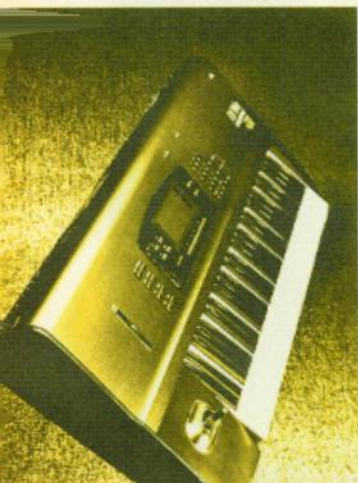
*How to Make Better Musical
Equipment Purchases*

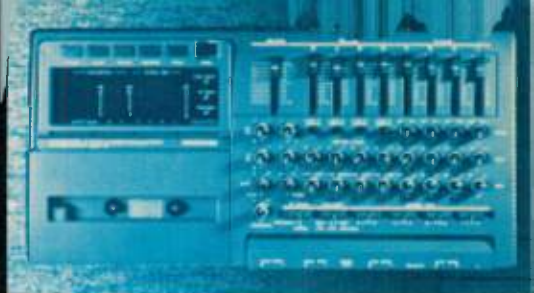
*C*aveat emptor! Buyer beware! If you're anxious about making your next purchase, you're not alone. With so many products to choose from and new technologies popping up faster than bytes can travel down a MIDI cable, it's a wonder people buy anything.

If you can't wait to get that killer MIDI widget, but you dread wading through a sea of spec sheets or negotiating a fair price, read on. This article should bolster your confidence and help you get the most for your MIDI dollars.

By Steve Peka

PHOTOS BY RON MILLER





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World Radio History

SQUARE ONE

Do not pass "Go," do not spend \$200 (or even two cents) until you decide what you want to accomplish with the equipment you buy. Think in terms of specific activities, such as playing with a band, learning to read music, or producing demo recordings of your songs. Most problems arise not because people buy bad products, but because they buy the wrong products for what they want to do. In addition, planning your system helps avoid unnecessary expenses. MIDI has a way of inspiring the most parsimonious people to previously unthinkable heights of reckless financial abandon.

Figs. 1 (The Home "Edutainment" System) and **2** (The Songwriter's System) show two typical systems designed around two common areas of interest. You don't have to shell out big bucks for all this equipment just to get started. Start with a single piece and build from there.

THE HOME EDUTAINMENT SYSTEM

With the advent of technology, learning is becoming more fun, and music learning is no exception. Home music "edutainment" systems (systems that provide both education and entertainment) are becoming increasingly popular. If you're planning such a system in your home, look for equipment that's easy to set up and use.

Start with a piano. Some digital pianos offer a few extra sounds and minimal sequencing capabilities, which is enough to get you started. After your daughter leaves for Juilliard to become the next Alicia de Larrocha, you can get down to some serious fun with a computer and new sound module.

THE SONGWRITER'S SYSTEM

Songwriters often combine acoustic instrument sounds with MIDI tracks. Ideally, that means using a multitrack tape machine and a sequencer, MIDI keyboards and sound modules, and some kind of synchronization. Using a multitrack allows you to record several passes through a song, laying down different tracks each time. Having sync capabilities also allows you to play extra MIDI tracks in mixdown along with parts you already have on tape.

First buy a keyboard to help you write songs. Then, after you spend six months polishing the material for your first

album, buy a multitrack and microphone and start recording your demos. Purchase a quality cassette deck for your mixdowns. When your album hits the *Billboard* charts, ask your record company for an advance to buy a computer, a DAT, and various other goodies.

MODULAR VERSUS ALL-IN-ONE SYSTEMS

These days, a single instrument offers weighted keys, a huge collection of sampled sounds, a sequencer, digital effects, and multitimbral operation. There are two main advantages to this all-in-one system: There are no cable connections to make between the components, so setup and troubleshooting are a breeze; and you need only learn one instrument to perform many different functions. This type of instrument is perfect for people who want to

can find excellent introductory-level programs for under \$100.

Notation Software. Some fine, beginner-oriented notation programs also are available for well under \$100.

Music Education Software. Most educational software to date has concentrated on ear-training, but there are now keyboard skills programs, and some delightful general music programs for children.

MIDI interface. Don't spend a lot of money here. The most basic MIDI interface should suffice.

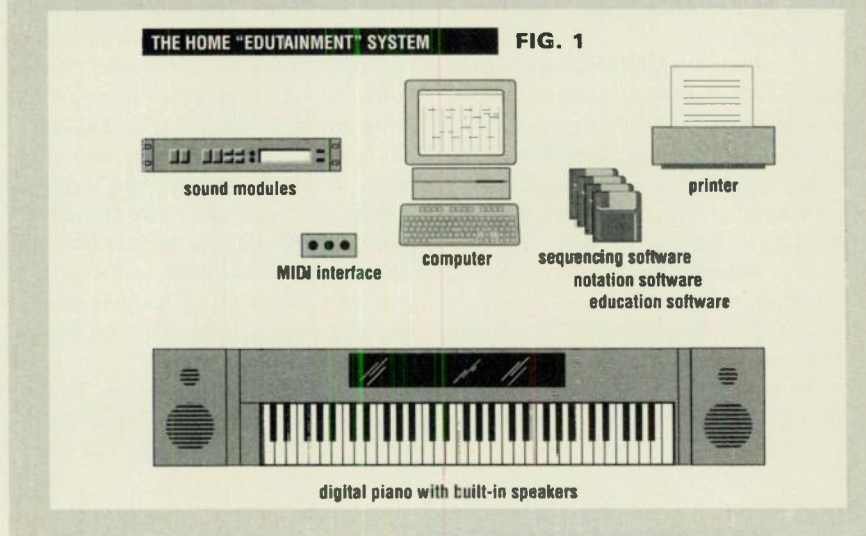
THE HOME "EDUTAINMENT" SYSTEM

Digital Piano. Many digital pianos have built-in speakers and audio inputs for use with other sound sources.

Multitimbral Sound Module. Most digital pianos don't have a wide variety of other sounds. An inexpensive sound module is a great way to expand your system.

Personal Computer w/Printer. The computer is certainly an option, but there is so much good, inexpensive music software available that you should seriously consider one.

Sequencing Software. You



pursue a number of different musical activities but need to get up and running in a hurry.

Its disadvantages usually lie in the area of price and performance. Recently, a friend asked for advice on a purchase. He had told a salesperson he needed a system with an 88-key weighted keyboard, a wide variety of sounds including an excellent piano, and multitimbral sequencing with floppy disk-based storage. The salesperson showed him a single instrument that met all of his criteria perfectly. My friend was quite pleased with the instrument, but decided to call me for some last minute advice. I suggested he instead take a modular approach, which would offer more music for the same money.

For roughly the same price as the workstation, most modular systems offer more than twice the sound-pro-

● BUYING GEAR

ducing capability, notes, channels, and sequencer tracks (see Fig. 3). You could lower the price of the modular system even more by choosing a less expensive, 88-key controller (which start at around \$900).

Don't immediately discount the convenience and simplicity of the all-in-one workstation, however. Such an instrument could be perfect if you're new to MIDI or you're buying a system to play live.

DEALING WITH YOUR DEALER

You probably know that dealing with salespeople and dealerships can be difficult. But a little preparation and the right attitude will help you get the best products for your needs at a fair price.

THE SONGWRITER'S SYSTEM

Near-Field Monitors. A basic pair of small monitors is all you need. Don't spend excessively for the privilege of mixing on the same monitors as your favorite producer, but you certainly shouldn't cut too many corners either.

Amplifier. About 100 watts gives you plenty of headroom for peaks. In a pinch, you can use a home stereo amp.

Cassette Multitrack w/ Built-In Mixer. A 4-track will get you by if you don't need to record more than a lead vocal and an occasional backup. However, if you plan to record more acoustic tracks, you should consider purchasing an 8-track machine.

Microphone. Get one decent, general-purpose mic.

DAT Recorder. DAT represents the best price/performance value in mixdown decks. Consumer models that have analog and digital I/O are just fine.

Cassette Deck. Get the best cassette deck you can afford because cassette will be your primary delivery vehicle for several years to come.

Multitimbral Keyboard. Get one good multitimbral synth with a little bit of everything: piano, orchestral sounds, drums, synth sounds, etc.

Personal Computer w/Printer. If you can afford it, a computer will make an enormous difference in your setup. Besides all the great music software available, you can use it to write cover letters, print lead sheets, design your band's logo, and pay taxes on all the money you'll make someday. If you can't afford a computer and the appropriate peripherals (MIDI interface, software, printer, etc.), you can get a good hardware sequencer with synchronization capabilities for around \$650.

Sequencing Software. Find a program that you really like and are willing to learn (you might not need

all the high-end features of professional programs).

Notation Software. To start with, all you need is something that can print lead sheets with lyrics. Don't spend a fortune.

MIDI Interface w/SMPTE. SMPTE is the best way to go for synchronization. The cheapest way to get it is in your MIDI interface.

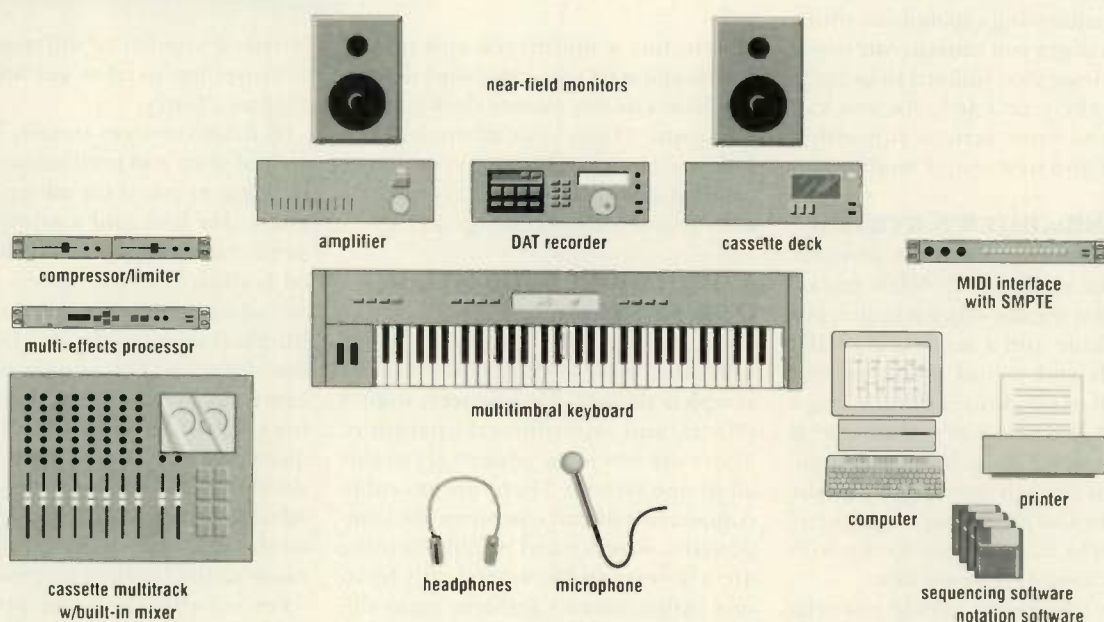
Headphones. You'll need headphones for recording vocals while listening to instrumental tracks on tape. Buy "closed" headphones to cut down on leakage from your monitor mix during vocal overdubs.

Compressor/Limiter. If you're cutting vocals, you'll need a compressor to smooth out their dynamic range. Spend the extra money and get a stereo unit so you can compress stereo material as well.

Multi-effects Processor. Get one good, all-purpose unit with lots of different effects.

THE SONGWRITER'S SYSTEM

FIG. 2



Before you visit the local dealer, do your homework. Read a few magazine articles and find out what equipment other people use. If you live in a large city, visit a music and computer user-group meeting. Salespeople only can sell the products their store carries. If you ask a salesperson, "What's the best drum machine for under \$500," he or she can really only tell you about the best drum machine their store carries in that price range.

Once you've determined what you want, negotiate a price. If you don't negotiate aggressively, you might feel like your salesperson is getting the best of you, but most of us don't have the energy or the inclination to haggle endlessly. And frankly, neither will your salesperson.

There are a few things to remember when negotiating. First, there is no such thing as list price, and street prices vary widely from store to store. In general, bigger stores do bigger business, which should translate into lower prices for you. In general, the

price difference between stores will be between five and fifteen percent. But prices vary as much as twenty and forty percent between large city stores and smaller suburban stores.

As with anything else, it pays to shop around. Get a quote from your local dealer, and then call a few other stores to compare prices. Call a few big stores in different parts of the country (many of them have 800 numbers).

Once you have several competing prices, the fun begins. If you want, you can get on the phone and play one dealer off against another, but I don't recommend it. It's time consuming and, in general, not an especially pleasant experience.

If your local store comes within a few percentage points of your best offer, I suggest you purchase your gear there. You may need help with your equipment after you get it home, and you'll probably need to shop again, so spending money locally makes sense.

If your local dealer can't beat your best price, you have to reevaluate how

much you need the service their store offers. There's no right answer here. Over the years, I have come to the conclusion that good service is probably worth between five and ten percent. If I get a mail-order price quote of \$1,000 for a keyboard, I'll gladly pay \$1,050 to \$1,100 to buy it from my favorite local store. But you need to decide for yourself about the stores in your area. Just as prices vary, service quality also varies tremendously.

A LITTLE MORE ADVICE

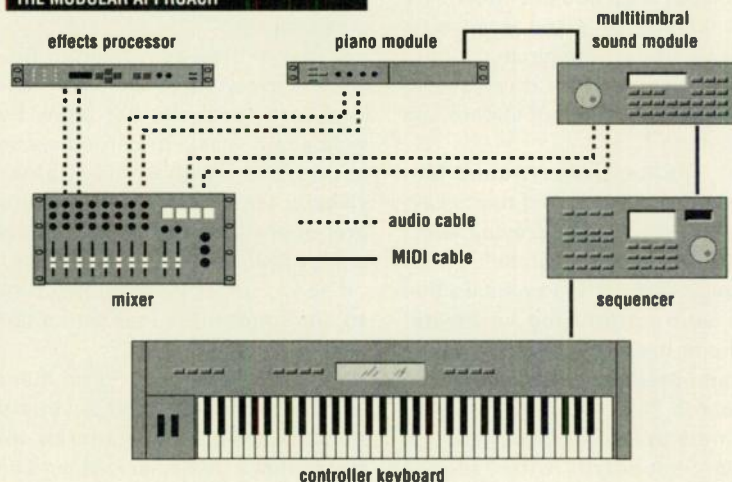
Here are a few miscellaneous tidbits to help you deal with dealers.

Seasonal Buying. It's best to buy during the retail music industry's slow months of January, February, July, and August. Also, stores often have huge inventory clearance sales during these months. The worst month of the year to buy is, of course, December. No matter how much your dealer brims with holiday beneficence, the deal he gives you in December will be that much sweeter in January.

continued on p. 47

ALL-IN-ONE VS. MODULAR SYSTEMS FIG. 3

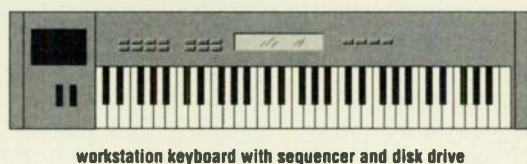
THE MODULAR APPROACH



- Deluxe Controller Keyboard (\$1,750)
(88-Key Weighted Action)
- Sound Module (\$650)
(315 Sounds, 24-Voice Polyphony, 16-channel Multitimbral Operation)
- Sampled Piano Module (\$400)
(16-voice Polyphony)
- Sequencer (\$650)
(128 Tracks, 32 MIDI Channels, Disk Drive)
- Small Mixer (\$250)
(8 × 2 with two effects sends)
- Multi-effects Processor (\$275)
- Cables (\$50)

Total Price: \$4,025

ALL-IN-ONE WORKSTATION SYSTEM



- Workstation Keyboard (\$4,000)
88-Key Weighted Keyboard
200 Sounds in ROM
16-Voice Polyphony
8-Channel Multitimbral Operation
Multi-effects Processor
8-Track Sequencer w/Disk Drive

Total Price: \$4,000

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"Flexible, powerful. Excellent output. Reasonably priced."

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● BUYING GEAR

BUYING A MIDI KEYBOARD

Most folks start out with a keyboard, so it's no surprise that this is the most crowded product area. There are many models available at every price range; how do you sort things out? Here are a few key issues to concentrate on:

Factory Patches. Most people buy an electronic keyboard for the sounds it makes. The best way to evaluate an instrument's sounds is to listen to them, all of them. Just sit there and play every patch. If you find 20 or 30 sounds that you really like, you're doing well. Then listen to the built-in demos if there are any. The demos will give you a pretty good idea of the instrument's multitimbral capabilities.

The Keys. Keyboards primarily come in three sizes (61 keys, 76 keys, and 88 keys) and two styles (weighted and unweighted). Almost everyone wants 88 weighted keys, but most folks just can't afford it. Fortunately, unweighted keyboards seem to be getting better all the time.

No matter what you get, make sure it has full-size keys and is velocity-sensitive (responds dynamically to touch). Beyond that, don't worry about extras like lots of sliders and aftertouch.

The Controller/Sound Module Option. If you can't find a keyboard you really enjoy playing, don't despair. You always can buy a MIDI controller keyboard (a keyboard that lacks sound-producing hardware) and hook it up to a sound module (a sound-producing device with no keyboard). This is usually considerably more expensive than getting a regular keyboard with sounds already built into it, but it gives you more choices.

Polyphony and Multitimbral Capability. The number of notes a keyboard can play at one time (polyphony) and the number of instruments a keyboard can play at one time (multitimbral capability) are important factors. Most keyboards available today have at least 16-note polyphony and can operate

simultaneously on at least six MIDI channels. But some instruments offer 32-note polyphony and 16-channel operation. The more notes and channels an instrument can provide, the more music you'll be able to make with it.

Keyboards for Live Performance, Composing, or Learning to Play the Piano. If you want a live performance keyboard, you need to look for sturdy construction, portability, and something that offers a complete music system in a single instrument.

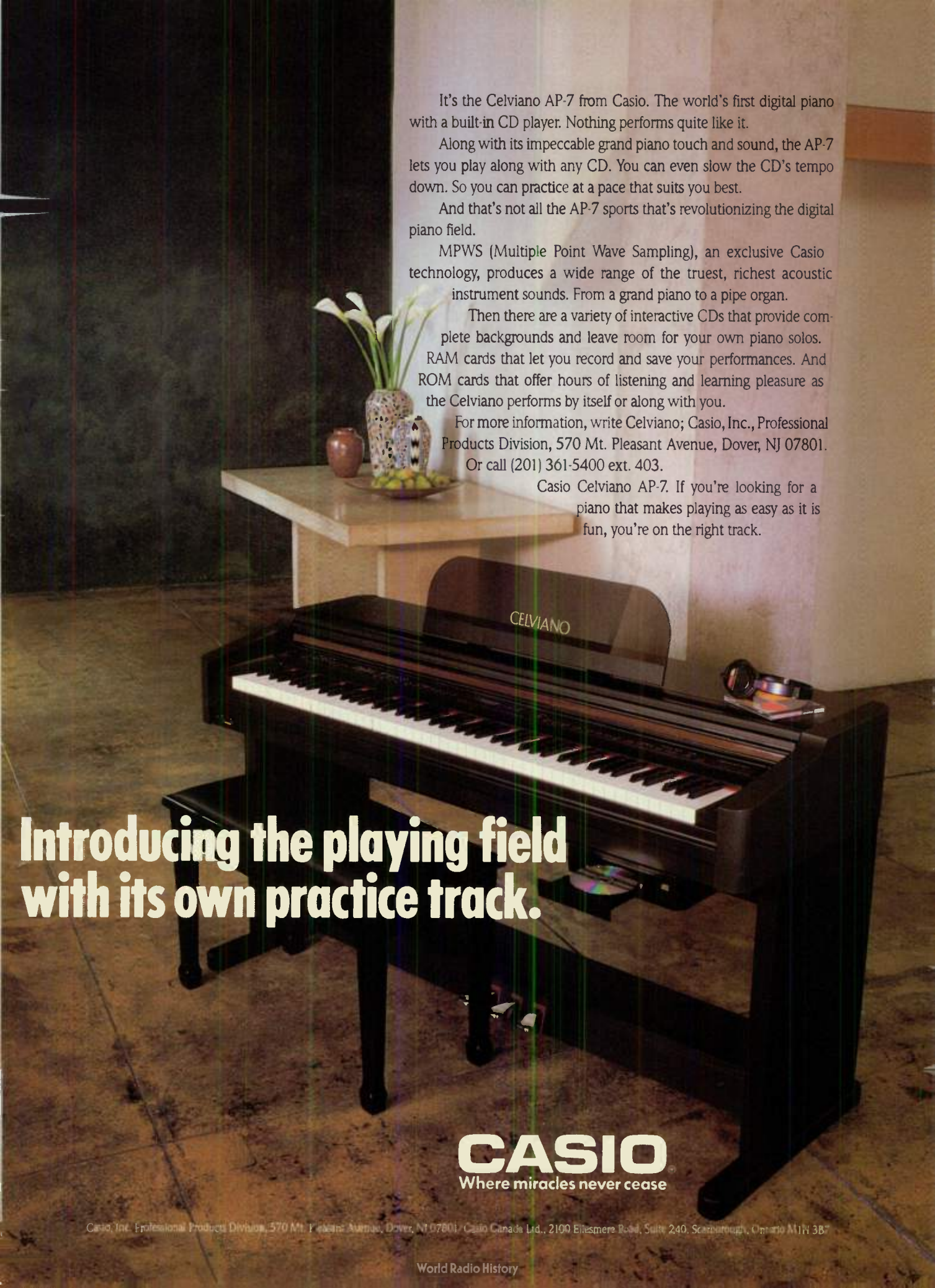
For composing, look for a wide variety of sounds combined with generous polyphony and multitimbral capabilities. If you're looking for an alternative to an acoustic piano (for piano study, for instance), you might want to look into the latest digital pianos.

Consumer Keyboards. These are the keyboards with the wacky features, the non-standard designs, and the super-low price tags. You'll find these instruments primarily in consumer electronics stores, not music stores.

A year or two ago, I would have advised everyone to avoid consumer keyboards entirely. But lately I've seen some excellent bargains, such as a keyboard with 61 full-size keys, velocity sensitivity, 4-part multitimbral operation, and built-in speakers for \$249.

If your budget is extremely limited, you might just look into a consumer keyboard.

Workstations. Some manufacturers advertise their keyboards as workstations. In general, this means that a particular keyboard has a good selection of sounds, multitimbral sequencing capabilities, and a number of other features that support its use as a stand-alone music-making environment. The idea is wonderful, but sometimes the implementation can leave a bit to be desired. As noted elsewhere in this article, you'll almost always get more bang for your buck if you buy a modular system.



It's the Celviano AP-7 from Casio. The world's first digital piano with a built-in CD player. Nothing performs quite like it.

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And that's not all the AP-7 sports that's revolutionizing the digital piano field.

MPWS (Multiple Point Wave Sampling), an exclusive Casio technology, produces a wide range of the truest, richest acoustic instrument sounds. From a grand piano to a pipe organ.

Then there are a variety of interactive CDs that provide complete backgrounds and leave room for your own piano solos.

RAM cards that let you record and save your performances. And ROM cards that offer hours of listening and learning pleasure as the Celviano performs by itself or along with you.

For more information, write Celviano; Casio, Inc., Professional Products Division, 570 Mt. Pleasant Avenue, Dover, NJ 07801.

Or call (201) 361-5400 ext. 403.

Casio Celviano AP-7. If you're looking for a piano that makes playing as easy as it is fun, you're on the right track.

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CONSISTENT SOUND QUALITY: you get the perfect PA sound at one of your regular clubs, then punch the EQ settings into memory. Next club, next button. Instant recall. Great sound.

This is but a small sample of the kind of magic you can achieve with the new MPE Series of MIDI programmable equalizers. The MPE 28 $\frac{1}{3}$ -Octave design. The MPE 14 dual $\frac{2}{3}$ -Octave format. The MPE 47 four-channel fantasy machine. We've combined our proven leading-edge filter technology with micro-processor control and an exclusive built-in software package. The result: actual expressive capabilities never before achieved by any equalizer.

Discover for yourself the new creative dimension that an MPE Series tonal controller can give you. Then let your musical imagination soar.



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● BUYING GEAR

Blow Outs. Sometimes the last few units of a product just don't sell. In this case, most manufacturers remedy the situation with a blowout sale. Suddenly, a product that has been hovering at \$1,500 will be available at \$795. Watch for these super deals. When a manufacturer releases a breakthrough product, keep an eye on last year's model. It may be ripe for a blowout.

Rental Programs. Some stores have great rental programs. For a reasonable fee, you can rent a piece of equipment for a day, a week, or a month. Some stores even let you apply a portion of the rental fee to the purchase of a new instrument. Can't make up your mind between two keyboards? Take each one home for a week and try it out.

Academic Pricing. Some manufac-

turers extend special prices to members of the academic community. These deals are not widely publicized, so if you are affiliated with an academic institution as a faculty member, staff member, or student, ask your dealer about academic discounts.

Deposits and Layaways. Sometimes a salesperson will ask you to put down a deposit to hold a price. It is not in your best interest to do this. If you don't have the money to buy something, you probably shouldn't buy it. If you are unable to make the balance in a timely fashion, your original deposit is tied up and you can't take the equipment. But the best reason not to put down a deposit is that prices in this business fall faster than Custer's cavalry at the Battle of the Little Big Horn. By the time you come up with the balance,

BUYING A MULTITRACK TAPE MACHINE

After keyboards, multitrack tape machines are probably the most sought-after pieces of gear. Because of the incredible success of low-cost cassette systems and small-format, open-reel machines in recent years, there are many different multitrack systems to choose from. Here are a few tips to put you on the right track:

Number of Tracks. If you're just getting started, a 4-track will suffice for demos and songwriting. An 8-track system enables you to do more sophisticated demo work and even low-end audio-for-video projects.

Mixing Boards for Multitrack Recording. Most cassette multitrack systems come with built-in mixers. But if the multitrack you want doesn't, you'll need to buy a board to go with it. In general, look for a board with at least half as many buses as your tape machine has tracks and 1.5 to 2 times as many inputs (e.g., for 8-track recording, a 16 x 4 x 2 board is fine). If you're running any MIDI instruments in the mix, you'll really appreciate the extra channels.

How Good Are These Cassette Multitracks Anyway? The latest 4- and 8-track cassette systems are quite impressive. Some of these units come with very advanced mixers, automat-

ed muting and signal routing (no need for a patch bay!), noise reduction, and built-in synchronization. Cassette multitracks (especially those with high-quality, built-in mixers) represent the best value to be found in analog recording today.

Affordable Digital Multitrack Systems. Many manufacturers are working slavishly to create the first truly affordable (and reliable) digital multitrack tape machine. You might see the first products in this category this year. But it probably will be several years before the the prices drop to something truly affordable (unless \$4,000 for the Alesis ADAT is no problem). People waiting for the digital revolution may be waiting longer than they think.

Consider Your System as a Whole. There's more to recording than just getting a good tape machine. You also need a mixer, microphones, headphones, a mixdown deck, and outboard gear like a compressor/limiter (don't cut a vocal without one). Matching up an awesome tape machine with so-so mics or a board that's too small is bound create a less-than-gold record. When budgeting for a multitrack, consider the other parts of your system.

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THE USED-GEAR BLUE BOOK

Here's a snapshot of the used-equipment market. This is a sample of store prices and classified ads from a variety of sources

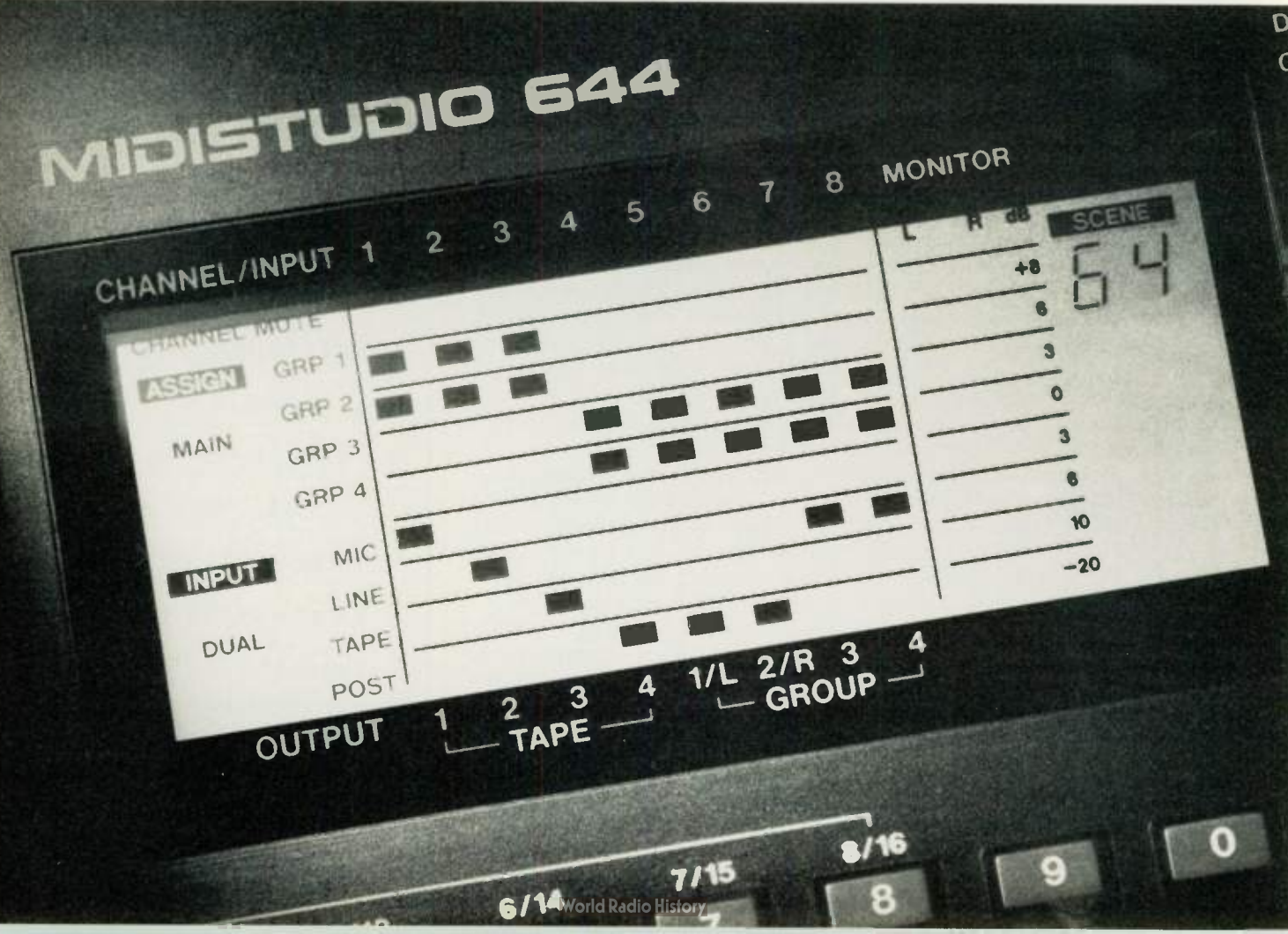
ITEM	HIGH	LOW	AVERAGE
Alesis HR-16	\$300	\$225	\$261
E-mu Emulator II	\$2,000	\$1,250	\$1,503
Ensoniq EPS	\$1,425	\$1,275	\$1,336
Ensoniq Mirage	\$790	\$475	\$537
Korg M1	\$1,350	\$1,150	\$1,254
Roland D-5	\$540	\$429	\$486
Roland D-10	\$750	\$549	\$630
Roland D-50	\$800	\$649	\$719
Roland MC-500	\$550	\$400	\$478
Roland MT-32	\$399	\$249	\$311
Roland R8	\$725	\$600	\$668
Roland TR-505	\$250	\$125	\$175
Tascam 234	\$525	\$400	\$480
Tascam 246	\$650	\$525	\$583
Yamaha DX7	\$700	\$399	\$567
Yamaha DX7II	\$1,350	\$800	\$1,075
Yamaha FB-01	\$229	\$199	\$209
Yamaha TX81Z	\$265	\$200	\$233
Yamaha TX802	\$879	\$699	\$765

that great price your deposit was holding might not be so great. The only exception to this is partial prepayment for a special-order item.

BUYING THROUGH THE MAIL

Ah, the joys of mail order: convenient shopping by phone, lower prices, no sales tax. What could be better? How about receiving the products you ordered? Or being charged the correct amount? In theory, mail order should be the ideal way to do business, but it tends to make even the most callous dealmaker nervous. In practice, you probably won't experience serious problems, especially if you know what you're doing.

In my experience, buying through the mail is not risky. Occasionally, someone processes your credit card number before the product ships, and if that happens near the end of a billing cycle, you may get the bill before you get the goods. Occasionally, someone ships you a floor model. Occasionally, the charge on your monthly credit statement doesn't quite



match up with what the salesperson told you over the phone. But these occasions are the exceptions, not the rule. You'll discover that most dealers, especially those who depend on a high volume of mail-order business, go out of their way to rectify the situation when problems occur.

MAIL-ORDER ETHICS

The existence of mail-order shopping presents purchasers with a small ethical dilemma. Is it acceptable to buy a demo from your local store and then order the product from someone else through the mail? The crux of the argument is this: If everybody bought mail order, your local dealer would cease to exist, and then there wouldn't be any place to get a demo of anything. We all know that isn't likely to happen any time soon, but that doesn't change the merit of the argument. I have come to realize that price isn't everything. Over the long haul, a good relationship with a local dealer who consistently offers good service can be highly valuable.

BUYING USED EQUIPMENT

A shrewd individual will tell you that buying a used car is smarter than buying a new one. The minute you drive a new car off the lot, it loses 20 to 30 percent of its value. Unfortunately, the analogy doesn't work when buying used electronic music equipment. Sure, you can find a good deal if you're lucky, and if you're low on cash, it may be the only realistic option available, but most of the time you're better off buying the latest and the greatest.

So why isn't used gear a good deal? Unlike new automobiles, new computer and music gear gets cheaper all the time. And playing the piano sound on an older FM synth doesn't compare to playing a new sampled piano module.

There are exceptions. Good used buys include vintage gear, ultra low-end gear that is no longer popular, and other equipment essentials rarely affected by technological advances, such as road cases and mic stands.

If you find an attractive piece of used equipment, and you think you've nego-

tiated a fair price, here are a few tips to ensure you get your money's worth.

First determine if everything works (and I mean everything). Take a few minutes to press every key and button. Try every jack and slider. It's a pain, but worth it. Make sure whatever you buy comes with all manuals and boxes. It's also a good idea to ask for a 24-hour trial period.

When purchasing used computer software, ask the previous owner to submit a written document to the software publisher legally transferring ownership to you. This will entitle you to receive the registered-user upgrade price when the next version comes out and you want to upgrade.

Many people try to add value to a deal by throwing in little extras such as cables, cases, or ROM cards. Don't fall for this gimmick unless you plan to purchase those items anyway. A \$200 keyboard case isn't worth a nickel to you if you plan to use your keyboard only in your home.

The used electronic-equipment scene is a real buyer's market. Don't let any-

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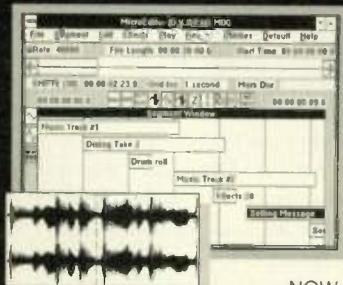
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● BUYING GEAR

one pressure you into making a hasty purchase. If you have doubts, pass. If you lose the item to someone else, chances are you'll easily find something better.

If you have a choice between buying used gear from a music store or an individual, favor the music store. If you're ripped off, you'll have a better chance of resolving the matter. In addition, stores frequently offer short warranty periods (usually 30 days or less).

FINAL WORDS OF WISDOM

Take your time. Shop around. Ask plenty of questions. Don't let anybody rush you. I have seen people take weeks to find the perfect car. They go from dealer to dealer kicking tires and comparing prices until they find the perfect choice. But, oddly enough, many people buying MIDI systems (many of which have car-sized price tags) will drop a bundle after just a few hours in one store. Don't let the "gee whiz" nature of music-technology products coax your wallet out of your back pocket before you know what you're buying and why you're buying it.

Information is your best asset when you go out into the world to spend money on electronic music equipment. Knowing what products are available and how much people are paying for them gives you the confidence to make a smart purchase. Read as much as you can. Talk to more experienced users. Seek advice from music professionals. Research the technology behind various products to determine which equipment or brand best meets your needs.

Buying a new piece of equipment should be an exhilarating experience. One great thing about spending money on music is that you're investing in your own creative growth. You're not buying a big hunk of metal and plastic, you're buying creative potential.

If, after reading this article, you still feel anxious about your next big purchase, hang in there. With a little perseverance and research, you'll soon feel as good about buying equipment as you do about playing it.

Steve Peha is president of Music Technology Associates, a Boston-based group of music professionals providing documentation, product development, and consulting services to companies in the music technology industry.



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SHIFT

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"**T**heodore!
Simon!
Alvin!...
Alvin!...Al-
lllllllvinnn!!!!"
"O H H H H H -
KAAYYY!" For many
of us, the first aware-
ness of pitch shifting
was David Seville's
Chipmunks, whose dis-
tinctive voices were the
product of a basic tech-
nique: changing speeds
on a tape recorder. The impact of the animated trio of
rodents was so great that the classic sped-up, spectrum-
shifted sound they introduced was christened "the chip-
munk effect."

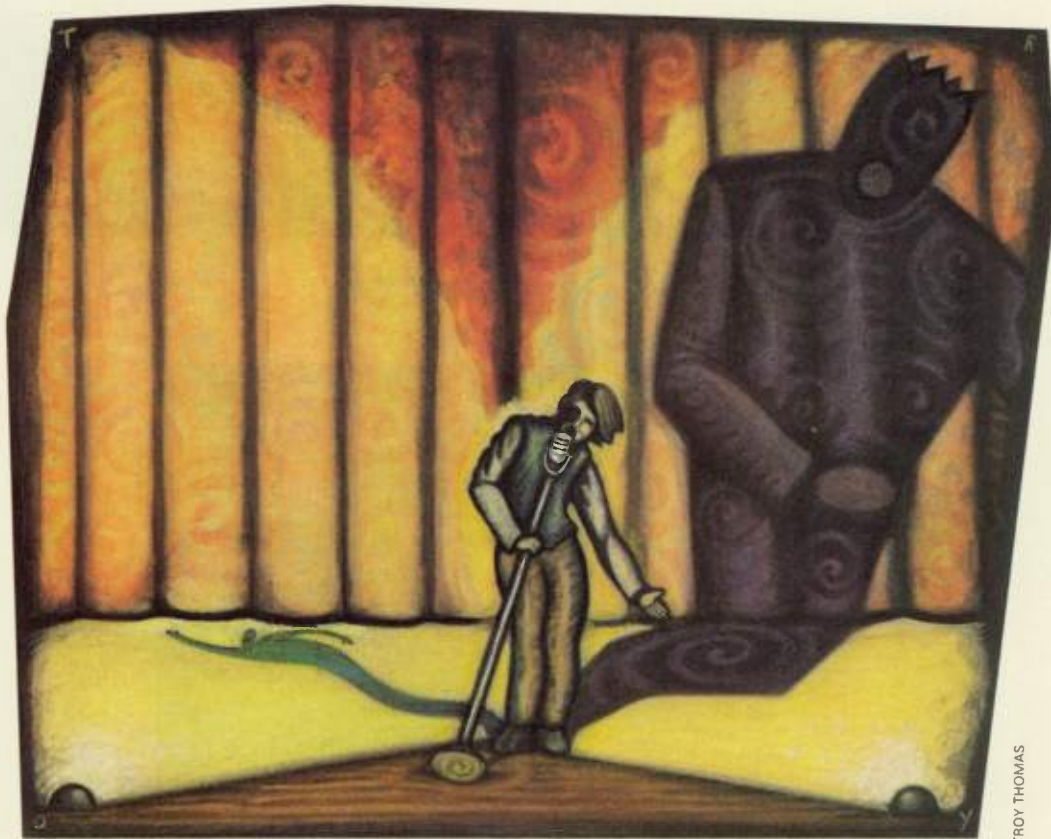
Pitch shifting has grown beyond the role of creating
cartoon voices, however, to become a major player in the
field of sonic enhancement. As with most signal process-
ing, pitch shifting can serve utilitarian functions or evoke
bizarre transformations. It's employed for everything from
fattening vocals to creating spectacular movie sound
effects.

UPS AND DOWNS

Note that we're talking about real-time pitch shifting,

rather than the variety practiced by samplers. Real-time
pitch shifting is achieved digitally in a fashion roughly
analogous to the chipmunk method: Upward shifting is
achieved by reading out samples faster than they came in,
while downward shifting slows the original rate. However,
real-time digital signal processing demands the A/D and
D/A converters run at a constant rate. Resolution of this
apparent contradiction is achieved with a trick: Some sam-
ples are skipped over for upshifting, and additional sam-
ples are added for downshifting. How does a pitch shifter
decide when to add or subtract samples? This question
separates the pros from the toys in the signal processing
world.

The simplest method of upshifting uses a ratio of the



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PERSPECTIVES

BY LARRY OPPENHEIMER

desired output pitch to the original pitch and drops every n th sample. This fixed-splice technique creates some nasty glitches, as it has no regard for what the original signal is or what it's doing. The larger the ratio, the worse it sounds.

"Intelligent" pitch shifting studies one or more aspects of the signal and attempts to choose optimal splice points. The first splice choice is anywhere the signal's waveform crosses 0 volts (called a "zero crossing"). This point usually appears during silence or consonants and obviates signal discontinuities that would occur with a splice between the signal's maximum and minimum values.

The pitch shifter also may perform some degree of analysis on the signal to help with splicing decisions. The most sophisticated pitch shifters (such as the Lexicon 2400) can analyze the spectral content or stereo width of the signal, or even determine whether the signal is voice or music. More basic devices often take the opposite approach and alter the spectral content of the input signal to mask artifacts created by a less-sophisticated splicing algorithm.

A pitch shifter's splicing choices also are limited by the device's sampling rate and RAM buffer. A large buffer allows more time to be used to store and study splice points. Some models have front-panel parameters for adjusting buffer size. However, a low sampling rate limits potential splice points, regardless of the RAM buffer size.

Pitch shifters also possess a certain amount of throughput delay (which often is not constant). Usually this delay increases with decreasing frequency, as splice points are further apart when the period of the signal is longer. However, the exact delay depends on a number of variables, including the sampling rate, size of the RAM buffer, and the specifics of the pitch-tracking algorithm. How much the delay time matters is more dependent on the application. A 30 millisecond delay is hardly objectionable on a pitch-shifted vocal harmony, but the effect would be unacceptable for synchronizing dialog.

Stereo pitch shifters pose yet another fateful question: Is the splicing of the two channels phase-locked? If not,

phase shifts between the two channels can occur that also may yield image shifts on mono material fed to both sides. More basic is the question of whether both channels are examined during splicing decisions. Some stereo pitch shifters, such as Eventide's H3000, only look at one channel. If only one channel is used for splicing decisions, that channel probably will sound pretty good, while the other may not.

STEREOIZING

Judicious and subtle use of pitch shifting evokes a stereo effect from a mono signal without introducing the image shift caused by delay lines, or the pitch and image wobble created by chorusing. For instance, a lead vocal sounds more full when the original track is panned to center, a slightly upshifted version (two to ten cents is plenty) is panned to one side and a version downshifted by the same amount to the other side (Fig. 1).

Variations on this effect can be created by playing with the panning of the three images, using unequal amounts of pitch shift for the two shifted images, changing the relative amplitudes of the images, or introducing delay to one or more of the images (try adding a few milliseconds of delay to the original signal). This technique processes two vocals by cross-panning a single pitch shift for each vocal. (Pan vocal 1 to the left and its pitch-shifted image to the right; Pan vocal 2 to the right and its pitch-shifted image to the left.)

"Of course, common sense dictates that pitch shifting an out-of-tune vocal track can have ugly results," says recording engineer John Cuniberti, who has worked on guitarist Joe Satriani's recent albums. "Use the technique more freely on instruments like synthesizers, which should be in tune to start with, or you can redo or pitch-correct an out-of-tune track before applying the stereo processing."

MODULATION EFFECTS

Many pitch shifters allow modulation of the pitch shift and/or delay time. This creates an exquisite shimmering effect. On one album project, I was looking for a spooky, unnatural bass sound, but not so radical that the bass became unrecognizable. The DigiTech IPS33B offers two

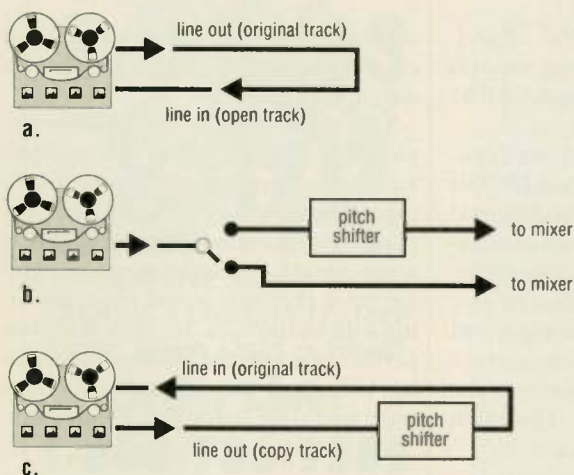


FIG. 2: Fixing off-pitch vocals requires (a) copying the vocal to an open track; (b) correcting the new track by adjusting the pitch shifter; then (c) punching the corrected vocal line(s) back into the original track.

ences (African, Celtic, and Middle Eastern) that use harmonies other than standard Western ones.

POST PERFECTION

Another popular use of pitch shifters is pitch correction (compensating for an out-of-tune performance or off-speed

pitch shifter sharp by five or eight cents, depending on how flat I thought the performance was. When I come to the offending word, I use the console mutes to switch from the original vocal to the pitch-corrected version for just that word, then switch back. I continue to make adjustments until I've cor-

tape deck). Most producers fall back on pitch correction for a flawed vocal as a last resort; it's better to get the right performance. But there are times when the feeling of a performance is so strong it can't be duplicated.

"Let's say every time the vocalist sings 'love' in the first verse of the song, it's flat. I transfer the entire vocal line to an open track (Fig. 2) and insert a pitch shifter on the return of the copied track," instructs Cuniberti. "Because 'love' is always flat, I adjust the

rected the pitch of that one word, then bounce it back onto the original track (since I wouldn't use up a track for a handful of pitched vocals). I work my way through the entire song this way."

Some musicians scorn pitch correction. It can be abused to make singers sound better than they are, but it puts a producer in a real bind when an otherwise great vocal performance is marred by a single sour note (as in Stevie Nicks' "Edge of Seventeen"). Punching in the pitch shifter to correct this one flaw can save the day.

In the right hands, pitch shifters are a valuable and useful tool. In the wrong hands, they are even more fun. Either way, remember that creativity doesn't stop when the music and lyrics are finished.

(Thanks to John Cuniberti, Greg Curda of Paramount, Steve Barber of Lexicon, and Rick Bos of DigiTech.)

Larry the O is an active producer/engineer and a performing musician who has been contributing articles to *EM* since its second issue.

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essential in digital mastering. And because the MDC is fully stereo, all the left/right balance stays intact.

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GROOVES

The Art of Deejay Mixing



JOSHUA ETS-HOKIN

For the past twenty years, the union of electronic musicians and technology has stretched the frontiers of composition to the point where musical innovation often is a byproduct of science. However, a select group of men and women who use fast hands and vinyl records instead of sequencers and samplers consistently pioneer musical innovations. We're talking about disc jockeys. Despite sneers from "serious" musicians, the deejay personifies a true roots culture of sound that draws inspiration and material from the widest reaches of the musical universe. The commitment to innovation serves one purpose: to get down and party.

TOOLS OF THE TRADE

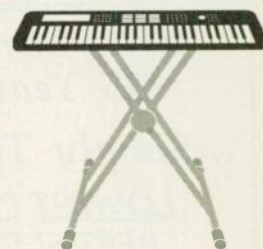
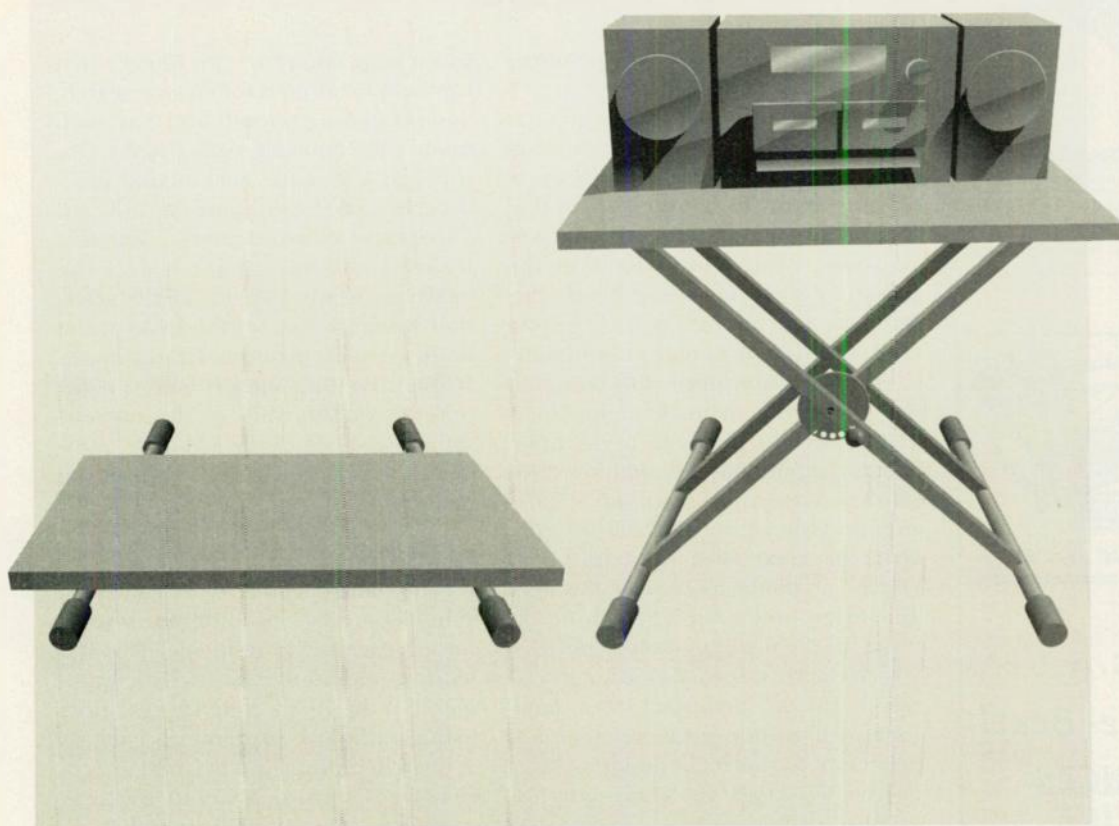
In the beginning, club mixing was strictly radio-style: Mixing consoles, turntables, and deejays were transplanted from a local station. But as discos gained popularity in the 1970s, manufacturers designed mixers and turntables specifically for the needs of club deejays.

Technics' direct-drive turntable (see Fig. 1), with its fast run-up speed (stable rpm within one rotation of the

By Mike Klasco and Pamela Michael

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• DEEJAYS

disc) and high motor torque, was a major innovation. The patented design included a motor strong enough to withstand constant slip-cueing, where a turntable platter is spun backward and forward until the deejay finds the desired place to start the record playing. In addition, the platter and other components are made of non-resonant materials, the head shell and needle are configured to make sighting a cue "drop" easy, and the finger lift is high enough to make handling the tone arm simpler.

Stanton phono cartridges, popular in radio stations and record libraries, became the standard in clubs because of their ability to handle backcueing (manually turning a record counterclockwise while the stylus is in the groove). Backcueing was used for years strictly as a technique for cueing up to the beginning of a cut, but eventually it led to the now-notorious "scratching" (deliberate manual manipulation of the disc to produce a rhythmic effect). Legend has it scratching started when a deejay inadvertently left the monitor volume up while idly playing with the next disc he had cued. Though no doubt apocryphal, this story illustrates how creative techniques evolve in the world of dance clubs.

With the vinyl record nearing its last gasp, several manufacturers have attempted to address the needs of mix and remix engineers by designing deejay-friendly CD players. These units fea-



Fig. 1: Technics SL-1200MK2 direct-drive turntable enhances deejay manipulations with a fast run-up speed, powerful motor, and accessible tone arm.

ture a large knob (the "joy wheel") that can be spun around for cueing, search, and scratching operations. One such model, the Numark 6020 (Fig. 2), features an automatic beat-mixing function that has stirred some controversy. ("Deejays mix, not machines.") The controller's microprocessor counts the beats per minute (bpm) of the selection being played. It then looks at the music cued on the other CD transport. If the incoming song is within eight percent of the bpm of the current song, the speed of the opposite transport is automatically shifted until the beats match.

REMIXING

A dance club deejay is expected to provide fresh, new, and different sounds for an often-fickle audience. This has led to some innovative uses of equipment. In the 1980s, club deejays began using outboard equipment, such as drum machines, samplers, effects processors, and synthesizers to augment their sound.

Bruce Forrest, a New York club deejay, pioneered the use of the drum machine in discos. Forrest was famous for leaving the turntables entirely in the middle of a mix and crushing the dance floor with preprogrammed drum loops. Other times



Fig. 2: As the vinyl record fades into history, CD systems such as Numark's 6020 protect the deejay's art with joy wheel cueing and tempo controls.



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he ran the drum loop with one hand and did voice drops and special effects with the other.

It is a deejay's job to provide a continuous flow of music, so they always are exploring new ways to move from one record to another. The "seamless segue" was brought to the level of an art by early deejays, who went on to develop a whole repertoire of effects created by manipulation and interaction of turntables.

Direct-drive turntables let the deejay manipulate tempo to achieve better rhythmic continuity between songs. Deejays began calculating the number of beats per minute for each song with a stopwatch to facilitate song sequencing. (However, changing speed also changes the pitch of a record, so variations must be limited to a few percent.) The hunt for the seamless segue requires most deejays to spend one hour of pre-production for every hour of actual club play.

As club mixes of popular songs became an art form, deejays began experimenting at home. Instead of real-time mixes in the DJ booth, they practiced and remixed tapes for sale at the clubs. The idea of (dance) remixing was born. A burgeoning business has cropped up in response to the demand for these fresh, highly engineered mixes. New markets, such as aerobics classes and health clubs, have prompted enterprising sound techs to obtain remix rights to current songs. Sometimes these rights are provided at no charge by record companies who have learned the promotional value of a hot remix.

Remixing has become so standard that some record companies regularly release as many as eight or nine alternate mixes of a record. Commercial remix companies, such as Razormix in San Francisco, sell subscription mixes to deejays and others. Each month three or four custom records remixed by Joseph Watt, Razormix's owner and founder, are sent to members. Also available are subscription services that provide the tempos (in bpm) of all the top songs of the day, as well as other pertinent information (intro and tag lengths, song key, etc.).

Remix artists suggest the early part of the mix should sound enough like the radio version to engage the audience; in the second half, you can let loose. Sometimes remixes become so popular

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they crossover from clubs to radio-waves. In some cases, a remix gets radio airplay even when the original did not.

MUSIC PROGRAMMING

No matter how sophisticated the setup, a deejay must be most concerned with building energy and changing the mood on the dance floor. This requires a smooth, harmonious flow of one song into another, which is accomplished in two ways: beat mixing and harmonic-key combining.

In beat mixing, most deejays begin a set with 30 minutes of music set between 95 and 100 bpm. Song speeds are gradually increased as excitement builds, reaching a climax at about 130 to 135 bpm. Initially, music programmers sequenced dance sets with tempo-matching and a personal feel for which tunes worked together. In 1986, a Florida disc jockey named Stuart Soroka devised a chart showing which keys are compatible and marketed it to deejays, furnishing them with song-by-song

information about key, chord progressions, and tempos. Adding harmonic-key matching to beat matching ensures that transitions avoid the "freight train" (overlapping unsynchronized rhythms) or a "sour mix" (overlapping instruments not in tune with each other).

PRO RAPS

Michael "Mixxin" Moore. A Los Angeles deejay and remix producer, Moore translated New York club techniques into a West Coast sound that uses samples of other records, movie dialog, vocal clips, nature sounds, and other oddities. Moore cites the legal perils of sampling other sources for commercial use and the creative limitations of "biting" (copying) other people's work as the impetus for his more personalized approach to mixing.

Using some of the same techniques that studio producers use, Moore might sample a drum roll and "fly it in" to the mix, or record an "oohh" and loop it. He might extend the intro, or take an instrumental break and add a pre-recorded "Get up, clap your hands, get up," or a similar vocal clip to incite audience reaction.

Moore transfers much of his source music from CD to reel-to-reel before mixing, preferring to manipulate tape. He also samples from vinyl records because "a little analog dirt can add a lot of interest and realism." He doesn't use much equalization, except to pump up the bass a little.

"Mixers should pay attention to the song lyrics," suggests Moore. "There's as much happening in the words as in the melody or beat."

Ted Cousens. Deejay for Emeryville, California's, state-of-the-art dance club Politics, Cousens still does his beat timing with a stopwatch. This is to ensure the timing is right and calculated to his particular equipment. The Politics deejay booth (which Cousens helped design) is uncharacteristically positioned near the center of the dance floor and has fully isolated turntables that sit upon metal beams set in concrete slabs.

Like most deejays, Cousens carefully selects tempo progressions to shape a dance floor ambience. Prewritten delay programs set to specific tempos are used to kick into eighth or sixteenth notes for extra oomph at the end of a

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World Radio History

● DEEJAYS

selected measure. Cousens' control panel can access satellite stations, the stage mike at the comedy club next door, assorted VCRs, and an Akai S950 sampler to spice up mixes.

Paul Evans. Beat reigns supreme in deejay mixing, maintains deejay Paul Evans of the nightclub Silver Sound in Frazier, Pennsylvania. No matter how processed a mix may be, the most basic skill for dance mixing remains the beat match. To illustrate, Evans provides a play-by-play of beat mixing:

"The current song is playing in the club from a CD. You are listening to it with one ear, while the other is monitoring the next cut with a single-cup headphone. As the CD music continues playing, you start the turntable, and with your finger you push and catch the record and try to synchronize the beat with the CD player. When you catch the beat, listen for how long the tempos match. If you stay on the beat only three or four seconds, the beats are probably off by a considerable amount. Try to determine (here's where experience counts) whether the

record is slower or faster than the CD. Then make an adjustment to the variable speed control and repeat the process until you've caught the beat again. If seven or eight seconds pass without either song falling out of beat (train-wrecking), you've established both sources at the same speed.

"Wait for the vocal passage on the CD to stop, and have the needle of the turntable lined up at the beginning of the record's instrumental passage. As the CD's instrumental passage begins to play, start the record by pushing it right on the beat and then bring up the volume control for the turntable on the mixer until both sources are playing in the room. You are now in the middle of a beat-to-beat transition mix. Fade the CD volume control down and give the turntable volume a little extra push until the record takes over.

"If you're really good, you will then adjust the bass, midrange, and treble on the mixer to compensate for any equalization differences between the record and CD. You don't want a major shock; the bass might be too over-

whelming or the record may sound dull in contrast to the CD. Sometimes you need to boost the bass or slap the mids to increase the impact as you mix. Do whatever it takes to generate excitement on the dance floor."

QUICK FADE

Disc jockeys move in a world that may seem far removed from that of a MIDI composer sitting in front of a computer. But in reality, deejays and electronic musicians do the same things. Both take the raw materials of sound and meld them together to create a listening experience that (hopefully) is exciting and rewarding for an audience. And by being where the action is, deejays often are a musician's link to the hearts of the people. Many musical innovations that define modern pop music developed from this relationship between deejays and dancers.

Pamela Michael is a freelance writer and radio documentary producer in Berkeley, California. Mike Klasco is technical editor for DJ Times magazine.

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Making Waves

By Scott Wilkinson

To make beautiful music, you need to understand the principles of the (sound) waves.



GORDON STUDER

Anyone reading this magazine is probably involved with sound in one way or another. After all, sound is the most fundamental building block of music. Most people can subjectively describe a sound as high or low, loud or soft, and it's relatively easy to distinguish between a violin and a trombone. But what are the physical characteristics of sound that cause these perceptions?

If you've never been exposed to the fundamental principles of sound, take heart: They're quite easy to understand. In this article, you'll learn about the physical phenomena associated with sound as well as some basic terms used to describe its properties.

CATCH A WAVE

When you hit a drum, it causes the drum's surface material, or drum head, to vibrate. This motion imparts a certain amount of energy to the air molecules immediately adjacent to the drum head, momentarily creating a region of higher-than-normal air pressure as the material moves outward.

However, air is elastic, which means that it tends to return to its normal pressure if it's not constrained. The

energy imparted by the vibrating material must go somewhere, so it moves to the neighboring air molecules a bit farther from the surface. These molecules then become momentarily compressed with higher-than-normal pressure.

This starts a chain reaction in which a region of air is compressed and then returns to its normal pressure, passing the energy of the compression to the adjoining region. It is important to understand that the air molecules themselves do not travel along with the region of high pressure; they vibrate in their own vicinity, somewhat like walking in place. It is the "energy" that travels outward from the source.

Meanwhile, the material moves inward, creating a momentary region of lower-than-normal pressure adjacent to its surface. This region also moves away as the material pushes outward again and creates another region of high pressure. This process repeats itself as long as the material continues to vibrate, which causes alternating regions of high and low air pressure to expand and move away from the sound source.

This expanding pattern of high and low pressure regions is called a *sound wave*. Again, air molecules do not move

with the sound wave, as many people mistakenly believe. Individual air molecules vibrate in their own vicinity as the air pressure around them changes. It is the *pattern* of high and low pressure that travels, or *propagates*, outward from the sound source (see Figure 1).

WAVE TERMS

If you measure the air pressure at a particular point in space, you will find that it alternates between slightly higher-than-normal and slightly lower-than-normal as a sound wave passes by. This often is depicted in a graph of the pressure as it changes over time (see Figure 2a).

The variation of pressure from its maximum value to its minimum value and back to its maximum value is called one *cycle* of the sound wave. The number of cycles through which the pressure fluctuates in one second is called the *frequency*. As you might guess from this definition, frequency is measured in *cycles per second*. In honor of the contributions to the study of sound by the German physicist Heinrich Hertz, cycles per second are also called *hertz* (abbreviated Hz).

As human beings, we are unable to

perceive a sound wave with a frequency of 7 Hz as shown in Fig. 2a. Theoretically, the lowest frequency that we can detect is 20 Hz; the highest is 20,000 Hz, or 20 *kilohertz* (abbreviated 20 kHz). In musical terms, this is a range of about ten octaves. As we grow older, the upper end of this range drops; most adults have an upper limit of about 14 to 15 kHz or so.

What we perceive as musical pitch is determined primarily by frequency. For example, the note A above middle C that is normally used to tune an orchestra is at a frequency of 440 Hz. As the frequency increases, we describe the note as being higher in pitch. The lower the frequency, the lower the pitch.

The speed at which a sound wave travels depends on the medium through which it is traveling. For example, the speed of sound in air is about 1,100 feet per second; in fresh water, it's about 4,900 feet per second. The speed of sound also depends on the temperature of the medium; lower temperatures result in slower speeds. Interestingly, the speed of a sound wave does not depend on its frequency; all frequencies travel at the same speed through a given medium.

The physical distance between one area of maximum pressure and the next is called the *wavelength*. This can be depicted in a graph of the air pressure as it changes over distance (see Fig. 2b).

WAVE MATH

The frequency, wavelength, and speed of a sound wave are related to each other. Using a simple formula, it's possible to calculate the wavelength of a sound wave if you know the frequency, and vice versa. The formula is:

wavelength = speed of sound / frequency.

Let's try this formula on the lowest frequency that humans can perceive. At 20 Hz (assuming that the sound wave is traveling in air),

wavelength = $1,100 / 20 = 55$ feet.

At the highest frequency detectable by humans,

wavelength = $1,100 / 20,000 = 0.055$ feet = 0.66 inches.

So the wavelengths of sounds that we can hear range from 55 feet to just over half an inch.

Another important characteristic of sound waves is the difference in pres-

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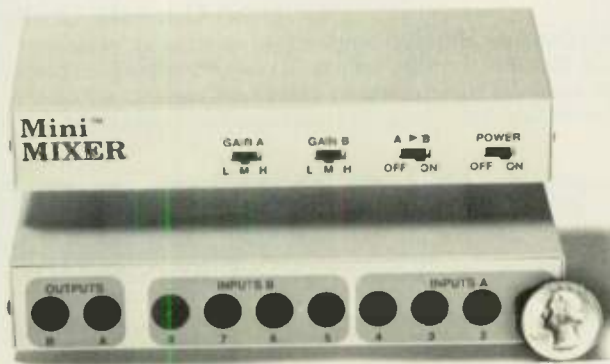
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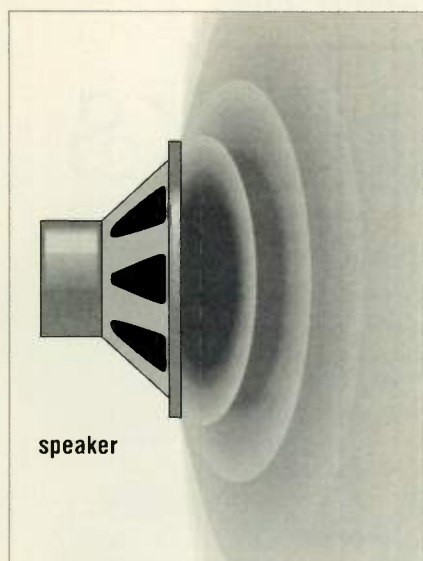


FIG. 1: Sound waves consist of alternating areas of high and low air pressure that propagate from a vibrating speaker cone through the air to our ears.

difference between the highest and lowest points. This difference is called the *amplitude*, and it determines the volume or intensity of the sound. The greater the amplitude, or the greater

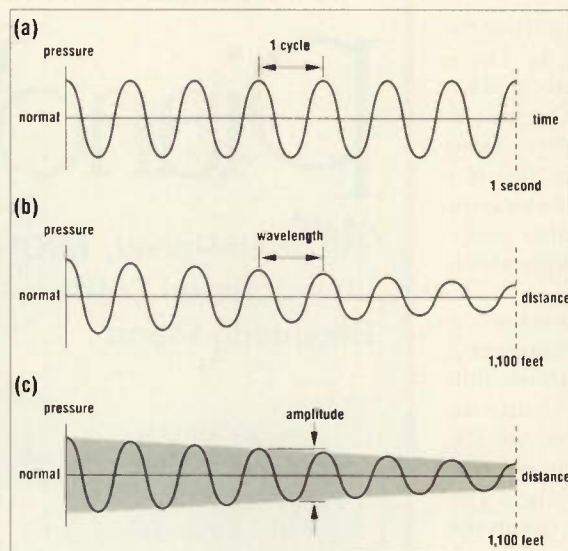


FIG. 2a: Frequency of a sound wave. In this example, the frequency is 7 cycles/second, or 7 Hz, which means that each cycle takes $\frac{1}{7}$ second to complete.

FIG. 2b: Wavelength of a sound wave. As in Fig. 2a, the frequency is 7 Hz, which means that the wavelength (in air) is 157 feet.

FIG. 2c: Amplitude of a sound wave. As in Figures 2a and b, the frequency is 7 Hz. Notice that the amplitude decreases as you get farther away from the source, even though the wavelength and frequency remain unchanged.

the difference between the highest and lowest pressure in the wave, the louder the sound.

In Fig. 2c, you'll notice that the amplitude decreases as you move away from the source. This is because there is a fixed amount of energy carried in a sound wave. As the wave travels away from the source, it expands in a spher-

ical pattern, similar to a balloon being blown up.

A light bulb, which gives off a fixed amount of light, provides another analogy. The light from the bulb travels in all directions at once. As you move farther away from the bulb, the light appears to get dimmer. The bulb is producing a constant amount of light, but

THE MISSING LINK

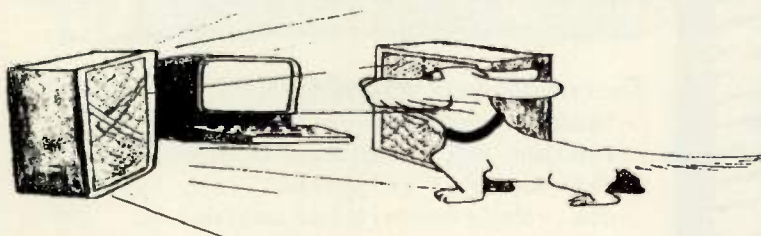
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less of it is getting to your eye. Sound works in a similar way. The sound source is producing a constant amount of sound, but less of it gets to your ear as you move farther away.

Amplitude is specified in several ways, of which the most common is a unit of measurement called the *decibel*. The details of this measurement are too complicated for the scope of this article (for more on the decibel, see "The Decibel Demystified" in the April 1990 EM). For now, suffice it to say that humans can distinguish between about 250 different levels of amplitude, from the softest audible sound to a level that's painful to hear.

WAVEFORMS

If you examine exactly how the pressure changes over the cycle of a sound wave, you can determine its *waveform*. Does the pressure suddenly switch from low to high and back again, or does it change gradually back and forth? Does it rise steadily from low to high, then suddenly drop to low before repeating the cycle? Does it change erratically with no apparent pattern?

Fig. 3 illustrates some of the common waveforms found on older analog synthesizers. As you can see, these waveforms are relatively simple. The waveforms produced by most musical instruments are far more complex. Even so, a waveform must be regular (that is, it must repeat itself with a constant frequency) in order to exhibit a recognizable pitch.

Almost 200 years ago, the French mathematician Jean-Baptiste-Joseph Fourier discovered that any waveform can be distilled into a series of *sine waves*, which are the simplest possible waveforms. These sine waves can be of different frequencies and amplitudes, and are collectively known as the *harmonic spectrum* of the waveform. Individually, they are called *harmonic components*.

The harmonic spectrum is normally depicted in a bar graph that reveals the frequency and amplitude of each component (see Fig. 4). The component with the lowest frequency is called the *fundamental*.

The harmonic components of a complex waveform can be of any frequency, but most waveforms with a recognizable pitch consist of components that are whole-number multiples of the fundamental frequency. For example,

continued on p. 108

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Apple System 7.0

By Steve Oppenheimer

The latest system software for the Macintosh opens new doors, but should you venture through them?



GORDON STUDER

The ballyhoo surrounding the release of Apple's System 7.0 for the Macintosh excited a lot of power users, but many everyday Mac owners hesitate to take the plunge. It has been many moons since a Mac operating system was acclaimed as "revolutionary," but as desktop computer op systems go, System 7.0 appears worthy of the sobriquet. The new system offers not only new features, but a dramatically different way of thinking about Macintosh applications. It also has an early reputation for being the most bug-free new Mac system in years.

As a result of the new system's revamped structure, however, many applications must be upgraded to run under it, and at this point, few music programs implement all its features. If you need to spend all your resources on immediate music and business production and can't allocate time to learn and implement System 7.0, it may make sense to wait. Still, Apple's latest op system offers a lot right now, and its huge potential may make it worthwhile to jump in as soon as possible. Let's peek through newly revealed doors and consider the potential benefits and drawbacks of upgrading.

KEY FEATURES

To begin with, forget Finder-only operation; System 7.0 always runs in *MultiFinder*. The move to *MultiFinder* and the segregation of controls, preferences, and a few other things into separate system sub-folders is part of Apple's effort to incorporate mini/mainframe file, communications, and memory-management tools into the world's friendliest user interface. For example, multitasking allows you to edit a sequence while *concurrently* printing a score or track sheet and downloading a file via modem in the background. Of course, the impact of this time-slicing arrangement on your real-time response is determined by what you select to run concurrently.

Two Inter-Application Communications (IAC) features, Publish and Subscribe and Apple Events, have long-term significance for both music and business applications. However, these features, which allow different programs to exchange information and functions, must be incorporated into specific applications. This is an important caveat, as it's still uncertain when the majority of music-software programmers will issue upgrades to support IAC.

Publish and Subscribe lets you dynamically link documents created by different applications. A change in the published, or *edition*, file automatically is updated in all subscribing documents. Say you're working on a song that exists in a sequencer, and you've transferred it to a notation program. Then you decide to change a few things in the sequence and want the notation file to reflect the changes. If you publish the data in the sequencer file as an edition and subscribe to it in the notation file, you only need update the edition, and the notation automatically will be updated. (You could go the other way, too, publishing the notation document and subscribing to it in the sequencer.) Perhaps you would like to write your lyrics in a word-processor, create your logo in a graphics program, and subscribe to them in all score files of a notation program; changes could be performed, as needed, in the original applications and automatically updated in all your scores.

Apple Events allow 2-way communication between active applications. This lets the programs access each other for specific tasks. For instance, instead of capturing data from a synth with your librarian, editing, and reloading to the



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synth, then switching to the sequencer's SysEx functions to capture the updated librarian dump, you could trigger the librarian's functions from within the sequencer, which grabs the resulting dump (assuming both programs support Apple Events).

Apple Events will have a significant impact on multimedia creation, too. When Apple Events and QuickTime (discussed in the November 1991 "Computer Musician") are implemented in music applications (expected in early 1992), multimedia creators will be able to play, in the background, digital audio and sequences created in programs such as Passport's *AudioTrax*, triggered from within, and in sync with animation from, programs such as Macromind *Director 3.0*.

In the long-term, Apple Events may prove the most far-reaching aspect of System 7. Eventually, IAC could lead to powerful software systems incorporating specialized modules from different vendors, rather than huge, integrated programs with overlapping functions. Why write lyrics with a text editor in an oversized notation program when

you can integrate a module from a company that specializes in word-processing with a proportionately smaller notation module from a music software company?

UNDER AN ALIAS

With System 7.0, the Apple menu no longer is limited to DAs and open applications. Now you can put anything—an often-used document, application, or DA—in the Apple menu for quick access (see Fig. 1). All you do is put the program or file in the Apple Menu Items sub-folder within the System folder. For instance, say you have a large score, a database, and a big sequencer file you need to work on over a few weeks. Instead of digging through folders, just put the documents in the Apple menu and launch them as needed.

You don't even have to move the actual application or document to the Apple Menu Items sub-folder; just place an *alias* there. Aliases are small (about 2 KB), duplicate icons that point to an application or file; when you double-click on an alias, the application

and/or document is launched or brought to the foreground.

Since aliases are just launchers, not copies, you can place multiple aliases in various locations without using much disk space. For instance, you could create a single folder that includes aliases of all your MIDI programs and current works, regardless of the folder in which they actually reside. This one-stop folder also can be moved or duplicated into the System/Startup Items sub-folder within the System folder, so when the computer is booted, all programs and files are opened and ready for immediate use.

MEMORY ENHANCEMENTS

System 7.0 offers two new applications-memory features, but 32-bit addressing is the one with immediate promise for musicians. If your machine supports it (see "System 7.0 Requirements"), this feature provides the ability to address as much RAM as is physically installable (up to 128 MB on the IIsi, IICI, and IIfx). While a 16 or 32 MB system may seem a costly endeavor, consider the payoff in terms of productivity. Using 32-bit mode and a lot of RAM will provide enough memory to record, edit, and play huge arrays of audio and video data for memory monsters such as multimedia, sampling, and recording audio directly to disk.

At present only a (rapidly growing) handful of MIDI vendors support 32-bit operation, and only the newer Macs are capable of it. But those with 32-bit machines can install enough addressable RAM to take full advantage of System 7.0's multitasking capabilities.

Unfortunately, the other new memory feature, virtual memory, is problematic for MIDI. In layman's terms, by swapping out pages of RAM data to disk, the computer is tricked into accessing unused hard-disk space as if it were additional RAM. However, virtual memory is much slower than RAM and can be a nightmare for MIDI applications, since the Mac could map out sections of a buffer while recording a sequence, or delay recording and playing while the system is swapping data to and from the disk.

One solution is to wait for Apple to deliver a *MIDI Manager* that includes controls over virtual memory management, mapping, and scheduling. But the only currently available solution is to disable virtual memory with the

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majority of MIDI applications.

MORE FEATURES

System 7.0 lets you create, for any application, preformatted templates called *stationary pads*. Stationary documents are duplicated when opened, so the original is not overwritten. These could be used to create preformatted forms for scores, track sheets, lyric sheets, contracts, etc.

The ability to communicate between applications and set up templates combines with TrueType typeface management to add considerable punch to your published works. TrueType, Apple's version of scalable fonts, replaces bitmapping to provide smoother lettering using any point size. You still can use PostScript Type 1 fonts such as Sonata, Seville, and Petrucci.

Increased productivity isn't confined to a single Mac. For the multi-Mac studio or school, the era of the "sneaker-net" is over. File-sharing lets network users share data without electronic mail or AppleShare. After five minutes spent in the Users & Groups file within the Control Panel folder, a person can con-

trol who has access to what, even if the other Macs aren't yet running System 7. And aliases let you access files and even applications on a remote, networked Mac, controlling a multi-processing operation from one computer.

System 7.0 boasts a lot more improvements, such as customized colors; balloon help (context-sensitive help that pops up in a comic strip-like dialog balloon); a file-finder that works; the demise of *Font/DA Mover*; and DAL (Data Access Language), which lets you use a spreadsheet or a word processor to access information from a mainframe or network database without knowing the database's query language. Many of these features can help your daily computing, but the aspects mentioned—especially Apple Events, Publish and Subscribe, 32-bit addressing, and alias-

es—seem the biggest news for electronic musicians.

SYSTEM 7.0 COMPATIBILITY

For most Mac users, the biggest factor in choosing System 7.0 is upgrading programs to run under it. Apple classifies programs as either not compatible, System 7.0-compatible, or System 7.0-friendly. While "compatible" pro-

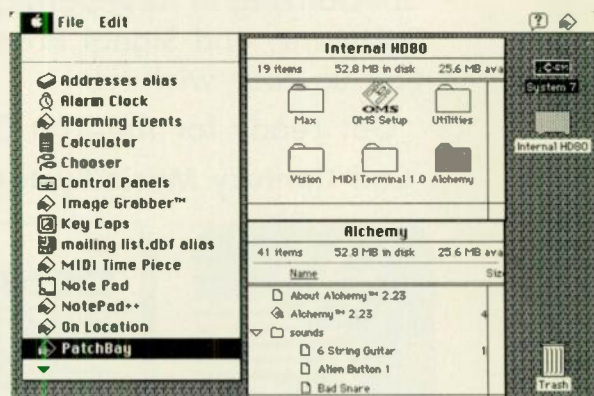


FIG. 1: On the redesigned System 7.0 desktop, you can place any document application, or alias—a duplicate icon that represents a file—in the Apple menu (left). When you view files by name (lower right window), you can open folders and see within them.

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grams run normally under the new system, "friendly" programs also implement its advanced features, especially Apple Events, Publish and Subscribe, TrueType fonts, 32-bit addressing, balloon help, and virtual memory.

Apple provides a *HyperCard* stack Compatibility Checker that identifies the programs on your disk as compatible, but its list is limited and includes few music programs. You'll have to ask the manufacturers if your versions work with System 7.0. Upgrade and compatibility information also are available from user's groups, bulletin board services, and Mac magazines. (Until System 7.0-compatibility becomes the norm, **EM** will note compatibility or "friendliness" in all "What's New" announcements and reviews of Mac programs.)

In some cases, incompatible programs that are critical to your work may prevent you from making a complete system switch until you can get upgrades. One possibility, albeit a painful one, is to install System 7.0 on a second hard drive or removable-cartridge drive and switch between systems as needed. But before you start switching systems back and forth, be aware that System 7.0 has a different desktop structure than earlier systems. If you boot System 7.0, the boot volume's desktop automatically is rebuilt, and you are prompted to rebuild the desktops on all mounted volumes. To return to System 6, you must remember to manually rebuild each volume's desktop, including the startup volume. Otherwise, System 6 will bomb. (To rebuild the desktop, hold the Command and Option keys and select Restart.)

The desktop-rebuilding game progresses slowly and gets old quickly. To avoid the whole mess, *Switcher 1.1* offers you a choice of systems at boot-up and automatically rebuilds the desktop when necessary. It's available from BMUG (Berkeley Macintosh User's Group; tel. [510] 549-2684), either on disk, or from the members' online BBS (tel. [510] 849-2684). Also, Opcode Systems' Doug Wyatt has written an INIT—incidentally, INITs now are termed "System Extensions"—called *Desktop6/7* that is supposed to eliminate the rebuilding blues. Members of the Performing Artists Network (PAN) BBS can download *Desktop6/7* free from the Opcode forum; others can contact Opcode Systems (tel. [415] 369-8131).

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SYSTEM 7.0 REQUIREMENTS

Apple says that almost everyone can use their new System 7.0 for the Macintosh, although it may require a hardware upgrade. Minimally, a hard disk and 2 megabytes of RAM is required, although 4 MB is needed to take advantage of multitasking. (System 7.0 always operates in *MultiFinder*, but you need enough memory to run multiple applications.)

This means that Mac 128, 512, 512ke, and XL owners are shut out of the System 7.0 world, and their only direct upgrade path is a new computer. The Mac Plus, SE, Portable, and Classic and the 68020-based LC and Mac II can run the new system, but without 32-bit addressing or virtual memory. A 68020-based machine can use virtual memory with the addition of a Paged Memory Management Unit (PMMU) chip. The Mac II with PMMU, IIx, IICx, and SE/30 won't support 32-bit addressing but can run System 7.0 and use up to 14 MB of virtual memory.

If 32-bit mode, with its ability to address 1 GB of virtual memory and all the RAM you can fit, is important, a

IIxi, IIci, IIfx, or one of the newest models (Classic II, PowerBook 170, Quadra 700 or Quadra 900, all of which require and ship with System 7.0.1) is required. (Apple is giving away Connectix' *Mode 32*, which adds 32-bit addressing to 24-bit, 68030-based machines. It's not as elegant as having a 32-bit-clean ROM, though.)

For \$99, an Apple dealer will sell you the complete System 7.0 Personal Upgrade Kit, including the official documentation and *HyperCard 2.1*. Some Macintosh user's groups, such as BMUG, offer the new system to their members, but without the *HyperCard* upgrade and the official doc. BMUG, for instance, charges members \$25 for the system software and substitutes one of several books for the Apple documentation. (Non-members can get System 7.0 plus a 1-year BMUG membership for \$60.) Preparation is essential before installation, so read the documentation carefully and use the *Installer*.

SHOULD YOU UPGRADE?

System 7.0 offers good benefits now

and great power for the future. By early 1992, many Mac applications will be upgraded to some degree of compatibility or friendliness. Most music programs run under System 7.0 now, although most aren't "friendly." Once applications developers begin to stretch the new system's limits, especially the IAC features, your perception of Mac computing will change dramatically.

You may not want or need more operating system than you have. If you're on System 6.0.5 or 6.0.7 and need a proven, productive operating system, you're already running it. But if you have the hardware to run System 7.0 and want to take advantage of the latest in Mac computing power, you should upgrade. If you're on a network, and your software is compatible (even if not System 7.0-friendly), you should upgrade immediately. In the end, you won't regret it.

(Special thanks to Constantine "Dean" Peters.)

Steve Oppenheimer, EM's multi-tasking managing editor, wants to upgrade his brain to System 7.0.

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3579C) USING MIDI, Casabona & Frederick. An intermediate-level manual with a hands-on approach.



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3557C) MUSIC & TECHNOLOGY, H. P. Newquist. Here's a hip new book for absolute beginners that'll get you up and running in the world of MIDI and home recording. Clearly explains what gear you'll need for a studio, and provides introductory coverage of sampling techniques, music software basics and signal processing aesthetics. Answers many of the common questions and clarifies much of the confusion encountered when first diving into MIDI. ©1989, 198 pp. (P) \$16.95

3572C) THE MIDI HOME STUDIO, Howard Massey. The heart of this fast, practical course on setting up a MIDI studio is a detailed explanation of the components you'll find in a MIDI system, followed by seven illustrated examples of typical studio configurations. Includes an overview of MIDI basics and an introduction to synchronization. ©1988, 77 pp. (P) \$14.95

3569C) MIDI FOR GUITARISTS, Ward & Cutler. MIDI isn't just for keyboard players anymore! This guide to the guitar-MIDI connection demystifies MIDI modes, gives tips for faster tracking, provides troubleshooting advice, and offers seven examples of typical guitar-based MIDI systems. Includes quick coverage of MIDI and synthesis basics, a chart on the various program change numbering schemes, glossary and soundsheet. ©1988, 80 pp. (P) \$14.95

3556C) MIDI SEQUENCING FOR MUSICIANS, Jim Aikin, ed. The main thrust here is an exploration of features found in almost all sequencers, and in-depth product reviews, including Sequencer Plus Mark III, Creator, Q-Sheet and Finale. Also looks at hardware sequencers, discusses the sequencer's place in a complete music system, and gives an overview of MIDI fundamentals. ©1989, 137 pp. (P) \$14.95

PA411D) 1990 HOW MIDI WORKS, Dan Walker. This supplementary manual for the intermediate-level MIDI user discusses multitimbral synths, MIDI workstations, music software and recording considerations. Recently expanded and revised to include a history of MIDI, a current equipment listing and a new look at applications. ©1989, 187 pp. (Spiral) \$24.95

3554B) MUSIC AND THE MACINTOSH, Geary Yelton. An exciting new title for Mac users only, that can help you find the right music software for your studio. Features profiles of 18 major programs, clear advice on configuring a studio, and tips on mastering the Mac. Lavishly illustrated with tons of screen dumps; includes glossary, index, and manufacturer listing. ©1989, 199 pp. (P) \$16.95

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3559C) SYNCHRONIZATION, FROM REEL TO REEL, Jeffrey Rona. Finally, there's a book that will answer your questions about synchronization.

Thoroughly explains theory and use of click pulses, FSK, SMPTE and MTC, with lots of hands-on applications tips and guidelines for system configuration. Whether you're slaving a drum machine to a sequencer, or doing full-blown soundtrack work, the clear language and ample illustrations provide practical solutions. ©1990, 120 pp. (P) \$16.95

951A) THE MIDI POSTER, Castalia Publications. This slick new reference chart belongs on the wall in every MIDI studio. It shows MIDI note numbers and corresponding keyboard/staff notes. Includes a glossary of MIDI terms, explanation of MIDI modes, list of controller numbers, and much more. Available in laminated version for extended life and durability. ©1989, 24" X 36"

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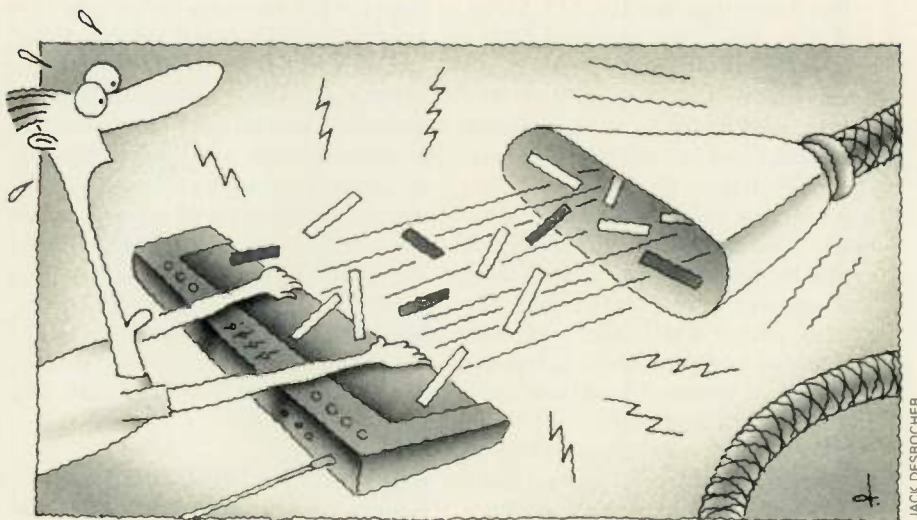
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JACK DESROCHER

Q. Is it safe to vacuum out the inside of equipment to remove dust and debris? I've heard that vacuuming generates a lot of static electricity. I recently removed the keyboard from my Kurzweil K-1000 synth to replace some contacts, and there was a lot of gunk inside, underneath. I wiped this out with a damp cloth, as I was afraid that the vacuum would zap some sensitive integrated circuits nearby.

A. A vacuum cleaner can generate a static charge by tribolic interaction ("friction") of the air with surrounding materials. Moreover, a human body makes a pretty good capacitor to store such a charge, especially in dry, indoor, winter air. Nonetheless, it is reasonably safe to vacuum the case areas that don't contain PC boards or electronic components, such as the area in which the keyboard mounts. *Do not vacuum PC boards.* For added safety with metal-cased instruments, connect a jumper cable from the case (attached to a bracket or screw) to a water pipe or an AC-outlet coverplate screw known to be grounded. The case will serve as a ground to drain static charge.

Be sure to wear an anti-static wrist

strap (Radio Shack catalog number 276-2397, or equivalent), grounded as above, when performing this procedure. In dry climates and in work areas that have electric, resistive heating, it is a good idea to operate a humidifier in the shop area. To avoid the airborne dispersal of the minerals commonly found in tap water—the dreaded "white dust"—use distilled water in the humidifier. (Bottled, distilled water is expensive. A solar distillation unit makes a good do-it-yourself project in these cases.)

A reader, in response to my reply regarding Ensoniq ESQ-1 cartridge data errors (June 1991 "Service Clinic"), reported fixing a similar problem after blowing dust and debris off the main PC board in the area of the cartridge ribbon. This is worthwhile to consider; depending upon the electrochemical characteristics of the contaminant, the temperature, and the humidity, the dust can cause problems.

Note that the common home-workshop practice of using a hair dryer, set to "cool," to blow dust and debris away from the interior of equipment should be approached with extreme caution. The electrostatic field produced by

such a device is considerable, especially if it recently has been used in the "heat" setting. Compressed "air" in a can (Radio Shack Dust Remover, catalog number 64-2325, or equivalent) is a safer choice.

Q. Your response regarding the Korg T3 with distortion problems (September 1991 "Service Clinic") couldn't have been more timely. I have a Korg T1 with the same problem. Are the affected output transistors (Q2, Q3, Q4, and Q5) the same, and are they the same type (C2878)?

A. They are the same; the T1, T2, and T3 use the same type KLM-1373 DAC/LPF/IO board. Note, however, that on noisy units, the transistors should not be indiscriminately replaced. Test for other possible defects before proceeding.

Q. I found the information on cassette interfaces (October 1991 "Service Clinic") helpful, but I'm confused about one thing: If I record data using a component cassette deck, should I record on both the left and right channels? If so, how might I accomplish this? If not, does it matter which channel I record on?

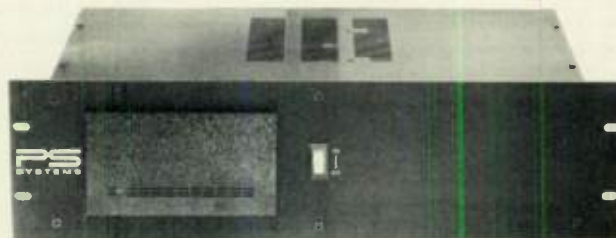
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Q. Can I use a Walkman-type cassette deck to record data from my synths?

A. You can record on one or both channels; it makes no difference. I often have wondered if, when recording both channels simultaneously, the high signal levels and high harmonic content used in data recording could cause out-of-phase crosstalk and attendant data errors, but I never have observed this to be the case. Indeed, both channels are used on most factory data-cassettes, and when data is recorded on inexpensive, monophonic, portable decks, it is recorded automatically on both. To record data on both channels simultaneously, you can use an input Y-adapter. The combined impedance of the parallel inputs should be high enough to prevent excess loading of the signal.

It is acceptable to use a Walkman-type cassette recorder for data storage, assuming that the recorder allows any onboard noise reduction to be disabled during recording and has mic or line inputs that are compatible with the output level of the synth data interface. You'll need an appropriate adapter cable.

Retrieving data can be a bit complicated. Unless the recorder provides line outputs (many don't), you'll have to use the headphone jack. Obtain a stereo mini Y-cable (Radio Shack 42-2475, or equivalent). These normally terminate in two RCA phono plugs, so you'll also need the appropriate plug adapters. Alternately, you could simply cut off the RCA plugs and install phone plugs, one 1/4-inch and the other 1/8-inch, to accommodate various cassette input jacks. (Of course, this is useful only if data is recorded on both tracks of the data-cassette.) Note that data retrieval is possible only with machines that allow noise reduction to be disabled during playback.

Q. I'm repairing a Roland RD-250 electronic piano (November 1991 "Service Clinic"), and I noticed the replacement membranes come in strips that are all the same length, but the original strips are different lengths. Is it okay to cut them to fit? In replacing the stop-felts, when is it necessary to replace the felts under the keyboard?

A. Replacement membrane strips often are supplied in uniform lengths and are intended to be trimmed, at the

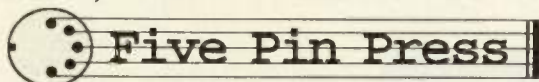
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ndentations, to fit. It is important to duplicate the pattern of segments of the original strips. Use the old strips as a guide. Strips can be cut with scissors; gently pull the strip, bilaterally, at the cut, to facilitate this.

Note that once cut, the shortest strips in the RD-series instruments become quasi-symmetric and might inadvertently be installed backward. The lower contact buttons install toward the rear of the keyboard.

The stop-felts below the keyboard normally last through several replacement cycles of the stop-felts above.

Q. There's something rattling around in my Yamaha DX7 synth. Should I take it to a service center for a check-up?

A. Is it ever of use to open up a dead synth to look for a loose wire, or the like, in an attempt to fix it? That's the first thing anybody ever thinks about: "Maybe it's a loose wire."

A. A rattle can be a sign of trouble. The first service procedure I perform on incoming gear is the "shake test": I pick it up and shake it to see if anything's loose. The noise you're hearing could be a plastic chip from a cracked key—a non-conductive and relatively benign bit—or it could be a paper clip or loose screw just waiting to short out the CPU board. Take the unit in for service if you do not feel qualified to disassemble it yourself.

While a loose wire as a source of failure is rare in a synthesizer, the underlying principle of checking the basics first is a sound one. The first procedures that I perform upon opening a "dead" unit (after attempting a reset) involve checking the electromechanical integrity of all the relevant subassemblies and testing the fuses, AC input, and power supplies. Only after these basic areas are determined to be trouble-free are more complex diagnostic procedures initiated. Nonetheless, the panicked practice of disassembling a non-working instrument in search of a "loose wire" minutes before a gig and without recourse to the proper tools and skills often creates more problems for the user and more business for service centers.

EM contributing editor Alan Gary Campbell is owner of Musitech™, a consulting firm specializing in electronic music product design, service, and modification.

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Reviews

Korg 01/W Music Workstation

By Scott Wilkinson

A leading synth maker improves on the world's most popular keyboard.

Korg pioneered the concept of the MIDI keyboard "workstation" back in 1988, with the best-selling M1. The combination of a keyboard controller, multitimbral sound module, sequencer, drum machine, and signal processor allowed the musician to realize entire arrangements

(with the exception of vocals and other acoustic sound sources) using a single device. While some would argue that a true workstation must include digital recording for vocals and other acoustic parts, there is no doubt that instruments such as the M1

(and the subsequent T-series) have provided an integrated and cost-effective means of making music.

With the 01/W, Korg has managed to improve on many aspects of the M1 and T-series while lowering the cost. Although the 01/W has no sample RAM, there have been some significant enhancements to the polyphony, sound generation, sequencer capacity, signal processing, and expressive potential of Korg's latest offspring.

DOWN TO BASICS

The new instrument is available in two versions: the 01/W and 01/WFD. The

only differences between them are the size of the sequencer memory, SysEx storage capability, and the inclusion of a 3.5-inch floppy disk drive in the FD model. Both versions feature a 61-note, velocity- and channel aftertouch-sensitive keyboard, 32-note polyphony (twice that of the M1 and T-series), 16-part multitimbral operation, and four outputs. The sequencer offers sixteen tracks (again, twice the number on the M1 and T-series) and greater note capacity than the M1 (7,000 notes—not events—on the 01/W and 48,000 on the 01/WFD). Interestingly, the 01/W retains its sequencer memory even after the power is turned off, while the FD does not (presumably because the user has a disk drive with which to save sequences).

As with many contemporary instruments, the basic sound source is a large selection of 16-bit, PCM multi-samples called "Multisounds" (255 onboard in 6 MB of ROM, as opposed to 100 in the M1 and 190 in the T-series). In addition, there are 119 drum and percussion sounds (as opposed to 44 in the M1 and 85 in the T-series). Many of these sounds are newly sampled, although some have been taken from the M1, T-series, and even the Wavestation. In addition, up to 2 MB of additional ROM can be online with the new higher-capacity PCM cards available for the 01/W.

VOICE ARCHITECTURE

Korg has enhanced their Advanced Integrated (AI) synthesis and called it "AI²" on the 01/W. This form of synthesis employs a signal path much like the old analog synths, except that the signal is entirely digital until you get to the outputs. In the original AI, a Multisound is assigned to an oscillator and passed through a variable digital filter (VDF) and variable digital amplifier (VDA), all of which can be modulated in various ways. This signal is then sent to the effects section and on to the outputs.

As shown in Fig. 1, AI² adds a new pro-



RON MILLER

The Korg 01/W's spartan front panel conceals its distinctive sound-creation capabilities. The FD version (pictured) includes a 3.5-inch floppy disk drive.

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cessing section between the oscillator and filter. This section modifies the signal from the oscillator with two processes: Emphasis and Wave Shaping. Both are velocity sensitive, adding a new level of expressive capability to the 01/W.

Emphasis works in conjunction with the filter and acts somewhat like an exciter, tending to brighten the sound. Wave Shaping is a form of amplitude modulation that changes the shape of the waveform to create new timbres. The input waveform can be modulated with one of 60 Wave Shaping "tables." Wave Shaping provides a means of "beefing up" a sound in addition to changing the original waveform into something entirely different.

The addition of Wave Shaping to the signal path expands the sonic palette of the 01/W immensely. I found it helpful to assign a sine wave to the oscillator while calling up the various Wave Shaping tables. Using this feature can add resonance, change the attack characteristics, or transform a sound into something entirely different. This technique hasn't been used much on digital synths (waveform modulation was available on several old analog synths), so it represents something relatively new in the realm of digital sound creation and modification.

Much of the terminology from the previous instruments has been retained. Programs consist of one or two oscillators and their accompanying wave shapers, VDFs, and VDAs, as well as modulation sources such as envelope generators, LFOs (which Korg calls "Modulation Generators"), aftertouch, joystick, etc. Key velocity and position can be programmed to affect the EG intensity and the times of all VDFs and VDAs. "Double" Programs use two oscillators and provide 16-note polyphony. A Program also can be set to Drum mode, in which you select a kit with different drum sounds assigned across the keyboard.

The 01/W can store up to 200 Programs and four drum kits in internal memory and 200 additional Programs plus four more drum kits in a RAM card. This is the same Program capacity as the T-series and twice the capacity of the M1. Programs are organized into banks of 100, with two drum kits per bank.

Like its predecessors, the 01/W can combine up to eight Programs in a

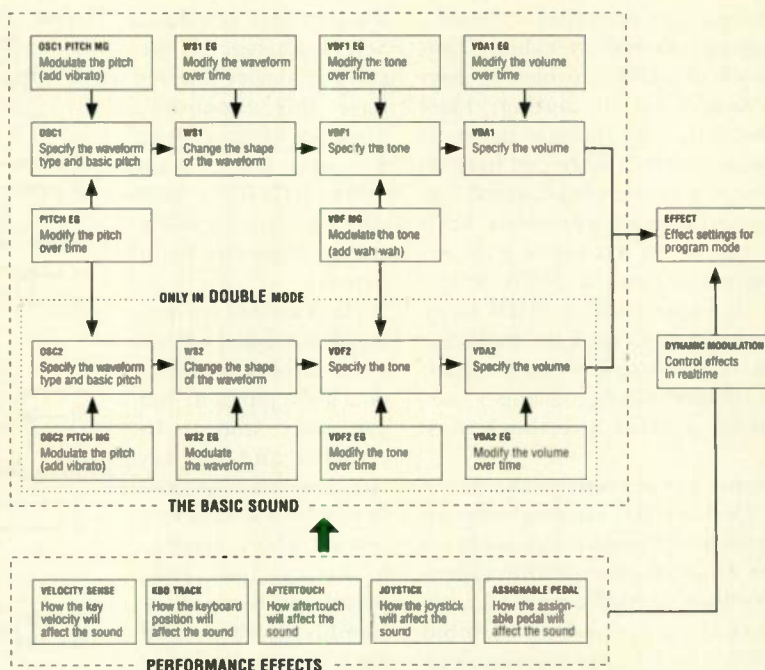



FIG. 1: The secret of the 01/W's sound is its Wave Shaping parameter, which operates between the oscillator and filter algorithms.



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Combination, also known as a "Combi." Programs in a Combi are called "Timbres," each of which can have its own MIDI channel, volume setting, transposition, detuning, and pan position. In addition, each Timbre can have its own velocity and note range, which limits when and where it will sound. Each Timbre can be set to control an internal Program or external MIDI device, or can be turned off. A MIDI filter determines whether each internal Timbre will respond to incoming Program Change, Control Change, Damper (sustain) pedal, and/or Aftertouch messages.

Program changes sent to the 01/W on the global MIDI channel change the Combi, while program changes on another channel change the appropriate Timbre (if its Program Change filter has been opened). In Global mode, Program Change messages can be completely disabled, enabled, or set so Program Change is disabled for the global channel but individual Combi or Song program numbers remain unaffected.

Internal Timbres in a Combi can be routed to the effects section according to a separate specification or the routing established in the Programs themselves. It's possible to store up to 200 Combis in internal memory and another 200 in a RAM card (twice the capacity of the M1 and T-series).

As with Programs, Combis are arranged into banks of 100. If you want to call up Programs and Combis with MIDI Program Change messages from an external device and want all 200 Programs and Combis available, the external device must be able to send

the relatively new Bank Select message. If the external device doesn't have this capability, program changes 0 to 127 only will call up A00 to B27; B28 to B99 will be inaccessible except from the front panel.

The Combis are primarily intended for layers and splits, and they do a good job of it. You can split sounds by velocity and/or key range, which allows you to combine several Programs without seriously eating into your polyphony. Many of the Combis don't use all eight Timbres, so I used the extra ones to control external sound modules. It seems that this capability would be more useful in a live performance situation (particularly considering that calling up a Combi can send a Program Change and Volume message to external modules for each external Timbre), but I had plenty of fun with it in the studio nonetheless.

THE SOUNDS

Clearly the instrument's features are impressive, but what about the sounds? I'm happy to say the 01/W sounds are extremely good overall, and the sound quality is clean. In an A/B comparison, many of the new instrument's sounds proved brighter and more present than those on the M1. In particular, the acoustic piano sounds on the 01/W are far better than those on the M1. The decay of the 01/W piano is much more natural, although I found that some of the upper notes exhibited a slight but sudden decay soon after the attack. The electric piano, bass, guitar, some of the saxes (alto and tenor), flute, some of the orchestral strings, and many of the synth sounds are excellent.

On the negative side, I find the soprano and bari saxes to be rather static, as is the clarinet (although the bass clarinet in the lower range is quite good). As a trombone player, I'm never satisfied with brass sounds, so I'll chalk that one up to personal bias. Also, the voice sounds generally are too noisy

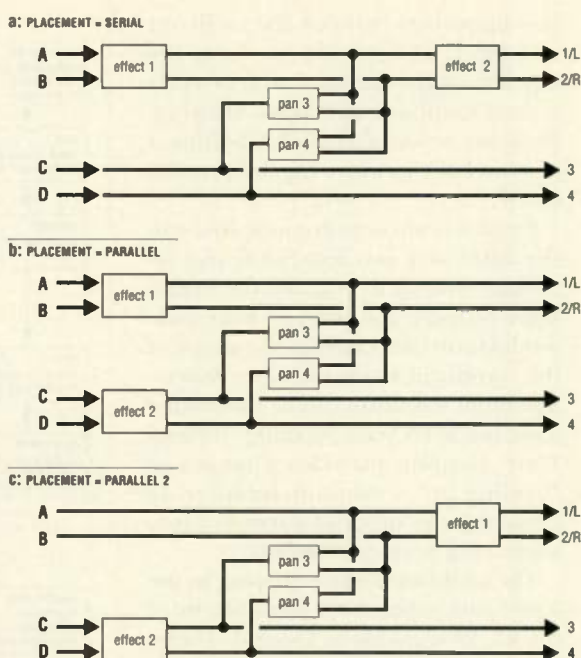


FIG. 2: Signals can be routed through the two processors in series (a), in parallel (b), and in a series/parallel combination.

for my taste.

The drums are fine, with a wide assortment of useful sounds to choose from. These sounds are aimed mainly at pop, rock, Latin, and rap (several scratch sounds), with some orchestral and other ethnic sounds (kalimba, gamelan). As I was playing some of the drum sounds, I had a moment of panic: A drum roll didn't shut off when I released the key. Quite by accident, I discovered that the roll is terminated when you play the Snare Hit key. This is actually a result of a new Exclusive mode that allows you to program certain sounds to cut off other sounds.

EFFECTS

Two stereo signal processors, with two inputs each, can be combined in one of three ways: Serial, Parallel, and Parallel2. The routing of signals through the processors and to the audio outputs is quite flexible (see Fig. 2).

Each processor can produce one of 47 effect algorithms, including many reverb, delay, chorusing, and flanging effects. Also included is an exciter, enhancer, distortion, phase shifting, rotary speaker, auto pan, tremolo, and parametric EQ. Two algorithms combine two effects in series within one processor (chorus-delay and flanger-delay) and eight algorithms split a single stereo processor into two mono processors, one of which produces a delay

Product Summary

PRODUCT:

01/W Music Workstation

PRICE:

01/W \$2,295

01/WFD \$2,799

MANUFACTURER:

Korg USA

89 Frost St.

Westbury, NY 11590

tel. (516) 333-9100

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

while the other produces another effect.

The intensity of the effects can be modulated in real time by one of a number of controllers, including the joystick, aftertouch, programmable pedals, VDA EG, and value slider. Another cool programming feature is the ability to copy or swap parameters between the two processors. You also can copy the effects parameters from a Program, Combi, or Song to any other Program, Combi, or Song.

The effects sound quite good, and Korg has provided a useful selection. The reverbs, delays, chorusing, and flanging are more than adequate, and like the rest of the instrument, the sound quality is clean. The exciter works well, as does the rotary speaker algorithm. However, I thought that the enhancer tended to constrict the sound, not unlike playing inside a tunnel. I would also prefer to see some dual-mono algorithms that employed a wider variety of effects, rather than a delay combined with something else. The real-time dynamic control works

well, providing additional expressive capabilities.

SEQUENCER AND DISK DRIVE

Aside from expanding the number of tracks and note capacity, new sequencer features include variable tempo, multiple time signatures, track muting, record modes (overwrite, overdub, manual and auto punch-in, and looping), and selectable base resolution (48 or 96 ppqn). Linear and pattern-oriented sequencing can be accomplished in real time or step time, and data can be transferred between patterns and tracks (patterns can be up to 99 bars long). You can quantize all data or just the notes, controllers, aftertouch, pitch bend, or program changes in the specified range of a track.

Like Combi Timbres, sequenced tracks can have their own MIDI channel, velocity and note range, transposition, and detune settings. Each track can be overwrite-protected. In addition, you can turn tracks off or set them to control an internal Program, an

external MIDI device, or both. Combi Timbres and sequence tracks employ dynamic voice allocation, which is becoming standard practice these days.

All of the normal measure, track, pattern, and song-management functions are well-represented, including copy, bounce, and erase. Also, songs can be chained to play one after the other. Up to ten songs and 100 patterns can be held in memory, subject to the overall note capacity. RAM cards can hold an additional ten songs and 100 patterns. One nice touch is that pressing the Record button starts the metronome to get you into the groove, but the count-in doesn't begin until you hit the Start button.

Event editing is fairly comprehensive and far easier than on the 2-line M1 display. You can insert, delete, or quantize events and compare the results to the previous version of the track, but this only applies to the most recent edit. Unfortunately, it is necessary to exit the Event Editing window and return to the main Sequencer page to take advantage of this function. The

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● KORG 01/W

Erase Measure, Track, Pattern, and Song functions have no confirmation message (they definitely should, even though tracks can be protected individually). With a relatively limited note capacity, the editor also should provide controller thinning, but it doesn't. Controller data might be thinned somewhat by quantizing the controller data in a track, but I would prefer something on the order of "remove every other controller event."

Even though the base model of the 01/W has twice the note capacity of the M1, it still must be considered a "scratch pad," and it certainly can't hold ten songs of a reasonable length. The capacity of the FD model is more appropriate for stand-alone sequencing, although I still prefer a computer-based sequencer. If you work mostly in a studio with an external sequencer, I recommend the less-expensive base model. However, if you do a lot of solo gigs and need to take a sequencer with you, the FD would be a better choice.

You can use the disk drive on the FD model to save the contents of the internal memory and to save and load SysEx dumps (up to 64 KB) from other devices. A single disk holds two files, each of which can include the entire internal memory of the 01/W (200 Programs, 200 Combis, ten Songs, 100 Patterns, two drum kits, and one set of global data) as well as a SysEx dump from another device. The disk drive provides relatively quick access to sounds and sequences: Loading all data from one of the two files on the demo disk (which includes Programs, Combis, global, and sequence data that fills 99 percent of the sequencer memory) took just under 23 seconds. You also can load a single Program, Combi, Song, Pattern, or drum kit from the disk into internal memory.

USER INTERFACE

The button and slider layout on the 01/W is virtually identical to the M1, while the 64 x 240-pixel LCD, backlit, fully graphic display is derived from the T-series. The single joystick, which normally provides pitch bend on the X-axis and programmable modulation on the Y-axis, is similar to the previous models. A Reset button has been added to start the current song at the beginning and to stop stuck notes.

All performance, editing, sequenc-

ing, global, and disk-management parameters are presented in a series of pages that can be stepped through using the page up/down buttons, or called up directly using the numeric keypad. (There are never more than ten pages, numbered 0 to 9, in any group.)

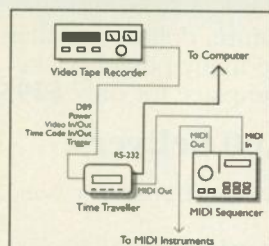
Cursor control on the 01/W takes a bit of getting used to, but after a short time it becomes quite quick and direct. The pop-up graphic envelope and key range displays are great, and the pages of parameters are well organized. In a welcome move toward consistency, the effects page appears as page 8 in the Edit Program, Edit Combi, and Sequencer modes (even when there's no page 7). Similarly, page 9 provides naming, saving, and copying utility functions in all modes. Even more important, when you leave and return to a set of pages (for example, after editing a Program, you go into the sequencer and then back to Edit Program mode), the display returns to the page and parameter you left. At last, someone got this right!

On the negative side, the abbreviations are too cryptic in general, although the full name of each parameter appears in the upper right of the display as they are selected (this is not true of the Program performance-editing parameters, discussed shortly). The Compare button should work more consistently in all modes (it only works in Edit Program and Edit Combi modes). Also, the labels appearing above the soft keys sometimes extend across two or more buttons or aren't well aligned with the button to which they apply. In these cases, either button works, but it is a bit confusing. Finally, there is no indication in the performance modes that anything has been edited.

Speaking of editing, the 01/W provides a quick and easy way to edit certain parameters of Programs and Combis without going into Edit mode. While playing a Program, you can adjust the overall octave, Wave Shaping intensity, filter cutoff, VDF EG intensity, VDA level, VDA EG attack time, VDF and VDA release time, and effect dry/wet balance. While playing a Combi, you can adjust the volume and change the Program for each Timbre.

The Performance-editing feature is convenient, particularly for live gigs. The ability to change certain groups of

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parameters in a Program provides a great deal of expressive control in real time without having to go into Edit mode. And the slider graphics in the display are fantastic. Unfortunately, there is a serious drawback in the Performance editing of a Combi: Editing the program number of an external Timbre does not send a Program Change message to the external MIDI device, which limits its usefulness in a live performance situation. Fortunately, editing volume in Combi Performance mode does send a MIDI Volume message as long as the Timbre is set to a MIDI channel other than the global channel.

MANUAL LABOR

User manuals are often singled out for ridicule, with good reason. Unfortunately, the 01/W manual is no exception. In fact, its documentation is among the worst I have ever seen (and I've seen plenty). There is no index and typos abound, some of which are very confusing. Furthermore, there is virtually no conceptual information. For example, there is no explanation of Wave Shaping at all; I learned more about it from the brochure than from the manual.

The *Quick Guide* is anything but quick, although it does have some of the conceptual info that should be in the main manual. On the other hand, the first few pages of the main manual include a few step-by-step "here's how" procedures that should be in the *Quick Guide*. Unfortunately, neither of these sections are adequate in any way. The vast majority of the main manual is a page-by-page, parameter-by-parameter reference with absolutely no indication of how to use them effectively.

Manufacturers should have gotten the message by now: Please, *please* have the documentation for instruments in the U.S. market written by native English-speaking people who know how to write useful manuals.

CONCLUSIONS

Aside from the documentation and some more or less minor gripes, I am quite impressed with the 01/W. It manages to deliver many enhancements to the T-series at a cost comparable to the original M1. True, it has no sample RAM or extended and weighted keyboard, but if you can live without these features, you get a lot of bang for the



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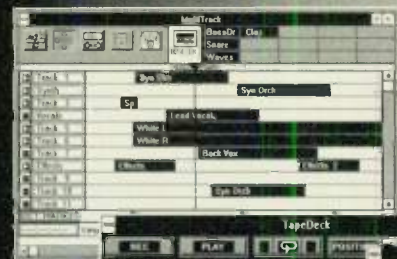


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buck in this instrument. If you're looking for a cost-effective MIDI keyboard workstation, you owe it to yourself to investigate the 01/W.

(The author wishes to thank Jim Mona at Goodman Music for his assistance.)

Scott Wilkinson fights a never-ending battle for truth, justice, and the perfect trombone sample.

**Fostex X-28 4-Track
Ministudio**

By Brent Hurtig

**A versatile cassette
ministudio offers many
happy returns.**

It's 1992. Legions of digital audio workstations flood the market. Digital 8-track tape recorders drop below \$4,000. DAT decks are a dime a dozen. And the people at Fostex (at the cutting edge of DAT technology themselves) build a new 4-track analog cassette ministudio.

Why? Simply because for musicians of all levels, a ministudio can be a perfect songwriting "sketchpad" if it achieves five design goals: ease of use, quick operation, reasonable quality, portability, and modest cost. Given these criteria, the sustained popularity of cassette ministudios is no harder to understand than the continued use of pencil and paper.

The X-28 is Fostex's middle-range ministudio, priced between the entry level X-26 and the elaborate 280. Does the X-28 meet our sketchpad criteria?

OVERVIEW

Like other ministudios, the X-28 is an integrated tape recorder/mixer. The transport section, which occupies the right side of the unit, includes the cassette well, transport controls, as well as a multifunction, backlit LCD screen.

The X-28 records four tracks in one direction (on one side) of a cassette tape, and any number of these tracks may be recorded simultaneously.

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Unlike most minis-
tudios, which oper-
ate at a "high" speed
of 3 1/4 inches per sec-
ond, the X-28 oper-
ates at the standard
cassette speed of 1 1/2
ips. It uses Dolby B
noise reduction.

A rather unortho-
dox mixer section
dominates the left
side of the top sur-
face. Fostex has
abandoned the typi-
cal design of four or
six dedicated input
faders accompanied

by four discrete tape monitor pots.
Instead, the design lets certain faders
and pots serve different roles, depend-
ing upon how they are configured.

The result is a mixed blessing. Some
people will find the complexity of the
X-28 prevents it from meeting our first
two design goals. However, those peo-
ple with the necessary experience,
insight, or patience to figure out the
X-28 will enjoy mixing flexibility
unmatched by other minisstudios in its
price range.

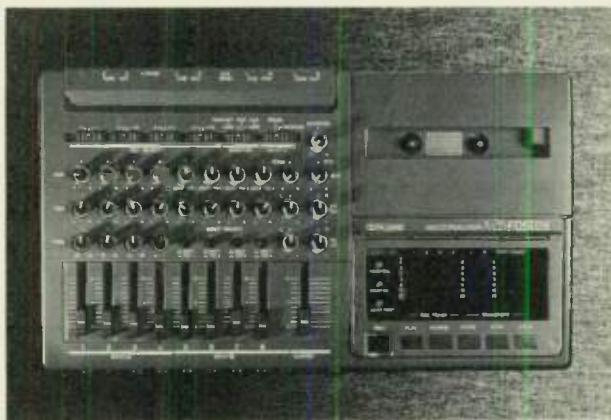
THE PACKAGE

The X-28 is about the size and weight
of a notebook-style portable comput-
er. There's no battery-pack option, so
you can't record tracks alongside
spreadsheet-pushing colleagues while
flying business class. Still, you could fit
the X-28, its power supply, a micro-
phone, and a Yamaha QY10 sequen-
cer/synth/drum machine into an
attaché case and still have room for a
pocket-sized cellular phone.

The case is made of impact-resistant
plastic with a grooved "pencil holder"
above the mixer section (remember
our sketchpad metaphor?). The inter-
nal wiring and overall construction
quality is good, and the cassette trans-
port is fabricated with a generous
amount of metal.

Unfortunately, almost all the switch-
es and knobs are mounted directly to
internal circuit boards through holes in
the casing. The casing itself provides
no additional support. Likewise, all
input and output jacks are board-
mounted.

Technicians welcome this type of
construction for two reasons: Service
is easy (the case pops apart with a min-



The unorthodox design of the X-28's mixer section requires signal-
routing gymnastics that can be frustrating.

imum of knob-pulling), and breakage
is inevitable (excessive pressure on the
knobs or jacks often results in a dam-
aged circuit board). To be fair, most
current audio products use direct
board-mounting, although many rein-
force the design with casing support.

Speaking of knobs, the X-28 sports
27 of them, squeezed into a small area.
To navigate through the crowd, dain-
ty fingertip manipulation is appropri-
ate etiquette. Thankfully, all of the X-
28's knobs are attached to smooth-feel-
ing pots.

I wish "smooth" described the nine
faders, which feel as if they were sal-
vaged from an automobile sound-sys-
tem manufacturer's \$49 powered
equalizer. Naturally, I don't expect
Penny & Giles eroto-tactile quality at
this price. However, the rough feel of
these faders makes an even, slow fade
tricky, particularly when manipulating
a stereo pair.

Input and output jacks are scattered
along the front and back panels. The
back panel accommodates RCA pin
jacks for tape out (1 to 4), line out
(L/R), aux send, aux return (L/R),
and monitor out (L/R). There also is a
sliding power switch and a connector
for the 12 VDC power supply. The
front panel has a variety of 1/4-inch con-
nectors, including line/mic inputs (1
to 4), additional line inputs (5 to 8),
two footswitch control jacks (Punch
In/Out and Zero Return/Play), and a
stereo headphone jack. A pitch control
(±10%) is included near the head-
phone jack. Sliding switches for record
select, monitor, and input modes, as
well as input select buttons and a swing-
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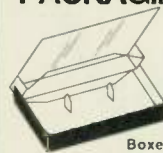
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• FOSTEX X-28

MIXOLOGY

In terms of sheer mixing power, the X-28 offers more inputs and flexibility than any other ministudio in its price range. During tracking, the unit can be configured with four faders feeding the tape and four faders handling monitor levels for tape tracks or synchronized virtual (sequencer) tracks. Alternately, all eight faders can be routed to the four tape tracks.

During mixdown, the X-28 can mix ten sources to stereo, utilizing four line/mic faders, four line/tape faders, and a stereo auxiliary return. If you sync to a sequencer, track 4 is surrendered to sync tone, resulting in a "MIDI mix" of three tape tracks, five virtual tracks, and a stereo effects return.

The X-28's split input configuration is one of the reasons for this mixing flexibility. Input A consists of four faders (numbered 1 to 4) each with trim, pan, and auxiliary send controls. Individual Record Select switches route these conventional microphone/line inputs to the tape tracks either directly (fader 1 to tape track 1, and so on), or via the stereo bus. An assignment to a bus must be made when routing more than one input to a single track, or when sending signal to a track other than the respective input (fader 1 to tape track 3, for instance). The X-28 has left and right buses, and any fader can be assigned to either bus via its pan control. The left bus is routed to tracks 1 and 3, the right to tracks 2 and 4.

Input B is another group of four faders (numbered 5 to 8). These lack trim pots, but have pan and aux send/track monitor pots. These faders can be used as line inputs, so if you need to record an ensemble of musicians live to two or more tracks, the additional inputs are great news. Input B faders also can be configured to monitor tape tracks 1 through 4 (fader 5 is track 1, fader 6 is track 2, etc.).

Unfortunately, the amount of "switch switching" (and the rationale for same) required to avail the X-28's increased flexibility can be daunting to the casual recordist. The configuration process is hardly intuitive and often requires frequent trips to the manual.

For instance, faders 5 through 8 can act as additional input channels, or monitor tape tracks 1 through 4, with the appropriate setting of Input Select switches. In addition, the Input B Select Switch can route faders 5 through 8 to

either the stereo bus or the monitor bus. A Monitor Select Switch determines which signals are sent to the monitor output and headphone jack. And even the aux sends can pull double duty: Aux sends 5 through 8 can be used to route signals to an effects processor (when the send is switched to Input) or act as monitor-level controls for tape tracks (when the send is switched to Trk).

Unlike most ministudios, which provide equalization for each channel, the X-28 has two channels of 2-band EQ dedicated to the left and right buses. A track must be routed to tape via one of the buses to be recorded with EQ, as direct recording bypasses the EQ section. However, EQ can be applied to the entire left/right mix.

The EQ section sounds comparable to competing ministudios: mediocre. The high band (± 12 dB at 10 kHz) is useful for adding sizzle or muffling excessive brightness. Cutting the low band (± 12 dB at 100 Hz) reduces rumble, but boosting it adds more mud than thud.

An overall monitor-level control affects headphone and monitor out levels. Few ministudios provide a dedicated monitor output for the amp and speakers.

TRANSPORT ME TO HEAVEN

When it comes to affordable, advanced transport technology, Fostex is a world leader. Trust them to include a few nice touches on the X-28.

The tape counter, six meters (four tape track meters and left/right), and the tape-direction indicators are represented on the LCD screen. There also is a cute illuminated tape motif

Product Summary

PRODUCT:

X-28 4-track Ministudio

PRICE:

\$599

MANUFACTURER:

Fostex Corp. of America
15431 Blackburn Ave.
Norwalk, CA 90650
tel. (213) 921-1112

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EASE OF USE	●	●		
SOUND QUALITY	●	●	●	
VALUE	●	●	●	●

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that shows whether the tape is moving or stopped. The screen is quite visible in most lighting, although some segments look falsely illuminated when viewed from certain angles in the dark.

Solenoid-activated transport controls are located below the LCD screen and deliver a satisfying click when pushed in. The pitch control is hidden from view on the front panel, making it easy to overlook its setting. Furthermore, the control has only a slight detent at the ± 0 position, and I inadvertently bumped it out of position more than once. Since there's no Pitch Control On indicator, a more visible and sturdy control could prevent tragedy.

Now, about those nice touches. The electronic tape counter (0 to 999) is visible from a good distance, which makes up for the fact it resets each time the X-28 is turned on. There's also a Zero Return button, just like those on professional multitrack decks. If you press play after hitting this button, the play indicator flashes, and the deck pops into play when the zero mark is reached.

Another nice function is a Rehearsal mode. This lets you practice a punch-in without actually recording. This works by switching the monitor to input at the punch-in and returning to tape monitor at the punch-out.

SOUNDS LIKE...

Overall, the X-28 sounds fine as a musical sketchbook. Frequency response is acceptable, and crosstalk between tracks is barely audible. Tape tracks bounce cleanly, with little additional noise or loss of frequency response.

However, I was sorry to find Dolby B noise reduction, rather than Fostex's usual choice of Dolby C. While I prefer Dolby C to dbx, I always prefer dbx to Dolby B. Consequently, the X-28's choice of noise reduction makes it considerably noisier than dbx-equipped decks from Tascam and Yamaha. In addition, the X-28 operates at a slower (and noisier) tape speed than other models.

Speaking of Dolby, for some strange reason it's necessary to switch the Dolby on each time you boot up the X-28. More than once, I recorded a fresh track, only to notice I had forgotten the important Dolby switch.

CONCLUSIONS

The British phrase "box clever" cer-

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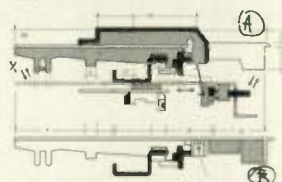
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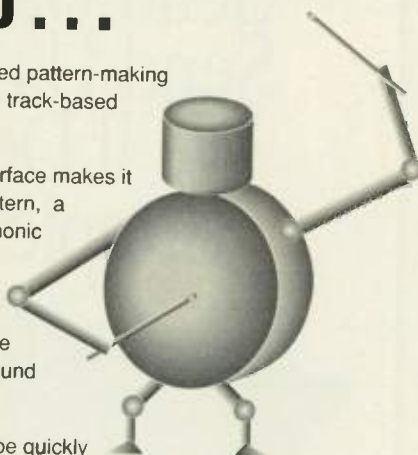
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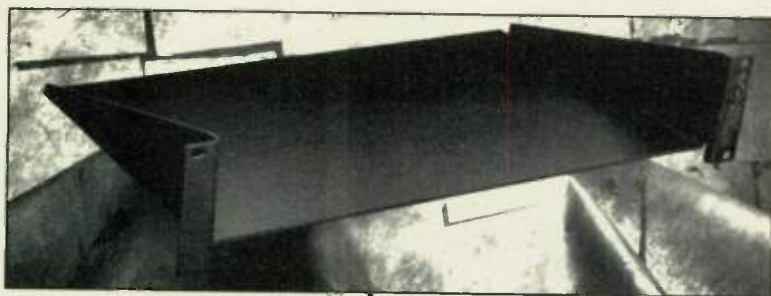
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• FOSTEX X-28

tainly befits the X-28. But for some musicians, the X-28 may be a bit too clever. Let me explain. I absolutely loved Fostex's G16 (reviewed in the March 1991 EM). The G16 also possesses a number of complicated functions. However, anyone purchasing a 16-track should already have the recording chops to decipher its operation.

This usually is not the case with minisudio buyers. Many musicians who opt for the "musical sketchbook" approach are beginning recordists who may lack the experience to grasp the X-28's mixing concepts.

The X-28's manual contributes to the trouble. Too much emphasis is placed on step-by-step instruction, without enough practical explanation. Musicians may eventually memorize which switches need to be moved to accomplish XYZ, but rote description of a task won't teach a user how to take full advantage of the mixer's fancy features.

Still, I made some fine musical sketches on the X-28, and I would be happy to own one. If you're confident of your recording abilities, or are willing to learn some important basics, the mysteries of the X-28 will fall away. What remains is a capable and flexible songwriting tool with unrivaled mixing power for the price.

Brent Hurtig is a widely published writer and a recording consultant based in San Francisco.

Peavey Pro-Fex Multi-effects Processor

By Daniel Kumin

MIDI control, configurability, and the quest for the perfect multi-effects box.

Someday, an enterprising manufacturer will design the perfect guitar box, a product that gives to each electric guitarist whatever his or her heart desires. A slim rack chassis, it will be infinitely programmable, completely MIDI-controllable, cost \$799, and sound pretty much however you like.

Peavey's new Pro-Fex, a mono-to-stereo, guitar-oriented, multi-effects processor is evidence we're getting awfully close to guitar-box heaven. The Pro-Fex meets nearly every aforementioned qualification, and does so at a price undreamed of a year or two ago by even the most dazed metal-thrasher.

The Pro-Fex's 1U rack-mount panel includes 1/4-inch mono input and stereo headphone jacks, a 5-segment LED input-level meter, and a 20 x 2 amber display. The interface consists of ten keys and Peavey's "speed" data-wheel, which permits rapid scrolling through long parameter lists and values. Also up front is an easily accessible button to select a 16 dB line/instrument input-level pad. Unfortunately, the power switch is extremely close to the data wheel, so care must be taken to avoid turning the unit off while twisting the knob.

Around back are 1/4-inch stereo outputs, a secondary line input (defeated by plugging a cord in the front jack), and a master output-level knob. Two TRS jacks for as many as four foot-switch controllers and an In/Out/Thru MIDI trio complete the rear. (There's no fussy little rear-panel Out/Thru selector switch, saints be praised.)

Although it is adequate, the 13-page manual assumes you know what you're doing, which sometimes is a dangerous assumption where musicians are concerned.

ARCHITECTURE

The Pro-Fex offers nineteen basic effects "blocks," with more than 30 possible variations. Different algorithms use varying degrees of processing power: Reverb, for example, is the most intensive. As many as sixteen effects, or as few as six or seven (depending on the blocks selected), can be combined in any order to form a multi-effects chain. Blocks can be software "wired" in series or parallel at any or all junctures. Combined with the fact that effects can be "patched" at will, rather than selected from a list of preset algorithms, this yields flexibility that's just about unmatched. The Pro-Fex can freely do crazy stuff such as put distortion in series after reverb; it's not pretty, but it can be done.

Available effects blocks include: compressor; distortion and overdrive; chorus; stereo, tapped, mono, and short-mono delays; auto-pan; a pitch

shifter (± 1 octave); eight types of stereo reverb; an exciter; "coil-tap" EQ; envelope filter (auto-wah); four EQs (swept-mid "Classic" guitar, 5-band graphic, 3-band quasi-parametric, and 4-band full parametric); four speaker simulations; and hum filter. A fixed noise gate is at the end of every chain.

The interface is a straightforward, paged arrangement, with left/right cursors and other keys for selecting and navigating pages and the aforementioned "speed" wheel for selecting parameters and values. (I'd like to see Peavey endow the wheel with soft click-stops for each value change, but it's nice just the same.) Overall, the layout is easy to get around, and with minimal practice, it's quite fast. The 2-line, 20-segment display is legible, and a utility-page brightness/contrast control ("View-Angle") helps keep the readout clear when viewed from above.

The unit includes 128 presets and 128 user program locations. (In Peaveyspeak, a program consists of a preset with a volume setting and memory location.) Any of the former can be mapped to any of the latter, with a user-specified overall volume setting for each. Presets may be edited freely to create custom multi-effects, but of course, you lose the original factory setup. Reinitializing restores factory patches.

MIDI FEATURES

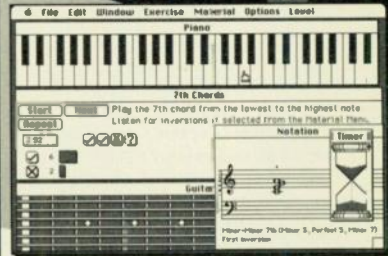
The Pro-Fex's MIDI implementation is impressive. SysEx operations dump and receive individual presets, banks of ten, or all 128, and the unit both receives and transmits program change data. But the Peavey device's clear trumps are its dynamic MIDI attributes.

Any eight MIDI Continuous Controllers can be assigned to modify dynamically any eight parameters across multiple blocks of any preset. Virtually every parameter is available for control, including EQ settings and level. With the exception of time-based parameters such as reverb time or pitch-shift amount, modulations are remarkably smooth. This suggests a couple of nifty uses. With an 8-slider MIDI fader box, tuning up Pro-Fex presets would become a joy rather than a job. An appropriate MIDI pedal array could play the unit almost like an instrument. You even could use the Pro-Fex as a one-channel, MIDI-controlled audio attenuator or attenua-

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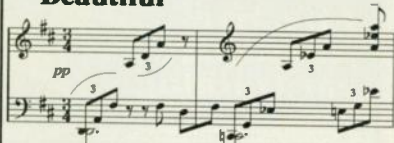
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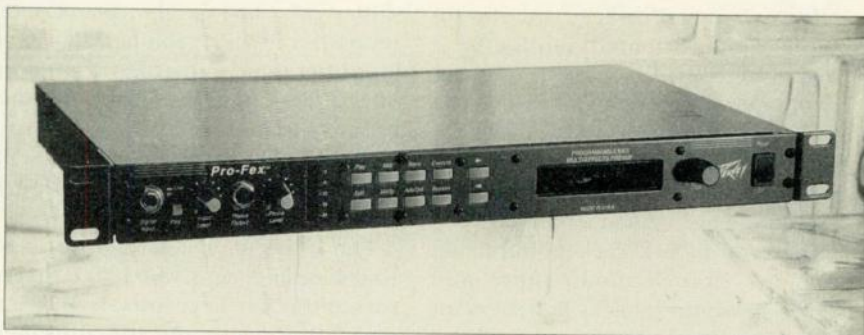
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● PRO-FEX



PETER DIGGS

Peavey's new Pro-Fex, a mono-to-stereo, guitar-oriented, multi-effects processor, offers a compressor, distortion and overdrive, chorus, delays, auto-pan, a pitch shifter, stereo reverbs, an exciter, envelope filter (auto-wah), four EQs, four speaker simulations, a hum filter, and a fixed noise gate.

tor/equalizer. A ninth MIDI parameter always controls program Volume (Controller 7).

For all MIDI controller inputs, a parameter setting of zero yields 100 percent change, 64 is unity, and -100 delivers +100 percent change. However, each controller can be scaled to ± 100 , so depending on the "native" setting of the parameter under control, you can invert or impose virtually any limits on modulation. MIDI setups save with individual presets, not globally, which is excellent.

The four footswitch inputs can be independently configured for bypass, program-change up and down (you can chain program changes in any order), mute, or repeat. The latter overrides any manual or MIDI delay-algorithm feedback setting, automatically pegging it for infinite repeat.

SOUND QUALITY

The Pro-Fex's MIDI and control flexi-

bility are superb, and most of its sound capabilities are of equally high quality. The eight reverbs (room, plate, spring, reverse, and more) range from good to very good, with decent programmability for a multi-effects box. (You can edit size and time, predelay, high-frequency damping, and wet/dry mix for each.) A few occasionally sound periodic when auditioned naked, but overall, the reverbs score high. Ditto the chorus and delays, and the multi-tapped stereo delay (up to 970 ms) is particularly nice. The Pro-Fex's compressor is effective and reasonably invisible most of the time. The last-up noise gate works well and usually is easy to calibrate for a given preset.

One of the Pro-Fex's strong suits is its EQ blocks, several of which ("Classic"; 3-band/swept mid) are optimized for guitar. The EQs are flexible, clean, and eminently useful. Also worthy of mention are the four speaker simulators, including the impressive "British" (a classic Vox/Celestion setup, to my ears).

The Pro-Fex's pitch shifter is a cool feature for a box of this cost. A full 2-octave range is on tap (one up or down), tunable by cents. You can set predelay and feedback (up to 100 percent for head-spinning auto-gliss and swirling patterns). It sounds good except for quite audible periodic pumping at settings greater than a half-step or so. Peavey says this is a side-effect of a relatively simple pitch-shift algorithm; one that leaves enough processing power for other effects to be available simultaneously.

However, like all guitar multi-effects boxes, the Pro-Fex has weaknesses. Salient are its distortion and overdrive algorithms. Like everyone else, Peavey has yet to crack the code for creating

Product Summary

PRODUCT:

Pro-Fex multi-effects processor

PRICE:

\$799

MANUFACTURER:

Peavey Electronics
711 A St.
Meridian, MS 39302-2898
tel. (601) 483-5365

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

truly great digital distortion. While a wide array of nice full-crunch sounds are on the Pro-Fex menu, smooth, rich, evenly sustained, tube-like sound is not. At lower drive settings, the sound can be brittle, slightly wan, and, well, "digital." (Adding chorus and/or pitch-shift thickeners helps.) At higher drive settings, guitar comping and double-stops musically are obscured.

However, in light of the Pro-Fex's \$800 tag, overall sound quality is little short of incredible.

TECH NOTES

The Pro-Fex's DSP engine consists of dual Motorola DSP56001s. This open architecture implies that while none are currently planned, algorithm upgrades via new ROM sets are possible.

Other tech notes include 64-times oversampled, sigma/delta A/D conversion, 24-bit internal throughput, and 18-bit D/A conversion (all good stuff). Peavey claims response to 16.4 kHz, THD below 0.06 percent, and noise some 90 dB below full output. My work with the Pro-Fex leads me to believe these figures. My guitars are Fenders, which by nature are disgustingly noisy and click- and hum-prone (the Pro-Fex's invaluable Hum Filter block helped); playing a friend's Les Paul through the unit yielded clean, quiet sound.

FIRST-RATE

The Pro-Fex is an unmistakable value and first-rate for a guitar rack effect. Coupled with even an inexpensive, real-glass, tube preamp (Peavey makes one), it becomes a *great* guitar box. (You can get some *huge* bass sounds from this thing, too.)

It also works nicely as an extra studio effects device. I used it on some test mixes as a snare reverb, piano chorus/delay, and synth-bass shifter/thickener with good results.

Now factor in dynamite MIDI flexibility, good ergonomics, and thoughtful layout. What you have is a clear winner, especially if you are an inveterate knob-twirler with a thirst for the new, the different, and the outside.

Daniel Kumin still hopes to recover his beloved 1964 Strat, stolen from a gig in Rutland, Vermont, in October 1975. It has a tobacco-burst/maple neck and looks like it once encountered a threshing machine. No questions asked.

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Dr. T's X-oR 2.0 (Mac)

By Geary Yelton

The Caged Artist's universal editor/librarian treats your gear as a networked system.

As MIDI systems with numerous synthesizers continue to grow, managing the hundreds or even thousands of diverse sounds that accompany them has become an increasingly enormous task. In 1990, a number of so-called "universal" editor/librarians surfaced to fill the patch organization needs of users with numerous synthesizer platforms. Unlike previous programs, they can handle dozens of different instruments. (The word "universal" is a slight misnomer; the programs work with many MIDI devices, but not all.) One of these editor/librarians is *X-oR* (short for System Exclusive Orchestrator) for the Atari ST, which evolved from Dr. T's Caged Artist series of individual synth editors by programmer Bob Melvin. *X-oR* was ported to the PC (reviewed in the January 1991 issue of *EM*) and now appears on the Mac in version 2.0. The program is System 7.0-compatible, but not System 7-savvy.

X-oR's concept is brilliantly convenient: Rather than dealing with your MIDI system as an assembly of disassociated devices, the program sees it as a single, integrated network. *X-oR* saves and recalls all your instrument setups in one data file. Once you've configured it for your particular setup, running *X-oR* loads all the current patches, banks, and modes for everything. *X-oR* comes on three double-sided floppies, one disk for the program itself and the other two for instru-

ment profiles and help files. The application is only 224 KB, so it won't eat up much space on your hard disk. *X-oR* profiles include the drivers and the editing templates for each supported device and range in size from 1 KB for the Sequential DrumTrax to 69 KB for the Yamaha TG77, with the average size around 20 KB. For many Mac users, disk space may be an important factor when you consider that Opcode's *Galaxy Plus Editors*, along with its required *OMS*, occupies more than 750 KB on disk, not including the editor templates. Another nice thing about *X-oR* is that it's not copy-protected, which means that you don't have to bother with key disks or install procedures.

X-oR supports more than 80 synthesizers, drum machines, effects processors, MIDI patch bays, and even the synthesizer parameters of a sampler (see sidebar). Among the supported synths are a few antique MIDI retrofits like the Prophet-5 and the Korg Polysix. Graphic editors are available for viewing and changing the parameters of all but a handful of devices. The Matrix-12 profile, for example, is strictly a patch librarian.

In addition to standard Macintosh MIDI interfaces, the program supports multi-port interfaces such as Mark of the Unicorn's MIDI Time Piece. If you use some sort of MIDI merger, switcher, or patch bay, the manual provides explicit instructions for various situa-

Performance					
Port	Ch	Instrument	Area	✓ Patch Name	Source
all	3	Matrix-12	Multi	SUSDRON2	Received
all	3	Matrix-12	Multi	NEW/FARE	Received
all	—	Roland D-50	Patch	Psycho Strings	Source file closed
all	—	DX7II Intern	Perform	?	Initialized patch
all	—	DX7II Intern	Voice	BASS 5	Untitled # 25
all	—	DX7II Intern	Microton	?	Initialized patch
all	—	Korg M-1	Combi	Init Combi	Initialized patch
all	9	Korg M-1	Program	Power Sax	Untitled # 25
all	—	Korg M-1	Drum Kit	Init Drum Kit	Initialized patch
all	—	Korg M-1	Global	Init Global	Initialized patch
all	10	Roland R-8M	Patch	InitPch	Initialized patch
all	10	Roland R-8M	FeelPch	Init Feel Patch	Initialized patch
all	10	Roland R-8M	Setup	?	Initialized patch
all	—	Yamaha TX-7	Voice	BAS-ROADS1	Source file closed
all	off	Wave Station	multiset	UNNAMED multiset	Initialized patch
all	1	Wave Station	perform	UNNAMED perform	Initialized patch
all	1	Wave Station	patch	UNNAMED patch	Initialized patch
all	1	Wave Station	wave seq	?	Initialized patch

FIG. 1: The Performance window is the center of X-oR's universe.

H-oR Setup											
Instrument Name	Port/Cable	SysX Chnl	Recv Chnl	Swch Send	Swch Updt	Bank Send	Performance Load	Enable Save	Switches Bank	Performance Bank	File
Matrix-12	all	3	3	none	none	on	on	on	on	on	OB Multi?
Roland D-50	all	15	15	none	none	on	on	on	on	on	?
DX7II Intern	all	11	11	none	none	off	on	on	on	on	?
Korg M-1	all	9	1	none	none	off	on	on	on	on	?
Roland R-8M	all	10	10	none	none	off	on	on	on	on	?
Yamaha TX-7	all	11	—	none	none	off	on	on	on	on	?
Wave Station	all	1	—	none	none	off	on	on	on	on	?

FIG. 2: Using the Instrument Setup window, you tell X-oR how to get around your MIDI network.

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Korg T-Series Alessis MM18 Data Disk SQ
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tions. If you use Apple's *MIDI Manager*, you can audition edited sounds with your favorite sequencer, or record *X-oR* data into a sequencer track.

SETUP

At the heart of *X-oR* is the Performance file (see Fig. 1). A Performance is a "snapshot" of all the supported instruments in your MIDI system. Each row in the Performance window displays a different "module," which can contain a single voice, combination program, drum kit, microtuning table, system setup, or other SysEx information pertinent to a particular MIDI device. Some instruments only have one data type, so only one module is shown.

The modules that appear in the Performance window are determined by the information you enter into the Instrument Setup window (see Fig. 2). This is where you describe each device in your system, giving its name, computer port (and cable number for multi-port interfaces), SysEx channel or device number, and MIDI receive channel. If you use a programmable MIDI switcher, you also can enter the appropriate program change number. Additional columns contain on and off switches to enable each module as an active part of the Performance file. To add modules, you copy the necessary profiles from the floppy disk, then enter the Instrument List Editor, where you can add instruments, remove

Product Summary

PRODUCT:

X-oR Universal System
Exclusive Orchestrator

REQUIREMENTS:

Macintosh Plus or better
with 1 MB RAM, System
6.0, and a MIDI interface;
more RAM and a hard disk
are recommended.

PRICE:

\$399

MANUFACTURER:

Dr. T's Music Software
100 Crescent Rd.
Needham, MA 02194
tel. (617) 455-1454.

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

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Crystal sounds are all over it!"



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instruments, and rearrange their order in the Performance window.

Almost every MIDI device has its quirks and special requirements, so it's a good idea to check the Profile information window for each instrument. Click on any module in the Performance window, then select Profile Help from the Apple menu. The screen that appears tells you how the instrument needs to be set up to exchange data with *X-oR*, who wrote the profile, and when it was last modified. It also discusses known synthesizer ROM-version problems. Only a few profiles lack help files.

DATA EXCHANGE

To transmit patch information from a MIDI instrument to *X-oR*, select a module in the Performance window and

choose Get Bank or Get Patch from the MIDI menu. To capture all the currently loaded patches from every instrument, choose Get Performance Patches. When you request a patch, it shows up in the Performance window module. If it's a bank, a bank window materializes. A MIDI data-monitor window displays patches and banks in hexadecimal form.

X-oR is capable of converting Opcode patch librarian or editor/librarian files into its native format, but only if the Opcode files are from version 5 librarians or from *Galaxy*. I had no problem converting files from several types of synthesizers. This is great because thousands of patches are readily available in the Opcode format. You also can convert *X-oR* data files and profiles from other computers by downloading them

from an electronic bulletin board or by using *Apple File Exchange*.

To hear patches within *X-oR*, you can automatically echo MIDI data from your main controller to the instrument in the selected module, play onscreen keys, or use the more sophisticated MousePlay. With MousePlay, whenever you press the Option key a note is sent, the pitch and velocity of which are controlled by the cursor's position on the computer screen. If you hold the Command key as you drag the mouse, you can send pitch bend, and pressing the Control key lets you send any Continuous Controller. A Panic command is available in the MIDI menu in case you encounter any stuck notes.

BANKS AND LIBRARIES

A bank contains all the data normally stored in an instrument or device. For some instruments, this means that individual patches and Multi patches are stored in a single *X-oR* bank. The type of data shown depends on the module selected in the Performance window. As one would expect, *X-oR* greatly simplifies the task of organizing banks. Replacing one patch with another is a simple matter of dragging it from one location to the next. And another option allows you to swap or move the contents of the source and destination patches.

A Library is a patch database that's arranged alphabetically or chronologically. Like other databases, an *X-oR* Library lets you classify and cross-reference patches by name, date, comments, or keywords. To place patches into a Library, simply copy them from a bank or the Performance window. When a patch is pasted into a Library, a dialog box appears to enter keywords and comments (see Fig. 3). The keywords are divided into groups and selected from a series of pop-up menus. For example, the Sound EFX group is divided into Animal, Automobile, Bird, Crash, Household, Human, Insect, Jet, Plane, and Train. If the supplied keywords don't suit your needs, a Keyword Setup dialog box lets you define your own groups and customize the keywords. A Find command makes it possible to search for patches either by name or keyword.

PATCH EDITING

You open a Patch Edit window by selecting a module or a patch name

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ART

MultiVerb, MultiVerb II

Casio

CZ-1, CZ-101, CZ-1000, CZ-5000, VZ-1*, VZ-10M*, VZ-8M

DigiTech

DSP-128, DSP-128+

Digital Music Corp.

MX-8

E-mu

Proteus/1, Proteus/1 XR, Proteus/1 w/Orch. Expansion, Proteus/1 XR w/Orch. Expansion, Proteus/1 w/Protologic, Proteus/1 XR w/Protologic, Proteus/2, MPS

Ensoniq

ESQ-1, ESQm, SQ-1, SQ-80, VFXSD

JLCooper

MSB+ Mark II

Kawai

K-1, K-1r, K-4, K-5*

KMX

MIDI Central

Korg

DSS-1, DVP-1, DW-6000, DW-8000,

EX-8000, 707, DS-8, Wavestation, M1, M1R, M1Ex, M1REx, M3R, P3, Polysix, Symphony, T1, T2, T3, Z3

Lexicon

LXP-1, LXP-5, PCM70

Oberheim

Matrix-1000, Matrix-6, Matrix-6R, Xpander*

Peavey

DPM-3

Rane

MPE-14, MPE-28, MPE-47

Roland

Alpha Juno 1, CM-32P, CM-32L, CM-64, D-10, D-20, D-50, D-110, D-550, DEP-5, GP-8, GM-70, GR-50, Juno 106, JX-8P, MKS-20, MKS-70, MKS-80, MT-32, R-8, R-8M, U-20, U-110, U-220

Sequential

DrumTrax, Max, Prophet-5, Prophet-600, SixTrak

Waldorf

MicroWave

Yamaha

DMP7*, DX7, DX7II, DX100, TX7, TX816, TF1, TX802, TX81Z, FB-01, KX76, KX88, RX11, SPX90, SPX90II, SY77, TG77, V50

* indicates Librarian support only

Library Patch Information

Name: CHROME BASS

Created: 10/01/91 20:27

Keywords:

synth	pluck
bass	
resonant	
metal	

Comment: Mystic Boom Boom timbre

OK

Cancel %.

and typing Command-E. An Edit window reveals all the instrument's patch parameters in graphical form (see Fig. 4). Most parameters appear as sliders, but some are simple on-off switches and some are text boxes with pop-up lists. For example, clicking on an oscillator parameter may summon a list of every available waveform, while envelopes are shown with corners that you can click-and-drag into position.

The user interface is similar in feel to, though not as graphically attractive as, Opcode's editor/librarians. Most *X-oR* Edit windows are larger than a single Mac screen, so it's usually necessary to scroll down to view every parameter. To make it easier for the user to jump from one part of the window to another, a Jump To pop-up menu appears in the lower left corner.

Combining and copying parameters from one patch to another can be done in several ways, and algorithms are available for blending, mingling, and randomizing patches. Blending two patches creates a new bank by progressively blending their parameter values. The Mingle command randomly and progressively swaps parameters between them to generate a new bank. If Masked Params is selected, only parameters you choose are affected. The Randomize command creates a new bank of randomized variations on the cur-

rently selected patch. Chaos Control buttons are used to set the degree of randomization.

IS IT COOL?

I like *X-oR*. It has editors for more instruments than its competition, it doesn't use as much disk space, and it seems reliable. The hardest part is setting it up, and that's not easy with any software that configures an entire MIDI system. Bank, Library, Patch Edit, Instrument Setup, and Performance windows can be printed for reference. The manual is well-organized and thorough, with a reader-friendly demeanor and an index. If you own an instrument that isn't supported, you can try to coax the programmers into writing a new profile, or you can wait until *E-oR*, a companion program that is scheduled for release in 1992, arrives and roll your own.

Of course, *X-oR* isn't perfect. Some of its concepts are a little difficult to grasp, such as the symbiotic relationship between the various windows. I also discovered a few bugs, including windows that refused to scroll and parameters that did nothing. I even got the program to crash a time or two, but I attribute that to using an obsolete JamBox 4+ MIDI interface. If you encounter technical problems, Dr. T's offers telephone support twenty hours

FIG. 4: Editing templates, such as this one for the Roland D-50, are included in each instrument's profile.

a week and modem support on the GENie information service.

There's a lot to be said for software that organizes your entire MIDI system. *X-oR* is especially useful if you're in the habit of changing everything in your studio whenever there's a session, and you want to change it back when you're finished. If you have more than three MIDI devices, and you're looking

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for a way to simplify your life, *X-oR* may be just what you need.

These days, Geary Yelton is calling himself a musical futurist. He spends less time making records and commercials and more time consulting, teaching, and composing music for his own purposes.

Bag End TA-15D Speakers

By Michael Molenda

**A versatile mammoth
kicks bass on stage and
in the studio.**

If you want to *feel* bass, you need a big speaker. Acoustic technicians may have my hide for that statement, but maybe they should try explaining to a drummer or bass player why the little pop knocking out of a 10-inch woofer doesn't rock the house.

Simply put, shaking down architecture requires moving a lot of air. Usually this is accomplished with a healthy dose of wattage and a 15- or 18-inch speaker system. While these systems often are too large to fit in the average home studio (or be transported in the average car), they are an invaluable reference medium for the bass-intensive sonics demanded by dance-club mixes, theatrical sound design, film soundtracks, and synthesizer/sampler programming.

If your home studio has room to spare (and enough isolation to spare the neighbors), Bag End's TA-15D Time-Align loudspeakers deliver all the glories of expanded bandwidth and crushing bass.

SPEC TIME

The TA-15D is a 2-way, ported enclosure with a 15-inch bass/mid driver and a constant-directivity, high-frequency horn. Frequency response is rated by the manufacturer at 50 Hz to 19 kHz (± 3 dB), and the enclosure is tuned at 40 Hz. Dispersion is claimed at 90 degrees horizontal and 40 degrees vertical. System impedance is 8 ohms, with a continuous, long-term power-handling

capacity of 200 watts.

The TA-15D's beautifully rendered birch cabinet measures 27 x 22 x 18 inches and weighs 78 pounds. (The cabinet also is available with a less expensive, though similarly rugged, black-carpet covering.) Each enclosure includes two dampened, spring-loaded handles. Input connections include two 1/4-inch jacks, one double banana jack, and one Neutrik Speak-on connector. The system also comes in floor-monitor and installation (stand-mount) versions.

SOUNDING OFF

Bag End utilizes a time-alignment design licensed from the trademark holder, E.M. Long and Associates. In non-aligned systems, the tweeter may reproduce part of the sound spectrum of a sound ahead of the woofer. Since natural transient response requires all audio frequencies be reproduced at the same instant, any time lapse imposed by the speaker causes a loss of definition. To maintain clarity, the TA-15D's time-alignment system produces an accurate audio "snapshot" by adjusting its loudspeaker components to achieve simultaneous reproduction of input signals.

Putting this concept to the test, I recorded several percussion samples at varying dynamic levels. On playback, the TA-15Ds reproduced everything from a subtle rimshot to industrial cacophony with crisp tonal integrity. Sharp attacks (snare drums, timbales, etc.) were tight and aggressive, and drastically detuned floor-tom samples retained rich lows without getting flabby. Sonic articulation was maintained even at minimal volume levels. Optimum listening is achieved at a distance of five feet or more, although at reasonable volumes, the system provides adequate near-field monitoring.

The TA-15Ds passed the rap test easily. Super-low kick-drum explosions and rat-a-tat sample runs reproduced clearly, as did subsonic synthesizer patches. Even at high dance-club volumes, bass frequencies never degenerated to envi-

Product Summary

TA-15D Time-Align
Loudspeaker System

PRICE:

\$1,026 each (birch cabinet)

\$896 each (Ozite covering)

MANUFACTURER:

Bag End Loudspeaker Systems
PO Box 488
Barrington, IL 60011
tel. (708) 382-4550

EM METERS	RATING PRODUCTS FROM 1 TO 5			
AUDIO QUALITY	●	●	●	●
VALUE	●	●	●	●

ronmental mush.

Although the TA-15Ds maintained a fairly uniform tonal spectrum, vocal sibilance and cymbal "sizzle" was accentuated when playback switched to the Bag Ends from Yamaha NS10M, Tannoy Super Gold, and TOA 280SE monitors. This slight treble boost occurred at every listening level but was never harsh enough to cause concern.

CONCLUSION

It's no small wonder Bag End has attracted heavy endorsements from "musicians' musicians," such as Herbie Hancock, Chick Corea, and Allan Holdsworth. The construction is first-rate and shows the obvious care be-



Bag End TA-15D speakers are available with ozite-carpeted finish (shown) for stage use, or birch finish for studio applications.

stowed by the manufacturer. Every aspect of the design, from the heavy-duty handles to the steel protective grill, proves the TA-15D is a precision instrument with a rugged constitution. The carpet-covered models are tough enough to handle double duty as stage and studio monitors. (The birch finish is too beautiful to risk damage out in the cruel world of live performance cartage.) In addition, they sound amazing at all listening levels and push enough bass to uproot the Statue of Liberty.

The TA-15Ds' big, crisp sound made them the "party" speakers of choice at Sound & Vision studios in San Francisco. When a final mix was completed, clients couldn't wait to crank up the Bag Ends and *feel* the music. ●

Sample Disks for the Ensoniq EPS

By David Bradfield

Third-party sample sellers stretch from steel to symphony to sonic space.

One of the great advantages of Ensoniq EPS and EPS 16 Plus ownership is the large number of samples marketed by Ensoniq and myriad third-party vendors. In addition to the better-known sources, some relatively small outfits offer an amazing variety of quality sounds. Bearpaw Sound's unique pedal steel guitar sample, Keith Thomas's mainstream synth and orchestral instrument samples, and Electro Acoustics' experimental synth sounds clearly demonstrate the breadth and depth of this sonic wealth for the EPS.

Bearpaw Sound Pedal Steel Guitar Sample

Bearpaw offers a half-dozen Ensoniq EPS sample disks, but Steve's Steel is by far the most popular. This instrument is well designed and I learned a lot about pedal steel guitar by reading the thorough performance notes packaged with the disk.

Since the EPS has polyphonic aftertouch it is well suited for this instrument. The aftertouch data for each key

is mapped to that note's pitch. You can bend the pitch of individual notes in a chord upward by as much as two semitones by applying pressure. For example, you could play a minor chord and by applying pressure to the third, bend it up a half-step to form a major triad. The pitch wheel allows global pitch bend up or down a whole step.

The Patch Select buttons allow switching between envelopes with a "picked" attack and envelopes simulating a volume-pedal swell. One patch is set to only bend selected keys (samples). The performance notes describe how to use this feature to create a I-VI-V chord turnaround without "restriking" the strings.

The sound occupies 894 blocks, so it should fit into a standard EPS with no memory expansion. I pulled the raw samples into Passport's *Alchemy* sample-editor for the Mac, and they appear carefully constructed and edited. However, I did find some disconcerting intonation shifts at loop points.

Actually, intonation poses a noticeable "problem." The performance notes anticipate keyboardists may be disturbed by the instrument's pitch because a properly tuned pedal steel is out of tune. (In the "Emmons" tuning, the B strings are tuned five cents flat and the G-sharp strings are roughly 3.5 cents flat.) They were right. Even though the notes forewarned me, the intonation bothered me. In practice, applying added pressure to notes that seem out of tune can correct pitch.

It may take time and practice to play

Product Summary

PRODUCT:

Steve's Steel pedal steel guitar sample

PRICE:

\$15 (plus \$2 shipping and handling)

MANUFACTURER:

Bearpaw Sound
P.O. Box 65
Lyman Station
White River Junction, VT 05001
tel. (802) 296-6757

BEARPAW

EM METERS	RATING PRODUCTS FROM 1 TO 5				
SAMPLE QUALITY	●	●	●	●	●
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VALUE	●	●	●	●	●

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● EPS SAMPLES

this instrument convincingly in real-time, but when used in sequences with precise control aftertouch and Patch Select values, it worked great.

K. Thomas Samples for EPS and EPS 16 Plus

According to designer Keith Thomas, these samples were developed to simulate "realistic sounding instruments no matter how much sample memory was required." Thomas produced more than 90 sounds for the EPS, divided into ten groups:

Group A: Orchestral (14 sounds; \$85)

Group B: D-50 Sounds (17 sounds; \$79)

Group C: M1 Sounds (11 sounds; \$49)

Group D: Miscellaneous Sources (Kurzweil, DX7, U110, Flamenco Guit.; 10 sounds; \$49)

Group E: Misc. (5 sounds; \$26)

Group F: More Orchestral (10 sounds; \$95)

Group G: String Effects (4 sounds; \$22)

Group H: Combined Strings (made from Groups A and F; \$71)

Group I: More Misc. (strings, orchestra hits; 9 sounds; \$80)

Group J: Saxophones (solo and sections; 9 sounds; \$69)

I received eleven sounds—five from the Orchestral Group, three from the D-50 group, and three from the remain-

Product Summary

PRODUCT:

K. Thomas Samples for EPS and 16 Plus

PRICE:

Individual sounds cost between \$4 and \$23 (U.S. currency, plus \$4 shipping and handling). Demo package is \$12.

MANUFACTURER:

K. Thomas
PO Box 174
Stratford, ON
N5A 6T1
Canada
tel. (519) 271-7964

K. THOMAS

EM METERS	RATING PRODUCTS FROM 1 TO 5				
SAMPLE QUALITY	●	●	●	●	●
DOCUMENTATION	●	●			
VALUE	●	●	●	●	●

Product Summary

PRODUCT:

Electro Acoustics Sound Disks

PRICE:

\$89

DISTRIBUTOR:

MacBeat
1314 Rufina Circle, Suite A4
Santa Fe, NM 87501
tel. (800) 622-2328
or (505) 473-4929

ELECTRO ACOUSTICS

EM METERS	RATING PRODUCTS FROM 1 TO 5				
SAMPLE QUALITY	●	●			
DOCUMENTATION	●	●	●		
VALUE	●	●			

ing groups—plus the product demo package (a diskette and a cassette). There are no written performance notes, but the demo cassette explains most of the controls on each instrument.

These are quality sounds. Great care was taken at each design stage, from the recording and editing of the sample to the creative and useful real-time performance controls. But there are tradeoffs. To increase fidelity, higher sampling rates were used, so many of these samples are extremely large. Thomas recommends a 4X expander, as a 2X expander cannot load some of the sounds in the Orchestral group. (For example, the Violin is 3,162 blocks and Double Reeds 2,666 blocks.) In contrast, the sounds from the synthesizer groups are excellent and use up considerably less memory.

My final test was a subjective one: When improvising, does the sample inspire idiomatic playing like the instrument it attempts to emulate? These sounds do, and I like them.

Thomas' marketing is unique. Each sound in the catalog is individually priced and can be custom-ordered in any combination. The demo cassette demonstrates all available instruments, with and without effects, so you can audition them before buying. I think this is a great way to sell third-party samples.

Electro Acoustics Sound Disk Set

Unlike most third-party samples, the Electro Acoustics set contains no imitations of strings, horns, drums, or other instruments. It consists of fifteen

unusual synthesizer sounds (stored on ten disks) designed with avant-garde or "new music" in mind. The sounds were prepared from analog synthesizer samples and have imaginative, poetic names such as Tolkien Trio, Ether-Screams, and Crescendo Pi. Each instrument fits into standard EPS memory, and all have stereo output. They use a variety of real-time performance controls, which are well documented in the performance notes. The set is available in EPS and Digidesign *Sound Designer* formats.

As an academic composer, I usually like experimental sounds, but I'm less than enthusiastic about these. There are some nice sounds in the set, and the controls make them suitable for live performance. But my favorite instrument, Digifloats, appears to have clipping distortion in the original sample. (I could see the distortion when viewing the sample in *Alchemy*.) Unfortunately, the Patch Select buttons are not implemented in any of the sounds.

Although the market for "experimental" sounds may be narrow (most experimental musicians design their own sounds as part of the experiment), performance artists who are not immersed in the technology of sound design will find the Electro Acoustics set offers some innovative textures.

(The author wishes to thank Keith Hefner.)

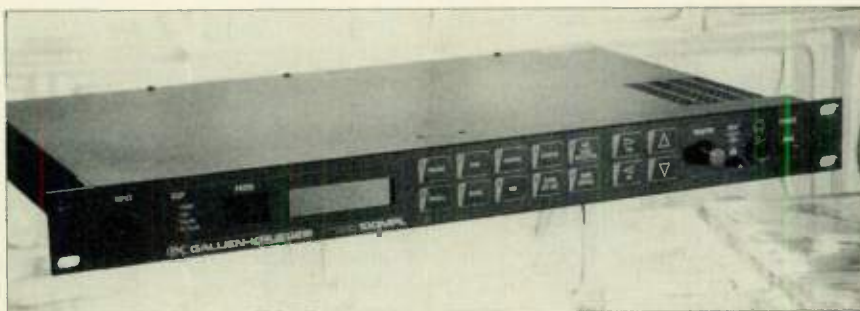
David Bradfield is a professor of music in the Audio Recording and Music Synthesis Program at California State University-Dominguez Hills. His E-mail address is HFAC001@CYB830.CSUDH.CAL-STATE.EDU.

Gallien-Krueger 100MPL/Preamp

By Peter McConnell

**A solid-state sound
specialist gratifies guitar-
ists whose goal is control.**

In the crowded market of MIDI-controlled guitar preamplifiers under \$1,000, the Gallien-



PETER DIGGS

Gallien-Krueger's 100MPL guitar preamp provides several stages of EQ, onboard tremolo, and stereo chorus, and an impressive array of MIDI control features.

Krueger 100MPL is an amp with an attitude. For one thing, it has no tubes, which immediately sets it apart from most of its competitors. This, of course, is Gallien-Krueger's specialty: making exclusively solid-state equipment.

The 100MPL makes its statement in its breadth of control, offering far more sound parameters than most preamps. What's more, all of these parameters may be accessed via MIDI controllers, a specialty feature usually reserved for synthesizers and effects processors. Most importantly, the sound lives up to the 100MPL's ability to control it.

A SWEET (INTER) FACE

The front panel of the 100MPL is unabashedly modern. All adjustments are made using membrane buttons, which may disorient guitarists used to twisting good old-fashioned knobs.

A large LED display tells you which program you have selected, and a 32-character, backlit display provides detailed information about your changes. Whatever you think of backlit displays, this one is well designed, with features such as moving EQ bar graphs to help you see at a glance how you are changing the tone. The display also allows you to see several parameter values on one screen, a courtesy not provided by most other preamps. Clipping LEDs show you if a part of the circuit is overloading.

All in all, the user interface is easy to understand, passing the I-never-read-the-manual test near the head of its class.

WHEN I GAIN CONTROL AGAIN

A block diagram of the 100MPL's circuit looks pretty much the same as that for many guitar preamps. The difference is in how much control the 100MPL gives you over each part of the circuit.

The signal path temporarily divides

after a gain stage, and you can select either the Overdrive "voicing" channel (i.e., type of amplification circuit) with four overdrive settings, or the Clean

The 100MPL

**produced killer
sounds, from cutting
metal leads to
the warm, meaty
sounds of
Classic Twins and
Mesa Boogies.**

voicing. In the Overdrive channel, the gain structure and a predistortion EQ are preset according to which overdrive setting is selected.

The Clean channel includes a compression circuit with adjustable compression ratios and threshold, and if you crank up the gain, you get soft clipping (mild distortion). Both channels are routed through a volume-control circuit and through four bands of active EQ (high- and low-frequency shelving and two midrange, broadband peaking bands) instead of the usual bass and treble controls. The 4-band EQ, which is based on a design used in earlier Gallien-Krueger gear, then runs in series through a 7-band graphic EQ for added timbral flexibility. GK also added a passive, midrange notch filter, called "Shape," that operates in either circuit. In the Overdrive voicing, Shape is post-distortion, while in the

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● GALLIEN-KRUEGER PREAMP

Clean channel, Shape comes before the soft-clipper.

The 100MPL also offers some built-in effects, a mono send and return, and noise reduction with adjustable threshold. The built-in analog stereo chorus has two waveforms to choose from—triangle and random (random peak heights, not periods)—with adjustable rate, delay, and depth.

Some other preamps have different waveforms for their choruses, but no others have a built-in tremolo. The 100MPL tremolo uses the chorus's LFO to alter the the volume, so while both chorus and tremolo can be used at once, they must have the same period.

The 100MPL is remarkable not only for how many parameters it has, but also in how you can get at them. All of the unit's sound parameters are accessible by MIDI controllers at any time. I know of no other preamps that implement MIDI control this flexibly. You can specify up to four different MIDI controller/parameter maps and can assign any map to any program.

So what? You get live dynamic control over every aspect of your sound. All you need is a programmable MIDI foot controller (many are available), and you can use it to ramp up your gain during a solo, turn up the effects returns, increase the chorus depth, boost or cut the highs, you name it.

SONIC SUBSTANCE

All of this power and flexibility would be useless without good sound to control, and the 100MPL doesn't let you down here. When performing under MIDI control, the unit sounded smooth and clean. I noticed a slight zippering

effect when changing the EQs via MIDI, but it was miniscule compared to the noise associated with most analog footpedals that do this.

When I first listened to the presets, I was not impressed. They don't have a broad enough range of sounds, and they tend to be set a little too trebly for my taste. In addition, I didn't immediately appreciate the importance of the VCV (Vintage Cab Voicing) button. It gets a quick mention in the manual, and the term isn't even spelled out. VCV is a special circuit used on several Gallien-Krueger products to simulate the warm sound of a live speaker cabinet. For all but the most cutting trebly rhythm parts, this button should be kept on. In fact, you probably should tape it on.

Once I got VCV on and learned my way around the subtleties of the 100MPL's tone, voicing, and compression controls, I was able to get an incredible range of really killer sounds, from cutting metal leads to the warm, meaty sounds of the classic Twins and Mesa Boogies, with just a hint of distortion. Those whose religion is against solid-state must listen for themselves; I did not miss the tubes at all. However, there are tube preamps that I think are punchier and hotter sounding in the most distorted lead settings. As far as noise goes, the sound is clean, and the unit does not seem to hum in live situations.

DID I SAY FEATURES?

I haven't mentioned the two male XLR "Recording Compensated" balanced outputs, the two extra stereo aux returns (stereo, 1/4-inch jacks), or the footswitch jack for stepping through one of four different "set lists" of 30 programs. The unit's MIDI program mapping feature remaps incoming program change numbers to 100MPL program numbers and sends up to three Program Change messages to external MIDI devices. You can archive your programs and maps using MIDI System Exclusive dumps and send stomp-box signal levels out two external control jacks whenever a MIDI Program Change is received.

With great sound and control features, it's hard to say anything negative about the 100MPL, but I will anyway. Changing values with membrane buttons is not lightning-fast. In addition, the manual is far too brief and

simply omits some important information. (For example, nowhere is the signal path mapped out.)

But it's hard to worry too much about a couple of drawbacks when there isn't room here to describe all the good features. There is not a control feature on any guitar preamp I have tried that isn't done as well or better on the 100MPL. If the name of your guitar-sound game is control, control this.

Peter McConnell is a musician and independent MIDI consultant living in Berkeley, California. He works for Lucasfilm Games and plays violin, guitar, and keyboards in the Bay Area band Never Land. He also runs his own production company, Little Big Note Music.

Anatek Pocket Curve and Pocket Mapper

By Charles R. Fischer

Two Pocket-sized MIDI processors add valuable functions to under-powered controllers.

Perhaps you are equipped with the ultimate in state-of-the-art gear, and your MIDI stack does everything you desire. If so, feel free to pass up the rest of this review. On the other hand, if your setup is older, and you want to add a few new features, you should know about two recent additions to Creation Technologies' Anatek Pocket Products line. The Pocket Curve supplies 24 velocity curves to transform the velocity data from any MIDI controller, while the Pocket Mapper provides a simple way to convert almost any Continuous Controller message into another Controller message. The products list for \$99 each.

POCKET CURVE

One of the hardest things to personalize in most older MIDI controllers is the velocity response. Each velocity-sensitive controller offers a unique "action," and its design determines the relationship (graphically expressed as a curve) between how fast a key goes

Product Summary

PRODUCT:

100MPL MIDI-controlled guitar preamp

PRICE:

\$799

MANUFACTURER:

Gallien-Krueger
1355 Dell Ave.
Campbell, CA 95008
tel. (408) 379-3344

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



The Anatek Pocket Curve provides 24 velocity curves, including two banks designed for the Yamaha DX7. The Pocket Mapper remaps almost any Continuous Controller message into another Continuous Controller message.

up and down on a keyboard controller and the Velocity values generated. Newer designs often offer a choice of velocity curves, but on older units, you usually get a single, preprogrammed velocity curve. (The most common velocity curve yields a 1:1 linear relationship between keystroke speed and Velocity data.) With the Anatek Pocket Curve, you can select from four banks of six velocity curves without buying a new controller.

Some controllers, such as the DX7, cannot reach the full Velocity value of 127, so Bank 1 curves expand the Velocity range to the maximum. The first curve in Bank 1 was designed specifically for the DX7, and the other curves offer variations of this with steeper slopes.

Bank 2 curves have the opposite effect: Designed for controlling a DX7 from an outside controller, they compress the Velocity range so the values don't reach 127. The first Bank 2 curve limits Velocity to approximately 120, and the other curves offer progressively less velocity.

The third bank offers exponential and logarithmic curves, which I found most useful. They are suited for compressing and expanding a controller's dynamic response in a natural and controllable way.

A controller that isn't velocity-sensitive generally sends a fixed Velocity value of 127 with all Note-on commands. Bank 4 curves readjust this so you can derive your choice of six fixed Velocity values from a controller that

isn't velocity sensitive. It's handy for folks who wish to remove the human expression from their music, however I definitely would prefer to have more exponential and logarithmic curves instead.

The Pocket Curve affects velocity messages on all MIDI channels simultaneously, and there is no way (short of purchasing a separate box that provides this function) to restrict its use to specific channels. I'd

like to be able to apply a curve to a specific MIDI channel, but how much can you expect from a \$99 product?

The unit worked extremely well. It's especially slick if you're using an original DX7 as a MIDI controller, but it also improves the response of many other controllers.

If you don't like the way your MIDI sound sources respond to your old controller's velocity messages, you should

Product Summary

PRODUCT:

Anatek Pocket Curve and Pocket Mapper

PRICE:

\$99 each

MANUFACTURER:

Creation Technologies
400 Brooksbank Ave.
North Vancouver, BC
V7J 1G9 Canada
tel. (604) 980-6850

POCKET CURVE

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

POCKET MAPPER

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

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● POCKET CURVE/MAPPER

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POCKET MAPPER

The Pocket Mapper, like the Pocket Curve, is dedicated to a single task: converting a Continuous Controller message (Pitch Bend, Aftertouch, Modulation Wheel, etc.) into another Continuous Controller. The incoming and outgoing message types are selected using a set of DIP switches. Like the Pocket Curve, the Pocket Mapper acts upon all MIDI channels simultaneously.

The ability to remap controllers is handy if your MIDI controller won't send your choice of controller messages. For example, your Yamaha TX81Z has patches designed to work with a breath controller, but your controller doesn't have the breath-controller input to use these sounds effectively. Rectifying this is as simple as setting the first four switches on the Mapper to accept messages from an available controller (such as a footpedal or mod wheel) and setting the outgoing switches to produce Breath Controller

messages. Now your module should come alive when you move the footpedal or wheel.

Another prime application takes the opposite approach: The Pocket Mapper lets MIDI wind-instrument players remap their controllers to address synthesizers that don't implement Breath Controller messages. I developed a bunch of radical tricks in less than an hour of messing around, converting Aftertouch into Pitch Bend, Mod Wheel and MIDI Volume into Pan messages, and so on. This is a versatile and genuinely useful item.

Now for the bad news. While Anatek is not known for wonderful documentation, the Pocket Mapper's single page of instructions contains more screwups than complete manuals published by other companies. On one side of the page, the instructions claim Pitch Bend is supported, while the other side states the opposite. (Pitch Bend is supported.) The instructions also imply the Mapper doesn't process aftertouch data; it does.

Finally, the sheet lists MIDI Program Increment and Decrement messages as Continuous Controllers 96 and 97, while the chart printed onto the box lists these as 60 and 61. (Both are true, as 96 and 97 are the decimal equivalents of 60 and 61 hex. However, the documentation doesn't indicate this.) There is absolutely no excuse for inflicting hazy information on paying customers.

The Mapper is useful, although it takes some experimentation to get the best results. It's especially good when paired with an Anatek Pocket Pedal (reviewed in the May 1989 issue of *EM*), so that a control-voltage footpedal can generate Aftertouch as well as other Continuous Controller messages in real time.

Documentation aside, the Pocket Curve and Pocket Mapper are built with the typical musician in mind and do what they're supposed to do for a reasonable price. Both units should find their way into the gig bag of any musician who needs to stretch a bit more performance out of a less-powerful controller.

Charles R. Fischer works as a studio musician and synth programmer, designs custom audio and MIDI equipment, and writes for several magazines. He is based in the San Francisco Bay Area.

Opcode Track Chart 1.0.1 (Mac)

By Tim Tully

This track tracker simplifies time-consuming tasks.

Opcode Systems' *Track Chart* for the Macintosh is a handy new tool for professional and home recordists. The program generates track sheets and time-line overviews of multitrack projects to document either MIDI sequencing or standard tape-recording sessions. The System 7.0-, OMS-, and *MIDI Manager*-compatible application also lets the user design and print various types of labels. Its manual, written by *Track Chart* programmer Rick Johnston, is clear, friendly, and easy to follow.

The program opens to a track-chart template displaying a grid of numbered boxes (Fig. 1). Using a dialog box, the user enters the desired number of tracks and columns, whether each track's start time is displayed, the size (in inches) of the track boxes, and other details. The more graphically minded user can size the track boxes by going to the chart and dragging a box corner. The manual doesn't say how many tracks can be charted, but I got it

Product Summary

PRODUCT:

Track Chart 1.0.1

REQUIREMENTS:

Macintosh Plus or better with 1 MB RAM; System 6.0.5 or later (System 7.0-compatible)

PRICE:

\$179

MANUFACTURER:

Opcode Systems, Inc.
3641 Haven, Suite A
Menlo Park, CA 94925
tel. (415) 369-8131

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EM Online, Electronic Musician, 6400 Hollis St. #12, Emeryville, CA 94608.

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

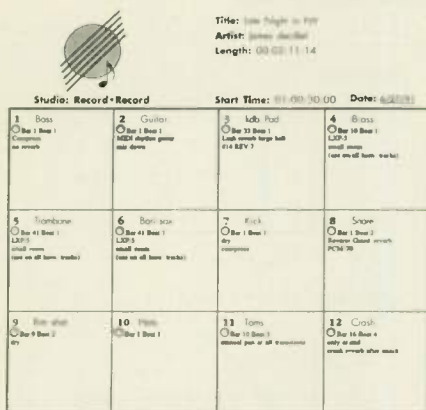


FIG. 1: Opcode Track Chart's Track Chart window displays the name of each track, start and stop times, comments, and the identification of the source of a track as MIDI, tape, hard disk, or live.

up to 96 without a problem.

Additional dialog boxes and pop-up menus allow naming of each track, specification of start and stop times, comments, modification of fonts in any of the usual Mac ways (including sizes from three to 255 points), changing screen colors, and identification of the source of a track as MIDI, tape, hard disk, or live. The start and stop times can be displayed in SMPTE time (24, 25, 29.97, 30, and 30 drop are supported), real time (to hundredths of a second), 16 mm film (40 frames per foot at 24 fps, measured in feet and frames), or 35 mm film (16 frames per foot at 24 fps). Identifying tracks is further simplified by a pop-up menu in the Track Info dialog box that proffers the names of more than one hundred instruments.

Track Chart uses an onscreen toolbox for chart headings. The toolbox contains boxes labeled Project, Title,

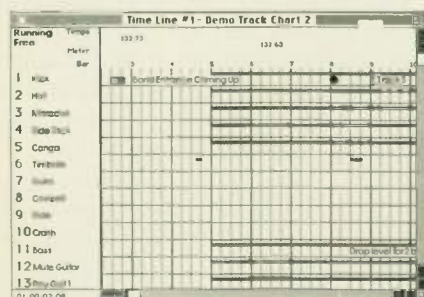


FIG. 2: The Timeline window syncs to MIDI clocks or SMPTE through MIDI Manager and scrolls as a sequence plays. In addition to displaying material in a track as a dark, horizontal bar (on a black-and-white machine), it shows highly visible streamers, punches, flashing text messages, and lyrics and will let you edit events.

Client, Artist, Studio, Start, Stop, Page Number, Length, Logo, Date, and Other. These headings can be dragged anywhere on the track sheet, and the chosen heading will appear, followed by a blank line. The Vital Statistics command then allows logging of information for each category, providing the user a complete system for identifying the elements of a recording. The Logo tool adds a nice touch of professionalism by placing a PICT or Clipboard paint graphic of your choice on the chart. At any time, a heading or track name, number, source, or comment can be dragged to any desired position.

To save keystrokes, Track Chart imports track names, tempos, start times, lyrics, and other data from Standard MIDI Files and rearranges track positions and numbers in the process. It also boasts a special relationship with Opcode's Vision and Studio Vision sequencers, which allows Track Chart to import sequences directly from their files (complete with instrument color-codes).

A feature I find even more useful than the basic chart is the Timeline (see Fig. 2). This feature, which can be opened from the standard display, syncs to MIDI clocks or SMPTE through MIDI Manager and scrolls as a sequence plays. It's an informative way to watch a sequence, and in addition to displaying material in a track as a dark, horizontal bar (on a black-and-white machine), it shows highly visible streamers, punches, flashing text messages, and lyrics. The Timeline also allows editing of events. It's a great rehearsal and mixdown tool.

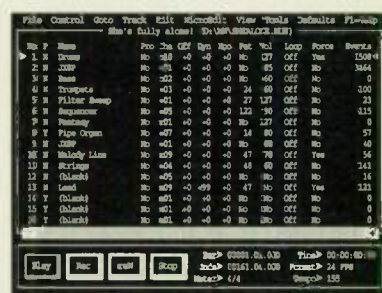
The program automatically takes information from a track chart and uses it to help design and print labels for console faders, tape boxes, or cassettes. While it's possible to move elements around and change font types and sizes, the simple design possibilities are often inappropriate for commercial applications.

The program is a good tool; my biggest gripe is the unfortunate presence of copy protection. (Opcode supplies three hard-disk installs on the master disk and three on a free backup disk that is sent when the registration card is returned.) If you need to keep better track of your tracks, Track Chart is well worth tracking down.

Tim Tully is a computer and music consultant based in Oakland, California.

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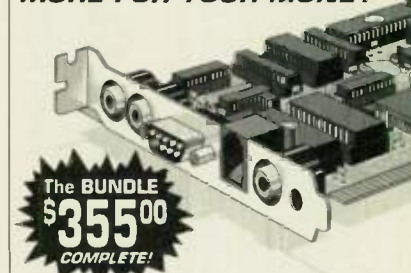


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Multiple Meter Maps	YES	NO
VU Meters on Screen	YES	NO
8 MIDI Ports Standard	YES	NO
Graphic MIDI Control Edit Screen	YES	NO
Tap Your Tempo In	YES	NO
"Live" Included	YES	NO
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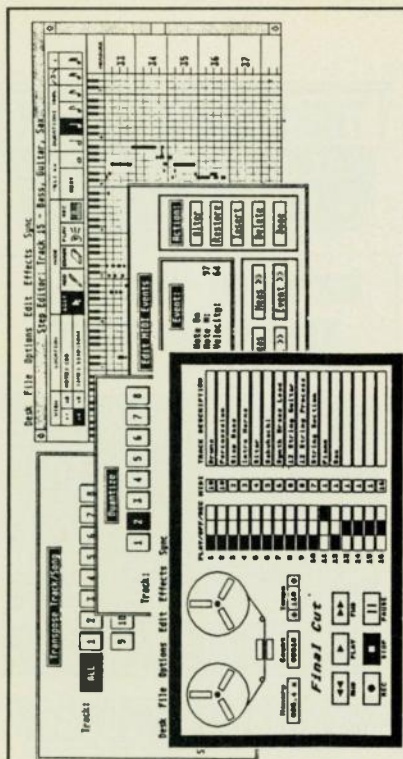
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● FROM THE TOP (continued from p. 69)

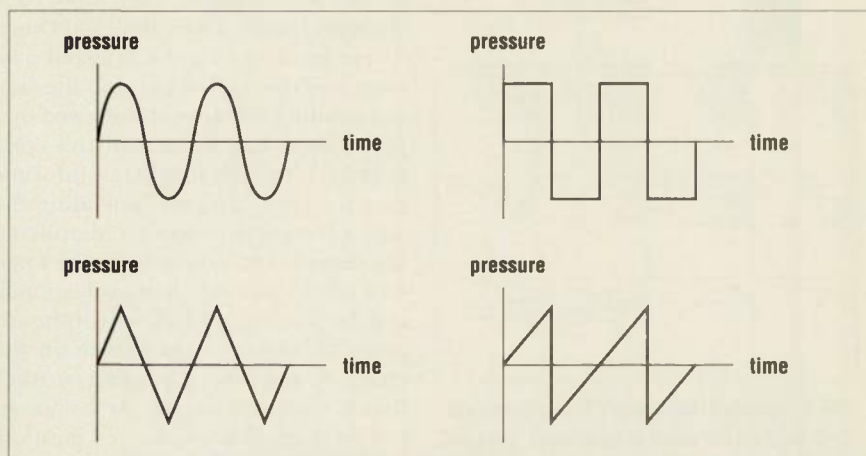


FIG. 3: Four common synthesizer waveforms: sine, triangle, square, and sawtooth. These graphs represent the way in which the air pressure changes during several cycles.

if the frequency of the fundamental is 100 Hz, the frequencies of the higher components would be 200 Hz, 300 Hz, 400 Hz, and so on. This special type of harmonic spectrum is known as the *harmonic* or *overtone series*, and the components above the fundamental are called *overtones*. Fig. 4 is an example of a harmonic series.

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As oscillators became more sophisticated, they were able to produce com-

plex waveforms with many harmonic components, such as the triangle, square, and sawtooth waveforms depicted in Fig. 3. (Sine waves have no harmonic components except themselves.) A technique called *subtractive synthesis* passes these complex waveforms through a *filter*, which is an electronic circuit that removes certain harmonic components from the waveform. Today, this technique is also applied to highly complex acoustic waveforms that have been digitally sampled.

A third common technique for synthesizing complex waveforms is called *frequency modulation* or *FM synthesis*. In this process, the frequency of one oscillator is varied, or *modulated*, at a frequency produced by another oscillator. The relationship between the frequencies and amplitudes of the modulated signal and the modulating signal determines which harmonic components are present in the resulting waveform.

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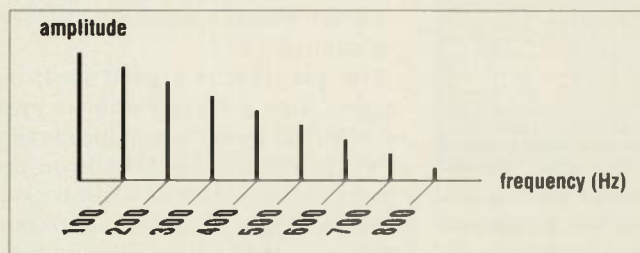


FIG. 4: The harmonic spectrum of a sawtooth waveform. Each line represents one of the sine wave components. The horizontal position of each line indicates its frequency and the height indicates its amplitude relative to the other members of the spectrum. This is an example of a harmonic series.

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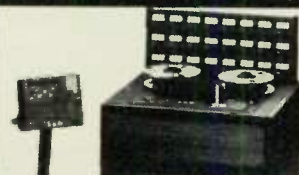
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Music: Who Makes It? Who Just Takes It?

By Laurie Spiegel



MARILYN MCLAREN

Once upon a time almost everyone made music. Households were self-sufficient, making their own food and clothing, too. People were generalists, doing their personal best at each activity. People sang or played at whatever their level of skill, adapting a constantly evolving grassroots repertoire to their expressive needs and personal techniques in what we now call "the folk process."

Some people still make their own music. But the era of self-sufficient generalists has faded over the centuries. During great socio-industrial revolutions, music acquired society's new premises: specialized divisions of labor (composer, performer, listener), a small specialized professional elite of technical experts, the concepts of authorship and ownership of music, its sale as a commodity, the socio-economics of distribution by centralized monopolies, the premise of finished fixed-form musical works (product versus process), and an increasingly skewed ratio between the few active music-makers and the majority who had become passive listeners.

Various technologies fostered these changes: notation, music printing, concert halls, and overwhelmingly, broadcast and recording, each isolating music's active and passive participants

further from each other. Then in the 1980s, another new technology, personal computers, appeared everywhere.

The potential of these logic-based machines is limitless. They could mediate between human touch and sonic/musical response in a potentially infinite variety of new ways. These newly ubiquitous, programmable, networkable info-handlers could explode musical interactivity out of its confinements.

People who have never played music before have started to tinker with it, home hacker-style, and love it. For every master musician, thousands have an equally sensitive ear, a desire to express, a beckoning imagination, and a substantial learned-by-ear music education gleaned from years of attentive listening. Society discourages people from making music if they start "too late" in life or don't play "well enough" due to a lack of time, money, or coordination. Computers give people new opportunities, but only as far as existing software allows.

Computer programs can put you in passive or active roles; they can just play prerecorded stuff or sit waiting, putting the whole creative burden on you. But computers also can be programmed many other ways: with logic, response patterns, music theory, performance practice, data, and decision methods. They can operate in isolation, or network people to each other. They can draw upon all the technique, experience, musicality, and variety their programmers can conceive of, providing human interfaces to music on all its levels: raw sound, compositional structure, orchestration, performance interpretation, and collaborative creation. Computers open an infinite variety of new ways for people to interact with music, an entire unexplored continuum between the extremes of active creation and passive listening.

Computers bring into question all post-industrial assumptions about music: specialized roles, distribution

monopolies, education, and the concepts of finished works and their origins and ownership. Like folk songs, musical data now can travel noise-free, independent of physical objects, without mass manufacture, warehouses, or shipments. Perfect copies no longer need be made by the thousands to be economically practical. Pieces need not have sole creators or fixed, final forms to move among people that are actively and meaningfully involved with them. Intercommunication of music among people now can become as varied, multidirectional, and interactive as the actual means of making it.

Again, as once upon a time, music can be created and changed at home and directly distributed by an expanding percentage of people.

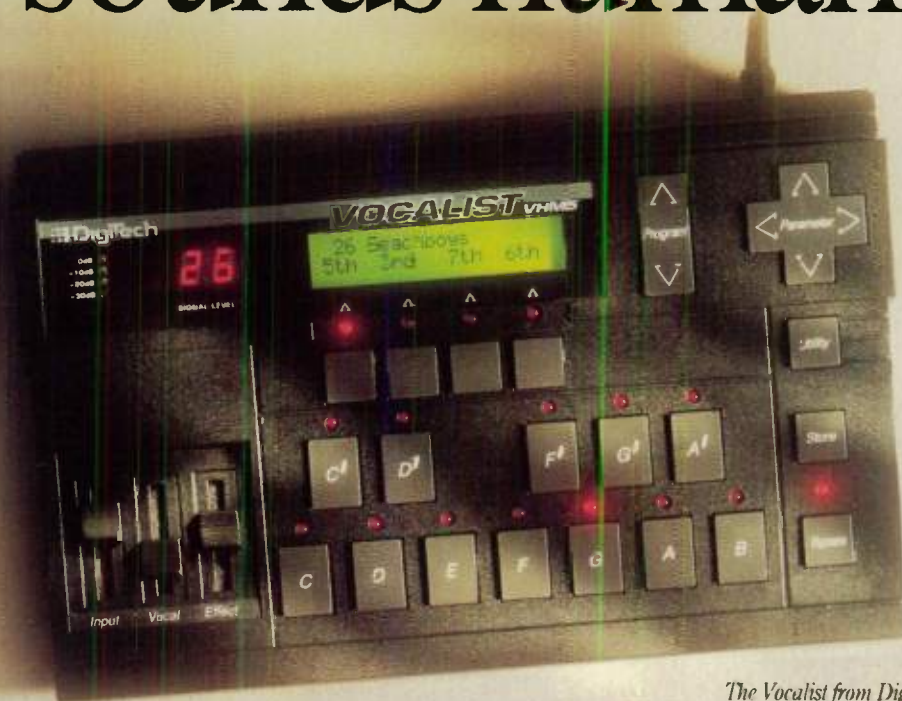
When will we start fully exploring and using these potentials? All music needs rethinking, open minds, innovation, the questioning of long-held assumptions, and more individuals making wonderful new discoveries affordably available to others. How can we improve traditional musical economics, extend beyond entrenched divisions of labor, beyond old concepts of authorship and ownership, without sacrificing support for creativity?

With today's computers, anybody can create music. However, there always will be artists so great we just want to sit passively and listen to their music, and music's traditional economics often fail them. How can we find new approaches? Support the new generalists of computer creativity? Liberate more "non-musicians" to create? Let musical minorities reach each other?

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