Reviews: Cakewalk Pro 3.0, Theme Notation Software, E-mu Proteus/2, A.R.T. DR-X

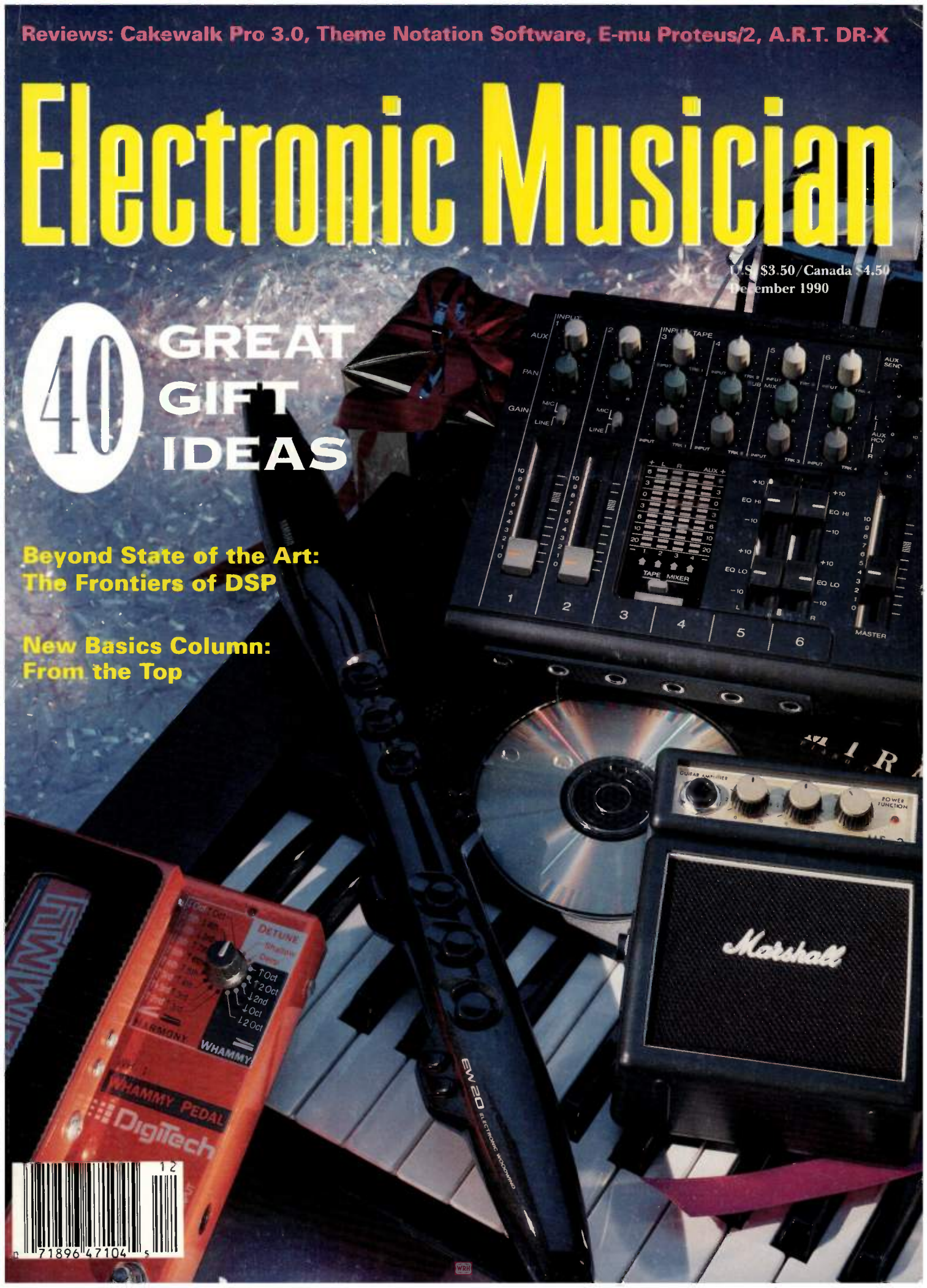
Electronic Musician

U.S. $3.50/Canada $4.50
December 1990

40 GREAT GIFT IDEAS

Beyond State of the Art: The Frontiers of DSP

New Basics Column: From the Top



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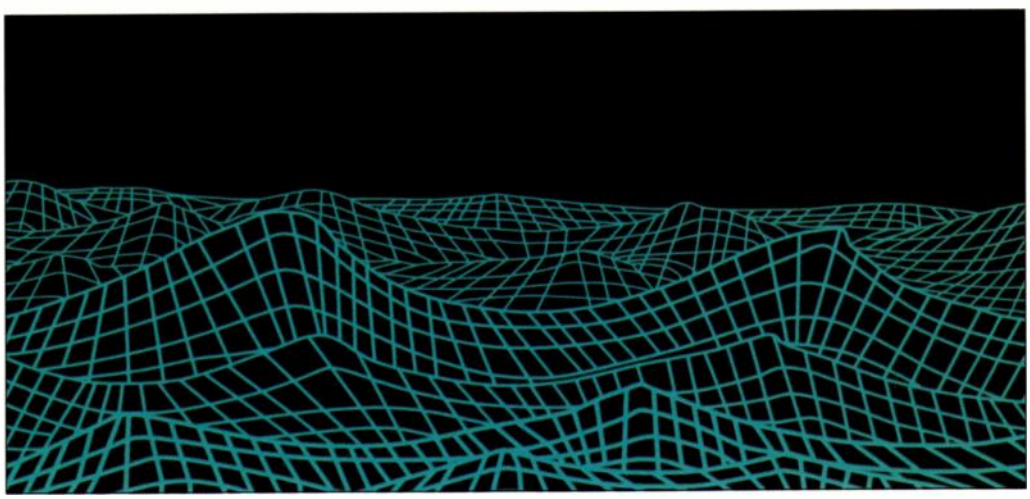
MAKE WAVES.



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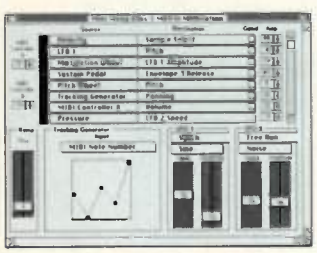
Grand Sample Station



Matrix modulation gives you dozens of creative options for sound. Try doing this on a tiny LCD.

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You say your music is going places but you're getting nowhere with samplers? We've got just the ticket—SampleCell,™ a revolutionary new 16 bit RAM-based stereo sample playback card for the Macintosh® II. With 16 dynamically allocated CD quality voices, 8 polyphonic outputs, and up to 8 megabytes of standard Mac II RAM, SampleCell delivers all the great sound and performance of a pro machine and adds easy to use features only possible on the Mac. Like point-and-click sample mapping. Visual editing. On-screen MIDI and modulation routing. And a mammoth 600 megabyte CD-ROM sound disc featuring everything from shimmering synths to screaming guitars.

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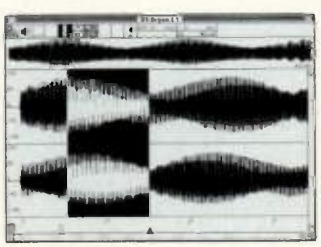

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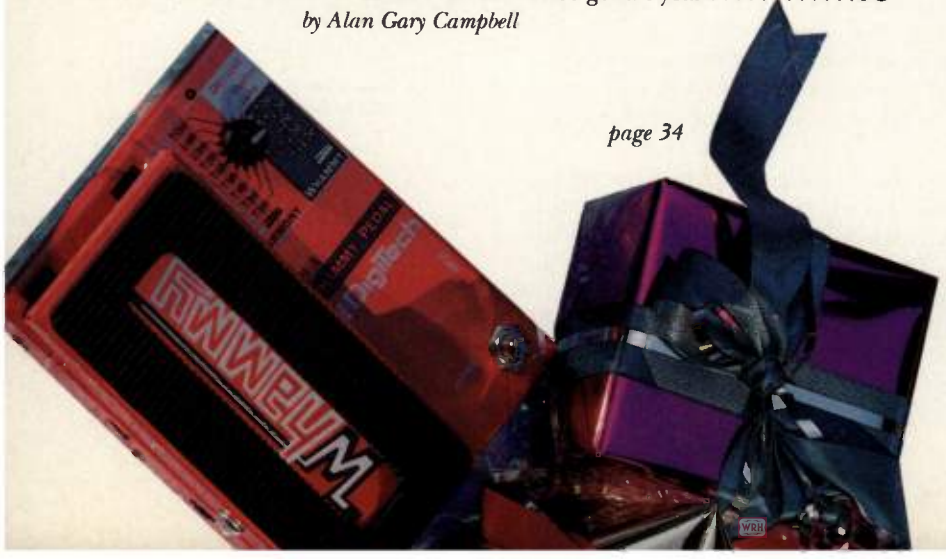
Electronic Musician

AN ACT III PUBLICATION
DECEMBER 1990 VOL. 6, NO. 12

features

columns



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Cover: Photo by Steve Underwood.

Electronic Musician® (ISSN: 0884-4720) is published monthly by ACT III Publishing, 6400 Hollis St. #12, Emeryville, CA 94608. This is Volume 6, Number 12, December 1990. One year (12 issues) subscription is $24; outside the U.S. is $39. Second Class postage paid at Oakland, CA, and additional mailing offices. POSTMASTER: Send address changes to Electronic Musician, PO Box 41094, Nashville, TN 37204.

From The Top

Confused by the terminology and technical details of electronic music? Our new column should help you overcome your fears.

If you're relatively new to MIDI, synthesizers, multitrack recording, and electronic music in general, this magazine's pages can be a confusing place. What initially appears to be technical jargon and complex concepts combine to create an environment that's not always conducive to learning at the beginner's level. It's not that we're intentionally trying to be difficult, mind you, but the subject matter can be challenging.

Some people have even voiced concern that both the editorial content of the magazine and the advertising often seem to be targeting an elite group of specialists—a group from which they feel isolated. Intellectual elitism is a criticism that sometimes can be applied to segments of the high-tech music and recording products industry, but believe me, it's rarely intentional.

Part of the confusion stems from the fact that instruments and music software programs are difficult for most people to use. Unless you're a member of the knowledgeable inner circle, the terminology used to describe features and capabilities of these instruments often sounds like a foreign language. The difficulty is compounded by the fact that there are many company-specific dialects.

If truth be told, however, the stuff really isn't that tough. Yes, there are a few idiosyncratic terms and concepts that need to be learned. But once you're over that initial hill of confusion—and the light bulbs start glaring in your brain—you'll find, as thousands of people before you have, that writing and recording music with electronic musical instruments and various accessories is tremendously fun and rewarding.

Over the years, we've made several efforts here at **EM** to teach basic principles. In addition to running occasional basics articles, we've tried to keep beginners in mind when we include our "Reviewing The Basics" (formerly "For The Beginner") sidebars. Thanks to a large, new influx of people interested in electronic music, we now feel it's time for even more. With our new "From The Top" column, we're very pleased to be making a commitment to educating newcomers on a regular basis.

"From The Top" will be a monthly feature dedicated to teaching the basic principles and terms needed to fully understand the current state of electronic music and electronic musical equipment. We won't presume any previous knowledge, so the column is ideally suited for beginners or newcomers to the field. But we hope to make it interesting to those who simply need a little refresher on some basic principles as well.

To start the column off, we thought we'd provide a little perspective on the topic by offering a (very) brief history of electronic music and musical instruments in the 20th century. As with nearly any subject matter, a study of its history can go a long way towards a better understanding of its present status. In future issues, we will address other essential topics, such as MIDI, sequencing, synthesis, sampling, and multitrack recording.

If you're a more advanced reader, don't worry; the primary focus of **EM** will continue to be intermediate- and advanced-level articles on all the latest technological developments. We simply want to help new readers along by serving as the friendly acquaintance who explains all the basic principles you need to learn before you can make sense of everything electronic music has to offer.

If you're a newcomer who's ready to make an effort, we're eager to share the wealth.

Bob O'Donnell

Electronic Musician

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THE TECHNOLOGY THAT PERFORMS

Our readers close the year by explaining why DAT-based piracy is unlikely, contributing more information on PostScript, and offering a few requests of their own.

P.S. ON POSTSCRIPT

I was happy to read Rudy Trubitt's "Conversing with your Printer" in the October "Computer Musician." The subject of deciding which printer to use for producing musical hard copy has been seriously neglected, and my hat is off to you for taking it on. I'd like to add a couple of items which might be helpful for folks looking into this area. I've done a lot of research, not only developing printer drivers for *The Note Processor,* but also while producing music for quite a few publishers. Here are some things I've found:

■ You won't necessarily get better quality by using PostScript. Bear in mind that all computer printers ultimately print with a bitmap. The important distinction is that PostScript itself creates the final bitmap, rather than the font designer, who will optimize each individual pixel by hand for the sharpest image.

■ PostScript files are not necessarily significantly smaller than bitmap files. A bitmap file may be compressed, making it about 50% smaller. Further, different methods can be used to create PostScript files, and I know of one notation package that produces PostScript files of 400K and more for simple pages.

■ As a software developer, I appreciate Rudy's concern about musicians installing multiple copies of notation software on both their home and work computers. Technically, this is a violation of copyright. On the other hand, as a practicing musician, I've encouraged our users to take advantage of the best printer they can get their hands on, within reason. I'd bet other companies would be willing to take a similar attitude.

I don't want to run down PostScript; *The Note Processor* has both bitmap and PostScript fonts. Of course, you will get much better results printing at 2,400 dpi than at 300 dpi. But you can get very good quality from bitmap printers, so don't spend the additional money for PostScript unless you really need the additional quality.

Stephen Dydo, President
thoughtprocessors
New York

SLEEPING BEAUTY

I've got a Matrix-1000 from Oberheim that is defective. It seems that Oberheim is dead; could you clarify this? Where can I find a service manual for this machine?

George DaNova
Ontario,
Canada

George—Oberheim is not dead; it was merely sleeping, albeit deeply. Prince Charming arrived in the form of Gibson Labs (the famous instrument-maker), which slowly is getting Oberheim up and running again. Call or write Gibson Labs at 13345 Saticoy St., North Hollywood, CA 91605; tel. (800) 765-4629.—Steve O.

DAT CRIME DOESN'T PAY

I am writing in regard to the DAT medium's legal/political trials. I've read Gary Hall's October "Back Page" and many editorials Craig Anderton and others have written. I think I'm missing something: Who is going to make all of these illicit digital-to-digital copies? Why would they bother?

I guess the anti-DAT lobby envisions both casual crime—we home recordists/audiophiles copying CDs—and serious thievery. Regarding the latter, let's assume I, Mr. Serious Thief, buy a number of CD players with good digital outs (or just one with a mondo S/PDIF Y-cord), a bunch of DAT machines, and a few thousand blank DAT cassettes. I tape the top ten CDs. I fake the artwork. Then what? In what year do the publisher/RIAA folks think enough people are going to own DAT machines and be buying enough pre-recorded tapes (at CD prices?) to make this scenario break even, let alone make a lot of money? I, Mr. Serious Thief, am concerned with short term profit, i.e., easy money. If you can make bootleg CDs for about $5 each, let me know. Bootleg DATs? I'll stick with fake Gucci bags, thanks anyway.

Regarding casual crooks/home recording criminals, I apply the same argument. It is not cost effective to rip off CDs. I recently bought the new Sony home DAT machine (DTC 700) at a local audiophile shop for $800. I intend to use it primarily for mastering my home 8-track/MIDI demos. Assuming I also had a CD player with digital out (preferably S/PDIF), I could borrow my friends' CDs and copy them, digital-to-digital. Would I? Of course not. Blank DAT cassettes cost $8 to $11, nearly as much as I pay for CDs. I would save myself the time and trouble of taping and go buy the CD (complete with

DAVID POVILAITIS

AND WE QUOTE:

"We also tested this monitor for each of its EQ settings. The EQUALIZED mode for the PRM 308S was very strong in the rock and dance music categories, proving the **highest scores in the gestalt, clarity, and depth areas of the dance music categories**. On top of these honors, the 308S monitors were felt to have some of the **best bass extension of any monitors tested**. In the EQUALIZED mode, they were smooth and provide a very deep stereo image that must be heard to be appreciated.

In REFERENCE mode, the PRM 308S took **first place as the best-liked speaker of any tested**. In this mode they were thought to possess the **clearest and most musical sound** for all three types of music. The main difference between the two EQ settings lies in the frequency balance characteristic, where the REFERENCE mode is much more even sounding than the EQUALIZED mode. Many of the near-field monitors tested had a light midrange feel to them, so it's nice to be able to flip a switch to get an idea of how your music sounds in an alternate environment. **The PRM 308S system is truly wonderful and must be heard to be believed!**"

Rolf Hartley • Audio Consultant/Journalist • EQ Magazine*

"I read with interest The Electric Near Field Monitor Test in your premier issue. I spend most hours of my rapidly dwindling life in front of the little beasties and don't have the time or the money to buy every speaker you reviewed. On the basis of your admittedly subjective evaluation I acquired, against my better judgement, a pair of Peavey PRM 308S's. I mean, just the logo, you know?

Boy, was I wrong. As you say, **the speakers have to be heard to be believed.** So far I've mixed two albums through them (Steve Earle and Colin James, both to be released in June) and **neither I nor the artist could be happier with the results.** Thanks for the tip and, if you're in the market for several pairs of NS-10s, please give me a call."

Joe Hardy • Ardent Recordings • Memphis, TN

Peavey Audio Media Research™ 308S ™ Phase Reference Monitors

From the 14 models of near field studio monitors tested by GPI Publications in *EQ Magazine*, the Peavey Audio Media Research™ PRM™ 308S ranked number 1 in Reference Mode*. In categories such as stereo imaging, spectral balance, transient handling, clarity, and gestalt, the 308S was picked as the best-liked of those tested. . . If that isn't enough, it also placed third in the Equalized Mode.

The PRM 308S features a unique foam blanket surrounding the high frequency and midrange components to provide more accurate "imaging" and "transparency." A highly desirable reference/equalization response mode switch is provided, simulating different listening environments . . . tracking or mixdown.

Experience what the test panelists of pro engineers and producers discovered. Call us at the factory for the name of your nearest Peavey AMR dealer to arrange a "test listen" of a pair of 308S reference monitors for yourself, and perhaps your ***frame of reference*** **will change, too.**

**GPI Publications, EQ Magazine MAR/APR 1990 "The Electric Near-Field Acid Test"*

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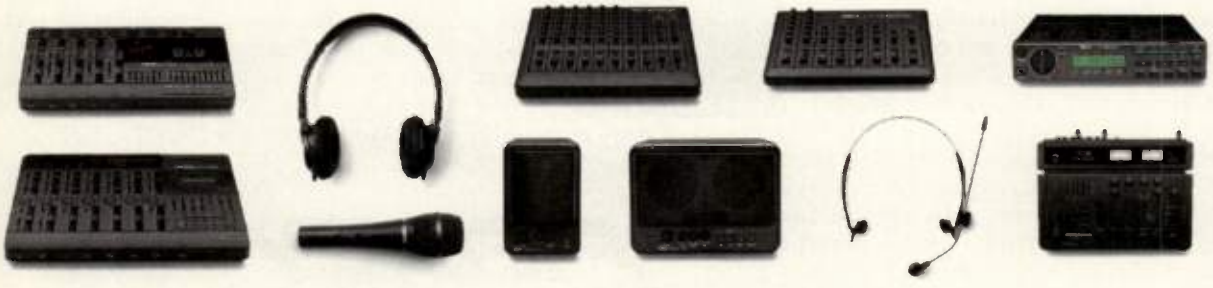

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Professional Audio Division

mini-artwork, liner notes, and CD's nonmagnetic medium). The old issue was blank cassettes versus LPs or CDs. The cost difference there is substantial; on DAT tape, it is not.

John Pearson
Massachussetts

A CALL FOR HELP

(The following announcement was sent to us by Curtis Roads of the Computer Music Journal, *who asked us to reprint the text here. Any readers interested in helping with the project are encouraged to contact Curtis or Bruno at the addresses listed.—BO'D)*

The history of electroacoustic music is only fragmentarily documented. Many instruments have been destroyed, many techniques and ideas lost. Information about instruments and their makers and users is scattered around the world, often buried in all but inaccessible archives (or in the memories of designers, composers, and performers).

We think that an effort should be made to preserve this heritage. We believe a society should be formed whose purpose it is to provide a forum for the dissemination of information and to increase general awareness about the heritage of electroacoustic music and the contributions of its pioneers.

We invite all those interested in participating in such a society to write to one of us at these addresses:

Curtis Roads
Computer Music Journal
The MIT Press, E39-346
55 Hayward St.
Cambridge, MA 02142

Bruno Spoerri
Swiss Center for Computer Music
Sommerau
CH-8618 Oetwil am See
Switzerland
FAX: (41-1) 929-2788
PAN: BSPOERRI

Tell us your interests, give suggestions about what such a society should do and indicate if you would be willing to volunteer time, services, and materials toward these activities. We will compile a mailing list and keep everyone informed about further developments.

ONE OF A KIND

I hope you can provide some information on a product in your April 1990 issue, pp.14 and 16. The Micro-Monitors from Ambrose Enterprises seem like a great way to reduce stage volume and still hear vocals clearly, which is of great importance to me. After calling the company, they referred me to a gentleman who is now handling the product. They are no longer for sale and can be leased for about $300 per week. Most working musicians could not afford that steep price for very long; which is the reason for this letter.

Are there any companies that produce similar products that can be purchased? I am disappointed to find I cannot get these.

Randy Anderson
Nevada

Randy—To my knowledge, there are no products similar to Ambrose Enterprise's Micro-Monitors—yet. As we mentioned in the article, there are potential dangers in monitors that go inside your ear: Any problem that causes feedback, or any other volume spike, in your monitors could wipe you out. Unlike headphones, or regular stage monitors, you can't pull them off quickly or cover your ears because the darn things are inside your ears. Products like that scare me. If you do get a pair, please put a properly adjusted limiter ahead of the monitors.—Steve O

THOSE PESKY ZEROS

Overall, I found "Hard Disk Recording and Editing" (in the October 1990 issue) informative. However, please let me know your source of 800 MB hard drives for the PC for $600 to $700. There are probably 25,000,000 PC owners in this country who would like the opportunity to buy one of these, and I would like to be the world's exclusive dealer.

Seriously, since I build PCs for application-specific projects, I keep pretty good track of prices. The general rule is about $100/10 MB. I can see $600 or $700 for 80 MB, but certainly not for 800 MB. (Pesky zeroes, anyway! If they hadn't put them on the top row, it wouldn't be so easy to hit them twice when you type your articles!)

Toivo Maki
Intermedia
California

Toivo—Like you said, it's the fault of those pesky zeros. I know such an error couldn't be our fault. Okay, if you insist, we meant 80 MB.—Steve O

OPERATION HELP

MIDI Retrofit Designs for Church Organs: As an engineer with over 35 years in analog design, I have long dreamed of designing and building an electronic organ. Although my tastes run more toward classical organ, I have long been intrigued and excited by the prospect of designing a MIDI interface from a classical, 2-manual, AGO church organ console to one of those new synthesizers. I have several of these old monsters that I would cheerfully give to anyone who may be crazy enough to attempt the same thing. I would like to hear from any of your readers who would care to exchange thoughts on hardware/software approaches to achieving pipe organ voices, or who have built stand-alone MIDI equipment.

John T. Heizer
401 Warwick Rd.
Haddonfield, NJ 08033

RMI KC-II Keyboard Computer: I have been searching the continental U.S. for years for someone who has one of these gadgets, let alone is willing to part with it. I also need a copy of the schematics. Any leads would be greatly appreciated.

Ted Hermanson
30 Lynnwood Dr.
Palmyra, PA 17078

1990 AES Report

Question: What has five days, seventeen technical sessions, nineteen workshops, five technical tours, and 225 exhibitors of high-tech sound equipment? Answer: The 89th Convention of the Audio Engineering Society.

By Gary Hall

Korg Digital Audio Production System

AES, ah AES. Nowhere else will you find so much raw audio technology, so much beefy gear, and so many intelligent and thoughtful people dedicated to the art and science of sound. Unlike NAMM, the Audio Engineering Society's first mission is education and development, and the convention includes numerous technical presentations, workshops, and tours of leading studios. Of course, here and there, you'll find some attention being paid to the art and science of making a buck as well.

But do you know what really makes AES stand out? They only have it *once a year*. When show time rolls around, everyone involved is good and ready for it (NAMM, take note). It makes it even better that the show alternates between New York and Los Angeles. The show has a distinctly different feel in each venue, and two years between visits to the Big Apple or Lost Angeles makes for sweet anticipation.

This year, it was L.A.'s turn, and thousands of audio professionals gathered for the largest exhibition of recording and sound reinforcement equipment ever assembled under one roof. What did they see? Well....

WAR OF THE WORKSTATIONS

There could be no doubt of what was most striking about the show. Digital random access systems seemed to sprout from the very walls. Well, not quite, but people who tried to count said they spotted thirty or more. An afternoon workshop was held in which no less than *ten* systems were presented. In order to qualify, a manufacturer had to be delivering systems to paying customers, and all demonstrations were conducted by owners and operators, not by representatives of the manufacturer. It was fascinating to observe so many different approaches to random access recording in one place.

The flowering of the digital audio workstation as a product makes it clear that these things *work* and are being used increasingly by professionals. Owners almost universally praise the increased productivity and benefits of their investments. It's remarkable to see an entire new genre of product grow up under our noses, developed almost entirely by entrepreneurs and visionaries working against the established tide. (The major manufacturers of multitrack tape machines missed this entirely. Studer and Otari have recently climbed aboard, but only by aligning themselves with, or purchasing, much smaller companies.)

The other thought on many people's minds is that it seems impossible for so many systems to survive in the long haul. Indeed, the first companies to delve into the area spent heavily on R&D, and some will admit privately that they are a long way from showing a profit. More recent entrants have been able (to some extent) to build on the work done before, avoiding some blind allies and taking advantage of recent advances in basic technologies. It seems likely that there will be a shaking out at some point, and it's anybody's guess who will be left standing. But there does appear to be a substantial market. *Mix* magazine surveyed professional studios in late 1989, and fully *52%* of the respondents stated their intention to buy a digital audio workstation in 1990.

At the sub-megabuck level, developments are following two distinct paths: dedicated hardware and personal-computer-based systems. The AES show had some interesting hardware-based

Take Control

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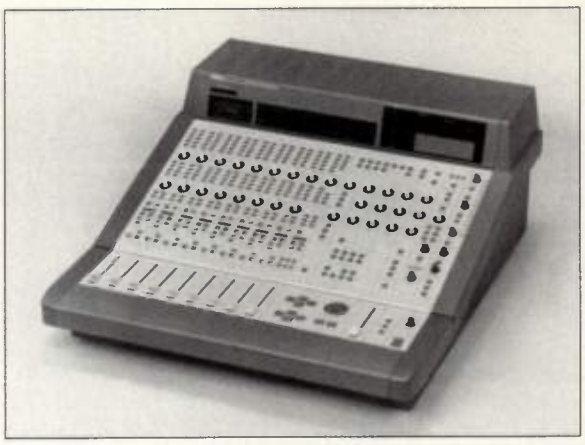
products. Hybrid Arts unveiled the **ADAP II Portable** system ($13,995 with 400 MB drive, $15,995 with 800 MB; tel. [213] 841-0340), a roadworthy, 3U rackmount version of the ADAP that uses the Atari STacy laptop (included) as a front end. They also introduced a software option (for either system), called *TimePage* ($695), that allows the operator to change the length of a sound effect or other audio cue without editing or alteration of pitch.

Korg (tel. [516] 333-9100) attracted a lot of attention with a nifty 8-track unit dubbed the **Digital Audio Production System**. The basic unit includes over 100 "track-minutes" of audio storage with built-in mixing, effects processing, and even MIDI sequencing. It's fully equipped with digital inputs and outputs and every time code option known to man. All operations are controlled by a sleek, tabletop unit that features what looks like an effective combination of dedicated sliders and switches with a graphic LCD display. The product isn't here yet—it's expected in mid to late 1991—and the price hasn't been finalized (probably in the $30,000 area). The price tag is still serious for the bedroom artist, but this package could be a hit for professional users.

Akai has been racking up an impressive record of late. Their A-DAM 12-track recorder, using 8mm video tapes as the recording medium, has become

AKAI DD1000 Optical Disk Recorder

accepted as a reliable, inexpensive (comparatively), and very good-sounding alternative to open-reel digital multitrack. Now the company is blazing its own path in random access audio as well with the **DD1000** ($13,500; tel. [817] 336-5114). The DD1000 is the first audio recording product to use a removable medium (a 650 MB magneto-optical disk), eliminating the need for time-consuming backup. Many people feel that magneto-optical is the way of the future, but Akai just couldn't seem to wait. The system provides four tracks, though only two can be recorded at a time. It's full editing features can be accessed via the front panel and graphic-LCD display, and the unit provides complete computer control and MIDI/SMPTE sync capabilities. The DD-1000 appears to be well thought-out and constructed, and I understand that many people are looking at it with interest.



Yamaha DMC1000 Digital Mixing Console

Otari teamed up with Digidesign and J.L. Cooper Electronics to produce the **DDR-10** ($19,990; tel. [415] 341-5900). This is a stand-alone system that is delivered completely configured, including computer, disk, monitor, etc. It includes high-quality audio converters, a 345 MB disk, time-code triggering, MIDI, parametric EQ, time compression/expansion, mixing, merging, and so on. The integrated control panel has been designed from the standpoint of studio ergonomics, with dedicated keys for most common editing functions, a jog/shuttle wheel to locate edit points, and a touch pad for cursor control.

Roland (tel. [213] 685-5141) got a bit closer to the heart of the personal recording sector with their **DM-80 Digital Multitrack Hard Disk Recorder**. The DM-80, the result of joint development between teams of engineers in the U.S. and Japan, is a complete, stand-alone system that comes in two flavors: The basic unit provides four tracks of recording with complete random-access capability and onboard digital mixing. The unit comes with a 100 MB drive (about 20 track-minutes), but recording time can be expanded with external SCSI hard disks or magneto-optical drives. Four more tracks can be added by purchasing an expander unit for the processing hardware and a second disk drive. The unit is operated by a dedicated tabletop remote with LCD display but can also be fully controlled via MIDI software. (A Macintosh program was displayed to illustrate the concept.) The best part of the DM-80 is the price: The 4-track is tentatively priced at $8,495, and the full-blown 8-track is projected at $11,995. Delivery is scheduled for mid-1991.

So far, Yamaha (tel. [714] 522-9011) has been sitting out the random-access battles, but has been very active in digital tape and digital mixing. Their DMR- and DRU-8X 8-tracks, first shown last year, are still the only digital recorders that put 20 bits of audio data on tape. This year, the company was proudly showing a prototype of the **DMC1000** digital mixing console ($32,000, projected to be available in April 1991), a fully automated, 22-input board with ten output buses and four auxiliary buses. Four-band parametric EQ is available for each channel, and a pair of SPX1000 effects processors are built in. Digital input and output connections are provided for Sony (SDIF-2), Pro-Digi, AES/EBU, as well as Yamaha's proprietary serial format. The **AD2X** ($1,695) and **AD8X** ($3,500) are super-high-quality A/D converters (2-channel and 8-channel respectively) that use delta-sigma conversion technology to yield 19-bit resolution with 110 dB of dynamic range. The **DA8X** (tentatively priced at $3,300) is an 8-channel, 20-bit D/A converter.

For those who are still less than blown away by the pricing of digital, hard disk recording systems ($10,000

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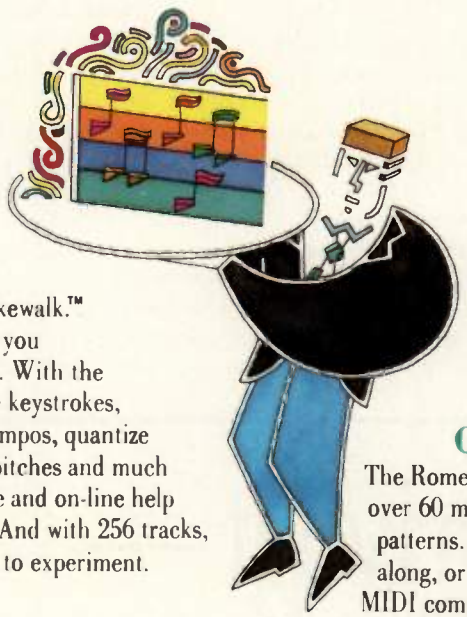

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and up may not be too much for a professional tool, but it's too much when it comes out of your lunch money), the most heartening trend is the introduction of systems that use IBM PCs and compatibles as the basic platform. There were at least four serious entries in this class at the show. Turtle Beach (tel. [717] 843-6916) is delivering their **56K** system. Spectral Synthesis (tel. [206] 487-2931) is also shipping their **Digital Studio** 8-track system. (The Spectral Synthesis SynthEngine, a RAM-based sampler, was reviewed in the September 1990 **EM**.) MicroTechnology Unlimited (MTU; tel. [919] 870-0344) has a 4-track package, one version of which was displayed by Pinc Link (tel. [818] 760-4539) as **Pincsound**. Digital Audio Labs (tel. [612] 559-6104) showed **The Card**, a stereo conversion and processing board, together with editing software.

In comparing these systems for features, performance, and price, there are some tough issues. Each manufacturer packages their system differently. For instance, Spectral Synthesis requires that you buy the hard disk from them (not necessarily a bad idea, because they will guarantee and support it), while Turtle Beach, Digital Audio Labs, and Pinc Link/MTU will let you use any disk, so long as it meets some basic timing criteria. On the other hand, the Turtle Beach system requires a DAT (or other) recorder to provide A/D and D/A conversion. Then again, you really should have one anyway. To make matters worse, some companies have multiple software and hardware options. It can get pretty confusing.

Tascam M3700

Well here we go, anyway. By any measure, the least expensive of these products comes from Digital Audio Labs. Their basic conversion and processing card (two channels in, two channels out), complete with editing software, is just $1,045. The Turtle Beach system lists for $2,689 (2-track only), but requires an external DAT, as mentioned before. Pincsound (or MTU) systems start at $3,495 for two tracks (expandable to four). The basic package from Spectral Synthesis will run you $6,495 for eight tracks (expandable to sixteen), but that includes a 180 MB disk drive.

Look for a comparison and buyers guide in future issues of EM.

CAN WE GET THINGS UNDER CONTROL?

J.L. Cooper demonstrated its unique flair for spotting and filling a market need with the **CS-1 Control Station** ($599.95; tel. [213] 306-4131), a small control box for convenient operation of digital audio hard-disk recorders as well as MIDI sequencers. Initially, the CS-1 has been adapted to work with Digidesign Sound Tools and Audio-Media, Mark of the Unicorn *Performer*, and Opcode *Vision*, but all the hooks and information are provided so that any manufacturer who wants to can have the CS-1 control their system. The CS-1 consists of a jog/shuttle wheel, a set of basic transport control keys (play, stop, fast-forward, rewind, and pause), a group of cursor control keys, and four soft "F" keys, together with a shift button. It's basic, but it should be extremely useful in the context of studio recording and sequencing.

DOES ANYBODY DO ANALOG ANYMORE?

Don't worry. Tascam (tel. [213] 726-0303) showed their commitment to cost-effective tools for personal and professional multitracking with a whole slew of new products. (How many are there in a slew, anyway?) First off, their **MSR-24** has dropped in price to $12,499, and a new model, the **MSR-24S**, has been introduced with Dolby S noise reduction (rather than dbx Type 1) for $13,999. The **M-3700 Series** is a line of mid-sized, fully automated consoles at positively scary prices. The 24-input version lists for $11,999, and a full 32-inputs can be had for $13,999. For those of more modest needs and means, the **M-2500 Series** comes with mute (but not level) automation in 16-input ($2,999) and 24-input ($3,999) versions. There were no fewer than three new PortaStudios shown, starting with a sleek entry-level product, the **Porta 03 MiniStudio** ($329), and continuing with a general-purpose workhorse, the **424 PortaStudio** (twice the speed, but not twice the price at $549). Finally, their **488 PortaStudio** provides full eight-track capability, complete with mixer, for just $1,599. Make that "Yow" times three, please.

Fostex (tel. (213) 921-1112) showed the **G-23S**, a new 1-inch 24-track recorder with Dolby S noise reduction and a slot for an on-board synchronizer.

SO LITTLE SPACE, SO MANY PRODUCTS

What, out of space already? Well, that's the way AES goes— not only wonderful new products, but also a glance at the larger trends that are shaping the arts of music and recording. We'll make you a deal. Come back next month and we'll tell you about new software, time-code R-DAT, rack-mount synthesizers, signal processors, new advances in recording tape, power amplifiers, an *incredible* spatial sound processing system (together with a bunch of other new products) from Roland, and the darnedest design for a 19-inch rack that you ever saw or imagined. Deal? Deal. See you on the Funway! ■

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Better still, the SY55 has editing power beyond anything in its class. And it's equipped with the same digital convolution filters found in the SY77 Synthesizer, so you can take any sample and give it anything from a minor tweak to a major overhaul.

It also includes a full-featured 8-track sequencer and a rich palette of 34 programmable digital effects, including reverbs, gates, early reflections, delays and distortion.

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BY JAN PAUL MOORHEAD

SEQUENCER WORKOUT

Sequencers offer a lot more than simple quantizing and editing functions. With little effort, they can help you learn orchestration, arranging, and other musical concepts.

Workers are shaped by the tools they use day after day. The choice of sequencing environment can mold, limit, or expand how artists think about their music. All too often, composers working with sequencers will let the power of MIDI systems, and all the gorgeous sounds they're capable of, substitute for learning the craft of composition. However, with a little thought, sequencers can be musical Nautilus machines for composition and arranging skills. What follows are a few ideas on how sequencers can "pump you up." The techniques introduced are not alien to your creative process—some can be utilized in your day-to-day work.

WARM UP

When sequencers were introduced, their strongest impact on popular music was in the area of timing. It soon became apparent that quantization could cover a lot of deficiencies in performance. Quantization moves notes to the nearest defined subdivision of the beat. However, this does not always make things more musical. Time is the one inescapable element of all music. How we design music through time is one of the most critical elements in an effective performance. This design has three different facets: *time* (as clock makers and astronomers think of it), *rhythm,* and *groove.*

Time is absolute, not subject to opinion. (All you Einstein fans calm down—I mean this only in relation to our normal space-time frame!) The sequencer, under normal operating conditions, will keep as perfect time as we can perceive.

Rhythm is the temporal structure of musical ideas. These structures demarcate subdivisions of the time.

Groove is the way a performance *feels* in relation to time. Small, and fairly subtle, factors control how well something grooves: the positional placement of the note, the length of the note, the relative loudness between notes (accents), and timbre. Finding the right sound for a part will also affect the groove and I'll discuss this under orchestration.

PERFORMANCE

You can test your ability to play accurate time by looking at the edit screen of your sequencer. See if you consistently drag or rush the tempo. Try different tempo extremes and musical styles. You may rush in one situation and drag in another. This may be desirable for some parts, but not in every case. This kind of analysis is useful for sorting out gross problems of rhythmic feel.

If you are rushing, concentrate on relaxing. Beat 1 will always get there whether you do or not. If your tempo drags, drink strong coffee and hang with more East Coast musicians. Seriously, try to focus on what you're playing, and listen to a consistent rhythmic element. Don't try to "catch" the time; you'll always be behind or ahead. At the risk of sounding new-agey, become one with it. If you play a note in the same place as the cowbell for instance, the cowbell should feel as if it's part of the envelope of your sound.

More valuable than worrying about time is understanding the elements of groove. I've known people who could keep good time but didn't swing, and very rarely people who did groove but didn't keep good time. I think if given an either/or choice, most people would rather play with someone who grooves.

In studying groove with your sequencer, you can learn more by studying the parts that groove *well* rather than the mistakes; there are a lot more ways to mess it up than there are ways to swing. The parts that will tell you the most are the ones played against an absolute reference, such as quantized parts. Have your local groove monster play into your sequencer, then take the performance home and analyze it at your leisure on the edit screen.

Note placement will have the greatest effect on how well a part grooves. You can study it by playing with parts that are relatively repetitive, such as drum tracks and simple bass lines. If you slide parts forward or backward in time, make sure there is at least one part somewhere that is always playing in an absolute time reference, i.e., on 1, 2, 3, or 4. Your analysis won't mean much if you've moved everything forward or backward. Sequencers that allow you to move parts while the music is playing, such as *Notator* and *Cubase*, are most helpful. Slide the part until it feels right and then examine what you've done. This way you avoid getting into ruts ("I always slide the snare drum back five ticks"). For instance, I often lay 2 and 4 back on funk, but find it usually works better to push it forward in straight-ahead jazz and rock shuffles. Once you understand what you like, some sequencers, such as *Performer*, *Cubase*, *Notator*, and others, will allow you to store your groove parameters as a quantization grid.

The second most important element of groove is note length. A bass line that has every note legato will be about as lively as a glue spill. Short notes sound more drum-like and emphasize the space that surrounds them. Longer notes get heard as accents. When look-

ing at a strong performance on a graphic editing screen in a sequencer like Passport's *Master Tracks*, these characteristics become obvious. *Texture* from Magnetic Music has a feature that will relatively alter note length. That is, if you use the function to shorten notes, the sequencer will reduce the short notes more than the long notes. You can lengthen notes in a similar fashion.

If your performance has the right feel, you can exaggerate the contrast in note length to increase the funk quotient of the music. This also can be done manually in the edit screen of any sequencer, although it can be pretty tedious and not at all intuitive on a list-type editor. Once again, if your funkiest friend plays some extraordinary lines into your sequencer, take the opportunity to study the parts. If you think you have a grip on what makes them work, record a similar part. Then compare it with the original by ear and eye. Repeat the passage until you've got it.

ARRANGING

Sequencers such as *Notator*, *Cubase*, *Pro-24*, *Performer*, and *Ballade*, which feature standard notation in the editing screen, allow for some very powerful techniques for manipulating harmonic elements of your music. For instance, you can use the notation edit screen to make a harmonic accompaniment much more open and airy. Using the mouse, go into the middle of the chord and drag the second note from the bottom up an octave or two. You may wish to do this with every other note in the chord. If you're slick, you can do this with whole groups of chords at once, thus saving a lot of time. This is especially effective when the accompaniment sounds muddy but transposing the whole part up an octave would be inappropriate.

You can reverse the procedure to turn open chords into denser parts, thereby getting parts out of the way of the melody. You might need this if you've changed instrumentation on the melody or switched from a female to a male vocalist. You can carry this to extremes by turning extended chords (ninths or larger) into clusters. This is very effective for high tension music (film scores, jazz, avant garde, etc.) and percussive effects. To generate a whole new instrumental part with an entirely new function, take a set of background chords (string pads for instance), condense them into clusters, shorten the note lengths, move them to another part of the beat, and send the data to a different patch. Presto, string parts become brass stabs.

Experimenting with voicings like this can teach you things that might take months in a traditional writing class. The virtue lies in the immediate feedback. If you've had trouble with muddy final mixes, the problem may not be your equipment or your engineering but rather your musical skills. Thinning out parts in accompaniments will tighten the impact of your compositions and add clarity. Watch out for unnecessary doublings. Power chords are all well and good, but doubling the part over and over in different parts and octaves may add mud instead of a bigger sound. Think out what the part's func-

tion is. If you notice that a chord has the root and third, and that you put the fifth in three octaves, you ought to consider dropping the extra notes. In harmonically rich music, if there is a bass part playing the root, eliminate the root from accompaniment chords. The root and the third harmonically imply the fifth, so it also should be one of the first notes to go. Trust me, you'll never miss it. (The exceptions, of course, are the augmented and diminished fifths, which are important in defining chord quality and function.) If the melody is leaning on a ninth or augmented eleventh, the effect may be more striking if you don't double it in the accompaniment. Experiment, and remember, less is more.

You can generate variations on lines and thickened melodic parts quickly from today's sequencers if you know what you're doing. Try copying and transposing the melody up a third or down a sixth to harmonize it. This by itself generates an exactly parallel line which is usually unpleasant unless you're doing horror movies. The next step is to go back and adjust pitches so the harmonies lie within the same scale framework. Opcode's *Vision* and Dr. T's software allow for modal transposition which can do this in one step. The tricky part is to make allowances for the appropriate change of scale when the melody crosses chord changes. You can repeat this process of copying and transposing to build up a very thick harmonic accompaniment.

You may wish to make these modal harmonizations more harmonically sophisticated. One place you can make adjustments is to passing tones in the melody. You can harmonize pitches that are not in the chord more freely, especially if the tempo is quick. For instance, non-harmonic tones in the melody that occur on off beats can be harmonized with diminished chords or dominant chords from other keys. This is obviously dependent on the application and the style of the music. A client who's expecting a country-western tune may not appreciate an arrangement that sounds like it was done by Debussy or Duke Ellington!

CRAFTING MELODIES

Modal transpositions are also useful for generating new sections in a piece of music. Copy a section to another place, then transpose it and change it from Major to Dorian, for instance. You now have a new, contrasting section that still has continuity with the previous work. This technique will also get more mileage out of a hook, or generate a counter melody.

To create counter-melody material, copy a coherent section of the melody that seems appropriate. Transpose it to another key and scale, assign it to a background instrument, possibly fuss with the rhythm, and voilá, you have a background melody. This last technique will work best with melodic parts that are primarily chord tones. Of course, with a good editor, one can easily turn non-chord tones into chord tones.

You can subject melody to the same dissection as the other elements I've mentioned. You can lift a melody out of the mix by transposing it up an octave, or by changing the timbre assigned to it. However, be careful about quantizing melodies. Unless you're deeply into

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a techno-pop bag, quantize after recording. Quantization on some sequencers is destructive. In other words, it actively alters the data instead of merely processing it while playing. If your sequencer works this way and has no Undo function, make sure you make backup copies of the track. If you don't like the quantization, you can try other values. I find myself using little or no quantization on melodies. If you habitually quantize lead lines, try experimenting with loose capture parameters.

If you or someone else comes up with a great melody, study it. Sequencers that allow you to play the music in the edit screen will also help you to spot effective motivic construction. Use your ear and your eye. A melody that starts well and then seems to die will usually have what you need to finish it in the first few bars. Look for the breathing points, and that will help you spot the sub-phrases that then can be used to finish the idea.

Remember that repetition builds continuity, variation creates interest. The same techniques that work for developing counter melodies and supporting material will work for finishing a melody. Most people don't have a problem with getting enough ideas. The problem is not knowing how to make good use of the ideas they already have. Even if copying, transposing, and altering rhythms and pitches results in something that sounds contrived, the process may inspire you to musical ideas that come more naturally. Work the craft and the inspiration will follow.

MORE READING

There are a lot of good texts available, but here are a few basic ones that get to the point, are readable, and would be good to have in any library:

* *Basic Materials in Music Theory*, Paul Harder, Prentice-Hall, Allyn & Bacon, Salt Lake City, UT 84118.
* *Twentieth Century Harmony*, Vincent Persichetti, W.W. Norton and Co., New York, NY 10110.
* *The Lydian Chromatic Concept of Tonal Organization*, George Russell, Concept Publishing, Cambridge, MA 02138.
* *The Technique of Orchestration*, Kent Kennan, Prentice-Hall, Englewood Cliffs, NJ. 07632
* *Composing for the Jazz Orchestra*, William Russo, The University of Chicago Press, Chicago, IL. 60637
* *Jazz Improvisation*, David Baker, Maher Publications, Chicago, IL.
* *Improvising Jazz*, Jerry Coker, Simon Schuster, Inc., New York, NY. 10020
* *Harvard Dictionary of Music*, Willi Apel, Ed., The Belknap Press of Harvard University Press Cambridge, MA. 02138
* *Aebersold Play-Along records and books*, Jamey Aebersold, PO Box 1244-d, New Albany, IN 47150.

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A spacious, easy-to-handle layout with luminous soft-top controls makes the CX Slant-Back sure to the touch — even in low light. The slant back eases setup and changes, all of which just might make TOA the easiest-to-use mixer ever.

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Of course there's wide, flat frequency response, noise below -130dB (EIN) and minimal distortion. Add optional transformer-isolated I/O's and guarantee absolute freedom from interference and ground loops.

ROAD WARRIOR.
CX SlantBack is designed around a rugged cast aluminum frame and components that stand up to touring's hard knocks. Heavy duty reliability is just as welcome in tamer surroundings — conference, church and performing arts installations — where legendary TOA quality makes contractor callbacks obsolete.

QUICK-CHANGE ARTIST.
Mix to four subgroups or direct to stereo L/R, all monitored by six peak-reading LED meters, switchable to monitor ten functions.

FINE TUNED.
Precise control comes from a staggered-dial three-band EQ with sweepable mids and independent pre, post and switchable sends.

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ORCHESTRATION

Even with just a couple pieces of MIDI gear, you can teach yourself orchestration. Though lots of noble effort goes into the creation of new patches, the greatest and simplest opportunities for orchestration lie in the same process Beethoven used: recombining the sounds at hand. Again, instant feedback makes the process almost painless and much more rapidly instructive. You can learn a lot by going through a traditional orchestration book. Think about a sound's traditional function in music and make it work effectively in standard situations. Then when you decide to do something bent with it (like using an oboe sample for the bass line), the result will probably be a more effective contrast. All too often I see people walk up to a sampler, play Stevie Wonder-type clavinet parts on a string patch, and then say, "Wow, what a crummy string patch!"

If your intention is to emulate traditional acoustic instruments, I recommend trying to get your hands on at least one member of each family of instrument and spend a few weeks struggling with it. I know more than one composer who's got to make a face like a trumpet player when playing a brass part on keyboard. When you're that far into it, the chances of coming up with a convincing emulation go up logarithmically.

Once you've played brass, reeds, double reeds, bowed strings, percussion, etc., you'll understand much better what they do best and what their natural limitations are. This is a must for anyone who wants to do film scores and make people think it's an actual orchestra playing, and not someone's MIDIfied garage.

DEVELOP YOUR CHOPS

One extremely powerful way you can use your sequencer is to create files to work out with when you practice your instrument. This is basically like the series of play-along records that Jamey Aebersold and Music Minus One offer. Using the sequencer takes play-alongs to a new level. If you are having problems with a particular passage, you can loop it, slow it down, and work the offending area until it submits.

Once you've gotten past knowing the obvious basics (what's the flat thirteenth of A flat?), the problem with playing over chord changes is not the chords or the scales that you apply to them—it's the connections between the chords, i.e., making your voice leading musical as the chords fly by. Most musicians do this by learning tunes, but this approach is not very systematic and tends to leave a lot of holes in one's playing. Just when you think you're getting it together, somebody throws a tune in front of you that knocks you into the back seat.

One thing I've done to overcome this is create a series of work sequences that take me through a very serious harmonic workout. You can custom-design your own. Pick up some of Jamey Aebersold's or David Baker's materials to get ideas on how to set up a workout. Start with typical song subunits such as ii-V or ii-V-I progressions. Take them around the circle of fifths, up and down in whole steps, half steps and major and minor thirds. Thirds invert to sixths, fifths to fourths, and seconds to sevenths. Therefore, these few progressions will cover 99% of any structures you're likely to encounter in real life. Work these first with the chords changing each bar and then with two chords per bar. Work the material slowly, one section at a time.

If your sequencer is pattern-oriented, so much the better. You can record a basic section and then just assemble it into all the various progressions. If you're into ethnic music you can do the same thing with odd meters. Again, look at the materials by Aebersold, Baker, and Jerry Coker to get ideas about what elements to practice with your workout files.

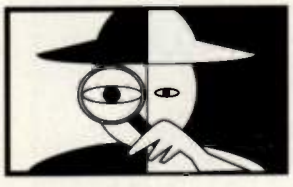
COOL DOWN

When MIDI first hit the scene, anyone who could get their hands on the technology had an edge in the marketplace. Now, after approximately six years, everyone has a MIDI setup of some kind. Musicianship can be the element that separates you from the rest of the techno-herd. Your sequencer can be the tool to build your musicianship or it can seduce you into being hooked on technical gimmicks. I have nothing against the non-traditional, eclectic, bent, or even ignorant approach to music, but it never hurts to know what you're doing.

Jan Paul Moorhead *is a composer and freelance musician in the Los Angeles area.*

PUT A MIDI SERVICE TECHNICIAN IN YOUR COMPUTER

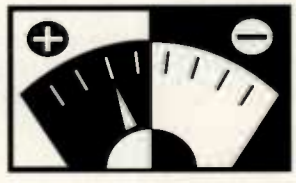
▼ What's *really* going on in your MIDI data stream? It's easy and inexpensive to find out.



SOLVE

AS MIDI SYSTEMS BECOME MORE COMPLEX, tracking down problems also becomes more complex. Fortunately, MIDI data analysis computer programs and hardware devices, which let you monitor the MIDI data stream, can give valuable clues on system operation and instrument characteristics.

Finding a suitable program isn't hard. For the C-64, Jim Johnson's *MIDIPrint* (September 1986 **EM**) does the job, and his program was ported to the ST by Walter Daniel (June 1987 **EM**). For the IBM PC, see Jim Conger's program in the October 1989 issue. For the Mac, Ralph Muha's *MIDIScope* program (see **Fig. 1**) is free from various MIDI bulletin boards and telecommunications services (such as PAN), and *The MIDI Terminal* (see **Fig. 2**), Laurie Spiegel's shareware program, is available on the Berkeley Mac Users Group (BMUG) PD-ROM, or from Aesthetic Engineering (175 Duane St., New York, NY 10013-3309) for $25. Both Mac programs are MultiFinder-compatible, so you might find it handy to just keep one running in a corner of your screen for convenient data stream checking. One important point: Not all types of terminal programs show all types of data, so make sure you know your program's capabilities before jumping to conclusions about the presence or absence of data.



TEST

Also note that some pieces of gear (e.g., A.R.T.'s SGE multi-effects processor and some of Kurzweil's keyboards) include MIDI data-analysis capabilities. A dedicated MIDI testing hardware device, the datastream MIDI Viewport ($159.95; tel. [404] 449-8536) not only displays MIDI data but can send test signals and check MIDI cords. Finally, Studiomaster makes the MA36 ($99; tel. [714] 524-2227), a handy little 36-function MIDI data-viewer with a bunch of LEDs that indicate whether particular types of data are present.

ISOLATE

How do you use this software/hardware? Here are fifteen tips to get you started.

1. ANALYZE KEYBOARD VELOCITY CURVES. Different keyboards sometimes offer different velocity curves to match the various "touches" with which different players play. A data analyzer helps correlate MIDI velocity to your playing style; for example, when you bash the keyboard, you can see whether it actually reaches the maximum velocity value of 127.

2. ISOLATE HARDWARE AND SOFTWARE PROBLEMS. The basic idea of troubleshooting is to isolate every component in a system and test it. Use the analyzer to examine each piece of gear,

▲ By Craig Anderton and Laurie Spiegel

MUSICPRINTER PLUS 4.0

The Musician's tool for the 90's

SPECIAL NOTE to Composers, Arrangers, Teachers and Students:
MusicPrinter Plus 4.0 is light-years ahead of other music notation/performance packages. You owe it to yourself to call and get our $10 demo packet and try this outstanding package before you invest 50 to 100 times that amount in the wrong program.

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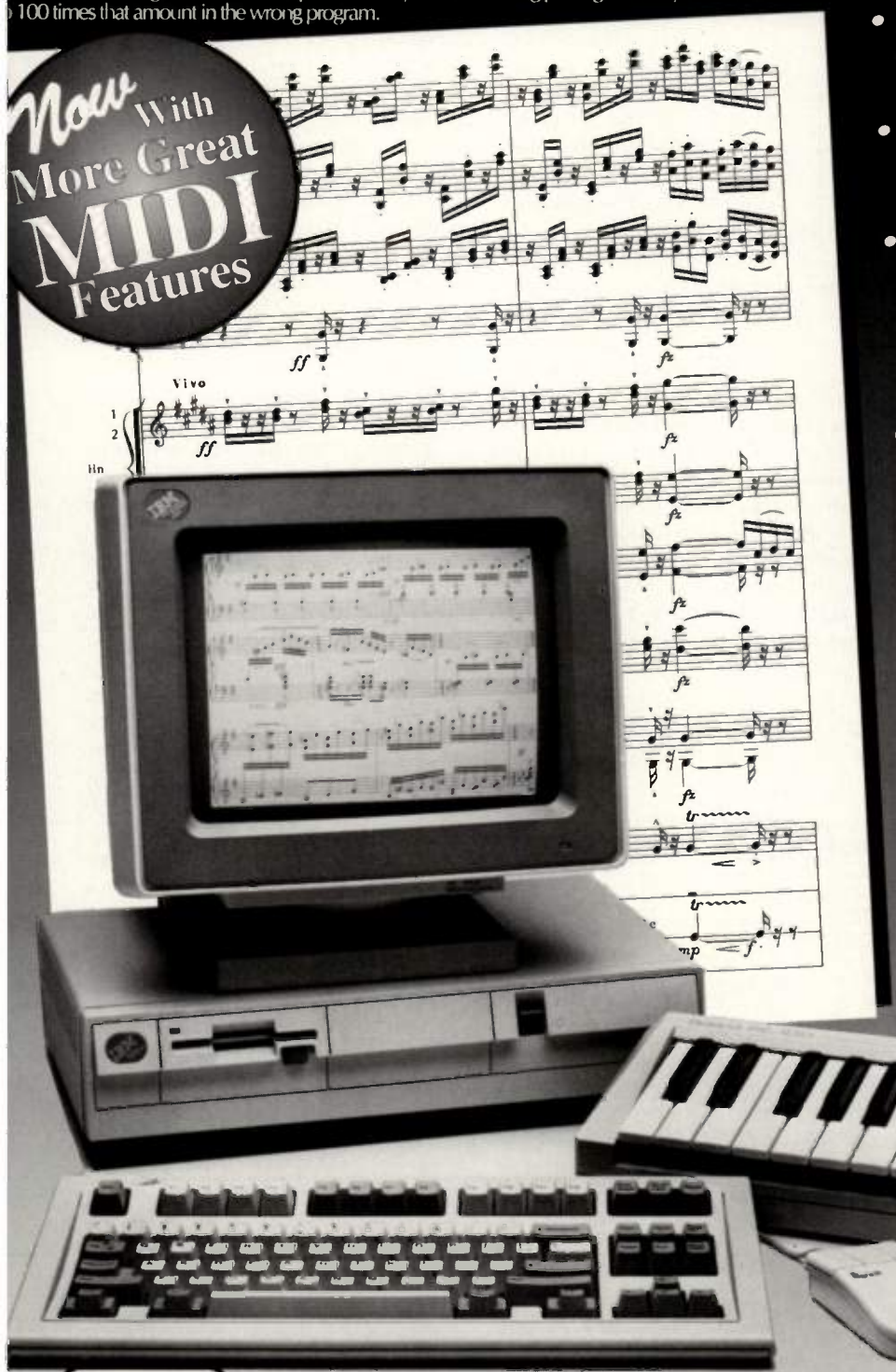

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determining whether the keyboard is transmitting data, if this data is being sent on the correct channel, and so on.

3. CHECK CONTINUOUS CONTROLLER RANGES. A data analyzer can reveal whether the mod wheel produces all 128 modulation data values (if it doesn't, you may need to recalibrate the unit). You can also determine whether pitch bend uses just the most significant byte or the two available pitch bend bytes, as well as whether the response tends to be linear or exponential, or whether there's a "dead band" of relatively small pitch bend changes around the pitch wheel's midposition.

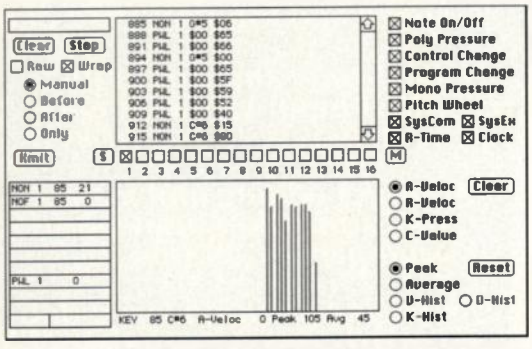

FIG. 1: MIDIScope has graphic data display as well as data lists.

4. DETERMINE DRUM MACHINE NOTE ASSIGNMENTS. There is no standard correspondence between drum sounds and MIDI note numbers, so plug your drum machine output to your MIDI interface input and hit the drum pads. The data analyzer will show you what MIDI note numbers are produced as a result, and whether the pads output velocity data or not.

5. HELP THE SERVICE TECH. If your synth is transmitting aberrant MIDI data, and you need to take the instrument in for service, make a screen dump of the "problem" data and give the printout to the service tech. This could provide information on the nature of the problem and help cut repair time and expense.

6. SOLVE THE HANGING NOTE PROBLEM. Sometimes a note gets "stuck" because the synthesizer producing that note fails to generate a note-off command, or because the receiving device fails to recognize the note-off command. Use a MIDI data analyzer to make sure that the synth is transmitting the note-off command (perhaps data is getting mangled in your sequencer, merger, or other MIDI receiver).

7. TEST PATCH CORDS. String a MIDI cord between your MIDI keyboard, drum machine, etc., and your MIDI interface. If the data analyzer doesn't show any incoming data when you play your instrument, the fault may lie in the cord. You also can check MIDI thru box outputs: Play into the thru box, and check each output with the data analyzer.

8. CHECK QUIRKY CONTROLLERS. Wind and guitar controllers typically generate data in a manner different from keyboards. Does that guitar controller really send an all-notes-off command with disturbing regularity? Is breath control on your wind controller mapped to velocity, aftertouch, or both? And does that drum machine actually produce *two* note-off commands for every note-on? An analyzer tells all.

9. HELP THE NO-DOCUMENTATION PROBLEM. If you buy a piece of second-hand gear, the manual may have been lost or have pages missing, or the software may have been updated since the manual was written. A MIDI data analyzer, while no substitute for a good MIDI implementation sheet, can at least indicate the type of MIDI data the machine can generate and what MIDI controller IDs get sent by which physical knobs.

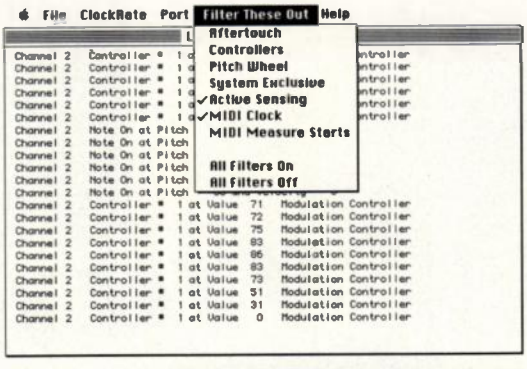

FIG. 2: Laurie Spiegel's MIDI Terminal includes a filter to isolate particular types of data.

10. DETERMINE THE TYPE OF NOTE-OFF. Some synthesizers send a note-off command to turn a note off; others send a note-on command with zero velocity. A MIDI data analyzer makes it easy to see how your synthesizer handles this all-important function.

11. MAKE SENSE OUT OF PROGRAM CHANGES. Synths often do not number presets in the same way as MIDI program change commands. And what about instruments that have internal, preset, and cartridge memory? Monitor the instrument with the data analyzer, and note what program changes are sent out in response to various preset selections. You might even want to use this data to generate a "look-up" table.

12. SORT OUT WHAT A MIDI PATCHER OR MAPPER IS DOING. Use data analysis software to remind yourself how your MIDI patcher or mapper has disguised, buried, or diverted your data, such as by channel reassignment or transposition.

13. VERIFY WHICH INSTRUMENT CONTROL SETTINGS ARE SENT OVER MIDI. This shows which of a unit's front panel controls can be recorded into a sequencer and played back.

14. SATISFY YOUR CURIOSITY. Most of us have heard of the MIDI data stream, but few of us have seen it. With data analyzers, we can. It's also possible to see how continuous controllers "clog" the data stream more than, say, simple program change commands. Looking at the data coming out of instrument can tell you a lot, especially concerning the differences between instruments. If you're really adventurous (or perverse), prowling through system exclusive data in the wee hours of the night can be not only a challenge, but quite a learning experience.

While data analyzers may not be glamorous, they sure can be useful. If you don't have this essential piece of "MIDI test equipment" in your studio, check one of the sources mentioned.

Craig Anderton *uses eight different incompatible disk formats and five different incompatible tape formats. He now understands why world peace has not yet been achieved.* **Laurie Spiegel** *is a longtime electronic composer and music software author (including the innovative algorithmic program* Music Mouse*) who dares to ask why, with only a dozen signal types in her studio, she has to use more than 30 different kinds of connectors.*

HOW TO FIT A SYMPHONY ORCHESTRA INTO A SMALL STUDIO.

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Built in the U.S., Proteus/2 is remarkably easy to use. And even easier to get your hands on. Just visit your E-mu dealer.

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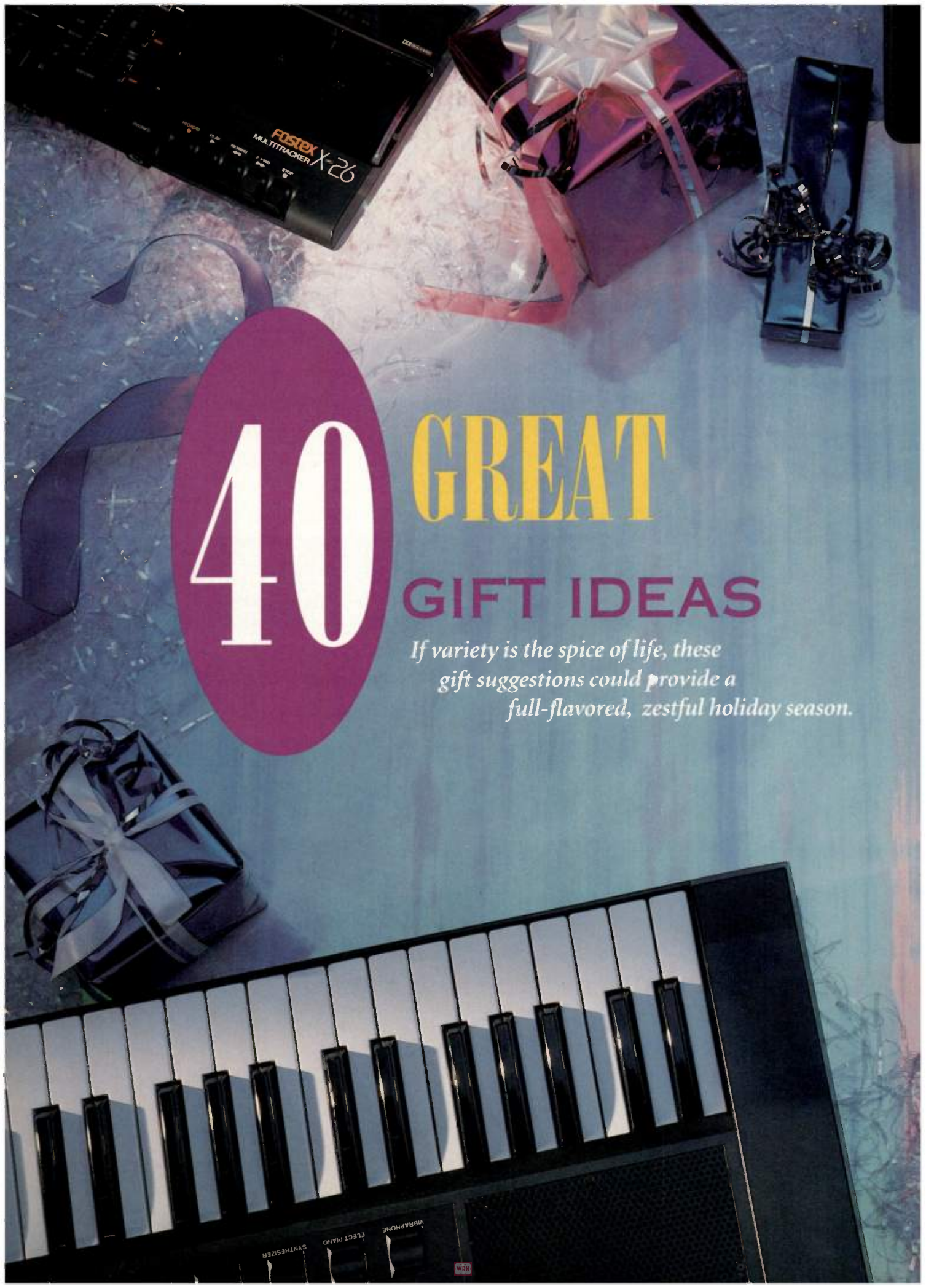
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GIFT IDEAS
If variety is the spice of life, these
gift suggestions could provide a
full-flavored, zestful holiday season.
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It's time for the holidays. It's time to start shopping.

Like it or not, gift giving is an important part of the holiday season. Your friends, relatives, and other loved ones dream of wonderful gifts they'd love to receive, and you need to come up with creative gift ideas. If you've ever bought someone a gift they absolutely loved, you know how rewarding the gift-buying experience can be. But, if you're like most people, just prior to the moment of savage unwrapping, a fleeting moment of dread rushes through your brain: Will they like it?

The question of what to buy can be a particularly sticky one if the recipient is an electronic musician like yourself—or, for that matter, is yourself. (Hey, you were good this year; live a little.) Electronic musicians are notoriously obsessed with the latest new gear. Reasonable, intelligent adults often turn into giddy, slobbering children when talk turns to their "toys" and what they'd like to add to their collection.

Sensitive to those needs, we've compiled a list of ideas for gifts, both specific products and general categories. Rather than concentrating on obvious choices— new synthesizers, drum machines, sequencers, etc.—our list is a bit more quirky, leaning toward items that tend to be overlooked. The prices range from cheap 'n' cheerful stuff under a dollar to a laptop computer costing nearly $2,000, so you can consume within a wide range of conspicuousness. Company phone numbers are given after each product so you can easily contact manufacturers to purchase gifts for your lucky friends. Of course, if you'd like to be the recipient, you may want to circle a few items—or add a few of your own; we only offer a few starting suggestions—and oh, so casually, leave the magazine lying open somewhere around the house or apartment. (Sometimes, subtlety really works.)

In any case, we hope you enjoy the list; we had a lot of fun putting it together.

BY STEVE OPPENHEIMER WITH BOB O'DONNELL

Steve Underwood

MAGICAL MIXOLOGY

Introducing the SM 82 Stereo 8-Channel Line Mixer

More mini-mixer sorcery from Rane. The SM 82: a mixing powerhouse in a miniscule chassis. Packed with the functions and features that cutting-edge performers desire.

16 SEPARATE INPUTS on the rear accept discrete Left and Right line level programs. Or a single cable plugged into the Left input will drive both L and R from a mono source, without having to use a "Y" adapter.

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FULLY EXPANDABLE via the Master and Auxiliary Expand jacks, any number of SM 82s can be linked together to handle a staggering number of inputs.

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THE MS 1 MIC STAGE accessory, available separately, allows you to use mic level programs with the SM 82, complete with phantom power and variable gain.

The new SM 82 Stereo 8-channel Mixer. Another supernatural musical miracle. From the wizards at Rane.

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Setting up a home studio is a dream of many electronic musicians. To make that dream a reality, the person in question needs a few pieces of equipment, the most important of which is a multitrack recorder. Several companies offer inexpensive multitrack cassette recorder/mixer combinations that can form the centerpiece of a home studio. **Fostex's X-26** ($449; tel. [213] 921-1112), for example, offers a 4-track cassette deck and a mixer with six inputs. The unit's 4 × 2 submix section uses rotary pots to let you adjust pan and gain for either the line-level sources at input channels 3 through 6, or the tape returns. Channels 1 and 2 have a rotary pan pot but use faders and mic/line switches for setting gain. The single aux bus includes a stereo return. The master controls include a single volume fader, 12-segment LED level indicators that can be switched between the tape tracks and the mixer outputs (the stereo outs and aux send), switchable Dolby B noise reduction, and a 2-band EQ (±10 dB) that is adjusted via sliders, rather than rotary pots. The unit runs at 1⅞ ips and includes a fine-adjust (±15%) "pitch" pot. All inputs and outputs are ¼-inch jacks, including a stereo headphone output. An optional footswitch provides punch-in/out capabilities. The manufacturer claims a frequency response for the recorder of 40 to 12.5 kHz at 0 VU, or 40 Hz to 18 kHz ±3 at -20 VU (and 20 Hz to 20 kHz for the mixer); a signal-to-noise ratio of greater than 58 dB, A-weighted; channel separation greater than 45 dB at 1 kHz; and wow/flutter ±0.15% (IEC/ANSI).

If you know a guitarist looking for a headphone amp with plenty of "crunch," check out the new **Rockman Guitar Ace** from **Scholz R&D** ($99; tel. [617] 890-5211). The lowest cost member of the company's product line, the Guitar Ace is a 9V battery-powered (with AC adapter) headphone amp that, in addition to its guitar input, includes an auxiliary input so you can jam with a portable tape player, drum machine, etc. Effects include two types of distortion—heavy distortion and a more subtle "semi-distortion"—and preset EQ and compression. Rotary volume controls, a mono headphone-level output (stereo signals are summed to mono), and a set of headphones complete the package. The optional Rockman Cable Kit lets you adapt the output to a line-level signal for mixers, amps, etc.

Yamaha offers the **EW20 Windjamm'r** ($650; tel. [616] 940-4900), a MIDI wind controller that includes a sound module, for those MIDI-loving windbags on your list. Designed as an entry-level version of the WX7 and WX11 wind controllers, the Windjamm'r's features include MIDI in/out/thru, adjustable tuning (A=438 to A=445), selectable sax or recorder fingering, tempered and natural (Werckmeister) scales, automatic key transposition, octave transposition (±2 octaves), and a thumbwheel controller. The 8-note polyphonic, 4-part multitimbral sound module includes 64 preset FM sounds (the unit doesn't have memory for user sounds); onboard reverb; and 32 user memory locations for storing performance combinations of factory sounds, settings (such as transposition), and reverb. The EW20 has headphone and line-level outputs. Optional footswitches default as increment/decrement keys but can be pro-

grammed for sustain or octave-transpose functions.

If you know someone who's sick of dealing with outboard, wall-wart power supplies and wants to clean up the mess of power cables in his or her MIDI rig, consider the **Juice Goose 12 PAQ** ($279; tel. [713] 772-1404). This incredibly useful 1U rack-mount device provides six independent power outputs, each of which supplies 9 VAC, 18 VAC, 9 VDC, or 12 VDC (selectable). Juice Goose offers output cables that work with equipment by Peavey, Lexicon, Alesis, A. R. T. , Roland, DOD, and more. Each output is isolated from the other and from the current input, and the Twelve PAQ includes line filtration and spike protection. Six 120 VAC outlets are included for a total of twelve outlets.

Some folks always complain about not having enough control in their life—you know, they're lacking footpedal inputs on their synth or sampler, or they just don't have enough other controllers for doing real-time sonic manipulation. They probably need an **Anatek Pocket Pedal** ($99.99; tel. [604] 980-6850), which can be used with most control-voltage pedals and footswitches (and with the Zimmerworks Zeebar) to supply MIDI volume, pitch bend (with 3-way selectable range), modulation, portamento time, sustain on/off, sostenuto on/off, start/stop, or portamento on/off messages. The diminutive (3.2 × 2.1-inch) Pocket Pedal has a merging MIDI in, a MIDI out, a pedal input, and a footswitch input. It sends on any MIDI channel (or all channels at once). Pedal operation may be inverted so you can, for instance, have the "down" position be either full modulation, or no modulation.

Anatek Pocket Pedal

Voyager's CD Companion Series CD-ROMs ($99.95/volume; tel. [213] 451-1383) are an excellent gift for Mac owners on your list who are intrigued by the educational and entertainment possibilities of interactive multimedia. The series' first volume presented Beethoven's *Symphony No. 9*, but it gets even better in Volume 2, which presents a performance, by Charles Dutoit and the Orchestre Symphonique de Montreal, of Igor Stravinsky's ballet, *Rite of Spring*. Voyager CDs utilize the interactive capabilities of *HyperCard* and a computer-controlled CD-ROM drive (both of which are required) to augment the performance with six interactive text sections; a single-screen orientation to the piece; a discussion of Stravinsky and his world; a general listening guide; a discussion of the dance aspects of the ballet; a continuous, real-time commentary that runs throughout the work; and a Stravinsky question-and-answer game. You can wander around the piece via *HyperCard*, examining the score and commentary at your leisure, or play it from start to finish.

For the budding do-it-yourselfer, **Sliger Sierra** (tel. [209] 295-5595) manufactures a line of **rack-mount enclosures and modules**. Specialized units include an exhaust-fan module with twin fans ($61.61); a front-panel light module with low-intensity, diffused lighting ($64.88); a disk drive expansion box that rack-mounts four half-height, or two full-height, 5.25-inch drives ($132.93); and rack-mount systems for the IBM PC AT/XT ($195) and the Macintosh IIci and IIcx ($92.37). The company also offers custom front and rear panels ($35 layout per part)—for instance, you can order one that mounts a fan and has a terminal strip, XLR plugs, and ¼-inch jacks—and a large assortment of locking drawers, sliding and fixed shelves, project boxes, and filler panels. As yet, half-rack boxes aren't available, but if enough people demand them, maybe we can change that.

Graphics-loving musicians might enjoy **CTM Development's *OvalTune*** ($100; tel. [415] 589-1059; formerly from Intelligent Music; reviewed in the October 1989 **EM**) for the Macintosh. The program lets you use the mouse to control both music and graphics in real time. Unlike a "classic" composer's sequencer (*Vision, Performer,* etc.), you step-enter a maximum of eight note patterns (via Mac or MIDI keyboard) of up to 32 notes each and loop them. Then, you create patterns within them, interacting with probabilistic algorithms *à la* Intelligent Music's *M* (now distributed by Dr. T's; see "Interactivity in Action: *M* Meets the Amiga" in the April 1989 issue). Patterns can be performed in real-time with the mouse as well, in a manner reminiscent of Laurie Spiegel's *Music Mouse* (also distributed by Dr. T's). Simultaneously, your mouse movements create graphics, using thirteen drawing algorithms—ovals, diamonds, lines, etc. In addition, the program can import most graphics files, including PICT files and Clipboard images, for fodder. *SamplePlayer,* a 128-sound sample-player program for the Mac sound chip, is included in *OvalTune,* so a MIDI instrument is optional. *OvalTune* supports the standard MIDI file format and *MIDI Manager,* exports PICS files (for import into presentation software such as MacroMind *Director*) and PICT files, and supports 256 colors on a Mac II, which sounds pretty holiday-like. CTM has dropped copy-protection, too.

Electric guitarists who perform live always like a new, flashy pedal. **Digi-Tech's Whammy Pedal** ($249.95; tel. [801] 268-8400) gives any one of three effects: pitch bending (up or down) by two semitones, by one octave, or by two octaves; pedal-controlled pitch detuning; and a harmonization effect that uses any of nine preset algorithms to generate a harmony note (creating a major second, minor third, major third, perfect fourth, or perfect fifth), which you then can bend with the pedal. This isn't really aimed at synthesists—you can accomplish what the pedal does with some creative synthesis—but it's fun for guitarists.

If you're the significant other of someone who insists on perfecting his or her new tune until 2 a.m. every other day, we're sure you will gladly part with money to purchase a good set of headphones. **Sennheiser** makes several excellent models, but the bottom-of-the-line **HD-25 headphones** ($199; tel. [203] 434-9190) sound fine and won't break a modest budget. They offer a frequency response of 30 to 16 kHz and 0.5% THD. You can swing one phone up on your temple, which is useful when cueing, and to remove a phone, you just snap it off the headband and

Aphex Studio Clock

Make the Impossible ... Possible.

"A major record company came to me with master tapes that were an absolute disaster. One tune was comprised of several different takes that had been spliced together. The time code was gone and there was no way to sync it to the drum tracks. Short of bringing everyone back in the studio, there didn't seem to be any hope for this project. I put my butt on the line and said I could fix the tapes *over a weekend.*

Monday I delivered the tapes with new time code, new drum tracks. Everyone thought I was a miracle worker ... in fact now they call me the *Rhythm Doctor.* My secret, the Aphex Studio Clock, without it I couldn't have delivered. By the way, that $700 Clock made me $4000 that weekend."

Steve Klong
Drummer/Electronic Percussionist
Session Musician, "Rhythm Doctor"

"Some marketing types decided to resurrect some 70's hits with new sounds, sequencers, drum machines, etc. In some cases they wanted to save only the vocals and replace all the music.

Since the beats in the original tracks were so complex, nothing on the market would lock up to do the job. Then we discovered the Aphex Studio Clock. This thing can sync to almost any sound ... not just drums. It made the impossible possible.

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Courtney Branch and Tracy Kendrick
Producer/Engineers Total Trak Productions

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Senheiser HD-25 Headphones

unplug the cable. The HD-25 has a split headband, good padding (though the muffs are on the small side), and a single audio cable of stranded steel.

11 Keyboards (including computer keyboards) suffer badly from exposure to dust and loose hair or pet fur. For that cleanliness-oriented person on your list, the **Mini-Vac** ($19.95 without AC adapter; tel. [818] 244-6777) **miniature vacuum/blower** will probably be appreciated with near reverence. Powered by a 9V battery, this handy little device includes a slender, round lens brush and a broader, utility brush that attach to either a bent, or a straight "wand," so you can hold the tool a comfortable distance from the keyboard. The handheld, electric windbag includes both intake (vacuuming) and exhaust (blower) ports and a cloth vacuum bag. Don't try to clean that spilled beer with the Mini-Vac, though, as liquid in its lung is fatal.

12 Guitarists who venture into the realm of MIDI are often frustrated by the lack of things they can step on. You can help that special MIDI guitarist on your list overcome these feelings of impotence by purchasing them a MIDI program change pedal like the **A.R.T. X-11 MIDI Master Control** ($129; tel. [716] 436-2720). The X-11 lets you send program changes on any of sixteen channels, using stomp switches—five patch-select and two bank switches—and a 2-digit display. A.R.T. built the unit to withstand rigorous stage work: The chassis is of 16 gauge, cold-rolled steel, and the switches are held in place with structural steel.

13 The frequent traveller will undoubtedly appreciate **Inmac's** shielded, **antimagnetic disk wallet** ($14.95; tel. [800] 547-5444; or [408] 737-8700; catalog no. 950879). Measuring 3½ × 9⅛ × ¾-inch, the wallet offers a safe haven for up to twelve 3.5-inch disks, protecting them from the large magnetic fields and X-rays generated by airport security machines. Sure, the machine operators insist they're safe, but do you want to risk scrambling *your* data?

14 The lucky Korg M-series, T-series, and Wavestation owners on your list can soup up their beloved instruments with the **Cannon Research Frontal Lobe** ($799 for basic model; $1,199 for fully expanded model; tel. [916] 272-8692). When fully expanded, the Frontal Lobe extends the M1's sequencer to 100 song segments, totaling approximately 64,000 events (the stock unit expands the M1 sequencer to 15,000 events); adds real-time looping and song changes with a footpedal; and lets you perform real-time editing of sound parameters during sequencer playback. The 3.5-inch/1.44 MB (high-density) floppy disk drive allows you to store sets

Easyverb

Suggested Retail Price: $249.00*

MICROVERB® III *is* the Easyverb.

It's the easy to use, 'does what it's supposed to' preset digital processor that covers all the bases from classic reverbs to mirror image delays, with the rich, luscious sound that's only found in an Alesis reverb. Featuring 256 programs, it's a Microverb times 16. Think about *that* for a minute.

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of songs, programs, and combinations. Thanks to IBM format disks, you can display or print the set's contents on a personal computer. The Frontal Lobe also adds a full MIDI interface and RS-232 port so it can communicate directly to personal computers with RS-232, other Frontal Lobes, or a modem. By adding the **PCM Channel** ($399) to the Frontal Lobe, via the RS-232 port, you can download 512 KB of your own samples in MIDI sample dump standard format, opening the Korg synths to endless libraries of waveforms.

15 For the hummers in the crowd, the **Breakaway Vocalizer 1000** ($350; tel. [415] 341-8300) is a voice-controlled, MIDI synthesizer that you trigger by humming into the hand-held mic. The Vocalizer includes a 10-note polyphonic and multitimbral synth with 28 preset horn, woodwind, string, and percussion patches; a 5-track sequencer; twelve prerecorded background sequences; a built-in speaker; an output jack for external amplification or headphones; and MIDI in and out.

Korg DTM-12 Digital Tuner/Metronome

16 A doubly useful gift for those into multifunction appliances, **Korg's DTM-12** ($249; tel. [516] 333-9100) gives you a 7-octave digital tuner with a straightforward LCD readout that shows calibration as well as the note being played, and a separate LED meter. Reference tones play, in four octaves, through the built-in speaker. The bonus is a metronome whose tempo ranges from quarter note=40 through 208. The DTM-12 runs on four AA batteries and comes with an AC adapter and an earphone.

17 A truly unusual gift for those unusual friends of yours is **New Sensor Corporation's Mike Matthews Soul Kiss** ($120; tel. [212] 980-6748). A belt-pack-sized, 9V battery-powered box combined with a mouth controller, the Soul Kiss converts mouth movements (essentially lip and teeth pressure) into a control voltage that sweeps an analog filter housed inside the box. By plugging the output of a keyboard or any other instrument into the unit, interesting, talk-box-like effects can be created.

18 Speaking of kisses, the KISS (keep it simple, stupid) crowd will probably love the **Musonix MIDI Beacon** ($29.95; tel. [818] 845-9622; reviewed in the June 1990 issue), a MIDI signal indicator. It's a one-trick pony, but its IC-based timer puts out a clean, steady 0.1-second pulse that's converted into a bright green LED blip no matter how short the MIDI message. It's great for folks who need to do quick MIDI signal-flow checks when rewiring or troubleshooting MIDI gear (which happens all too often).

19 Heavy metal wanna-bes (as well as closet metal freaks) will go ga-ga if you tell them you're getting them a Marshall

"The VFX[SD] has the best performance sequencer I have ever laid hands on—it is so intuitive it's like a MIDI mind probe!"
Peter-John Vettese
Keyboardist, producer-Simple Minds, Pet Shop Boys, Jethro Tull, The Bee Gees

"Compared to other hardware sequencers, the SD's event-editing features are stunning. This is one of the most complete synth/sequencer systems we've ever seen."
Mark Vail
Keyboard Magazine

"The VFX[SD] is the perfect writing tool . . . I would have lost a lot of those '3 AM compositions' had it not been for this wonderful machine!"
Richard Souther
Narada/MCA recording artist

"The VFX[SD] has replaced a lot of my old synths in my setup. It sounds original, and the layout makes total sense."
Philippe Saisse
Producer, Windham Hill recording artist

"Very unique, one-of-a-kind sounds!"
Michael Boddicker
Synthesist, composer

"I was told you always have to wait for something special. I'm recording the second ABWH album and I'm using the VFX[SD] constantly. All I can say is it really was worth waiting for."
Rick Wakeman
Keyboardist, composer

What more could we say?

"We're using the VFX[SD] as the master keyboard for all the production work we do. The performance parameters are *very* happening, and there are so many sounds that are just right for our music."
David Frank/Mic Murphy
The System

"It's bloody marvelous—it does everything!"
Tony Hymas
Keyboardist, composer-Jeff Beck's Guitar Shop, PhD

"The VFX[SD] is the perfect road companion. It allows me not only to perform, but to compose new material and have it at my fingertips whenever needed."
Oscar Peterson
Jazz pianist, composer

Plenty. As you can see, many musicians have already found the ENSONIQ VFX[SD] Music Production Synthesizer to be the most versatile keyboard available today. But we didn't stop there. At ENSONIQ, we're committed to making the best even better.

Announcing the VFX[SD] Version II. Now we've added the features you requested the most. Like all-new "Mega-Piano" waves to give you the definitive acoustic piano sound. New sequencer features include Multi-Track Record, so you can transfer sequences from outside sources in a single pass. And an advanced Step-Entry mode for greater flexibility when you want to record difficult or non-real-time passages.

The right instrument can help your talent and music grow. With the ENSONIQ VFX[SD], your instrument will keep growing with you. Enough said. Check out a VFX[SD] today. Call 1-800-553-5151 for an Authorized ENSONIQ dealer near you.

TOP TEN April 1990

KEYBOARDS ($1,400 and up)	Rank
Ensoniq VFX-SD	1
Korg M1	2
Roland U-20	3
Roland D-20	4
Yamaha SY77	5
Ensoniq EPS	6
Kurzweil K1000	7
Korg T3	8
Roland D50	9
Yamaha V50	10
Yamaha X4500	(N)

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EPS

EPS-M

SQ-1

VFX

From synthesizers, to samplers, to complete workstations, ENSONIQ has an instrument that's right for you.

The above artists are not paid endorsees. They *use* ENSONIQ products.

Yes, I want more information about the following:
(Check as many as you like.) ☐ VFX[SD] ☐ VFX ☐ SQ-1 ☐ EPS ☐ EPS-M

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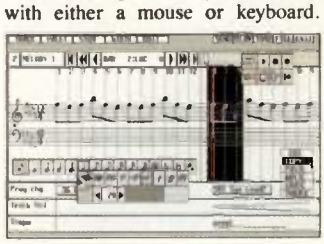
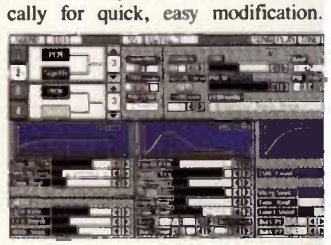
Ballade™

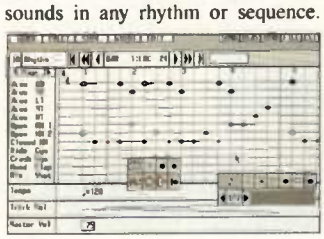
Song Mode There's no need for complex computer commands – enter notes or changes directly into the score with either a mouse or keyboard.



Tone Mode Bring to life the sounds you imagine, then save them to disk. Lets you see the tones graphically for quick, easy modification.



Rhythm Mode From tympani to tom-toms, you can mix and match a full range of percussion sounds in any rhythm or sequence.



Play Mode Create a full symphonic sound with 8 separate tracks. Lets you fully control playback speed, volume, panpot and reverb.

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amp, conveniently forgetting to mention its 6 × 4-inch dimensions. Nevertheless, the **Marshall MS-2 practice amp** ($45; tel. [516] 333-9100) looks like the real thing and has real grill cloth. The tiny amp is a 9V battery-powered, working unit, with volume and tone knobs and a switch that selects between standard and Marshall overdrive (!) sounds. It even has a belt clip.

Marshall MS-2 Practice Amp

20 Keyboard players looking for a solid keyboard amp might enjoy **Peavey's KB 300** ($549.99; tel. [601] 483-5365), the Mississippi manufacturer's top-of-the-line model. Each of the three separate channels has high, mid, and low EQ controls, and an effects bus. Channel 1 also has a pre-EQ insert point. The master section includes effects level and master volume and Peavey DDT compression. The amp pumps 150W RMS into 4 ohms, driving a 15-inch Peavey Scorpion Plus speaker and a CDH high-frequency horn. (The amp is available with a Peavey Black Widow speaker for $599.99.) The KB 300 also includes a preamp output, line-level out, power-amp direct input, ground-lift switch, and a jack for an optional reverb footswitch.

21 If you know someone who needs to hawk promo copies of their latest CD project, you should know they'll need safe, secure packaging that lets them show off their product. **Univenture's CD Viewpak** ($0.40 ea./quantity prices available; tel. [614] 761-2669) is a single-CD, reusable distribution/storage package that includes a pocket for a booklet and graphics. Univenture's special Safety-sleeve technology incorporates a nonwoven polyester "clean-room" material that uses no chemical binders in the fiber or laminate. The idea is to give the CD a soft, clean bed, with minimal surface area, due to the fibers. The fibers suspend the disc above the main surface of the material; small particles fall into the depths of the material, away from the disc. The manufacturer also has a line of 3- and 5-ring binders with pages of Safety-sleeve pockets that hold four CDs, or nine CD-3s, per page. The 10-page, 40-disc binders weigh five pounds when filled. If you want to travel with a collection of CDs (including CD-ROMs), here is a great way to store them.

22 Books are a traditional holiday gift, and our own **Mix Bookshelf**

(tel. [800] 233-9604 or [415] 653-3307) has an incredible collection of books about audio, electronic music, the music business, songwriting, and related media. (If you think plugging a part of our company is shameless, wait until you read about our final gift idea!) This year, a public-spirited **EM** editor convinced Mix Bookshelf to sell **gift certificates**, which are available in any denomination and may be redeemed up to one year from date of purchase. The certificate is shipped with a copy of the latest Mix Bookshelf catalog, which has so many great books that it's hard to make a decision, so here are four suggestions: As I stated in the February 1990 **EM**, the second edition of ***The Sound Reinforcement Manual***, by Gary Davis and Ralph Jones (417 pp.; paper; $34.95), "is one of the best beginning- to intermediate-level books on sound reinforcement." Reasonably complete discussions systematically examine every aspect involved in sound reinforcement work, from current and cables to speaker placement and room equalization. The beginner who's trying to grasp the basics of MIDI and home recording technology should check out ***Music & Technology***, by H.P. Newquist (198 pp.; paper; $16.95). Macintosh-based musicians will enjoy **EM** author Geary Yelton's ***Music and the Macintosh*** (199 pp.; paper $16.95; see the October 1990 "What's New"), which discusses music and acoustical rudiments, digitized sound, various types of music software, Mac hardware, and more. Yelton offers advice on configuring a studio and tips on mastering the Mac, along with profiles of eighteen major software packages. In ***Synchronization from Reel to Reel*** (120 pp.; paper; $16.95), MIDI Manufacturer's Association president (and **EM** author) Jeff Rona thoroughly explains synchronization theory and the use of click pulses, FSK, SMPTE time code, and MTC, with lots of hand-on applications (including video) and tips for system configuration.

23 Other education-oriented gifts are the 80-minute ***Shaping Your Sound*-series videos** from **First Light Video Publishing** ($59.95 ea.; tel. [213] 467-1700; available from Mix Bookshelf). The first three—in which producer/engineer/teacher Tom Lubin explains applications of microphones; equalizers, compressors, and gates; and reverb and delay—arrived last year and were welcomed with great reviews (see the September 1989 issue). This year, First Light added two more titles. *Shaping Your Sound With Multitrack Recording*

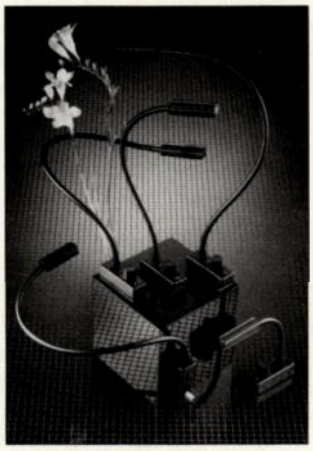
First Light Video Publishing

walks you through a multitrack recording session and discusses recording techniques, creative editing, tape effects, etc. In *Shaping Your Sound with Mixers & Mixing*, Lubin explains the recording console and how to use it when making mixing decisions in a 16-track

mixing session, including the use of EQ, reverb, and dynamics processors.

21 Musicians longing for a good back-up band should appreciate gifts that offer the next best thing, MIDI accompaniment programs. Two similar products have made their appearance this year: **MiBAC Software's** ***MiBAC*** ($125; tel. [507] 645-5851; reviewed in the September 1990 **EM**) for the Macintosh and **PG Music's** ***Band-in-a-Box*** ($59; tel. [416] 528-2368; see the October 1990 issue), which runs on the Mac, IBM XT/AT, Atari ST, or Amiga. Both programs utilize algorithms to create piano, bass, and drum accompaniment over user-entered chord progressions. As the accompaniment plays, you can jam along and record your overdub. *Band-in-a-Box* comes with an accompaniment-file library of "Fake Book" tunes in a variety of styles—jazz, country, pop—so you can get on with the jam session. *MiBAC* is mostly oriented toward jazz, including Latin. It's easy to set up the program's MIDI channel assignments for piano, bass, and drums to match your instruments, or use the default channel setup, designed for a Roland MT-32 synth. You simply enter the chords for a tune (or load a file), and play. The program's sequencer records your solo or comp and saves it, with the accompaniment, for playback, printing, or export. Both *MiBAC* and *Band-in-a-Box* save in standard MIDI file format, so you can export the results to a regular sequencer.

25 For those who feel like they're always in the dark, **CAE, Inc.** (tel. [313] 231-9373) offers several types of **Littlite gooseneck lamps** that are great for use with musical gear. The high-intensity version illuminates an area twenty inches in diameter at twelve inches from the lamp, to a level of 25 footcandles, while the low-intensity version covers the same area with five footcandles of light. L-series lamps ($47 to $67) are available with permanent or detachable gooseneck, and CAE offers several other series of Littlite lamps, with various configurations.



Littlite Gooseneck Lamps

26 "Live" performers on your list who use sequences (a contradiction in terms?) can play their computer-fried sequences, complete with sysex patch dumps, without hauling their computer — if you buy them a **MIDMAN 32K** ($299.95; tel. [818] 449-8838). Its misleadingly simple task is to encode MIDI data so you can record and play back the data with a small cassette recorder, just like its older sibling the MIDIMan MIDI-to-tape interface (reviewed in the December 1989 issue). The 32K has a larger (32 KB) buffer and adds the ability to encode sysex dumps.

27 If you, or someone you care for, loves building or fixing electronic gear, **Contact East** (tel. [508] 682-2000) offers a huge catalog of electronics test gear, tools, and assorted shop furniture. The **tool assortments** range from specialized kits, to a 144-piece Master Field Service Kit ($575 with ATA flight case; $528 with 9-inch polyethylene case), to the 53-piece Compact Tool Kit ($145), and the 39-piece Lab Roll Pouch Kit ($115; see the July 1989 "What's New," p.30). Incidentally, a Hitachi 20 MHz, dual-trace oscilloscope—which is on technical editor Gary Hall's wish list—is available for $487.15.

28 DAT technology is finding popularity for general data backup as well as recording digitized audio. Consequently, DAT-equipped recipients will appreciate **Bryco Products'** (tel. [818] 783-9133) **DATRAX** line of DAT storage units. Included in the line are: the Traveler ($89), an 18-tape, black leather carrying case, available with or without a shoulder strap; and the 60-tape DATRAX-60 ($59.95 in Oak or Black Oak; $65 in black-speckled "Designer" finish) for tabletop and wall-mountable storage.

29 Psychedelia is back in a big way, and anyone interested in staying in the hip crowd will want to check out ***FracTunes*** ($89; tel. [208] 342-5849), from **Bourbaki**. Available for the IBM

PC, *FracTunes* enables you to create animated patterns of fractal images that change as a function of MIDI data. The program creates 16-color images—it supports 16-color EGA and VGA monitors—so the image consists of sixteen "regions." *FracTunes* maps MIDI notes to the sixteen regions in different patterns. As the MIDI data is played, the color regions change, producing an animated image or a MIDI-controlled fractal "Slide Show."

30 If you know a deserving soul who owns a sampler or has an upcoming recording project that needs special sounds—anything from wild effects and rare instruments to common, everyday stuff—you can almost certainly find things that would interest them from the many distinctive **CD sample and special effects libraries**. Before you buy, read Geary Yelton's reviews of sample libraries from **McGill University** (May 1990 **EM**; tel. [514] 398-4548); **Prosonus** (June 1990 issue; tel. [213] 463-6191); and **Valhala** (imports from Sonic Images and Masterbits; August 1990 issue; tel. [313] 548-9360). These, and CD sample and effects libraries from **Earworks** (tel. [708] 446-4263), **Sound Ideas** (tel. [800] 387-3030; or [416] 886-5000), **Dimension** (holophonic sounds; tel. [800] 634-0091 or [813] 763-4107); and **CBS** (tel. [212] 975-4321) also are available from Mix Bookshelf. *ProSamples Vol. 1*, an impressive CD sample disc that was announced at the 1990 AES show by **East-West Communications** (tel. [213] 659-2928), features drum samples by TEC Award-winning engineer Bob Clearmountain. **Dorsey Productions' Sonic Boom Library** (tel. [714] 535-3344) includes the *Dynamic Range* disc, with over 873 sound effects.

31 The special MIDI drummer on your list will purr with delight if they find **KAT Percussion's MIDI KITI** ($369; tel. [413] 594-7466) among their gifts. The MIDI KITI is a percussion controller that offers nine pad/trigger inputs, a MIDI in, and two MIDI outs. Each trigger has completely independent MIDI parameter settings, including MIDI channel and note assignments, user-definable minimum and maximum velocity response, a selection of sixteen velocity curves, gate time, and program change. Triggering parameters include sixteen levels of gain, triggering threshold, mask time (length of pause between hits to avoid double-triggering), minimum and maximum dynamic (impact) response, cross-triggering protection, adjustable MIDI delay, and adjustable headroom (another protection against double-triggering). An LED display shows which triggers are being played.

32 Storage, storage, storage. No one ever seems to have enough of it, including probably any computer or sampler owner on your list. For example, I want to get copy-protected music software off my regular hard drive so I can optimize the drive without messing with partitions. I also want convenient mass storage to back up all my files. When Apple finally releases System 7, some software won't be upgraded immediately, so I want to be able to choose between hard disk-based op systems. Finally, I want a rack-mount drive to store samples and load them directly into my sampler via SCSI. One solution to all these needs is an **Eltekon RX-2 rack-mount, 44 MB removable hard disk drive** ($1,229 with one cartridge; tel. [313] 462-3155). The Syquest mechanism-based drives are shock-mounted and quiet, and you can get a second drive (removable, fixed, or CD-ROM) installed in the same 2U case. As an added plus, a lot of companies sell samples on 44 MB removable Syquest cartridges.

33 Nintendo freaks on your list will surely be delighted and intrigued by an impressive new product from **The Software Toolworks**, developers of artificial intelligence-based programs. The company combined a MIDI keyboard controller with a program cartridge that connects to the NES joystick port on a Nintendo system to create the, **Miracle Piano Teaching System** ($299.95 not including Nintendo; tel. [818] 885-9000).The system uses the video game environment of the Nintendo to teach note recognition, rhythm, and other important musical skills. The program's artificial-intelligence lets the Miracle "know" about commonly repeated mistakes, and it automatically designs customized lessons in response. The keyboard can operate as a stand-alone MIDI controller without using the system. It offers five octaves of full-sized, velocity-sensitive keys, built-in speakers, over 100 onboard sampled sounds, built-in effects, MIDI in/out, and a sustain pedal.

34 **Air Transport Association-approved flight cases and racks** are a great gift for hard-core touring musicians and weekend warriors alike. An ATA case or rack meets the construction requirements for flight insurance and should be a given for virtually any music gear that travels. You can get foam-lined ATA cases that, as the inimitable George Petersen put it, "could probably survive anything short of a direct hit by a 105mm artillery shell." (See "The Case for the Defense," p.125, July 1988 **EM**.) For a "live" gig, you can do a lot with a well-stocked, 5-space ATA rack, especially with the increasing availability of half-rack signal processors and sound modules, single-space line mixers, and 1U MIDI patch bays. **Anvil Cases** (tel. [800] 242-4466 in CA; [800] 423-4279 outside CA; or [818] 575-8614), **Star Cases** (tel. [800] 822-STAR; or [219] 922-4440), **Sound Engineering** (tel. [800] 837-CASE; or [317] 463-6364), **Hybrid/Island Cases** (tel. [516] 563-1181), ATS Cases (tel. [800] 451-4242 outside MA, or [508] 393-9110) and **JanAl** (tel. [213] 260-7212) are among the companies that make a wide variety of ATA-approved racks and cases, often including custom-built units.

Hybrid Cases

35 Sooner or later, most people who move around the stage a lot consider shedding their wires. **Wireless systems** can be used for more than audio (mics and electrified/electronic instruments), too. If you have a MIDI wind controller, guitar controller, strap-on MIDI keyboard, etc., a MIDI wireless rig can bring wonderful freedom of movement. Complex wireless rigs are found in many live venues, but you should expect to deal with some pitfalls (see "Look Ma! No Cables: Wireless Systems Applications" in the December 1989 **EM**). If you want some ideas of what to look for in a wireless system, see "Cutting the Cord: Choosing a Wireless System," by the Nady Staff, in the November 1989 issue. **Nady Systems**

NOW THIS CHANGES EVERYTHING.

If you want to sound like everyone else, go right on ahead. You'll have plenty of company.

But if you want to take the music you make and make it all your own, you'll have to change just a little. With the Yamaha TG33 Tone Generator. A perfect way to not only have more sounds, but to give them your fingerprints.

The TG33 has unique new voices. There's 32 note, 64 element polyphony. 196 internal voices, of which you can play 16 at one time.

And the TG33 gives you the power of Vector technology—so you can delicately stir both the FM and AWM sounds together—and get rich, gutsy, unique, completely personal sounds captured intuitively, straight from your brain.

50-stage voice and detune Vector.

The TG33 is rack mountable. Or keyboard mountable, if you like to tweak voices, effects and volume on the fly. It's totally programmable, while being remarkably easy to use or edit. It has a collection of built-in effects. It looks different. It is different.

And it's irresistibly inexpensive. Which means that whatever else you planned to do today, you'll be running down to see your Yamaha dealer instead.

See? The TG33 is changing things already.

YAMAHA

BROTHER PROFILE:

MATT HAHN

HOME: Piscataway, NJ

AGE: 35

PROFESSION: Weekend warrior in the New Jersey club wars with his band "Innocent Eyes". Has a day job.

LATEST ACCOMPLISHMENT: "Getting more than 4 hours of sleep one night last week."

WHY I DO WHAT I DO: "I don't really like sleep all that much anyway."

PROFILE: Lives to compose and play. "Music is great. Where else can you find a hobby that pays 50 cents an hour."

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(tel. [415] 652-2411) manufactures a popular line of wireless systems, and the article is a good, impartial guide to the genre. **Samson** (tel. [516] 932-3810) also makes wireless systems for musical applications, as does **Sony** (tel. [201] 833-5200), **Shure** ([800] 257-4873 or [312] 866-2542), and **Beyer** ([516] 935-8000).

36 One of our staff members needs quality studio monitors, but she doesn't want to buy a separate amp-and-speaker setup, and she can't place the cabinets at ear level. The gift she, and anyone in a similar situation, needs for the holidays is a pair of powered monitors, such as the **Acoustic Research Studio Partners** ($470/pr.; tel. [617] 821-2300; reviewed in the June 1990 **EM**). The 15 × 9 × 9-inch cabinets used in the Studio Partners are wedge-shaped (at a 15-degree angle), so my friend can place them on a low shelf. The 2-way system uses an 8-inch polypropylene woofer and a ferro-fluid-cooled, 1.25-inch dome tweeter. Acoustic output is rated in excess of 106 dB SPL (frequency and distortion unspecified), and bass response is -3 dB at 55 Hz. On the other hand, if my friend can find a way to mount the speakers at ear level, she could get **Bose RoomMate IIs** ($299/pr.; tel. [508] 879-7330). The 6 × 9 × 6-inch remodeled Bose speakers work with either wall current (AC), or battery power (DC) and offer a frequency response of 78 Hz to 15 kHz. Both AR and Bose systems offer built-in power amps and simple line input connections.

37 Somehow, musicians never have enough recording tape, whether cassette, videotape, or open-reel. A winning gift for the open-reel recordist is a supply of **3M's 996-series open reel tape** ($14 per 7-inch reel of ¼-inch tape; tel. [800] 245-8332; or [612] 736-5019). The tape is available in any size from ¼-inch to 2-inch. 3M says the new tape formulation operates at +9 dB levels with virtually no distortion and has a S/N ratio of 79.5, purportedly the highest of any analog audio mastering tape on the market. The manufacturer claims that along with its improved maximum output (79.5 dB), the new tape displays improved signal-to-print characteristics. Translated to plain English, 3M says you can put an exceptional on 996 tape, and the

signal still transfers ("prints") to tape more cleanly than with other tape. The new tape formulation is bias-compatible with 3M 226 and other common recording products.

38 There's a dreamy quality to the holiday season, but a lot of business is transacted, too. A gift that is, or will be, many a practical business person's dream is the **Airis VH-286 laptop computer** ($1,895; tel. [312] 384-5608). The notebook-sized (10 × 12 × 2-inch) and weighted (6½ pounds with battery), 12.5 MHz, 286-based IBM AT-compatible includes a 20 MB hard disk (with 23 ms access time); an 11-inch, supertwist, backlit VGA LCD video screen with sixteen levels of gray shading; a 2400 baud modem; 2 MB RAM, expandable to 4 MB; and a socket for an 80287 coprocessor. The rear panel includes an RS-232C serial port, a parallel port, a PS/2 mouse port, and RJ-11 connector (for the modem), and a connector for the optional floppy disk drive ($150 with the system, $249 separately). The operating system is MS-DOS 4.01. Special power-saving features, including innovative use of excess video RAM as an onboard disk cache, reduce battery drain. The VH-286 CPU was tested by *Byte* magazine ("Notebook Newcomer," July 1990 *Byte*) and found to be much faster than 286-based laptops such as the Compaq SLT/286 and faster than many 386SX-based laptops. Just wire a MIDI interface to the serial port (see the September 1990 "Computer Musician" column), and you're ready for mobile MIDI mania.

39 A big part of having a reliable studio is using reliable AC power (see "Getting Wired: A Power Primer" in the April 1990 **EM**). The home studio owner who thinks he or she has it all could lose it all to a power surge or spike. You can save this person a lot of grief with a **Panamax Max-series surge and spike suppressor** ($69 to $99; tel. [800] 472-6262 or [415] 499-3900). The Max clamps at 240 volts, 90V better than the UL requires, and its "auto-shutoff" circuitry doesn't allow current to pass in the event of a catastrophic surge or spike. Panamax's lifetime warranty covers the Max, and all equipment properly attached to it, against surge and spike damage, so it's the first thing you ought to have in a power distribution system. To even further refine the juice, try the 1U rack-mount **Furman AR-117 AC Line Voltage Regulator** ($499; tel. [415] 927-1225; reviewed in the June 1990 **EM**). It also protects against surges and spikes but does much more, accepting line voltages in its capture range of between 97 and 131 volts, and supplying a steady 117 volts of clean, EMI- and RFI-filtered AC. (It even supplies usable output voltage when the wall voltage is outside the capture range, down to 89 or up to 139 VAC.) The AR-117 offers eight isolated outputs and handles up to 15 amps of power. In a large system, the rest of your AC strips could be wired in a "star" pattern to the AR-117. You wouldn't run a fine car on bad gasoline, so why run your valuable electronic gear on questionable electric power?

40 Talk about the "gift that keeps on giving!" We modestly but unabashedly assert that you can best help your favorite musician keep up on electronic music and recording products, techniques, and ideas by giving a **subscription to *Electronic Musician*** ($24 [illegible] twelve issues inside the U.S.; $39 [illegible] side the U.S.; tel. [800] 888-51[illegible] [615] 377-3322).

Well, folks, that about wraps i[illegible] sure to enjoy the holiday se[illegible] new gear.

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A short time ago, A.R.T. stunned the recording world with the release of the SGE Mach II. Offering 12 simultaneous effects and a 400% more powerful processing section, the Mach II offered spatial realism that defied description. The all new DRX uses that same processor and is expressly designed for studios and live sound applications. The DRX will do 10 simultaneous audio functions and features an exciter, compressor, limiter, noise gate, expander, envelope filter, 24 different reverb algorithms, 21 different delays, sampling, pitch transposing, panning, equalization, leslies, stereo flange and chorus and more—over 60 effects to choose from with bandwidth to 20 KHz! The creative power is astonishing. The noise gate can gate off microphones so the wash from live drums doesn't trigger your effects buss. The compressor can smooth out wild dynamic swings on vocals. The exciter will increase the edge and clarity of any type of material. The noise gate can "turn-off" noisy guitar amps in between songs or allow you to run higher gain levels without feedback on vocal and drum mics. The limiter can hard limit any source so that clipping can be totally prevented. And you can pick and choose effects and mix and match at random into 200 memories!

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FRONTIERS OF DIGITAL SIGNAL PROCESSING

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s.

By Gary Hall

When we think of signal processing, we usually think of common items such as equalization, compression, limiting, reverberation, chorusing, flanging, etc. These are processes that have been with us for some few years, and they have become standard tools for the manipulation of audio signals.

Today, we stand at the brink of a whole new era in processing technology. Advanced digital signal processing (DSP) techniques are emerging from university computer music labs into the light of real-world application, driven by rapid-fire advances in processing chips. This nascent revolution could be compared to going from hammers, saws, chisels, and adzes to power lathes and numerically controlled milling machines. Processing functions that seemed frankly impossible just a short time ago are rapidly becoming practical tools for music and audio. In this, the final installment in our series on signal processing, we will take a look at some of the techniques of this DSP revolution and some of the people who are making it happen.

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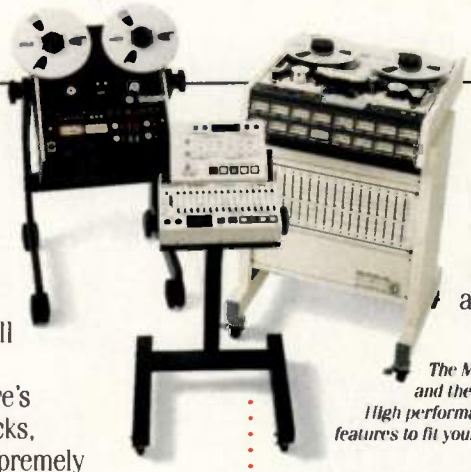

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DR. JAMES MOORER, SONIC SOLUTIONS

Beginning in 1986, Sonic Solutions established a world-wide reputation as *the* place to go to restore old or damaged recordings. Their first project set the pace. A classic recording of the Doors performing at the Hollywood Bowl was scheduled for release, but there was one little problem: Throughout the show, Jim Morrison had been plagued by an intermittent mic cable. This otherwise excellent recording, a fine example of one of the most famous rock bands in history performing at the peak of their powers, was filled with gaps of as much as a tenth of a second in the lead vocal. Despair is too mild a term

FIR AND IIR FILTERS

When we consider filtering, we are accustomed to think of it as a process that affects only the frequency content of a signal. Strictly speaking, however, a filter is anything that changes a signal in a way that is linear and consistent, and this is the way the term is used in digital signal processing. Delays and reverberators, for instance, are digital filters.

Digital filters fall into two broad classes, *Finite Impulse Response* (FIR) and *Infinite Impulse Response* (IIR). Both types are based on the principle of using time delay and control of level to produce the desired effect. On the surface, the

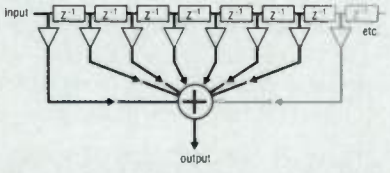

FIG. 3: The basic structure of an FIR filter. The blocks labeled z-1 represent delays of one sample period. The triangles depict the scaling of a delay tap by a fixed coefficient.

distinction between the two is minor: IIR filters use regeneration, FIR filters do not. This seemingly small difference results in drastically different capabilities and requirements.

The structure of an FIR filter is shown in Fig. 3. On first examination, it appears rather simple, just a tapped delay line (with a tap at each sample interval) in which each tap is attenuated (weighted) by a set amount and summed together with all of the other taps. FIR filters are characterized by their length in samples: The greater the length, the more accurate and powerful the filter. The term Finite Impulse Response refers to the fact that the signal will stop completely after the last tap of delay.

The advantage of FIR filtering is that it provides precise, stable, and detailed control over filter response both in time and frequency domains. An FIR filter also can be used to perform *Direct Convolution*, in which the response of a known filter (such as the outer ear) is reproduced by exactly emulating its effect on an infinitely narrow impulse.

The digital effects with which we are most familiar, such as reverberation, are all IIR filters; that is, they use delay coupled with regeneration to produce the desired effect. Fig. 4a shows the most basic form of an IIR filter, and Fig. 4b shows a slightly more complex structure that is sometimes used for digital EQ. The term Infinite Impulse Response means that there is not a precisely determined point in time when the response of the filter ends. In theory, it goes on forever, becoming smaller and smaller with time. Digital multi-effects units are very efficient engines for producing IIR filters.

The advantage of IIR filtering is that far less processing is required to produce the desired response. For either filter type, the basic unit of processing is an access of audio memory, followed by multiplication (equivalent to attenuation), and summation of the result with the results of previous operations. This is called a *multiply-accumulate cycle* (MAC). A typical multi-effects unit has a processing capacity of between 96 and 128 MACs. For comparison, the Crystal River Convolvotron typically runs two filters of 1,024 taps each, requiring a capacity of 2,048 MACs.

The disadvantage of IIR filters is that they can be very sensitive to overload and limitations in arithmetic accuracy. Multiple recirculation paths easily can result in conditions of instability for certain inputs. Designing IIR filters often comes down to finding the best

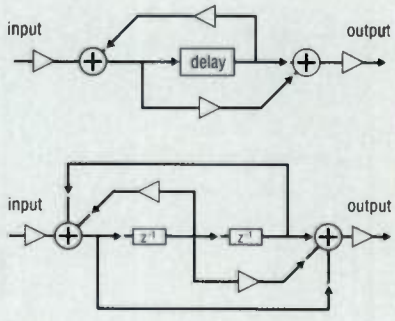

FIG. 4a: (top) The basic IIR structure. FIG. 4b: (bottom) A second-order IIR filter.

compromise between the desired effect and conditions of instability or excessive noise. By comparison, FIR filters are easy to design (presuming the needed processing power is in place), and they are inherently stable.

As available processing power increases, FIR filters will become increasingly common. For applications that require detailed control of phase and frequency response, we can expect that they will be the rule, rather than the exception, before long. On the other hand, IIR filters are overwhelmingly more efficient for time-based processes such as reverberation, and can be expected to dominate that area for the foreseeable future.

for what the producers felt when they contemplated their chances of being able to repair the damage.

In desperation, the tape was packed off to a new venture in San Francisco that had been founded by veterans of Stanford University's Center for Computer Research in Music and Acoustics (CCRMA) and Lucasfilm's Droidworks subsidiary. There, Dr. James (Andy) Moorer and his associates used their newly designed signal processing system to analyze the tone of Morrison's voice both immediately before and after each gap in the recording. Each break in the vocal was examined individually. Then, using the massive computer power at their disposal, they literally *synthesized* the voice of Jim Morrison, bridging the gaps with audibly perfect simulations of the missing material. At that moment, the reputation of Sonic Solutions as a house of audio magicians was secured.

Since then, Dr. Moorer and his band have restored literally hundreds of classic and damaged recordings to near-pristine condition. Their list of projects reads like a veritable history of recording: Ravel conducting Ravel, rare big band 78s restored and released on compact disc, Barbara Streisand's earliest recordings; the list goes on and on. Their original, in-house system has been refined and released for sale as one of the leading contenders in the digital audio workstation war, and the future looks bright for these computer audio wizards.

I caught up with Dr. Moorer at the company's headquarters in the bustling heart of San Francisco, where he was kind enough to answer my questions about "No Noise," their name for the process they use to bring classic recording back to life.

"There are four main categories of de-noising, depending on the exact nature of the problem encountered. There's broadband noise, which is tape hiss, or surface noise from records or film soundtracks. There's impulsive noise, ticks and pops, which require a separate technique. There are crackling sounds, as found on old 78 records and optical sound tracks, also known as "bacon-frying" noise, or "the rainforest effect." The last category might be termed "parasitic" noises, such as 60 Hz hum, buzzes, SMPTE feed-thru, camera whine, things of that nature.

"No Noise is really a tool kit, a set of processes that can be applied to each of these categories of noise. To distinguish the different types: Impulsive noises or clicks are like comparatively large areas that have to be replaced; crackle is actually millions of tiny clicks and pops. The techniques used are related, but the two are not identical. In de-clicking, you might have to replace sections ranging in length from a couple to several tens of milliseconds.

"My origins are in computer music, and one of the things I worked on was called analysis-based music synthesis, that is, analyzing musical tones for the purpose of resynthesizing them. The de-clicking algorithm uses a set of these analysis-based synthesis techniques because you have to fill in the area; you can't just repeat the last sample or copy over the region next to it. You have to do a mathematical analysis of the material that's around it, then synthesize the best approximation, the best fit for the region of the click. That's the essence of the de-clicking algorithm.

"Let me give you an example. We were doing Orson Welles's *Mercury Theater.* These were air-check discs that were taken off the broadcast. One of the records was broken, so they had physically glued it back together and put it back on the turntable. Of course, there was this regular *whap whap... whap whap,* and these things were about forty or fifty milliseconds long. But our

For More Information

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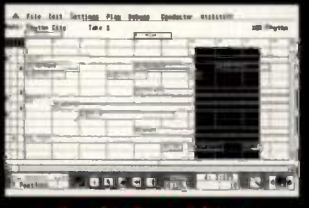
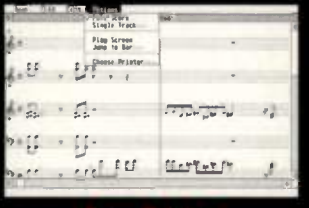


Graphic Song Editing



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de-clicking technique worked well here because even though the gaps were very large, they were surrounded by lots of good material.

"In de-crackling, it's similar except that the areas you're replacing are only five samples, seven samples, twenty samples. I think the longest region you replace in crackle is maybe a millisecond or a millisecond and a half. The problem is that they're everywhere. Crackle is pure hash: You can get three hundred or more crackles per second, each one being ten samples long. Even doing the analysis is difficult because the analysis algorithm typically requires continuous, good data. So, we had to invent something I called punctuated analysis, that is, you do an analysis on a length of signal that has holes and pieces missing from it, and you still get a good estimate of what the signal is and how to resynthesize it.

"Broadband de-noising is more like a multi-band expander. This differs from other multi-band expanders. You can go out and buy ten-band expanders, but ours differs in one important respect: We've taken perceptual information into account in determining the gain, which frequencies are expanded, and which frequencies are attenuated. It's much finer than 31 bands or even 100 bands. By one way of reckoning, it's technically a 2,000-band expander.

"There's a great deal of perceptual knowledge that's involved in making this work in a way that captures the last little bit (as much as you possibly can) of a good signal without audible pumping or artifacts. As a result, there's a bit of a compromise between how much noise you can take out and how much high-frequency and transient information you can preserve. Perceptual-based algorithms do about as good as you can do at predicting what things a person is going to hear, and getting rid of every thing else.

"Parasitic removal consists of a very powerful filter package. For instance, we've done projects where there was an open wire or an open ground on a mic and it picked up buzz. The problem is that the buzz isn't just 60 hertz; it might have 100 harmonics of 60 hertz, mostly odd-numbered—60 Hz, 180, 300, and so on; all through the audio spectrum. So you can take a notch filter at 60 hertz and it won't make any difference whatsoever. We have had to run as many as 190 notch filters on a signal in order to get good results.

"The problem is that, as you build up notch filters, you start to get a slap echo. If you pile tons and tons of notch filters on it becomes identical to a comb filter, a sound that everybody knows. So we have ways of perturbing the regularity of the filters to reduce the echo artifact of using 100 to 200 notches. The numerics of the process hold up with our 24- or 56-bit processing, up to 512 filters, which is how many we allow in that kind of pass. Of course, the processing gets slower as you do this, but in general, there isn't any accumulation of noise that's audible until you get hundreds and hundreds of filters.

"The sum total of these things constitutes the No-Noise package, an interactive de-noising environment. When a piece comes in, we diagnose it first—what's wrong with it, does it need

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de-clicking, de-crackling, etc. Then we select the appropriate tools and go to work. It's very much an active interaction between man and machine."

SCOTT FOSTER, CRYSTAL RIVER ENGINEERING

Crystal River designs and builds "auditory display systems," processing equipment that assigns an apparent location in three-dimensional space to a recorded or synthesized sound source. Their products are being used in the budding markets for "virtual reality" and in related applications such as telerobotics and flight-training simulators. (For more on the principles of localization processing and its application in virtual reality, see "Into New Worlds: Virtual Reality and the Electronic Musician," in the July 1990 **EM**.)

To achieve the detailed control of phase and frequency response required for localization processing, Crystal River uses a process known as *Direct Convolution*. This process is based on the principle that the exact frequency and phase response of a given filter can be created by reproducing its effect on the *shape* of a waveform.

The first step is to record the response of the system, or filter, to an infinitely narrow pulse. In this case, the system to be imitated is the outer and middle ear. Once the impulse response is determined, any audio signal can be processed by applying this response to *each individual sample* of the input, as shown in **Fig. 1**. When the impulse response of all the samples are combined, the resulting signal will exactly reproduce the effect of the original filter. The hardware that creates the individual impulse responses and sums them together into the final output is known as a *Finite Impulse Response Filter* (see sidebar).

The phase and frequency cues that determine the apparent location of a sound are dependent on the shape of the outer and middle ears, which vary markedly from person to person. For that reason, it is necessary to obtain individualized measurements of the impulse response, at the eardrum, for sound sources from a variety of directions. Ordinarily, this is a lengthy process that involves sitting in an anechoic chamber, with your head held absolutely steady, while test signals from a variety of directions are recorded by

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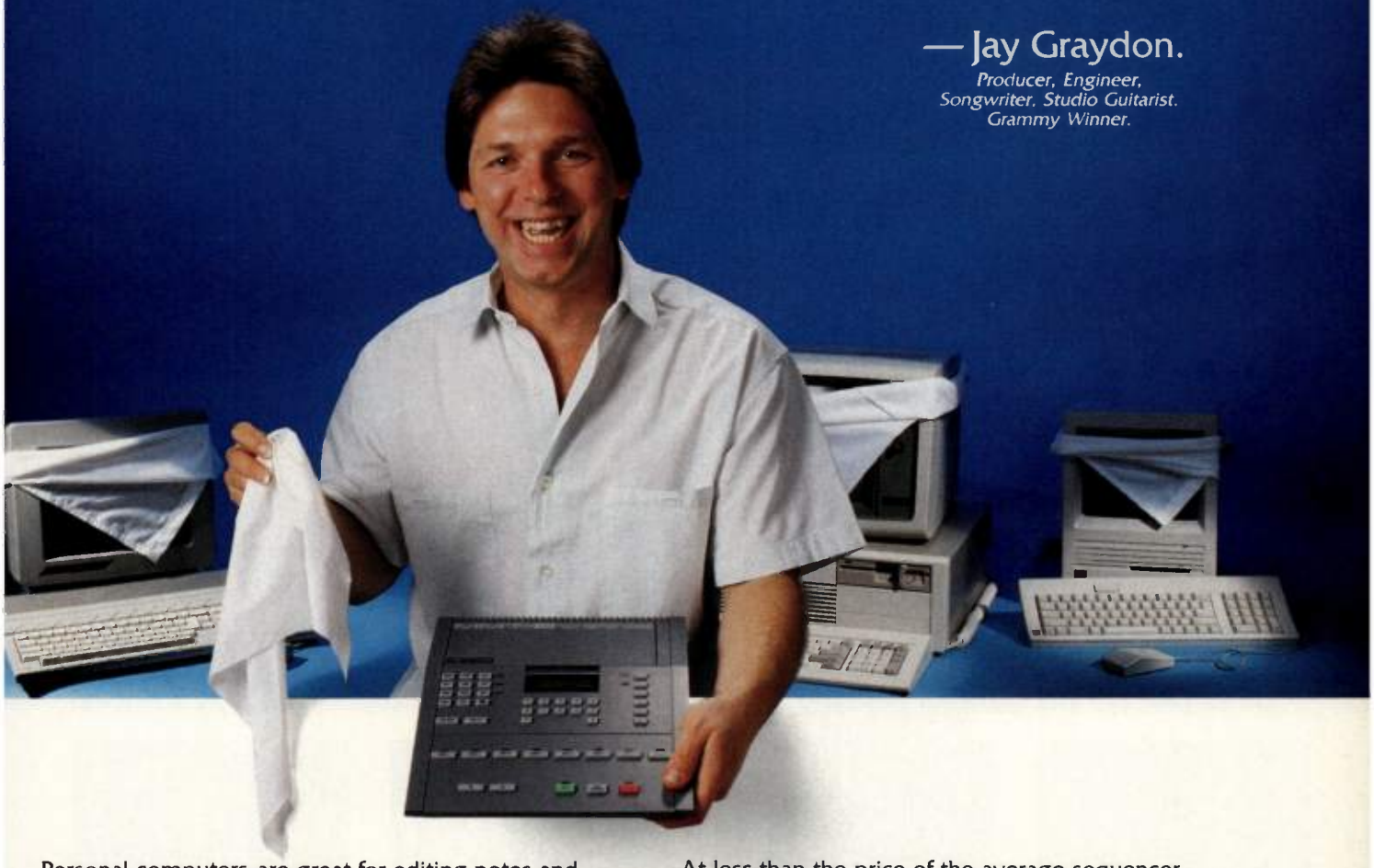

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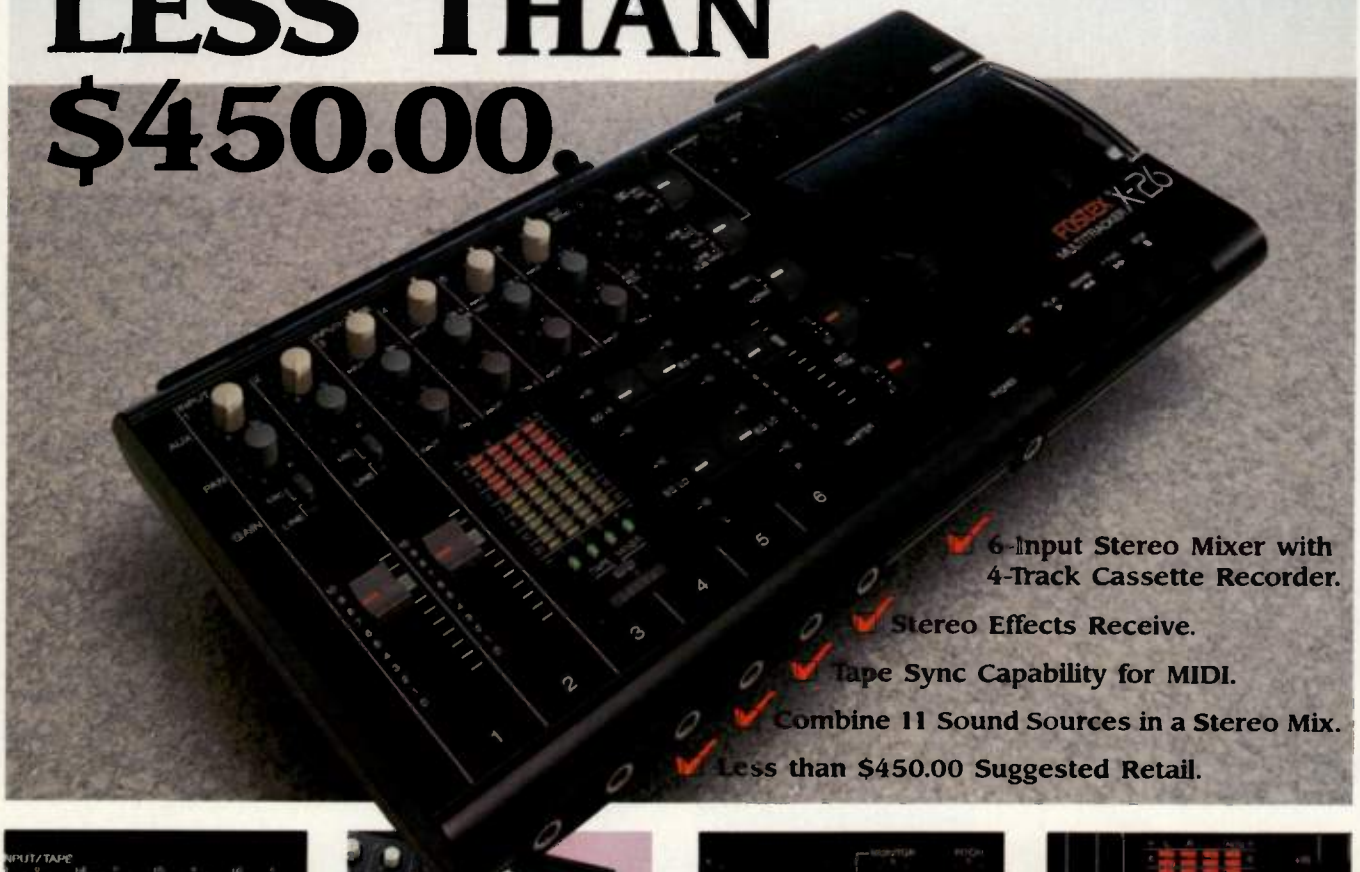

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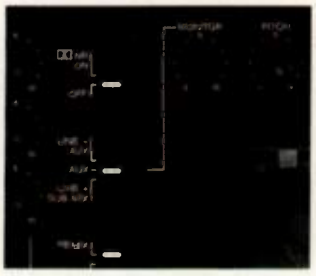

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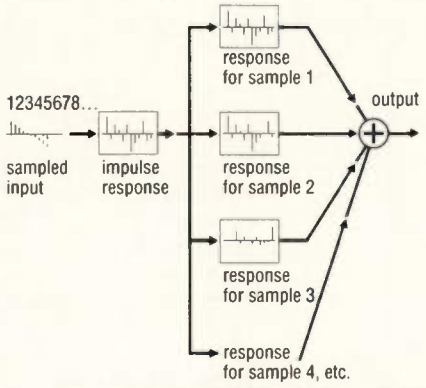

FIG. 1: Direct Convolution by an arbitrary impulse response.

microphones inserted in the ear canal. This provides the impulse response information needed to resynthesize the auditory cues for sound localization.

Scott Foster has been able to simplify this procedure considerably. Instead of using an elaborate test room with multiple loudspeakers, he uses a single loudspeaker and has the subject change position relative to the speaker. A sensing device affixed to the subject's head provides information on the head position to a host PC. The computer uses a voice synthesizer to direct the subject into proper position for measurement. The impulse responses from twenty different directions are taken. From these, the appropriate responses for all of the in-between positions are interpolated.

On my visit to Crystal River's headquarters, I had my ears "measured" in this fashion. I found the process surreal, but not uncomfortable. With a modified bathing cap to hold the position-sensing device in place, and tiny microphones inserted into my ears, I spent about twenty minutes twisting and turning as a computer-synthesized voice directed me to look up, look down, turn right, etc. Once proper position was obtained, a blast of carefully designed test tones was used to derive the correct impulse response for my position. I have no doubt that I looked like a perfect idiot.

At the end of the process, the results were input directly into the Crystal River Convolvotron and used to synthesize location cues that were often startlingly realistic. In some ways, Dr. Foster's measurement process is superior to the usual process because some

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of the properties of the listening environment are captured, too. Recent research suggests that reflected, as well as direct sound, is crucial to accurate localization of sound.

Potentially, Direct Convolution could be applied to complete room simulation and reverberation. Imagine being able to accurately synthesize any listening environment simply by recording a test signal in the original space. The countless possibilities are very exciting.

The difficulty is that the requirements for processing power are enormous and rise directly with decay time (unlike conventional digital reverbs, which use the same amount of processing at all times). Consider that a separate delay tap, with scaling and summation, is needed for every single sample in the decay period. A 2.5-second decay, typical of concert halls, would require approximately 1,000 times the power of a high-end digital reverb of today. The 1,024-tap filters used on the Convolvotron, by comparison, account for decay times of just over one-fiftieth of a second. Nonetheless, Direct Convolution may be practical for simulation of early reflections in the not-distant future.

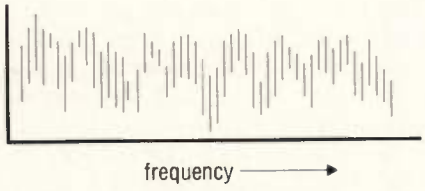

FIG. 2: The resonant structure of a single piano note. Each vertical line represents the initial amplitude and duration of a component resonance.

ADRIAN FREED: RESONANT SYNTHESIS

Working at the Center for New Music and Audio Technologies (CNMAT) of the University of California, and in collaboration with Poly-sonic Inc., Adrian Freed wants to change the emphasis from imitation of sound to modeling of the behavior of an instrument.

Instead of directly recording a sound, as in sampling, or synthesizing it using techniques such as FM or subtractive synthesis (which have little to do with the way sounds originate in the acoustic world), he breaks down instrumental sounds into their individual components and analyzes them in terms of the resonances characteristic of the various parts of the instrument. In the case of a piano, for instance, the individual strings, the interaction of the other strings when the damper pedal is depressed, the resonance of the sound board, and noise of the actuator mechanism are individually analyzed and resynthesized. A complete model of an instrument may involve hundreds of simple resonating sections, each of which, when the system is excited, produces a sine wave that decays exponentially over time.

Fig. 2 shows the resonant frequencies and their decay times for a typical piano note. The horizontal axis represents frequency, and each vertical line corresponds to a single component resonance. When the system is excited by an impulse (similar to the strike of the piano's hammer), or by a continuous stimulus (such as the bow of a violin), each of the component resonances sounds at its characteristic pitch. The initial amplitude of the resonance is shown by the position of the top of the the vertical line, and decay time is indicated by its length.

This process models the acoustics of the instrument body, in contrast to attempting to replicate the sound without representing the nature of its source. For this reason, the resulting synthetic instrument can be expected to respond to the player in the same manner as the original acoustic instrument. As with conventional instruments, but in contrast with synthesizers as we know them, the response of the instrument depends not only on the notes played, but on the state of previously played notes.

Polysonic has built a powerful signal-processing engine to realize this method in real time. Dubbed the "Reson8," the device uses eight Motorola DSP56000s working together to simulate the resonances of a single instrument. In the case of particularly complex models, all eight processors may even be used to generate a single note. The Reson8 is being manufactured and marketed as a tool for DSP research and development, but the ultimate goal is to refine the models and lower costs to a more practical range. The end result will be an entire

new category of electronic music instruments.

In addition to accounting for the internal resonances of an instrument, there is also concern about the way that the sound waves produced by an instrument spread in the listening environment. The sounds of acoustic instruments, after all, do not emanate from a pair of loudspeakers, but spread from their source in complex and often asymmetrical patterns. They further interact with the surfaces of the listening environment and can even excite sympathetic vibrations in other instruments nearby.

Adrian points out that "real" acoustic instruments are complex systems that operate in three dimensions and respond to stimuli in complex ways. The prevalent technologies of sampling and synthesis are gross, one-dimensional simplifications that never can capture the rich behavior of their acoustic counterparts.

Besides being on the frontier of synthesis technology, Adrian Freed and his colleagues at CNMAT are helping to take the MIDI software and human interfaces to its next development phase. The design of control programs for the resonant synthesis process is being done in *Max*, Opcode Systems' graphic programming language, which was developed by Miller Puckette and David Zicarelli at IRCAM in Paris (see "Programming for the Rest of Us" in the July 1990 **EM**). According to Freed, *Max* provides them with a powerful and flexible system for developing the elaborate control structures needed to harness the resources that resonant synthesis offers.

The development of advanced digital signal processing techniques has already changed the way we work with music and sound. Much more than just new and better effects and filters, DSP technology is opening up entire new categories of processing. The next few years promise to be a time of unprecedented progress in DSP, a revolution with profound implications for musicians. No technology, not even MIDI, promises to have a greater effect on the world of electronic music and recording.

Gary Hall *is* **EM***'s technical editor. One of his hobbies is forcing freelance writers to push bicycles through the desert.*

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FROM THE TOP

Inventors and Iconoclasts

by Peter Elsea

Each month, this new column will offer easy-to-understand information for those new to electronic music or simply needing a brush-up on the fundamentals. We begin with a brief history lesson.

Music always has been at the cutting edge of technology. J. S. Bach would walk for days to try the newest pipe organ, and Mozart wrote pieces for music boxes and clocks. These instruments grew out of major technological developments of their time—the organ was made practical by discoveries in metallurgy and techniques for forming metal into sheets and tubes, and clock mechanisms were the very pinnacle of 18th Century engineering.

The first effective marriage of music and electricity was the Cahill Telharmonium. In 1900, America was being wired by dozens of competing telephone companies. Inventor Thaddeus Cahill wanted to provide a different kind of phone service; one in which you would pick up the receiver and hear music. In order to realize his dream, he constructed a special instrument that directly generated electrical signals, at wattages high enough for hundreds of people to listen in. This machine consisted of 145 individual generators, each producing AC power at a different frequency. The signals could be combined and shaped with transformers under the control of an organ-style keyboard. According to contemporary accounts, the sound was pure and sweet (although compared to what, we don't know).

This was a fairly sophisticated instrument. Cahill knew about combining sine tones to create differing timbres, provided for adjustment of attack and decay times, and even referred to the process as "synthesis." Unfortunately, the Telharmonium was not a financial success. For one thing, its sheer size—it weighed 200 tons—made it very expensive, and its kilowatts of music power tended to leak into other people's phone lines.

With ensuing technological developments, important changes began to occur. By 1929, Laurens Hammond was able to build an instrument similar to the Telharmonium but the size of a piano. He called it an electric organ and was very successful at selling it to churches and people who didn't have the space or money for the real thing.

Several experimental instruments were also released between the two World Wars, most notably the Theremin (1919 by Leon Theremin) and the Ondes Martenot (1928 by Maurice Martenot). These used principles derived from radio technology to produce pure, sweeping tones in loudspeakers. The most interesting feature of the Theremin is the way it is played: You wave your hands near two antennas to control pitch and loudness. The Ondes has a more conventional keyboard augmented by a sliding ring to produce glide effects. A few composers wrote works featuring these instruments, but aside from eerie effects in horror movies, they did not have much impact on music at large.

The real revolution came just after World War II. The phonograph and radio had changed how music generally was heard, but the tape recorder changed the way music was made. Because tape could be spliced easily, it was no longer necessary for pieces to be recorded straight. The musicians could stop and rest, try a tough spot several times, even fix mistakes after the session. After multiple tracks were added to tape decks in the 1950s, it was even possible for musicians to record each part separately, creating ensembles that never had met. These possibilities were very intriguing to the post-war generation of composers who felt limited by the conventions of music notation and the abilities of live performers.

The individuals who established tape-based studios in the 1950s generally are considered the founding figures of electronic music: Herbert Eimert and Karlheinz Stockhausen at Radio Cologne, Pierre Schaeffer and Pierre Henry at the French National Radio (they actually began work before tape, using disc recorders), and Vladimir Ussachevsky and Otto Luening at Columbia University, among others.

Besides tape recorders, the equipment found in these institutions (now called "classic" studios) included various signal generators and filters intended for the design and calibration of electronic systems. This gear could produce many sounds, but was certainly not efficient for the

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production of music. The difficulty of working, combined with the fact that most of the composers at these studios were interested in post-Romantic and serial music, led to a conception that electronic music was spare, harsh, and cerebral. There were occasional tape music concerts, but public exposure to electronic tonalities was primarily limited to soundtracks of science fiction films.

The large studios were only half of the story of electronic music in the 1950s, however. There were many independent composers who found uses for electronic equipment on the concert stage. Most influential among these was John Cage, who already had shocked the musical world with his chance-based compositions and assertions that music could include any sound, or even no sound at all. Cage used groups of shortwave radios and phonographs "playing" sandpaper and other surfaces, and wrote pieces that enticed performers to experiment with even more exotic sounds.

Around 1966, the first commercial synthesizers were separately developed by Robert Moog and Donald Buchla. These instruments were a collection of circuits that had been found useful in studios and live performance, packaged in convenient cases. Each of these circuits (usually called modules) was independent until the musician connected them together. The nature of these connections and adjustments of the modules (called a patch) determined the behavior and sound of the instrument. It often took a long time to get a patch set up and working, but it was possible to use the synthesizer to create a wide range of tone colors, and play it with a variety of control schemes. It even could be set up for simple automatic performance.

In the early 1980s, synthesizers began to outsell pianos in music stores.

The original studio synthesizers were a bit unwieldy, so Moog and others produced comparatively simple-to-use, portable instruments. There were some interesting models produced, and a few (such as the Minimoog and ARP Odyssey) were successful in the marketplace. However, a truly satisfactory performance instrument had to wait for one more technological revolution.

From the late 1950s onward, related developments based on using computers to produce music were also happening. Studios such as MIT and Stanford accumulated an impressive library of techniques for generating and processing sound. (Max Matthews, John Chowning, and Barry Vercoe are prominent among the names of computer music pioneers.) Unfortunately, this knowledge was of little use to most composers because music generation required fast, powerful computers that (at the time) cost millions of dollars. The introduction of the microcomputer in 1975 changed that situation drastically.

Early microcomputers were too slow to directly generate sound, but they

were effective in controlling synthesizers, making it possible to change patches quickly. The same technology that reduced the computer to postage stamp size was applied to synthesizer circuitry, and soon companies such as Oberheim and Sequential Circuits began selling instruments that had powerful sound-producing capabilities but could be carried under one arm and operated with relative ease. The synthesizer became a common instrument in the pop groups of the late 1970s, and in the early 1980s began to outsell pianos in music stores.

The popularity of synthesizers attracted the attention of major music instrument manufacturers, who had the financial clout to develop sophisticated products. In the mid-1980s, a sort of arms race developed in the music stores, with dozens of new products appearing each month. Synthesizers became all-digital as the computing power of microchips grew, and whole new types of signal processors, controllers, and personal computer music systems appeared.

Interest began to develop in the idea of linking synthesizers with personal computers and with each other. Compatibility problems between various brands and models were worked out by formal and informal agreements between the manufacturers, the most famous of which is the MIDI standard. MIDI provided for the digital transmission of musical information between devices from different manufacturers, making it possible for performers to play several machines from a single keyboard, or for a composer to create an orchestra composition on computer and play it back immediately on a variety of instruments.

This is how things stand today. Composers have remarkable, unprecedented power at their fingertips and are creating works ranging from 15 second TV ads to operas featuring computers interacting with full orchestras. Performers have practically any sound in the world under their fingers, sticks, or feet. In fact, the distinction between composer and performer is beginning to disappear, as the gap between imagination and sound becomes as short as a piece of wire.

Next month: What is MIDI?

Peter Elsea *is a teacher and studio engineer at the University of California, Santa Cruz, electronic music studios.*

Alternate Input Devices

By Dave (Rudy) Trubitt

Voice and handwriting recognition are changing the way people think about computers.

Can't type? Alternatives to typewriter keyboards have the same advantages as alternate MIDI controllers—people who can't use the traditional input device gain access to a powerful technology. Even if you *can* type, you may find these alternatives let you work in ways not possible without them.

Rather than inventing new ways for people to communicate with computers, many researchers are enabling computers to recognize *our* existing forms of expression. Speech and handwriting form the base of human communication, and there are systems that can recognize one or the other. Note that these devices have their limits—lacking the certainty of a keyboard's open or closed switch, these complex controllers occasionally misinterpret commands.

OPEN THE PATCH BAY DOOR, HAL

Voice-recognition systems use a combination of digital sampling, signal processing, and pattern-matching technologies. Everything works together smoothly if you follow some rules. When we speak normally, we tend to *runourwordstogether* in a continuous stream. However, voice recognition systems require a discrete...pause...between...words (¼-second or less). Each incoming word is broken into its phonetic components and compared to a list of known words. Some systems require each speaker to "train" the system before using it, which is done by recording each command word a few times. Other systems use a more general model of speech and don't require user-specific training.

Voice-recognition systems work with off-the-shelf software by simulating keyboard and mouse messages. This means voice-recognition systems can control most programs that weren't designed with voice control in mind. Adding voice control requires defining the keyboard and mouse commands generated in response to a spoken command.

Articulate Systems has developed such a voice-command language for several popular Macintosh MIDI programs (voice control of programs not included in the package can be added easily by users). This package, called *VoiceWaves MIDI*, must be used in conjunction with the company's Voice Navigator I or II voice-recognition systems. With it you could, for example, play back a sequence while changing patches and tempo—all without touching a mouse or computer keyboard. The current version of the system's software requires training of command words, which precludes using it as a general-purpose dictation tool. However, the company maintains (and I agree) that the system shines when used to complement the Mac's keyboard and mouse interface. Connecting to the Mac's SCSI port, the Voice Navigator II is certainly easy to install and use: It recognized my first spoken command only twenty minutes after I unpacked it.

One voice-recognition product for the IBM PC is Dragon Systems' *Dragon Dictate*, which runs on 80386-based AT-bus computers. The system is capable of interpreting speech input at rates of up to 40 or more words per minute. It also requires no training, so new users can immediately begin working with the system's large vocabulary (30,000 words online). The system constantly analyzes the speech of each user, thereby improving its performance with continued use. Dragon Systems also licenses its technology to others in the field, including Articulate Systems. At the moment, the company does not specifically support any MIDI programs, but you could add that capability yourself.

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While the ultimate goal of understanding continuous speech without training has not been achieved, today's voice-recognition systems work well for many tasks and have been very helpful to physically impaired users.

PEN-BASED COMPUTING

Handwriting-recognition systems have the same limitation as voice recognition—the basic components of messages (written characters or spoken words) must always be separated. There are systems that can read printed block letters, but recognition of connected cursive writing is still out of reach. Rather than raise users' expectations, many developers avoid the term "handwriting recognition." Instead, "pen-based computing" is the buzzword manufacturers are using to describe these products. All are stressing portability and ease of operation as key selling points.

So who will be the first to buy into this technology? Several types of users are being targeted, including mobile jobs that require filling out forms, such as census-taking, inventory control, etc. Other uses include note-taking in situations where keyboards might be disruptive, i.e., classrooms or board rooms.

The only pen-based computer available domestically is GRiD Systems' PC-compatible GRiDPad, which is a four-and-a-half pound, clipboard-sized device. A brass-tipped pen is used to hand-write data on a large LCD display that covers the unit's surface. Among other companies working in the pen-based arena include Go Corporation (Foster City, CA) and Momenta (Mountain View, CA).

Go is developing a brand new operating system for pen-based computing, and licensing its technology to others, including IBM. Microsoft is also developing pen-based extensions to their operating systems. Momenta believes a combination of pen and voice will control new computers. As far as operating systems are concerned, the company has not decided whether to follow Go's proprietary approach, or GRiD's PC-compatible path. Neither Momenta nor Go have released any details about upcoming products or their availability.

It is unlikely that pen-based systems will offer short-term benefits to elec-

FOR MORE INFORMATION:

* *Articulate Systems*
  99 Erie St.
  Cambridge, MA 02139
  tel. (800) 443-7077; or (617) 876-5236

* *Dragon Systems, Inc.*
  Chapel Bridge Park
  90 Bridge St.
  Newton, MA 02158
  tel. (617) 965-5200

* *GRiD Systems Corp.*
  47211 Lakeview Blvd.
  Fremont, CA 94537-5003
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* *Wacom*
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  tel. (800) 922-6613;
  or (201) 265-4226

REVIEWING THE BASICS:

Graphics Tablets & Mice

Graphics tablets (sometimes called digitizing tablets) and mice transmit their physical movements to a computer. These signals are used to move a pointer or *cursor* on the computer's video display in the same direction and speed as the control device (mouse or pen). The appearance and/or function of the cursor depends on the program being run and can change depending on its proximity to other objects on the screen.

Graphic tablets differ from mice in that they are *absolute* positioning devices, whereas mice provide *relative* position control. Pen-based computers differ from graphic tablets in that they integrate video display and pen positioning onto the same surface, allowing you to "draw" right onto the screen.

tronic musicians, but an older integration of pens and computers, the graphics tablet (see sidebar), has some immediate and useful applications.

Graphics tablets are supported by Passport Designs' *NoteWriter II* music notation program, whose Quick Scrawl feature lets you draw notes right onto the staff. The system recognizes "strokes," which are a series of line segments drawn in a pre-defined sequence and direction. Each stroke corresponds to a specific notation object—notes, rests, etc. According to the company, most strokes resemble the notation symbol they correspond to, keeping training time to a minimum. Position on the staff and orientation of stems are controlled by the same stroke, providing quick note entry. Strokes can also be drawn with a mouse, but most find graphics tablets more natural.

One graphics tablet that should work with *NoteWriter II* is the Wacom (Paramus, NJ) SD-series digitizer. It is a cordless, pressure-sensitive graphics tablet—sort of an electronic pen with aftertouch. Just as keyboard aftertouch can be used to control synthesizer parameters such as modulation depth or filter cut-off, pressure on the tip of the SD's pen can be mapped to brush width, color, blending, etc. Since pressure sensitivity is fairly new, only graphics arts software vendors have really gone out of their way to support it. High-end console manufacturer Solid State Logic uses the Wacom tablet (under an SSL label) for use with their ScreenSound video editing system. I found the Wacom tablet to be an extremely responsive and elegant tool. In fact, I haven't been so excited by an input device since I started using a Yamaha breath controller.

To paraphrase Wacom's motto, all these tools are working toward the harmonious interaction between people and computers. What could be more harmonious than adapting these technologies to musical applications? Doing so will require work from both manufacturers and users. Let's get started!

Dave (Rudy) Trubitt *plays guitar in a band called Waiting for Dave. Call for details on their "Play Your Second Wedding at Half Price" promotion.*

Questions and Answers

Our inimitable tech looks into soldering options, sampler woes, and making your own MIDI cables.

By Alan Gary Campbell

JACK DESROCHER

Q. What's the difference between 60/40 rosin-core solder and 63/37? Which is better for do-it-yourself projects and repair work? Is there any reason to prefer multi-core solder over single-core? What type of solder should be used with gold-plated, keyboard-contact J-wires?

A. Solder, as used in electronic fabrication and repair, is an alloy—loosely defined, a "mixture"—of tin and lead, in extruded form, with a core of rosin-based flux. Commonly, the ratio of tin to lead in solder is 60/40; however, this ratio is not ideal for modern printed-circuit applications. The ratio of 63/37 is closer to that of *eutectic* tin/lead alloy; the alloy that changes phase at the lowest possible temperature, while transforming directly from solid to liquid phase, without passing through an intermediate, plastic state.

When you heat 63/37 solder, it flows straight away, without sitting there getting mushy. You get more uniform results, with fewer cold solder joints. Further, its wetting properties are critical for use in soldering double-sided and multilayer printed circuit boards with plated-through holes.

For these reasons, the use of 63/37 solder is preferable in repair work and serious do-it-yourself project-construction. It costs more than 60/40, and isn't as readily available, but most well-stocked electronics supply houses carry it. Radio Shack carries 0.05-inch diameter, 63/37 solder (catalog number 64-015), which, unfortunately, is rather large for IC work.

Rosin-core solder is manufactured with single or multiple flux cores. "Multi-core" solder is touted to provide more uniform flux delivery and activation, and to produce better joints. However, I have had consistently good results with quality, single-core types. In terms of brand recommendations, Kester single-core solders and Ersin "Multi-core" solders dominate the service market, and both are excellent.

Standard 63/37 rosin-core solder can be used to solder gold-plated J-wires. Some gold will dissolve in the solder, producing a joint with a gray, grainy appearance and reduced strength; however, since there is little mechanical strain on the joint (silicone sealer is commonly applied to the J-wire, just beyond the joint, for strain relief), this will not significantly affect reliability.

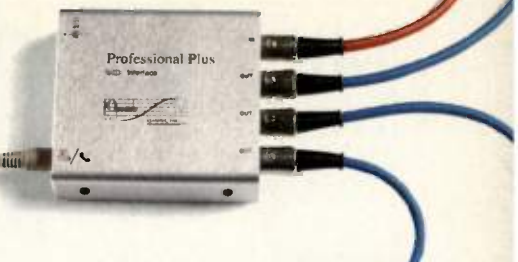
Silver-plated contacts present similar soldering problems. Silver-alloy solder (Radio Shack catalog number 64-013, or equivalent) can be used to minimize "leaching," or dissolution, of silver *or* gold plating into the joint. "Silver" solder is typically a 2% silver, 62% tin, and 36% lead alloy .

Aside: Lead-free solder—typically 98% tin and 2% silver—is normally used only for special applications (e.g., medical equipment). It has physical properties that make it undesirable for use in general service work.

Caution: Use *only* rosin-core solder for electronics work; *never* use acid-core solder. Acid-core solder, though necessary for plumbing and metalworking, is severely damaging to printed circuit boards and electronic components.

You should also be aware that solder fumes contain lead and organic compounds and are potentially hazardous. Use proper ventilation when soldering. Further, lead is transferred to the hands when handling solder; subsequently, there is some danger of lead absorption through the mucus membranes. Wash hands thoroughly before eating, drinking, smoking, rubbing the eyes, or evacuating the nasal passages (blowin' your schnoz). Food, drink, and smoking materials should be prohibited in soldering areas.

Mac, MIDI & More



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• SERVICE CLINIC

Q. Is microphone cable okay for making do-it-yourself MIDI cables? Is it important to use shielded DIN plugs? Do I wire the shield to the plug at both ends?

A. The specifications for *high-quality* microphone cable parallel the specs for MIDI cable. Specifically, mic or MIDI cable should provide a low-capacitance, twisted pair of conductors, surrounded by a continuous-coverage shield, encased in a flexible, wear-resistant jacket.

Mic cable that meets these requirements is a good choice for do-it-yourself MIDI-cable construction. The DIN plugs should be wired as follows: One wire of the twisted pair connects to pin 5 at each end of the cable, and the other one connects to pin 4. The shield connects to pin 2 at each end.

Shielded plugs are preferable—and sturdier—but the plastic type will work. For strain relief, squirt some silicone sealer (Radio Shack catalog number 64-2314, or equivalent) into the plug shell before final assembly (but don't try to get it apart again if the cable fails).

Aside: Recently, Conquest U.S.A. introduced an inexpensive "Tour Link" brand MIDI cable made from S2B Microphone Cable, which comes clearly marked as such. This caused some consternation among purchasers of the cables, but this construction is perfectly acceptable.

Q. When I power up my Ensoniq EPS sampler, the display gets stuck in the keyboard calibration mode. I've heard that there is a simple fix for this. Is it something I can do myself? The instrument is out of warranty.

A. Several Ensoniq instruments use the Polykey/Polypressure Keyboard: the EPS sampler and the SQ-80, VFX, and VFX^{SD} synths. Keyboard-calibration problems on these instruments have several possible causes. On older instruments, such as the one in question, a defective KPC (keyboard processor) board, or a defective mainboard, is probable. Because Ensoniq provides service by module exchange (see the August 1990 "Service Clinic"), the job should be referred to an Ensoniq authorized repair station.

On some later EPS, VFX, and VFX^{SD} units, flux residue on the connectors that join the two keyboard-coil boards ("contact" boards) and the KPC board can cause random calibration problems; and some coil boards exhibit thermally-dependent calibration drift. Flux residue can be effectively removed using isopropyl alcohol. This is probably the "simple fix" referred to. Thermal drift is corrected by replacing the 4.7-kilohm coil-board resistors R9 and R10 with 510-ohm resistors, and installing an updated KPC-operating-system ROM.

Nonetheless, effecting either repair requires complete disassembly of the keyboard, including removal of all the keys—hardly "simple." (These procedures are covered in detail in Ensoniq *Service Bulletin #9*, which, incidentally, could serve as a model of how to write a truly lucid service document.) Moreover, these repairs apply only to recent units, which should be under warranty; so this job, too, should be referred to an authorized repair station.

Notes: There are two different types of EPS/VFX keyboards; one has foam pads under the keys, and the other does not. Each requires a different KPC operating system ROM. Version 2.02 applies to keyboards with pads, and version 2.22 to keyboards without. Also, the 4.7-kilohm resistors to be removed are ¼-watt types, but the 510-ohm resistors supplied by Ensoniq to replace them are ⅛-watt types. Ensoniq's service department reports that this is acceptable.

NEW ADDRESS

EJE Research Corporation, providers of parts and service for Moog products, has a new address and phone number: EJE Research Corporation, 17 Blackstone, Jamestown, NY 14701; tel. (716) 664-3755. The old address and phone number are now being used by another division of EJE.

XMAS XCESS

In case you're not busy enough, here's some irreverent holiday irrelevance: While sequencing the obligatory holiday-synth version of "Hark the Herald Carol Bells," save a track for your MIDI lighting controller. At last, you can get those blasted Christmas-tree lights to blink in rhythm. The kids will love it.

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

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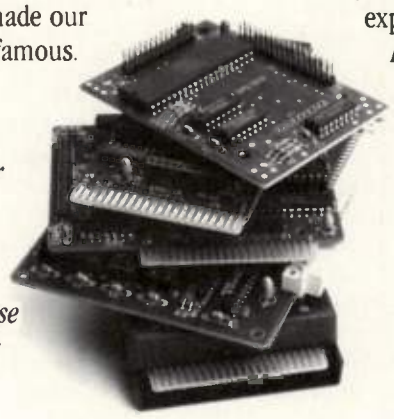

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First Takes & Quick Picks

Passport Trax 2.0 Sequencing Software ($99.95)

By Connor Freff Cochran

Escape the winter chill by checking out a 16-bit orchestra-in-a-box, an entry-level sequencer for the IBM PC, the Swiss Army Knife of signal processors, and more.

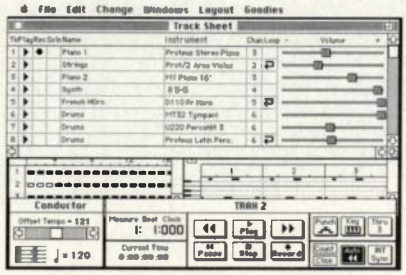
Trax is Passport's new beginner- to mid-level sequencer for IBM PCs and compatibles. All the basic features associated with professional sequencers are included, which is astonishing in a program that costs just under $100. Already updated to version 2.0, it offers 64 data tracks that may be channelized or not, as you wish; a 65th "track" for controlling tempo; straightforward controls; a decent selection of editing tools; and the ability to run standard MIDI files. In addition, it isn't copy-protected. To make the deal even more exciting, the people at Passport have included a few extras (such as selective quantization of notes based on their proximity to the beat and flexible MIDI data filtering) that normally are found exclusively in much more expensive packages.

What most obviously distinguishes *Trax* from its direct competitors, however, is its strong graphic orientation. The program runs under Microsoft *Windows*, but its overall look and feel is incredibly Mac-like, with movable windows, pull-down menus, dialog boxes, and the like. This is not surprising, as *Trax* is a simplified Macintosh-to-PC port of Passport's well-known *Master Tracks Pro*. You don't have to have *Windows* already in order to use *Trax*, by the way, because Passport supplies a run-time version along with the sequencer.

For most procedures, *Trax* is quite simple to use. Everything is controlled through five windows and a set of pull-down menus. A mouse is recommended but is not required, as there are keyboard equivalent commands for everything.

The Transport window contains controls for recording, playing, and moving through sequences; buttons for turning on and off features such as punch-in/out, sync source, MIDI thru on/off and channel, metronome, and count-in; and readouts for both current measure/beat/clock and current time. Changes in tempo alter the latter but not the former.

The Track Sheet window shows a listing of each track, with a name that can be up to 30 characters long, per-track play/record/solo selections, and settings for output channel, initial program, and loop on/off. The MIDI channel setting for each track allows you to pick any one of seventeen choices: MIDI channels 1 to 16, or a dash. A dash tells the sequencer to play back the track's data on the same



The Track Sheet and Transport Window for *Trax*.

the EM rating system

EM reviews include 11-step "LED meters" showing a product's performance in specific categories chosen by the reviewer (such as ease of use, construction, etc.) and a "VU meter" indicating an overall rating. The latter is *not* a mathematical average, since some categories are more important than others. For example, if a guitar synth has great documentation and is easy to use, but tracks poorly, it could have several high LED meters and a low overall rating.

The rating system is based on the following values, where "0" means a feature is nonfunctional or doesn't exist, while a value of "11" surpasses the point of mere excellence (a rating of 10) and is indicative of a feature or product that is truly groundbreaking and has never before been executed so well.

Please remember that these are opinions, and, as always, EM welcomes opposing viewpoints. We urge you to contact manufacturers for more information, and, of course, tell them you saw it in EM.

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E	9. Analog 10. Modern Rock
F	11. Techno 12. Metallic
G	13. Bells 14. Gongs, Jars, and Glass
H	15. New Age 1 16. New Age 2
I	17. Spectral 18. Space
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channel (or channels) on which it was originally recorded. Version 2.0 adds two useful extras to each track: one field for instrument names and a fader for setting the track's initial MIDI volume level. The instrument field comes with a popup menu that lets you select from a long list of common MIDI synths and devices, and it includes the names of the factory preset patches. Changes made in the two new fields are sent out over MIDI in real time, so you can audition patches and volume levels before running your sequence.

Trax's manuals are written in a clear, concise manner.

The Song Editor window allows you to manipulate your music structurally, providing a global overview in which measures are represented as filled or empty blocks, depending on whether or not they contain MIDI data. In this view, blocks of musical data can be cut, pasted, inserted, changed, filtered, or deleted at will. You also can place text and graphic markers to identify different sections of your sequence.

The Step Editor window shows one track at a time in piano-roll graphics. These displays can be zoomed in or out for different levels of visibility and either regional, or note-by-note, editing accuracy. Individual notes can be edited "by the numbers" at any time. New notes can be entered using the mouse and note-editing window, or they can be stepped into place using the mouse (to fill in the note parameter blanks on the screen) and any MIDI controller (to provide the pitches and velocity). Rests can be inserted by pressing the computer's "R" key.

Finally, the Conductor window lets you control tempo, meter, and beat settings. *Trax* supports multiple meters linearly; that is, meters can change as often as needed so long as they are identical in all tracks at the same time.

Trax's manual is written in a clear, concise manner. Between that and the program's general ease of operation, a beginner should experience little or no difficulty. There are, however, a series of small bugs and oversights that Passport should correct in the next release.

Most of the bugs relate to the program's Macintosh origins. Mac file names can be much longer than PC file names, for example, and while *Trax* won't accept a file name longer than PC standards, it *will* let you enter one. It also will change the file name displayed on the screen, even after showing you an error message and refusing to make the save. There are several other such translation glitches, all of them easy to ignore (and easy for Passport to fix).

The oversights are a bit more problematic. Perhaps the biggest is the fact that if you start playback of a sequence after the end points of any looped

tracks, the looped tracks *don't play*. Also annoying are the lack of a zoom level indicator, the fact that accidentals are always shown and entered as sharps, and the lack of any cautionary warning when you paste measures on top of other measures (thereby risking accidental loss of data). There is an Undo function, but it only can help you recover errors immediately after making them. I would prefer to have an additional warning when using the paste function.

In addition, the interface is inconsistent in some places. For example, there are some surprisingly clunky methods for value selection when using the Change menu to quantize, transpose, lengthen, shorten, or change the velocity of notes in a sequence. In the Step Editor window, note values can be picked by clicking on icons showing those notes, but in the Change functions, note values typically must be selected by clicking on an area showing a numerical note value (listed in terms of *Trax's* 240 clicks-per-beat resolution), then either entering a new value from the computer keyboard, or scrolling the value up or down using the onscreen arrow controls. Given the overall graphic orientation of the program, this implementation seems like an oversight.

It's best not to get too picky, however, especially with a program that has a $99.95 price tag. Kudos to Passport for setting a new standard in the price/performance ratio of music software. Taken as a whole, *Trax* is a competitive, easy-to-use sequencing alternative for PC owners who are looking for a simple way to get started.

Connor Freff Cochran *has been known for the last twenty years as just plain Freff. He writes for a variety of music and computer magazines and owns (or is owned by) way too many instruments, MIDI and otherwise.*

Passport Designs, Inc.
625 Miramontes Street
Half Moon Bay, CA 94019
tel. (415) 726-0280

E-mu Proteus/2 Synth Module ($1,495)

By Alex Artaud

E-mu's Proteus/2 arrives amid high expectations. Based on, but not a replacement for, the stunningly successful Proteus/1 sample-playback module (reviewed in the October 1989 EM), the Proteus/2 is virtually an orchestra-in-a-box, presenting musicians with a large ensemble of traditional instruments to explore. Hefty allocations of string, woodwind, brass, percussion, and ensemble presets should be enough to convince the curious: Here is an instrument with real potential, endowed with remarkable sonic resources, serious programmability, and a friendly user interface that lets the artist tailor the unit to meet his

or her own creative needs.

Like the original Proteus, the Proteus/2 offers 32-voice polyphony; 16-bit audio; three independent, stereo output pairs (two of which use stereo jacks to offer effects sends and returns); and alternate tuning capability, all in a lightweight, rack-mount module. Presets can be constructed by pairing *Instruments* (sets of multisamples or digital waveforms), and the timbral brew can be enriched by linking or layering presets. The MIDI implementation is extensive, with a multitude of modulation options via continuous controllers. It's an impressive array, one to which the Proteus/2 makes some notable contributions.

First and foremost, the samples are completely different from those in Proteus/1, occupying fully twice the ROM space (8 MB, instead of 4 MB). These are used in 128 ROM-based presets, designed to span the gamut of conventional orchestral instruments and then some. Besides this new base of ROM samples, the Proteus/2 provides full control over the amount of chorusing

E-mu Proteus/2

(values from 1 to 15), rather than the fixed value available on the Proteus/1.

The first 64 ROM presets cover the core of instruments found in a symphony orchestra. Many of these have been constrained to the realistic playing ranges of the instruments, affording the novice a perspective on practical orchestration. Presets are carefully arranged so that a series of similar instruments leads to small and large ensembles. Given the ability to link and layer, edit parameters, and assign modulation routings for each preset, it's not farfetched to approach the performance characteristics of traditional instruments. What's critical is the quality of sampled sounds, and Proteus/2 has several strong suits.

There are 27 Instruments used in the design of string presets, including Solo Cello, Viola, Violin, Quartet strings, Tremolo strings, and Pizzicato strings, as well as larger ensembles of Dark and Arco strings. All are quiet, with sensible loops and exceptionally few noticeable multisample points. The first twenty presets reveals the richness and quality of the samples, as well as the module's programming potential. Among my favorite selections are: "Legato," "Marcato," "Concerto," and "Tremulus" (with an evocative tremolando). Editing and controller options also provide lots of room for fine-tuning.

The woodwind and brass presets, for the most part, meet the same standards of excellence, with 24 clean Instruments and agreeable loops. Characteristics such as the velocity-controllable attack ("chiff") of "Flute," the soaring "Oboe"—which benefits from slight aftertouch emphasis—and the endear-

ing Harmon-muted trumpet contribute to a mostly favorable impression. However, certain brass presets are not up to par (notably "Trombone 1" and "Bright Brass"), with a significant lack of expression and a feel that seems too electronic. Fortunately, the fullness of the B-flat and D trumpets make up for this.

The combinations of woodwind and string sections are particularly beautiful. "Divertimento's" layering of a string quartet with a woodwind section is effective and complementary. The link matching the crispness of "Marcato" with "Resting Pad" provides the perfect environment for linking an Oboe, too. Assigning the mod wheel to the release time of "Marcato's" alternate envelopes allows the Oboe to become slightly more prominent in the patch.

For pure fun, the Percussion presets win hands down. The raw multisamples, all eighteen of them, are impeccable. "Timpani" has a discernable pitch bend on attack and resonates clearly in the lower register. The layering of Tam Tam and Piatti is intelligently executed in "Gong/Cymbal," and "Tubular Bells" has just the right amount of envelope decay and release to realistically scale the progression up the keyboard. "Percussion 1" and 2 are the potpourri sections, with an assortment of temple blocks, xylophones, rim shots, snare rolls, triangles, timpani, brass tambourines, tam tam, and bass drum.

To broaden the appeal of the module, E-mu also has included Keyboard, Texture, Sound Effect, and Bass presets. Most of the sounds are good, abundant with textures that would work well in film scores. Kudos to composer/programmer Richard Burmer for "Wrong Room," "Sombre Winds," "Marimbala," and the awesome "Machine Room." The XR version of the Proteus/2 ($1,795) offers 192 additional RAM locations, several occupied with linked, or layered, presets that demonstrate the depth of the instrument and teach different programming approaches. While I've emphasized the orchestral side of Proteus/2, these RAM locations are ideal for using the source timbres as a launching point.

Proteus/2 doesn't replace Proteus/1, but is designed as a complementary module.

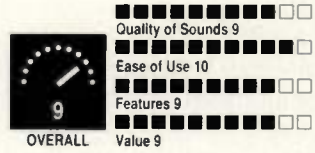
Proteus/2 "opens up" as an instrument when using continuous controllers. Pitch and mod wheels, aftertouch, and even foot controllers can be used to develop the highest level of realism and gain complete command of the instrument.

Since E-mu has been careful to emphasize that Proteus/2 doesn't replace Proteus/1, but is designed as a complementary module, it's fair to ask if the two truly work together. While I favor the sounds on the Proteus/2 for my applications, they don't replace the Proteus/1, with its strengths as a pop/rock module. One telling aspect in comparing the same instrument on both units

is that the tonal coloration of samples differs slightly. Brass on the Proteus/1 is markedly rounder and crisper than on Proteus/2. By the same token, the string samples in the latter Proteus are cleaner, replete with the distinct timbral characteristics of bowed instruments.

All in all, the Proteus/2 is an instrument that incorporates the best aspects of the Proteus/1 while presenting a wholly different, and very well integrated, palette of sounds. There's no doubt that musicians who try to take this unit to its limit will be deeply satisfied with the results of their efforts.

Alex Artaud *dots the i's and mines for p's and q's at* **EM**. *He's convinced that interactive, reindeer/muskrat MIDI controllers are the next big thing.*



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A.R.T. DR-X Multi-effects Processor ($629)

By Jock Baird

Is more always better? Maybe. After all, the ability to run more than one digital effects program in the same unit has mushroomed—two years ago, four was a lot; now, the benchmark is twelve and counting, especially in guitar-oriented units. But quality is as important as quantity, as evidenced by Applied Research & Technology's (A.R.T.'s) new DR-X, a veritable Swiss Army knife of digital processing for use in the studio or in sound reinforcement.

Oh sure, it has quantity—in addition to two seconds of 16-bit sampling, the DR-X has the capability to run up to ten effects at once, and its parameters can be accessed by up to eight different MIDI continuous controllers—but the DR-X sounds even better when it's *not* running ten effects at once. That's because it dynamically allocates its programming algorithms depending on

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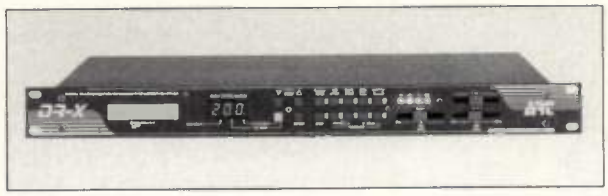
how many others are running, so if you run a multitap delay or reverb by itself, instead of alongside four other programs, you get a more sophisticated effect and more adjustable parameters. Still, having extra processing power does give the DR-X an advantage in being able to combine two time-based effects to produce a warmer, more full-sounding digital chorus or flange than a lot of multi-effects units can muster. And who could resist that vast menu of sonic goodies on call? You get everything from analog variable-gain effects such as a noise gate and compressor/limiter to a 3-band equalizer, a 2-octave pitch transposer, and a full bag of twenty delay and 24 reverb algorithms.

The DR-X is a first cousin of current A.R.T. products like the SGE/SGE Mach II and the MultiVerb, and it shares the same front panel and programming setup. It has a 3-digit, red, numeric display for program numbers and a 32-character, green, liquid crystal display for titles and vital statistics. In its regular operating "keypad" mode, it changes between its 200 onboard programs (110 of them factory presets that can be recalled even after they've been overwritten) using either increment/decrement buttons or the numerical keypads. There's also a Bypass button to take everything out.

When a Mode button is pressed, the DR-X goes into Edit mode. The ten number buttons then become named function keys, and you step left or right through a continuous loop of adjustable parameters. A third level and programming loop is entered by pressing the MIDI/Utility button. Although a decimal point on the display tells you which level you're in, it's easy to get these three modes confused when programming, which can be annoying. Fortunately, though, the DR-X is forgiving when you push the right keypad in the wrong mode.

It won't take a degree in rocket science to program the DR-X. An effects chain is built up in Edit mode by stepping with the Add Effect key until your desired processing appears and then hitting Enter. (Offending effects are booted out the same way, using a Delete Effect key.) The list of available effects is large when the program is blank and grows progressively smaller as others become unavailable due to processing allocation. For example, three classes of reverb algorithms are avail-



A.R.T. DR-X

able at the beginning, whereas only one of these may be available for use once you've added a delay to the chain. Less-demanding effects, such as compression or EQ, usually stay available and offer the same number of programmable parameters.

Connections to the DR-X are via phone jacks—two in, two out—but, regrettably, all are unbalanced. Stereo inputs are passed "dry" to the output jacks. There's also a footswitch input that can be programmed to be a bypass, a program stepper, or a sample trigger. Two front-panel sliders adjust line levels in and out, and a third slider either adjusts the mix between the input and processed (wet) signals, or pans between dynamic effects and time-based effects . Four LED indicators simplify level setting for a broad range of inputs.

In a full course of studio activities, including external real-time MIDI control of its parameters via a sequencer, the DR-X passed with flying colors and terrific sound quality. Many of the presets are specialized for use with vocals and drums, and these performed as advertised. Sampling was especially easy to operate, thanks to an Auto feature that starts the recording when the sound first appears. It's also a breeze to change the start and end points, set up a repeat, or trigger the sample from any external MIDI instrument. (No, it can't loop.) The sampler also can be run at half the memory capacity, freeing up memory to be used with a simple reverb program or the pitch-shifter.

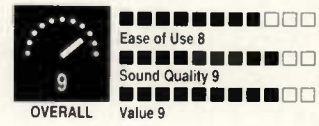
The DR-X included not only good stereo delays, but a set of multitaps that have several imaginative ways to vary the regularity of echoes. DDL nitpickers may fret about the absence of modulation and the fact that many of the algorithms lack a regeneration control, but after all, this is a $629 unit. The reverbs were stellar, including halls, rooms, plates, and gated programs (though predelay controls are lacking). The pitch transposer has three different operating modes (Smooth, Normal, and Quick) that help correct delays or funky tunings. A clever bit of MIDI control allows you to use note numbers to adjust the amount of pitch-shift. As mentioned, the flanges and choruses are a cut above average.

The dynamic processing in the DR-X is helpful in setting and limiting levels, but sometimes adds undesired murk and coloration. The compressor/limiter is serviceable but basic, as is the EQ, which has three fixed frequencies at 100 Hz, 1 kHz, and 10 kHz. The harmonic exciter's impact was barely discernible, and the panner is also somewhat subtle. The increments in which the DR-X changes its parameters could be finer, but this is a problem most multi-effects processors share.

It's hard to see how A.R.T. could've crammed much more into the DR-X considering its price tag. All in all, it's a

smooth, excellent-sounding processor that can function both as an audio specialist and as a general practitioner, and is a worthy addition to any studio or stage rig.

Jock Baird *is a free-lance writer and musician who lives in Gloucester, Massachussetts. He was with* Musician *magazine for ten years, five of them as editor.*



Applied Research & Technology, Inc. (A.R.T.)
215 Tremont St.
Rochester, NY 14608
tel. (716) 436-2720

Toucan Software Live Control for the IBM PC ($299)

By Rob Rayle

Live Control is an extremely general MIDI mapping program with which you can generate almost any kind of MIDI output from your controller. Any incoming MIDI message can be translated into a different outgoing MIDI message, including sysex. This makes it possible to turn a large MIDI system into a single, highly programmable instrument.

The program runs on IBM PC and compatibles under Microsoft *Windows* (version 2.0 and later) and supports MPU-401-compatible MIDI interfaces, the KEE Midiator, and the Yamaha C1. Because it uses *Windows*, *Live Control* requires, at minimum, an AT-class machine.

The first time you bring up *Live Control*, you must initialize the system by entering a list of your gear and the MIDI channels on which it sends and receives. This is a tedious task, but unless you reconfigure your rig, you only have to do it once. This information allows the system to specify connections in terms of devices (e.g., "connect the DX7 to the Proteus"), rather than MIDI channels.

Any mapping of a MIDI input to an output is referred to as a *connection*, and connections are specified in an extremely flexible fashion, including specification of source, destination, in-

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put and output message types, input and output value ranges, and information about which input values control the various output values. Controllers can be remapped to do an endless variety of tricks, such as mapping note-on messages to change delay time on a DDL, or controlling MIDI volume with the mod wheel.

If you want to get more bizarre, you can control key number with velocity and velocity with key number, map note-on to note-off for an infinite sustain or a monophonic effect, or send program changes from your pitch bender. Incoming MIDI messages can be used to generate harmonization according to a user-defined interval and scale, initiate sysex dumps, or totally reconfigure the current set of connections. Although a connection contains a lot of information, *Live Control's* user interface makes programming fairly simple.

Live Control provides a generic sysex librarian that gives you centralized control over each piece of gear. If your synth receives sysex messages that control individual parameters, you can use this feature to add another level of responsiveness to your instrument. There is also a window containing eight onscreen faders controlled by the mouse, allowing you to use the computer itself as a MIDI controller.

The program comes with a MIDI monitor function for both input and output events, exceedingly useful in setting up and debugging maps. The monitor displays events in hexadecimal notation, but the rest of the interface uses decimal by default; you must remember to put an "x" before any numbers you want converted to hex. In the pitch fields, you can also enter the pitch values themselves (e.g., C4, F5, etc.). To use the monitor effectively, it helps to be comfortable with converting hex to base 10.

Compared to MIDI mappers that offer only preset kinds of connections (i.e., splits, layers, transposition), working with *Live Control* seems like total freedom, but there are a couple of fundamental limitations. The first is that all output events go out immediately. You can have a single input event trigger multiple notes, but the effect is that of a chord rather than a sequence. *Live Control* is strictly a real-time system.

The second limitation is that you can only use single MIDI input messages as

the basis for output events. For example, you can't create a note-on event by taking the note number from a pitch bend message and the velocity from a modulation controller. You can generate a note-on from either event by itself, but not from the combination.

Because *Live Control* is a general system, the user interface makes few assumptions about what you're going to do with it. This can make it somewhat tedious to set up some simple MIDI configurations. Five or six connections are needed to provide complete control over a typical module (note-on, note-off, pitch bend, mono or poly aftertouch, program change, controllers). Using *Live Control* can be like trying to paint a wall with a tiny brush: You have very fine control, but it turns into an encumbrance when you don't need it. Some sort of macro facility would be a great addition to this product; it could make the simple cases easy without sacrificing generality.

I found one serious bug in the system: Using the copy and paste options in the connection edit window will eventually trash the setup you are editing. On several other occasions, I thought I had found bugs, only to discover that *Live Control* was doing exactly what I told it to; I just hadn't told it to do what I wanted. You'll need some skill at MIDI troubleshooting to be effective with this program.

Live Control has a quirky user interface, a high price tag, and at least one bug. On the other hand, it lets you do things that are impossible with anything else of which I am aware. If you want to improvise using your entire MIDI setup as a single instrument, or to turn your DX7 into a powerful alternate controller, *Live Control* could be just what you need.

Rob Rayle *is a computer programmer/musician, a composer of intricately sequenced instrumental music, and keyboard player for Advance, a San Francisco Bay Area progressive rock group.*

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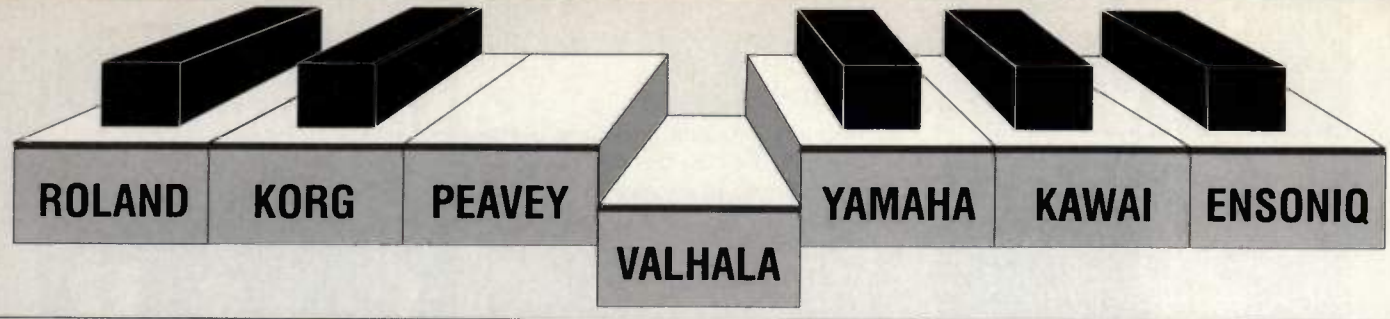

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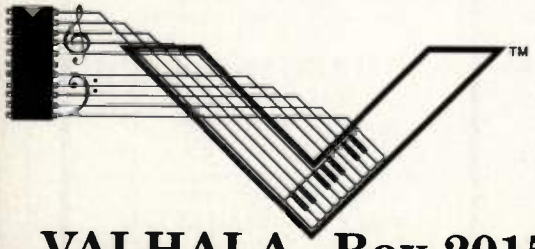

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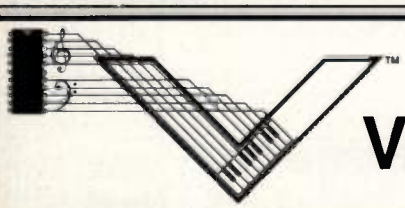

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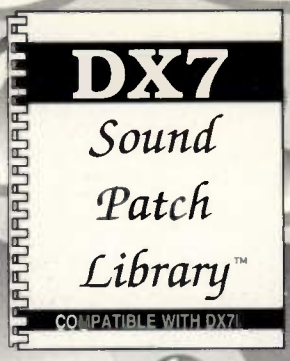

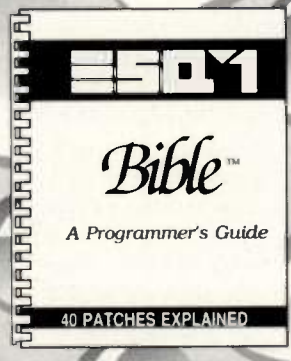

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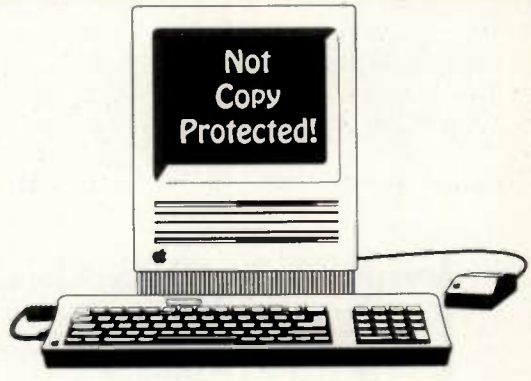

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Cakewalk Professional 3.0 Sequencing Software

By Dennis Miller

It doesn't have a graphic user interface, but Twelve Tone Systems' program is loaded with features—and you can create your own.

If you're in the market for an IBM sequencer, you've got a pretty tough decision to make. Taking their cue from Macintosh software, many new IBM programs sport colorful, graphic interfaces that can't be beat for ease of use and clarity of design. On the other hand, you'll also find numerous character-based programs, some of which remain highly successful by adding new features with each new revision. If you think the text-based route is right for you, take a look at Twelve Tone Systems' *Cakewalk Professional 3.0,* a 256-track sequencer for the IBM and compatibles that is one of the best-selling IBM music programs around.

Cakewalk Professional 3.0 has an enormous list of functions that are easy to use and, in most cases, very simple to learn. If you happen to find something missing from your wish list, you probably can create it yourself using Cakewalk Application Language (CAL), a robust programming environment that is built into the program. With support for standard MIDI files, a generic sysex librarian, and all flavors of SMPTE sync, *Cakewalk Pro* is a powerful tool for the amateur and professional.

To run the program, you need an IBM or compatible with 640K of RAM and virtually any standard graphics adapter, including CGA, EGA, VGA, and Hercules. A hard drive is recommended, and a mouse is handy but optional. The software supports Roland MPU 401-compatible MIDI interfaces (including the Music Quest MQX-32M) and the Yamaha C1. *Cakewalk Pro* is not copy-protected and lists for a very reasonable $249. *Cakewalk Live,* a companion program for building playlists, sells for $49.

Though I'd never worked with it before, I felt right at home with *Cakewalk Pro* because of its intuitive layout and clear-cut organization. I wouldn't call it "stunning," but the program has a clean, attractive design that is easy on the eye and pleasant to work with. Interestingly, *Cakewalk Pro* incorporates many of the same elements that you might find in a graphic interface: Pull-down menus, dialog boxes, and scroll bars all work as they would under Microsoft *Windows.* Only the mouse implementation leaves something to be desired. If you run into trouble while hard at work, there's extensive online help available, and a clear well-written user's manual includes examples and mini-tutorials.

Cakewalk Pro is organized into four main screens, called "Views." Each View gives you access to essentially the same features, and you can edit, playback, and/or record from any of them, but your data is displayed differently in each. This arrangement works well, as it allows you to select the area that is best

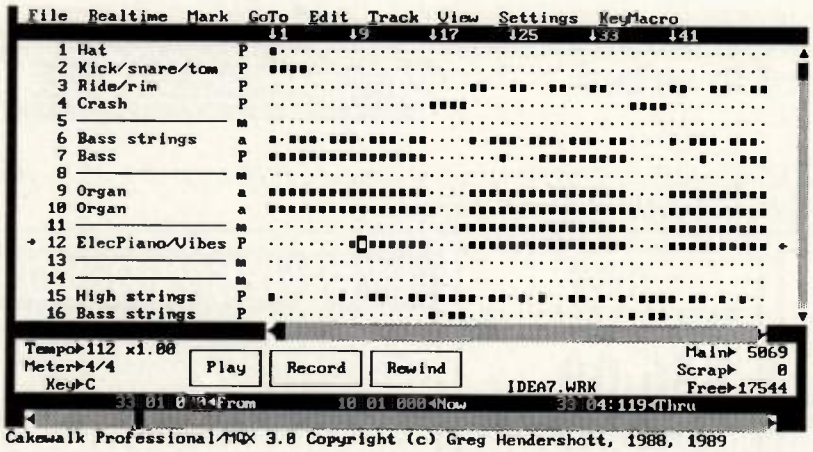

FIG.1: Measure View is used for block functions and provides an overview of your data.

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for the type of work you're doing: You set up tracks in the Track View; cut, copy, and paste from the Measure View (see **Fig.1**); fine-tune individual note data in the Note View; and work with a range of events in the Event View. Each View screen displays a row of menus labeled File, Realtime, Mark, Goto, Edit, Track, View, Settings, and KeyMacro, and one or two keystrokes or mouse clicks will move you between the Views, even while playback is occurring.

RECORDING AND PLAYBACK FUNCTIONS

Recording and playback from any of the Views is simple. A small area at the bottom of your display contains boxes marked "Play," "Record," and "Rewind." To enable a function, just click on a box, or type the letter that is highlighted in each. There are also keyboard shortcuts and user-defined macros that can be used for these and many of the program's other main features.

The default mode for recording sends all data, regardless of its MIDI channel, to a single, selectable track. Everything goes into a scrap buffer before being saved, so you can decide whether to keep, or throw out, every take. Unfortunately, there's no multitrack record mode (i.e., a mode in which you can send data on a single channel to multiple tracks), but a number of other useful options almost compensate. First, if you record data from several MIDI channels simultaneously, perhaps from an external sequencer, you can split the channels out to any tracks you want with just a few keystrokes, using the Channel-to-Track Conversion Table. Next, you can set *Cakewalk* to MultiTake Mode, where every take you record will be placed onto successive tracks. If you're working on a solo and want to record several versions while the creative juices are flowing, this option will help by asking if you want to keep, or throw out, each take, then move on to the next track and initiate recording. Every version you keep is numbered in sequence, then muted while the next recording is taking place.

There are lots of other recording features, such as a MIDI Filter, that lets you keep certain types of events from being recorded, and an automatic punch-in option. I like *Cakewalk Pro's* Step Recorder because it allows you to work with both musical units and clock ticks. Its auto-advance option saves you time by moving ahead after each note-off received, and its Pattern feature lets you set up a recurring pattern of up to sixteen notes and/or rests. Though not the fanciest I've seen—the step sequencer in LTA's *Forte II* certainly gets that distinction—this Step Recorder is easy to use and adequate for most jobs.

Playback options are fairly straightforward in *Cakewalk Pro*. You'll find all the standard features but no great surprises. The default in all screens sets playback to begin at your current cursor position, which is shown by a "Now:" indicator on your display. While a sequence is playing back, you can preview different tempi, transpositions, and velocities, but you can't send a program change; it must be recorded in a track. I wish all programs allowed you to change voices on the fly, as it's the thing I like to experiment with most. (*In the next version, Twelve Tone plans to add a feature that lets you audition patches while the track plays back.—SO*)

Product Summary

PRODUCT:
Cakewalk Professional 3.0
TYPE:
Sequencing software
HARDWARE REQUIREMENTS:
IBM-compatible with 640K RAM; CGA, EGA, VGA, or Hercules graphic adapter; hard drive strongly recommended
MAIN FEATURES:
256 tracks; standard MIDI file support; step recorder; CAL programming language; multiple view screens; macro recorder; text-based user interface
PRICE:
$249
MANUFACTURER:
Twelve Tone Systems, Inc.
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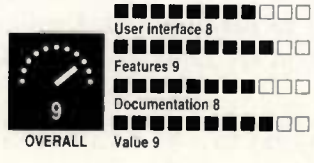

An Auto Shuttle option provides what some other programs refer to as a "play range" and is used to play repeatedly a range of measures, or to rewind automatically to some starting point after a whole sequence is finished playing back. I needed something slightly different, a feature that stopped play, rewound, and then restarted, so I jumped into the Macro menu and created one myself. The whole process took about ten seconds.

EDITING

Cakewalk Pro's editing features rival those of virtually any program on the market, though here, more than elsewhere, you might miss the graphic editing capabilities that some other programs offer. At the heart of *Cakewalk's* editing functions is an Edit Filter that can be used to determine exactly what data gets altered, no matter what the particular edit operation is (see **Fig. 2**). Select any command from the Edit pulldown menu, and you'll find an option allowing you to choose whether or not the Edit Filter will be in effect during that operation. If you want to work on only a range of notes from a track (say, C4 to C5), you simply enter that range in the Filter's Note Range parameter, and you're all set. You can also exclude those notes from an operation by telling the Filter not to include that range.

The Filter allows you to set up some fancy conditions under which things will happen by using multiple controls simultaneously. You might delete all notes between C5 and C7, in measure 6 through beat four of measure 9, with durations of a quarter note or less, and velocities not falling between 50 and 100. Though it takes a little getting used to, the Filter is a powerful tool for manipulating specific types of events.

Another unique editing feature is the Interpolate option, which also allows you to isolate certain events and quickly modify their parameters. You can "interpolate" just about anything that has variable values associated with it, e.g., find all E's in your music and increase their durations by 400 ticks, or expand the octave range of all notes falling between E4 and E7 to cover the entire keyboard. I spent lots of time with Interpolate and felt I was just scratching the surface. This is definitely one to explore further.

Cakewalk Pro provides other, more

familiar, editing features, such as a Quantize option with both an adjustable resolution setting (down to a single tick) and a Percentage control. There are transposition, inversion, and retrograde functions for pitch manipulation and compression/expansion, offset, and Fit Improvisation for time transforms. If you have a track on which you improvised or performed freely, without concern for the meter, you can use Fit Improvisation to synchronize that track with a strictly metered reference track. Your music will sound the same, but note-start points will be more closely aligned with the beginnings of measures and beats. You also can "loosen up" a track by going from strict to free. Velocity scaling is available, and Controller Fill quickly fills in a range of values for any MIDI controller. Feel free to experiment as much as you want with your data; there's an Undo command to override the last edit.

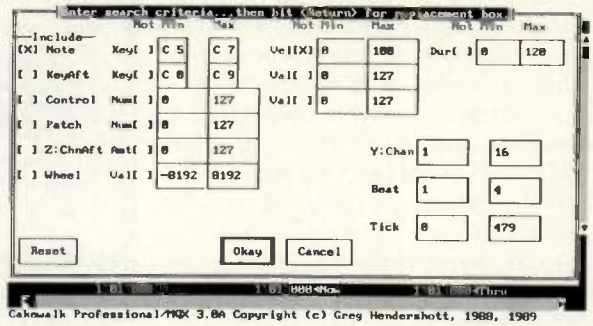

FIG. 2: The Edit Filter is a powerful tool for isolating specific events on which to work.

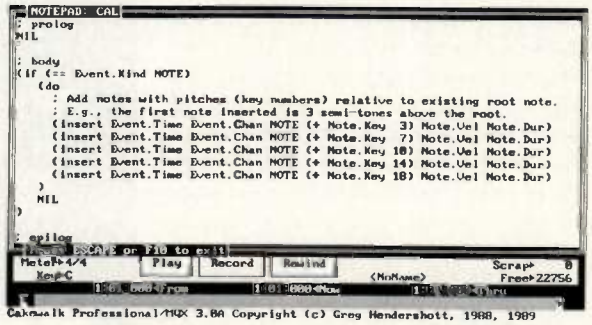

FIG. 3: With CAL you can add your own features to *Cakewalk Pro*.

While the similarity among all of the edit features makes them simple to learn and use, I do have two minor complaints about the way you enter data when editing. First, some, but not all parameters can be changed by clicking on a value with the mouse and dragging the mouse forward or backward. For example, transposing from the Track View responds to mouse input, but setting the transposition values from the Track pulldown menu does not, so you must type in your choices. I'd like to see the mouse more fully implemented. Next, the values themselves don't wrap around, i.e., when you get to the maximum allowable value for a parameter, you have to reverse gears to get back to the minimum. Adding these two features would be, well, the icing on the cake.

One of the advantages of working with a graphics-based program is the ability to define a large block of data with the sweep of a mouse. Fortunately, *Cakewalk Pro* fully supports the mouse for marking single or multitrack blocks, making cut-and-paste operations a breeze. There's one aspect of the block functions I'd quibble with, though: When you copy or cut data from several tracks at once, it only can be pasted back into the same set of tracks. That's fine if you want to repeat the refrain of a song at some point later in the tune, but not so great if you're trying to double a few parts, perhaps using new patches on different MIDI channels. The workaround is to copy-and-paste the tracks one at a time, but that takes some effort. I was happier working with the Paste to One Track option, which lets you merge all data from a group of tracks into a new, or an existing, single track. By the way, a block can start and end anywhere within a measure, right down to a single tick. I like having that level of control. And, as always, the Event Filter is available for selecting only specific types of data for moving.

CAL

Once you're familiar with *Cakewalk* and have determined that a feature you really need is missing, you can turn to CAL (Cakewalk Application Language) and attempt to code it in yourself. This ability to extend the limits of a com-

mercial program follows on the heels of Jim Miller's *Personal Composer*, which provides a similar, but not as easily integrated, capability. It's a major development in MIDI software, something I hope other developers will implement. If you've never done any programming, CAL might be a good place to start, since it's not only highly intuitive, but will give you immediate feedback. If you're experienced in C or Pascal, you're already in great shape.

To work with CAL, it's a good idea to look over carefully the examples that come on the disk and make minor adjustments to them before writing your own. One routine, for example, creates a dominant seventh chord out of any single note. I easily modified the command to build a minor 9th chord with sharp 11 by adding three lines to the file (see **Fig.3**). CAL is especially geared towards manipulating MIDI events, thinning data, changing velocities, etc., and you can use many C language-style statements, operators, and functions to build your commands. Once you've written a function, you simply run it from the CAL submenu of the Edit menu, like any other command. The whole process couldn't be easier, and there's an endless list of features you can add to the program. I expect to find CAL files around some of the bulletin boards soon, as people swap their original creations.

IN SUMMARY

It's hard to complain about the features of *Cakewalk Pro*, since you can write your own features with CAL and customize many others with the Macro Editor. Many times, these two options helped me extend the program's functions and kept me from losing my temper. Judging by its best-seller status, it's clear the program has satisfied many other users. While I can't help thinking that graphics-based programs will become more dominant in the future, *Cakewalk Professional* clearly is capable of handling nearly any type of music you want to make.

(Thanks to Jeff Miller, of Software By Design, for his technical assistance.)

Dennis Miller *is associate professor of music at Northeastern University, in Boston, where he teaches courses on music technology and theory. He is on a never-ending quest for the perfect computer music system.*

Cheetah Master Series 7P MIDI Controller

By Steve Oppenheimer

This new, weighted keyboard from Britain may not be everything you could wish for, but it does possess some tempting capabilities.

I have several MIDI keyboard controllers, but none of them does everything I need. Synths with keyboard-controller capabilities come in for review and go back out again without making my fingers feel good. (Being a piano player from way back, I love weighted actions.) Some controllers have outdated MIDI implementations, some are fragile, most are prohibitively expensive, and many seem to weigh a ton. I eagerly awaited the arrival of the Cheetah Master Series 7P, a British-made MIDI keyboard that combines impressive programming power and flexibility with an 88-key, weighted action in a relatively lightweight package at an attractive list price of $1,829.

One reason for having an 88-key controller is to play piano parts with a realistic, weighted action, and Cheetah's controller passes that test with good marks. The action is faster than that of the Yamaha KX88 (favored by many pianists) and reminds me of my old Kohler & Campbell studio piano — fast, but not synth-like.

Part of the MS7P's appeal is its manageable size and weight. Although it's 57 inches long, the depth is only 10 ½ inches (front-to-back), fitting on virtually any keyboard stand. Despite its weighted action, the keyboard is light (just over 45 pounds), a refreshing contrast to other weighted controllers, and the unit seems solid and roadworthy.

The MS7P is still not my ideal controller, though, partly because the current version lacks aftertouch and programmable sliders. I'm surprised that Cheetah entered a controller in the 1990 American market without poly aftertouch, but I'd settle for channel aftertouch. (Without aftertouch, it loses a point off the Features and Overall EM Meters.)

Fortunately, Cheetah is expected to release the Master Series 770, an MS7P with channel (not poly) aftertouch. I examined an MS770 and found that the touch was unimpaired by the addition of aftertouch sensors. You have to lean into the keys a bit to trigger the aftertouch, but I consider that a benefit with a weighted keyboard, as you're less likely to trigger it accidentally. (There is a tradeoff for aftertouch, though; see "Under Control" for details.)

ZONES, LAYERS, AND CHANNELS

The Cheetah really struts its stuff in the programmability department. The MS7P offers up to eight, non-overlapping zones, each of which has up to four layers (which Cheetah calls *notes*). Each layer can be assigned its own MIDI channel, output port, controllers, transposition value (in half-steps), attack- and release-velocity curves, touch sensitivity, and program change number (transmitted from the panel). The multiple zones can be used to simulate overlapping zones, although

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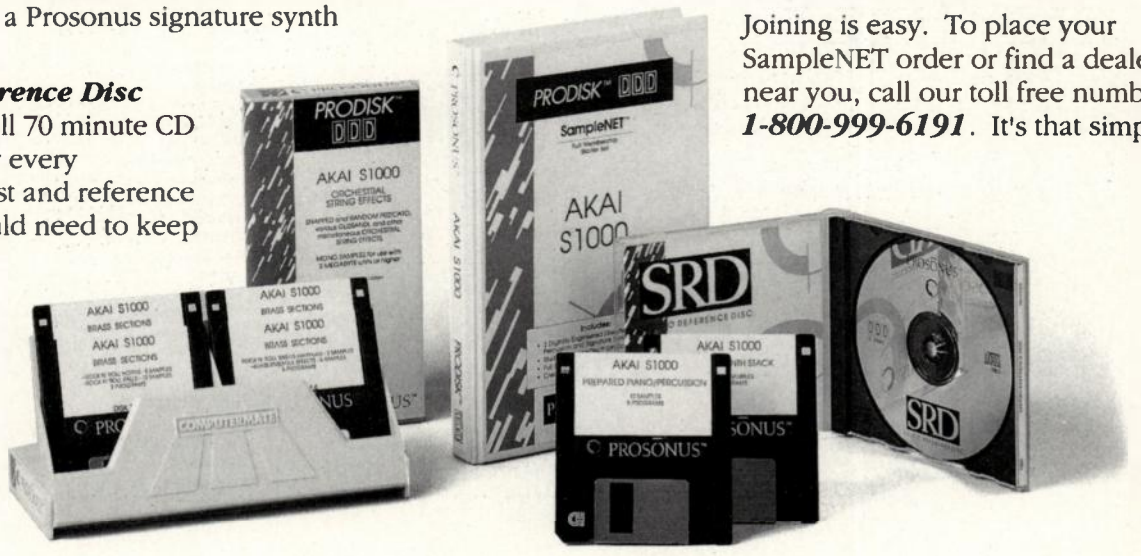

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this requires some planning.

Having selected a zone, you enter Note mode to program the layers. You have to hit Enter after every parameter change; otherwise, you lose your edits. Eventually, you get used to this, but it's frustrating. You can set the parameters in almost any order, but due to the wealth of programming possibilities, it's useful to create a system. I prefer to start by assigning layers to MIDI channels, keeping in mind that each layer can be assigned to any of the MS7P's four independent MIDI outs, for a total of up to 64 MIDI channels.

You can select from fourteen attack and release velocity curves (including inverse curves), turn off velocity, or map the MIDI volume wheel to set velocity data. A Sensitivity parameter shifts the keyboard's velocity response up or down the vertical axis of the curve.

UNDER CONTROL

The MS7P includes three controller wheels and an expression pedal that can be assigned to any MIDI controller number. The first wheel defaults to pitch bend and is spring-loaded and bi-directional, with a center detent. The other two wheels default to modulation and MIDI volume, respectively, and are unidirectional. The pedal transmits channel aftertouch data as its default. (In the MS770, the pedal transmits MIDI volume as its default, and when the pedal is plugged in, the third wheel is disabled. You don't gain a controller, you swap the wheel or pedal for aftertouch. Sometimes, you just can't win.) Each controller can be set for normal or inverse action.

Additional control is provided by two programmable footswitch jacks, which default to sustain pedal and increment pedal. Using either pedal, you can step through a chained sequence of patch changes. A more powerful option lets you step through a sequence of Performance presets (complete sets of parameters, discussed later), in any order.

Each performance controller is assigned to a separate MIDI controller number for each of the eight zones. In each layer of a zone, each controller is assigned to a MIDI channel (1 to 16), an output (1 to 4), and a controller-sensitivity value (0 to 127). There is also a provision for the second wheel (normally modulation) to transmit two different controllers within each zone. Mode control messages such as Local Control On/Off and MIDI Mono/Poly mode can be transmitted from the front panel.

PORTS AND PERFORMANCES

The MS7P has a MIDI input port that can be used to merge, route, transpose, or rechannelize incoming MIDI data. A MIDI thru port is also provided. A complete set of parameters—zones, notes, controllers, ports—can be saved to any of 90 battery-backed Performance memories. (According to the manufacturer, the battery life between recharges is about one year.) The manufacturer provides ten additional preset Performances (most of which are not particularly useful), and the unit defaults to the first and simplest of these at power-up. A set of patch sheets in the rear of the manual details the settings for the factory presets.

Performances can be selected via external program change commands. You can save Performances via sysex,

but the procedure to initiate a dump is not clearly described in the manual, and there is no sysex implementation chart, which rates a loud "hiss" in my book. As it turns out, dumps *are* easy to initiate from the front panel, and according to the manufacturer, you can send a dump request message from a computer. To ascertain this, Jessico (the U.S. distributor) had to contact the manufacturer in Britain, which makes me wonder about getting technical support.

SPECIAL FUNCTIONS AND EFFECTS

The Cheetah controller offers several special functions. Two useful, real-time test modes proved to be convenient programming aids. One shows the number of each key, which helps in programming note ranges of zones. The other shows the transmitted velocity.

In Solo mode, the entire keyboard is assigned to a selected zone, regardless of the normal zone assignments. For instance, if you have a piano sound

Product Summary

PRODUCT:
Cheetah Master Series 7P
TYPE:
Keyboard MIDI Controller
MAIN FEATURES:
Eight non-overlapping zones; four layers per zone; four independent MIDI outs; MIDI in with merging and processing; 100 Performance memories; sysex support; versatile controller assignments; MIDI effects; good keyboard feel.
PRICE:
$1,829 (U.S.)
DISTRIBUTORS:
Jessico (USA distributor)
11230 Grandview Ave.
PO Box 2034
Wheaton, MD 20902
tel. (301) 949-9314

MusiCan (Canadian distributor)
211 Granite Run Dr.
Lancaster, PA 17601
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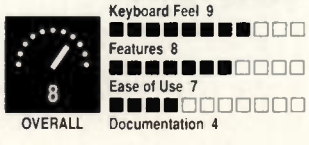

● CHEETAH MS7P

assigned to a few octaves in Zone 3, and you want to switch to a full, 88-key piano without loading a whole new Performance, assign the Solo function to Zone 3, hit the Solo switch, and *presto!* instant 88-key piano. Hit the Solo switch again, and you're back to your regular Performance setup.

For folks who love MIDI effects, the Cheetah controller includes MIDI arpeggiation, echo, and delay. These can be applied to any, or all, zones. You can arpeggiate different zones independently and select arpeggiation on, or off, for each of the four layers within a zone. Arpeggiation patterns include up, down, combinations of the two, and random. You can set the number of repeats as well as the rate (controlled by either the internal clock, or an external clock). MIDI echo creates a loop with up to 32 repeats. You can program the rate at which the looped notes fade or increase with each succeeding repeat. MIDI delay simply delays the transmission of note data.

Only one MIDI effect is available at a time within each zone, but the processed (arpeggiated, echoed, or delayed) MIDI data can be sent from one zone to another, where it can be processed again. Thus, you can arpeggiate the data in zone 1, then send it to zone 2 and delay it or arpeggiate it.

The MS7P accepts MIDI clocks for running the MIDI effects, but also includes its own internal clock, the rate of which can be set between 40 and 240 bpm. This can also be transmitted. MIDI start, stop, and continue messages control the internal clock and can also be routed to any of the outputs.

I WISH...

Some things about the MS7P drove me half-crazy until I got used to them. After a while, hitting Enter after every move becomes automatic, but it's still an unnecessary pain. The numeric keypad has no labels on the keys; instead, the labels appear screened onto the front panel to the right of the pad, a minor annoyance. The lack of a power switch is a hassle, too. (Fortunately, the MS770 has a power switch.) Far more important is the lack of programmable sliders and aftertouch, even if you *can* send aftertouch messages via other controllers. (With the MS770, I regret the loss of a wheel or pedal as the tradeoff for aftertouch. I want it all.)

The 4-digit LED display shows only one parameter, in one mode, at a time,

but the programming power of the unit requires setting lots of parameters in many different modes. As a result, working with the MS7P requires patience and planning. You should keep a note pad handy to write down every parameter as you set it. Because of its complexity and its small display, this controller cries out for a computer editor/librarian program.

Documentation was the single biggest problem, and it rates the **EM** Boo of the Month. There are no numbered chapters or sections, and the only cross-references were "see above" notes; unfortunately, "above" may be three to five pages back. Information is scattered all over the manual, and you have to search every paragraph of every page because you never know where the tidbits you need are hidden. There is no index and, as noted earlier, no sysex implementation chart. Fortunately, there is a flow chart, which helps you cut through the confusion. Unfortunately, Jessico (the U.S. distributor) has no expert, on-staff tech support (although it can handle repairs), so high-level tech questions are referred to the British manufacturer.

Despite my wish list and criticisms, I enjoy playing the Master Series 7P. Regular programming procedures (and writing everything down) reduce confusion about what you've put where and assure that all the controller and note data are directed as planned. I don't think many people will use eight zones with four sets of note data each, but if you need them, the Cheetah is the only keyboard I know of that supplies them. I also liked the fact that I didn't need a road crew to move the thing.

The unit lists for less than most of its competition and has more programming power than similarly priced controllers, so a few missing features (sliders, for instance) can be forgiven. The Cheetah keyboard's feel is a major selling point, and the MS770 (with aftertouch) feels as good as the Master Series 7P. In my estimation, it's worth waiting for the MS770 to reach the American market. It isn't the perfect controller, but if you're willing to put up with the manual, it's a good buy.

Sometimes, **EM** *associate editor* **Steve O.** *is tempted to give up the publishing biz and go back to playing live shows. Then he watches bands starve in low-paying gigs, "pay-to-play" clubs, and other rip-offs, and he goes back to his studio and computer.*

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Features & Applications

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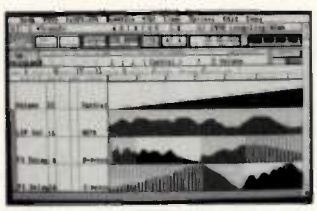
State of the Atari

Introducing new creative options from C-LAB Software and Digidesign: Notator/Creator™ 3.0 and Sound Tools™ for the Atari® Mega ST. The best sequencing/notation software and digital audio recording system combine to transform your Atari Mega ST into a powerful music production system.



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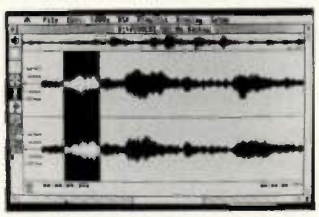

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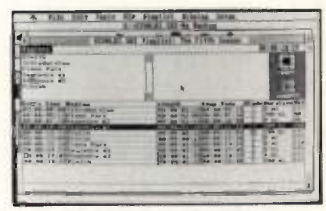

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e. ☐ Other

3 *Please check the ONE best description of your recording involvement.*
a. ☐ Full-time professional recording engineer or producer
b. ☐ Part-time professional engineer or producer
c. ☐ Sometimes or always record in a professional studio
d. ☐ Record in my home studio only
e. ☐ Have not recorded yet

4 *Which ONE of the following is your main computer used for music?*
a. ☐ Apple Macintosh
b. ☐ Apple IIe
c. ☐ Atari ST
d. ☐ Commodore Amiga
e. ☐ Commodore 64/128
f. ☐ IBM PC/XT/AT or compatible
g. ☐ Other brand
h. ☐ Don't own

5 *Which was your ONE favorite article in this issue? (Please see opposite page for list of articles.)*
a. ☐ b. ☐ c. ☐
d. ☐ e. ☐ f. ☐
g. ☐ h. ☐

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• ARTICLES *cont. from page 112*

Do-It-Yourself Articles

Theme Music Printing Software

By Dennis Miller

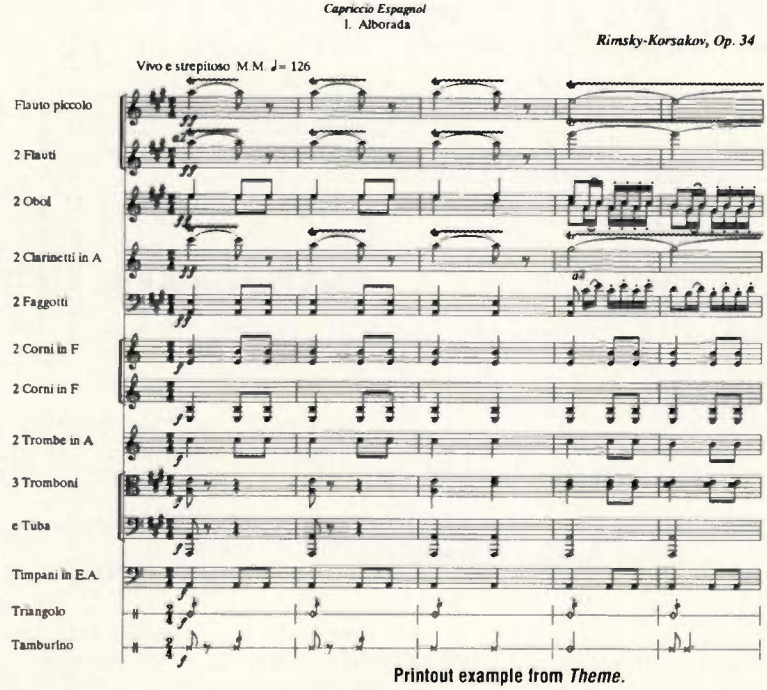
This IBM program offers a singular approach to music notation, emphasizing quality printed output over MIDI functions.

In the crazy world of music software, programs often receive so much attention before their release that you have to wonder if they could ever be as good as they sound. This seems to be the case with *Theme,* a music-printing program for the IBM that has been creating excitement since it was first previewed to the mainstream music industry at the 1989 Winter NAMM show. With Theme Software's recent release of Version 3.4, *Theme* has reached maturity. In many ways, it lives up to its billing, but because of a sometimes-quirky interface and a few surprising limitations, the program takes some getting used to.

Most high-end music-printing programs get notation onto the page via some combination of three methods: "on the fly" MIDI-to-graphics conversion, where you simply play your score on a controller and notes appear on the screen, normally with some rhythmic quantization (e.g., Coda's *Finale*); onscreen editing, which puts music symbols directly on the screen using a point-and-shoot method, usually with a mouse (e.g., earlier versions of Temporal Acuity's *Music Printer Plus*); and non-graphic data entry, where alphanumeric keys are used to write lines of "code" in text files for later conversion to notation (e.g., Passport's *Score* and thoughtprocessors' *The Note Processor*).

Theme's method is somewhat different from any of these: It's based on the Dvorak keyboard concept, where your hands rest on the most frequently used keys, in this case, the keys used to enter musical durations. It clearly is optimized for copyists, professional musicians, and scholars who are probably good typists and need to keep their eyes on the music they're entering, not on the screen. That doesn't mean the average MIDI musician can't find it useful, only that if you're a non-typist and must rely on your performance skills to enter your music, you will need to enter your music into a sequencer and use *Theme's* standard MIDI file conversion utility (discussed later). The program does convert its notation to MIDI for playback, however.

To run *Theme,* you need an IBM, or compatible, with 640 KB RAM, a hard disk, and a Hercules, AT&T, Toshiba, VGA, or EGA graphics adapter card. The program supports MPU-401 or compatible, MIDI interfaces, HP LaserJet II, DeskJet, or compatible printers, and most dot-matrix printers. *Theme's* package includes a laser driver with dot matrix-like, 150 × 75 dpi resolution. The package of 300 × 300 dpi laser drivers costs another $200. A companion program, *CHANT,* is optimized



Printout example from *Theme.*

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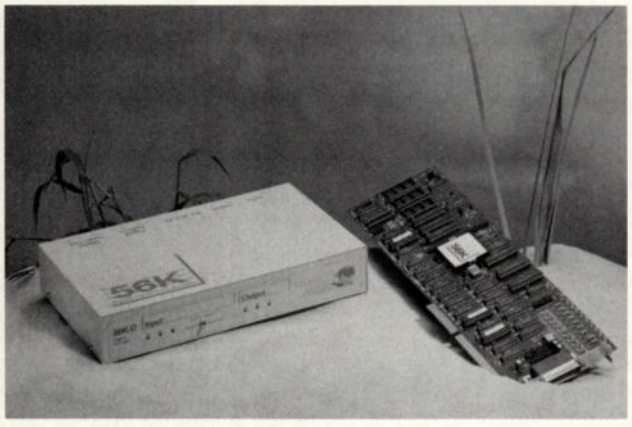

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Keyboard Magazine Aug. '90

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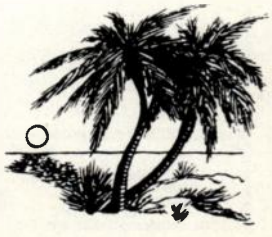

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for medieval notation and sells for $200. Recently, the manufacturer dropped copy protection on both programs.

THE OPENING BARS

Before you can enter music, you must first "format" your score page. This is done by choosing Create Format from the startup screen and selecting from a wide range of available options. These options—which include part name, clefs, spacing between staves, number of staff lines per part, and bracketing assignments—are easily defined by hitting two-letter command keys followed by the specific setting you want . Many options only work on a single part, while others are global. Unfortunately, one of the global settings is Time Signature; although you can use as many time signatures as you want, all simultaneous parts must have the same time signature, a significant limitation for modern concert music.

Using the Format Assignment menu, you can change formats within a piece so that the first page of your score can have four staves while the second has only three, but a new format can only be assigned at the beginning of a measure. Formats can be saved for use in other pieces, or you can record the setup process with *Theme's* Macro Recorder and easily "play back" the whole operation in another score.

ENTER THE MAIN THEME

Once you have the page set up, proceed to Music Input mode, where, with a VGA monitor, you can see up to ten staves per screen, or six staves with EGA graphics. If you want to customize your display further, you can choose any of sixteen colors as the background for your score.

When entering data, you work with one of four modes: Music Input mode; Window mode, for moving through your score measure by measure; Point Mode, for selecting a place in the music where you want to perform an edit; and Change mode, where you actually make the edits. Each of these modes is selected by hitting a function key, and in many cases (for example, to add dynamics), you have to drop down to a sublevel to enter the symbols you want. When I first began working with the program, I kept getting messages that said, in effect, "You can't do that from here!" I quickly learned that it's best if you work with only one function at a time, doing all your note entry, then all your corrections, then adding your edit marks, etc.; otherwise, you'll be doing a lot more mode-switching than you may care to.

Theme has a number of "intelligent" features that are useful for data entry. The program always knows where you are in a measure, and as you enter notes in one staff, it will automatically align music in any others. It has an end-of-line "note wrap" feature that, like a word processor, allows you to enter data continuously without manually shifting your position to the next line. It also will warn you if you've entered too many durations for the time signature you've specified, automatically beam most combinations of rhythms, and align music with text, even for multiple verses.

The program's interface lacks the clarity of *Finale's* graphic approach and is not as intuitive as the mnemonic

Product Summary

PRODUCT:
Theme 3.4
TYPE:
Music notation software
HARDWARE REQUIREMENTS:
IBM PC XT/AT or compatible; 640 KB RAM; Hercules, AT&T, Toshiba, VGA, or EGA graphics card; MPU-401 or compatible MIDI interface (optional); HP LaserJet, DeskJet, or compatible printers, or most dot matrix printers
MAIN FEATURES:
Automatic vertical and horizontal alignment of notation; end-of-line "Note Wrap"; automatic beaming of rhythms; high-quality laser printing
PRICE:
$395; $200 for optional laser drivers; $200 for optional *CHANT* software
MANUFACTURER:
Theme Music Software
PO Box 8204
Charlottesville, VA 22906
tel. (801) 971-5963

method of Temporal Acuity's *Music Printer Plus*. There's no mouse option or online help, and only a modest MIDI implementation. Nevertheless, if you're a good typist and have some time on your hands, there's plenty of power lurking behind the scenes.

Theme breaks from the pack by being the only program I'm aware of that is geared for the touch typist. Like the "cursor diamond" in many word processors (any *WordStar* fans out there?), the keystrokes for the various duration symbols are arranged in a "home position": Rest your hand over the "D" key, used to enter a quarter note, and you'll find the eighth note one key to the right, on "F," the half note to your left, on "S," etc. This layout works best if you already have a copy of a score laying around that you want to enter. It's perfect for a composer or copyist whose main interest is transcribing pre-existing music. I'm no great typist and happen to be more comfortable with a mnemonic approach—"Q" for quarter note, "E" for eighth, etc.—but with a little practice, I was really flying using *Theme's* method.

I liked the program's flexible handling of tuplets, with one exception: You easily can create irrational rhythms of three to 30 units, but the total time they span must be an even fraction or multiple of the beat. In other words, if you're in 4/4, three eighth notes in the time of two is just fine, but four in the time of three wouldn't be allowed. There's also a little problem with ties: The notes a tie connects must be adjacent to each other, as the program automatically draws the tie to the note immediately to the right or left of your cursor position. I would rather see *Theme* "locate" the closest occurrence of the same pitch and make the connection to that point. You can always fake a tie by using slurs that are completely adjustable, but this would throw your MIDI playback out of whack.

Because there's no mouse support, you have to position every pitch on the screen manually, using key combinations such as K to move up a space, Shift-J for down an octave, etc. There is an advantage to this approach, however, in that once you get oriented, you don't have to watch the screen to place your cursor. You can use MIDI step entry to select pitches by playing them on your MIDI controller, pausing to enter each note's duration. There's also an AutoStep mode that will advance the music according to a predetermined rhythmic value. As a piano player, I found AutoStep to be the most useful form of data entry, but it would be a lot nicer if the program provided a real-time, play-in option so you wouldn't have to change durations constantly. (*According to the manufacturer, a real-time entry feature is under development.—SO*)

Adding dynamic and articulation marks to a score is mostly straightforward, with only a few minor inconveniences. For dynamic mark- ings, hit F3 from Input or Change Mode, and a cursor arrow will appear below the staff. You can move the cursor to the correct position first, or enter the symbol anywhere and position it later. Dynamic marks are entered by using mnemonic keystrokes—"P" for piano, "F" for forte —while adjustable

● THEME

"hairpins" are found on the ">" and "<" keys. Unfortunately, *Theme's* playback utilities don't support crescendos and diminuendos, so you won't get to preview subtle dynamic changes.

Articulation marks work pretty much the same way as dynamics, except instead of using F3 you type in the keyboard symbol that represents the articulation mark you want. While not a comprehensive set (for example, many of the symbols used in modern concert music are missing), the basic library of articulation marks includes a good number of choices. A nifty little option allows you to assign one or more specific articulation marks to every note you enter, and you can also override the default settings that determine where a symbol will be positioned. Once a symbol is on the screen however, it's a bit of a pain to adjust manually. I would like to see an option to click-and-drag the symbol into position, preferably using a mouse.

VARIATIONS ON THE THEME

The editing functions are fairly well-implemented, but again, some features seem to be a little quirky. If you want to change the duration of a note entered previously, you hit F2 for Change Mode, adjust the cursor placement, then press the duration key that represents the new value. If your new duration is less than the previous value, everything gets realigned, and you're in good shape. But if the new duration is longer, some or all of the music in the measure will be deleted so the new note can fit. The new value will always overwrite the pre-existing music; you don't have the option of inserting a single note into a measure. On the other hand, changing pitch is a breeze. If you have a chord and want to change one or all of its notes, enter Change Mode, then replay the chord on your controller, and you're set. There are also numerous transposition options, both chromatic and diatonic, and when you use them, the program automatically takes care of all rebeaming and accidentals.

The Block Copy function is accessed from Input Mode and can be used to insert, replace, or overlay an existing section of music. This function is fairly limited—you can only copy complete measures, for example—and hinders *Theme's* usefulness as a composition tool when you want to cut-and-paste

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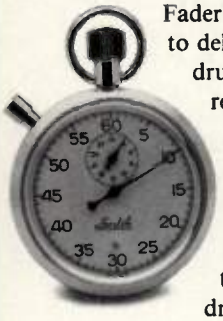

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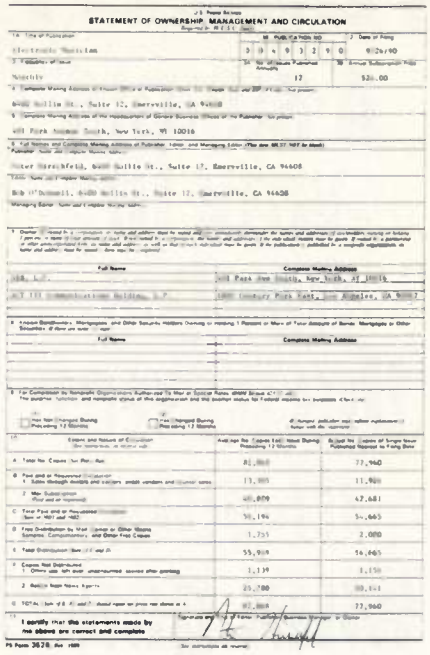
STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION

• THEME

chunks of music to try out different arrangements. More useful is a Copy-and-Peel option that lets you assign each voice in a chord progression to any part in your score. I stepped in a series of sixteen four-part chords and was able to transfer each individual chord voice to another staff with just a few keystrokes. Using this option, all articulation and dynamic marks of the original chord sequence are retained in the new parts—a tremendous time-saver.

MIDI MODE

Many of *Theme's* MIDI capabilities don't rival those of other high-end programs, and in some cases, seem to have been added as an afterthought. If you want to play back just a short section of a score, you can select F9 from within the main program and choose program assignments, tempo, channel number, and several other options. To play a full score, you must quit *Theme* and run a stand-alone utility that provides you with essentially the same choices. You can't see your music scroll or adjust its tempo during playback, but for a simple preview, the feature is acceptable. This area of the program will need some enhancing to catch up with the state of the art.

More useful is a standard MIDI file-to-*Theme* format converter, added in Version 3.4. This utility is also packaged as a stand-alone program and provides very fancy conversion options in a well-organized, menu-driven layout. To use the converter, run *TMT* from the *Theme* directory, and you'll come to the Main Menu screen, where you can assign any track of your MIDI file to any staff of your *Theme* score. You can specify a clef and key for your parts and can transpose any or all tracks of your original sequence. There are other useful options, such as quantization and auto-beaming, and if you intend to convert a lot of files, you can save your whole setup using *TMT's* Project Manager. The conversion is extremely fast and accurate, converting a 40 KB, multitrack sequence in just under twelve seconds.

ELABORATING ON THE THEME

I received a transitional version of *Theme* for review, and the manuals were not in the best shape. My copy contained a number of addenda, each with its own index, and it was often difficult to find my way through the maze. In

general, the manuals are good, but I'd like to see more examples. The manuals also need to be clearer about many of the program's functions, and a "Quick Start" chapter should be included. (The first 40 pages of the manual were limited to setting up a Format.) Some comprehensive tutorials would also be appreciated. (*The manufacturer recently released a new manual with a tutorial and sample data. All addenda are under one cover.—SO*)

Documentation limitations aside, *Theme* provides you with very sophisticated printing capabilities, and after all, that's what you want the program for. There's an extensive list of page layout commands used to customize a score, and you'll have a level of control over your printer that few other programs provide. There are two different music font sizes available (though you have to run a different program for each), and you have full access to any text fonts you can download to your printer. Because the program used for printing the larger of the two laser fonts requires a whopping 570 KB of free RAM, I wasn't able to run any tests with it. The smaller-size laser fonts, however, produce beautiful, well-formed characters and will serve admirably for all but the most demanding music publishing jobs.

When working with a program that combines playback capabilities with music printing, it's important to remember that you always have to make certain compromises. You can find ways to get the music you want onto your printed page, but not necessarily in a form that you can play back. If printed output is your number one priority, *Theme* can hold its own with the competition. It's especially well-suited for high-end users who have large amounts of music to input and provides lots of small touches that automate many of the most mundane aspects of the job. If you're turned on by a slick user interface, or want sophisticated MIDI features, you'll probably need to look elsewhere, but before you do, give *Theme* a try. You might like the sound of the tune.

Dennis Miller *received his doctorate in composition from Columbia University in 1981 and since that time has been on the faculty of Northeastern University in Boston. He spends all his spare time squeezing every last byte out of his computer.*

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* Special thanks to MACWORLD for permission to print their research on this topic.

Music For Its Own Sake

The growth of music for video and film is a welcome development—but music without visuals puts your imagination in the picture.

By Paul D. Lehrman

I love doing music for visuals. When I was fifteen, I spliced together bits of Varèse's *Arcana* with guitar feedback to make a soundtrack for a film that explored the angst of a teenaged girl who had an impossible crush on her English teacher. Today, I still get a thrill from matching the rhythms and movements of a scene and underscoring an emotional point with just the right key change or orchestral punch. It's a satisfying way to compose.

It's also a common way to compose. These days, the entire music production industry seems to be driven by the need for sound to accompany an endless stream of visual images. It's happening at every level. New studios are being built not to make records, but to handle post-production audio, and existing studios are buying 1-inch video machines so they can stay competitive.

Even home studios are getting into the act, with ¾-inch, or industrial VHS decks and time code equipment next to every Mac and Atari. Music software companies are putting out products with more and more features for integrating music and effects with video. There's talk that the Audio Engineering Society (AES), an organization dedicated to the quality of sound production and reproduction, may merge some functions with the Society of Motion Picture and Television Engineers.

The aspirations of the next generation of musicians have changed as well. Young composers don't dream about writing hit records any more; they salivate at the thought of scoring an Arnold Schwarzenegger film or a Chevy commercial. Teenage wannabe rock-n-roll heroes don't lust for the thrill of playing Madison Square Garden as much as they want to be able to pose—in waist-length hair, leather, and studs—on television. After all, the dominant medium for disseminating new music is no longer FM radio, it's MTV.

In a way, this is very exciting, as it means expanding markets for composers, arrangers, programmers, studios, players, and software and hardware manufacturers to come up with tools and product to feed that insatiable maw. And all the recent hoopla about multimedia may make us even busier, although a certain amount of consciousness-raising about audio will be necessary first. (Of some nine panel discussions on multimedia at the recent MacWorld Expo, not one had a participant from the world of music.)

But there is another side to what's going on, which is that the music industry is in danger of becoming merely a subsidiary of the film and video industry. That means music for music's sake is in grave danger of becoming passé.

While audio can go a long way to enhance the effect of a visual image (even the producers of silent movies knew this, which is why every theater had an organist or piano player), the reverse is not necessarily true. Sound is a more primitive sense than sight, and it forces us to use our imagination and emotions more. While a movie garners pretty much the same reaction every time you see it, a musical passage can conjure up an entirely new flood of images each time you hear it. Therefore, music by itself is effective over a longer period of time, while in order to keep an audience stimulated, images constantly must be replaced. Of course, when the images are replaced, the music accompanying them gets thrown away, too.

For me, listening to a CD of Jefferson Airplane's *Crown of Creation* is a far more profound experience than seeing *The Godfather*. The movie puts me into Coppola's brilliantly crafted reality for three hours, but the album plunges me into my *own* reality, filled with everything I did, saw, or thought in all of 1968.

This is why we buy records but rent videos. Listening to music is a far more participatory activity than watching a film or video. As a friend of mine puts it, "When you watch TV, there's no 'you' in there, there's only 'them'."

So, while we can celebrate the great audio mixes on Arsenio Hall's show and revel in the heightened sense of realism a stereo broadcast gives to an NFL game, let us not forget that music and sound, all by themselves, are powerful communicators. Music for its own sake must survive, or we will be much poorer people. Now that the marriage of audio and video, predicted and written about for many years, has been achieved, we cannot let that blessed union deteriorate into a lopsided relationship in which one spouse exists only to serve the other.

Paul D. Lehrman *has been an audio journalist for thirteen years. He writes film scores, music to accompany storytellers, instruction manuals, and books, and he teaches at the University of Lowell.*

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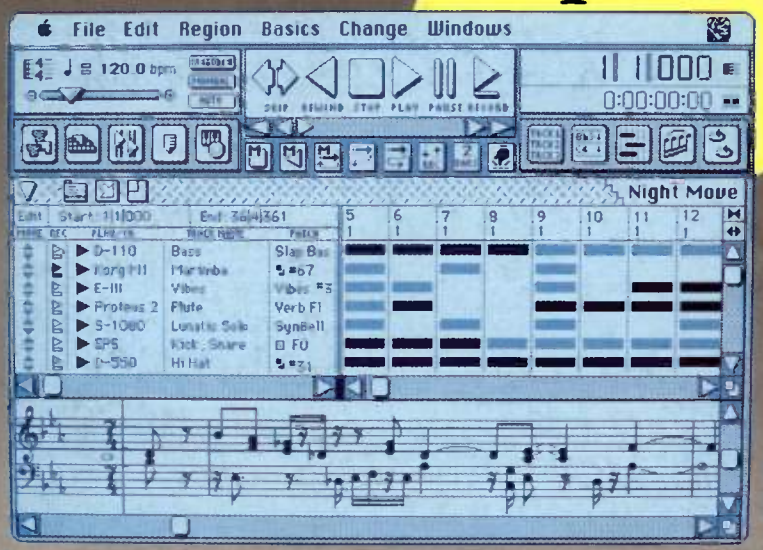

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