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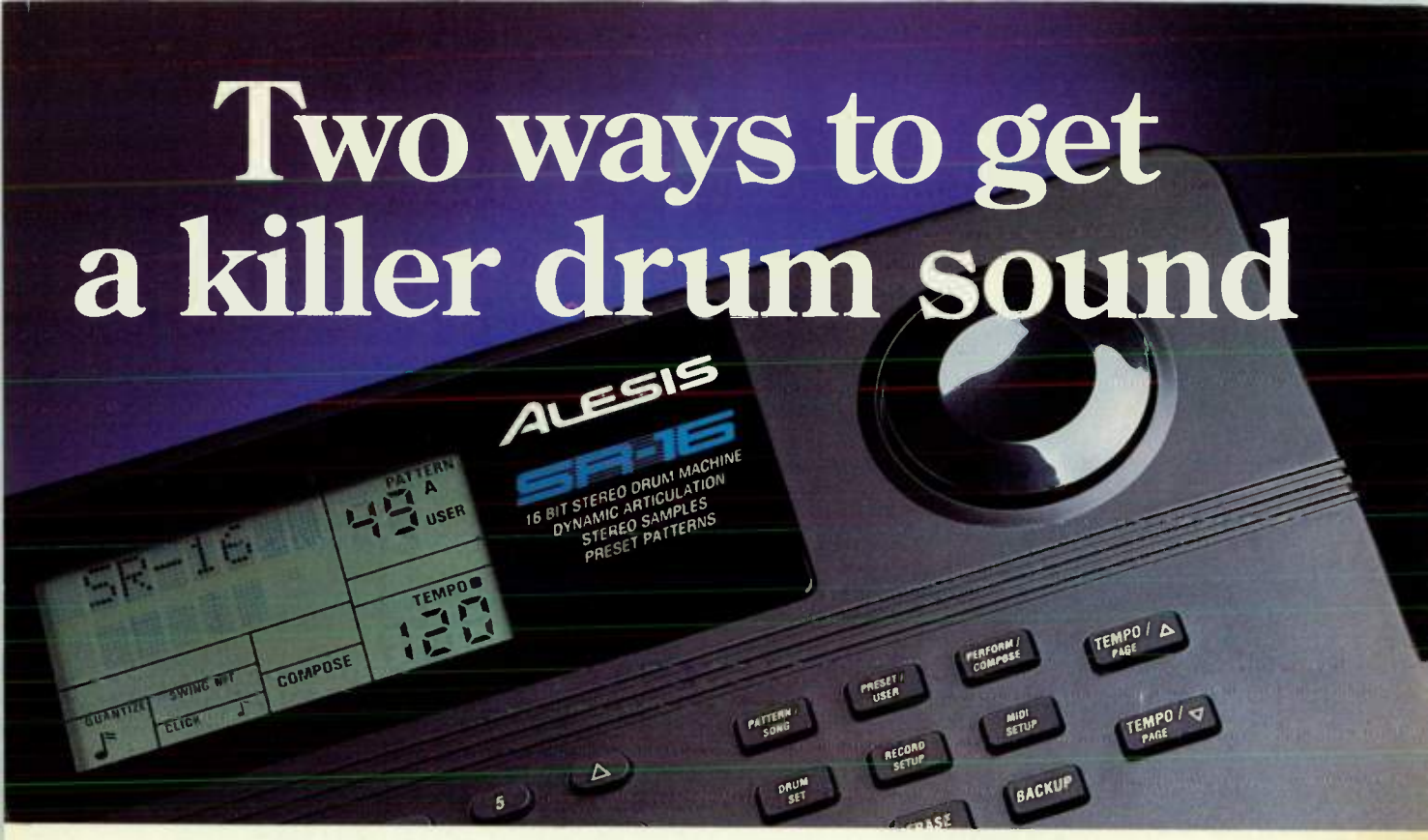

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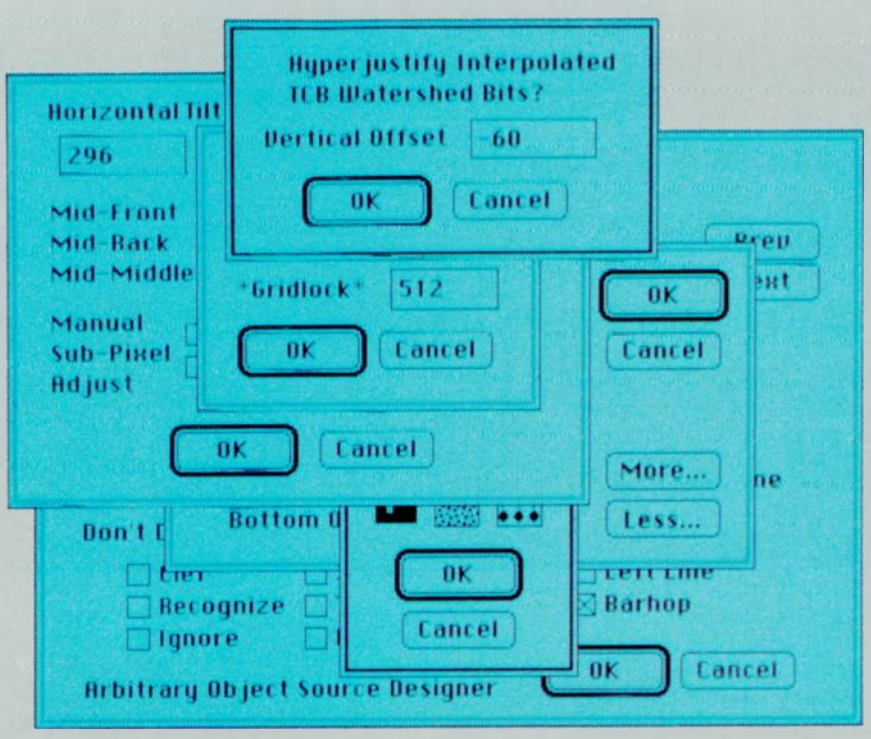

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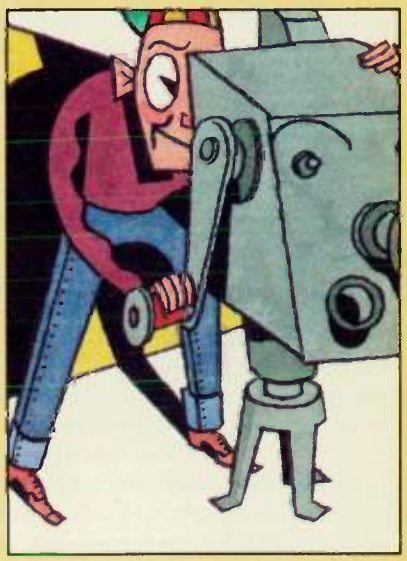

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Cover: Photo by Peter Diggs.

Hard-Disk Recording: Ready for Prime Time?

Digital recording systems offer amazing potential, if you can afford the ante.

ANNE HAMERSKY

Like the music industry, the electronic musical instrument industry often is affected by trends. Over the years, we've been through several periods where one technology has weighed heavily on the minds and lips of musicians and industry folk alike; FM synthesis, sampling, and sample playback come to mind. Now, we're on the verge of an even larger movement. This one promises to revolutionize all types of recording in the same way that MIDI transformed the process of using synthesizers.

I'm referring, of course, to hard-disk recording.

The technology that allows digital recording straight to a mass-storage device is not new. Indeed, several companies have made a good living selling these systems to professionals for over three years. But what is changing is the interest among regular folks: part-time pros, dedicated semi-pros, and even newcomers to electronic music. Musicians of all levels are clamoring for more information and more products. And who can blame them? Hard disk-based systems promise the ability to manipulate analog audio signals in the same way that sequencers let you mold MIDI data to your heart's content.

Manufacturers are responding to this interest. It seems more hard-disk recording systems debut at trade shows than any other type of product. At the recent Frankfurt Musik Messe (see this month's "What's New," on p. 12), Yamaha joined the fray with its CBX-D5, as did Anatek with RADAR. At the AES convention in Vienna two weeks later, more companies threw their hats into the high end of the market. Keeping track of them all is almost impossible.

But is all this interest really justified yet, particularly for those on a limited budget? Let's look at the facts. To get started in hard-disk recording, you need a fairly powerful computer to process the data and shuttle it around—either a mainstream model for card-based systems, or the computer hidden inside the guts of stand-alone systems; A/D and D/A converters; the required software (which may or may not be included with the hardware); and a very large hard drive.

Just how large should this hard drive be? Let's say you want to record three 4-minute demos with four tracks per song, assuming the system can support four tracks. At a little over 5 MB per track-minute of audio, that's nearly 250 MB. Some systems require even more space if you want to perform large-scale editing. If you have more ambitious plans, such as an entire CD's worth of music, you'll quickly be in the gigabyte range. On top of that, if you ever want to record anything else on that disk, you'll need to invest in some type of backup system, probably a SCSI DAT drive, or at least a DAT recorder with digital I/O, if you have the appropriate software.

Once you've made those investments, you need to worry about the rest of your audio system. Digital recording's greatest virtue—lack of noise—quickly turns into its greatest vice if you've got some gear whose audio specs aren't up to snuff. (If you listen critically, you'll find a lot of hi-tech stuff is noisy.) Mixers, in particular, reveal their weakest side when connected to digital recorders. Also, if you're working with a computer-based system, you may to have to deal with difficult hum and grounding problems caused by the plug-in board's interaction with the computer and mixing board.

Am I recommending against buying a hard-disk recording system? Absolutely not. I think hard-disk recording systems are an amazing development that completely justify their current prices. But if you're thinking about making the move to digital, it's important to know the cost. It may be more than you think.

Bob O'Donnell

Electronic Musician

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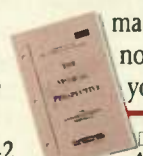

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LETTERS

ORCHESTRAL SYNTHOPHOBIA

This is in response to your April 1992 "Back Page" by Jack Jarrett. I agree 100% with Mr. Jarrett's concerns and his proposals. However, he raises an issue that has plagued electronic synthesis since its inception: Traditional instrumentalists have always been against synthesizers imitating real instruments. Given the technology of modern synthesizers, it is apparent that the manufacturers can build the type of instruments Mr. Jarrett proposes, but they seem to keep in mind the backlash from the 1970s over synthesizers replacing real musicians. Once a synthesizer that can imitate orchestral instruments is produced, traditionalists and musician's unions will resume their usual complaints.

Paris E. Kelley
Chicago, IL

Paris—Actually, current synthesizers and samplers can re-create the sound of orchestral instruments quite well. Sure, some union traditionalists don't like this fact, but the manufacturers are more interested in whether a dedicated orchestral-instrument synth will sell. At this point, musicians of many stripes use orchestral instruments, and the number of electronics-savvy classical musicians has increased, so E-mu created the Proteus/2. But most manufacturers apparently haven't felt enough people would buy an orchestral instrument of the type Mr. Jarrett described.—Bob O'D and Steve O.

MUSIC BOXES

Overall you did a fine job comparing different computer platforms ("Music Boxes, March 1992), but there are a couple of misleading statements.

First, the only computer of the top four (IBM, Mac, Atari, and Amiga) that can truly multitask is the Amiga. And as far as system support is concerned, the Amiga had no need to address MIDI and synchronized audio specifically, since it's been there from the beginning via its dedicated chips for multitasking.

You stated that Macintosh is the only platform that allows sophisticated data-sharing on the system level. Many programs offer this ability on the Amiga, in music and especially in multimedia. The only computer that you can make an MTV video on, both audio and visual, without another computer, is the Amiga. When it comes to video and multimedia, the Amiga is head and shoulders above the Mac or any other computer.

Other points: When it comes to color, the Amiga has them all beat right out of the box with 4,096 colors to start with, and it can use just about any monitor, digital or analog. And what about the built-in NTSC signal and the PAL option? These are critical points if your readers are interested in multimedia.

The Amiga is not limited to 32 MIDI channels; Blue Ribbon SoundWorks offers 48 and supports Serial Solutions, by Check Point Technologies, which offers 72. Sample-playback boards? Check out Beta Unlimited or Sunrize Industries. And, to sum it up, the ST and PC aren't any closer to Mac when it comes to software integrating MIDI and digital audio, nor are the Mac, PC, and ST the only choices for hard-disk recording. These also are now available on the Amiga.

Adam Strange
N. Hollywood, CA

Adam—With all due respect to the Amiga, many of the capabilities that originally made the Amiga a superior technological solution have been equalled or surpassed on other computer platforms. Other computers can perform true multitasking. High-resolution, 256-color output for everyday use (as opposed to a special low-res mode with more colors) is standard on most color PCs and Macs. The ability to use other monitors is common, too. The Amiga's multitasking does offer benefits to application developers that make it easier to run sophisticated multimedia applications together, such as animation and sequencers. Synchronizing these types of programs, however, requires a custom solution from the two companies; there is no system-level standard for doing so.

With regard to your factual points, Blue Ribbon SoundWorks recently released a MIDI interface that supports 48 channels, but Check Point Technologies is no longer in business. Also, Beta Unlimited is not yet shipping their audio board, nor is Sunrize Industries' originally promised 16-bit audio board with DSP ready yet. Sunrize does have a 12-bit mono board (mentioned in the August 1991 "What's New"), and a different stereo, 16-bit board is expected soon. Both boards will work with Blue Ribbon's Bars&Pipes Pro *sequencer for integrated MIDI and hard-disk recording, thanks to a new piece of free software from Blue Ribbon.—Bob O'D*

Your article "Music Boxes" was informative. However, we were disappointed that two references regarding available MIDI software for the PC failed to mention that Passport has been supporting *Windows* for some time. *Master Tracks Pro* and *Trax* for *Windows* have been available since fall of 1990, with upgrades to *Windows 3.0* in 1991. Both of these programs use a graphical user interface and are ported from the Macintosh to the *Windows* environment. In fact, *Master Tracks Pro* just received *Windows* magazine's "Win-Award," presented to the top 100 *Windows* products of the year.

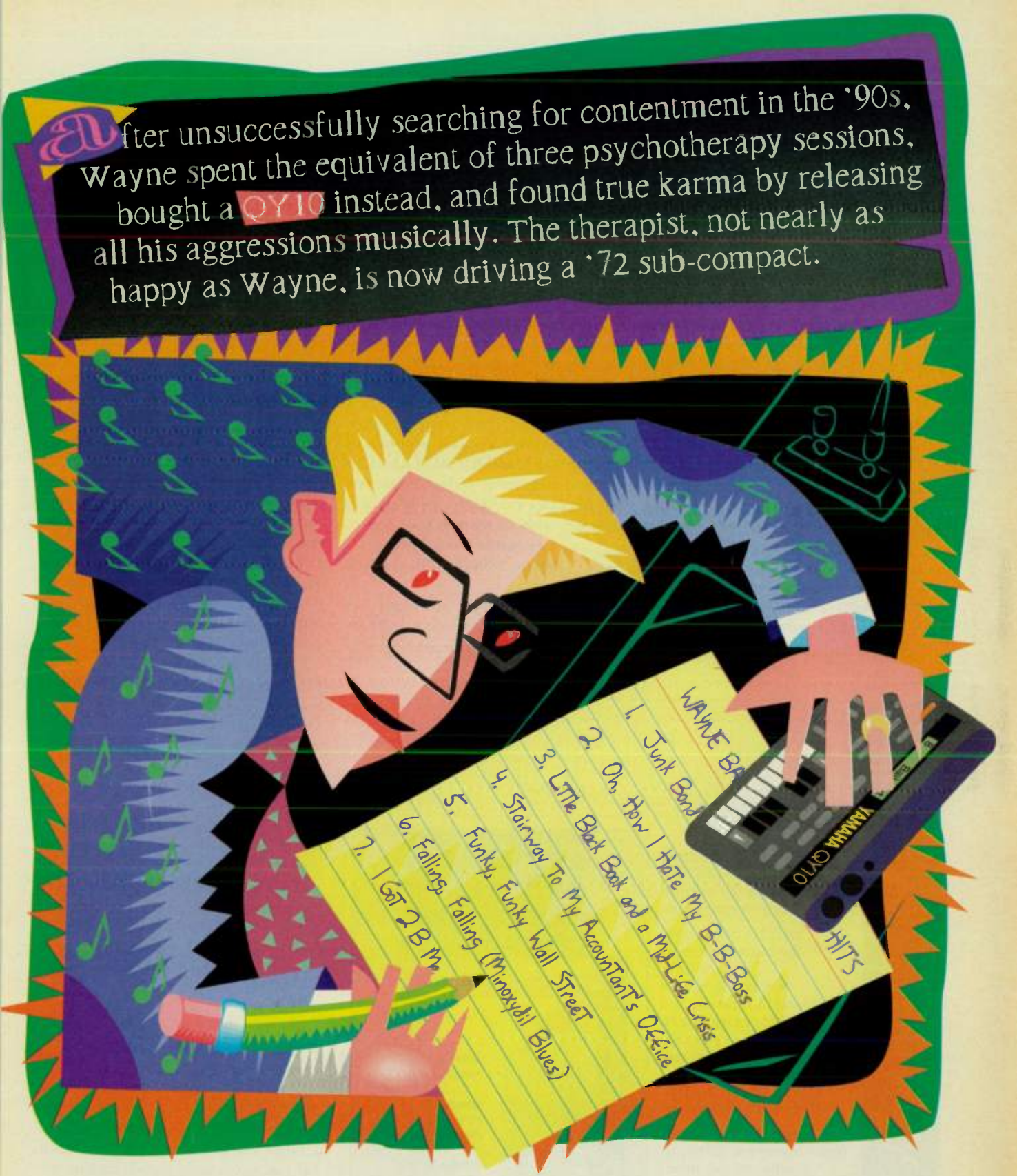
EM is an excellent resource for information on MIDI products, and we rely on you to keep readers informed about our products.

Anastasia Lanier
Passport Designs
Half Moon Bay, CA

I enjoyed your article about computers. Which companies have announced products for the Mac that allow hard-disk recording and editing via the SCSI ports and off-load all processing to an external box?

SUSAN GROSS

After unsuccessfully searching for contentment in the '90s, Wayne spent the equivalent of three psychotherapy sessions, bought a QY10 instead, and found true karma by releasing all his aggressions musically. The therapist, not nearly as happy as Wayne, is now driving a '72 sub-compact.



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I have a Mac with a NuBus slot and some DATs I would like to edit without getting Sound Tools. It would be great to use a PowerBook 170 this way, together with a big hard disk.

Stephen Bezruchka
Seattle, WA

Stephen—The companies that have announced such systems are Plasmec Systems (distributed in the U.S. by Digital I/O; tel. [310] 398-3993) and Digital Expressions (tel. [206] 389-9895). Also check out this month's "What's New" report on the Frankfurt Musik Messe to hear about Yamaha's new offering.—Bob O'D.

FROM THE DEAD LETTER FILE

Your article on the Grateful Dead's MIDI monitoring systems ("Working Musician," March 1992) was a real eye-opener. The system the Dead are using, with Mark of the Unicorn 7s mixers and the FaderMaster, is excellent. The way it is all tied together using the MIDI Time Piece and Mac makes for an almost optimal system.

You state that there is no way in the current system for the data changes made by the monitor engineer to be reflected back on stage to the performer. Here's a thought: an inexpensive MIDI splitter or Y-cord inserted between each channel out of the MIDI Time Piece and the MOTU 7s. Then take one of the split signals and route it to a laptop PC at each musician's station. This may or may not require more Lone Wolf Fiber Links and more optical cable; I am not familiar with the ins and outs of that piece of equipment.

While buying four additional laptop PCs isn't cheap, we are talking about the stage budget of the Grateful Dead. (Also, the PCs need not be the latest state-of-the-art techno-gizmo, as they would be running a simple program to recognize the incoming MIDI data and display it as graphic sliders.) The system they have now is dream food to a composer without a budget.

Lawrence Benzmiller
Wake Village, TX

Larry the O responds: *Your suggestion seems like it would work, but it might be difficult and distracting for the musicians in the Dead to try and see the display of a laptop computer in the highly contrasted light conditions they experience onstage (bright lights in their faces, relative darkness at their amps). It does seem feasible, however, to concoct some sort of highly visible display, perhaps employing large LED ladders, to give the feedback that you suggest. There are still pesky problems to overcome, though, such as what to do when the fader is at an extreme of its physical travel and further adjustment is still needed. My impression is that the whole system is an advance in that it allows the musicians some level of control, but is still less than perfect.*

FINGER DRUM

I was fascinated by Charles Fisher's article in **EM**'s March 1992 issue ("DIY: Build the EM Finger Drum"). I never knew how simple it was to build triggers.

Despite my fascination, however, I did not build myself a FingerDrum because I don't have a trigger-to-MIDI interface. Those things are just too expensive. If I had one, I would only use it to spice-up once-in-a-blue-moon live performances (with drum pads).

How about showing readers like me how to build a trigger-to-MIDI interface? Something simple would be wonderful: One channel, eight trigger jacks, each trigger permanently set to C1 thru C8.

John Lee, Jr.
Cupertino, CA

John—PAiA Electronics (tel. [405] 340-6300) sells FingerDrum kits with an optional trigger-to-MIDI converter card. The complete kit, with converter, lists for $179, plus shipping. You also could opt for an Alesis D4 drum module (reviewed in the February 1992 issue), which includes over 500 drum sounds, twelve trigger inputs, and trigger-to-MIDI conversion. At $399 list, it might fit in your budget.—Steve O.

DEFENDING DIGITECH

I would like to comment on Michael Molenda's review of the DigiTech DSP-256XL (March 1992).

High marks were given to the unit for raw processing power and incomparable user-friendliness. Yet low marks were given for factory presets. Factory presets could be compared to salt and pepper. Some like more, others prefer less. This is one's personal taste. This said, it would seem that having 256 programs (128 factory plus 128 user-pro-

grammable) available to the most persistent tweaker is the best of both worlds. This number of presets is better than double the amount available in units costing far more.

Also, to suggest that the GSP-7 would be a more cost-effective alternative to the DSP-256XL is clearly a case of not qualifying the customer. The DSP-256XL is a studio-quality, multi-effect digital signal processor, hence the name DSP. Mr. Molenda is correct when he states that the GSP-7, or for that matter the GSP 21 Pro, would be a more cost-effective purchase, especially if you're a guitar player. With five distortions plus nineteen other guitar effects, these units were solely created for guitar.

Add to this the fact that all parameters are MIDI-controllable, the LCD simultaneously displays the program name and effect configuration, and the unit features programmable individual outputs mix and balanced inputs and outputs. The DigiTech R & D team is clearly right on the mark, delivering a formidable unit at an affordable price.

Matt Mello
Rehoboth MA

Matt—I agree that the DSP-256XL is a great processor for the price, and I supported this assessment in my review. My misgivings regarding the presets were directed at sound quality, not quantity. Many purchasers of affordable signal processors never venture beyond factory presets. While it's no sin to rely solely on the DSP-256XL's presets, it is my duty to inform users that the best sounds are not necessarily the ones provided by the manufacturer. Also, keep in mind that creative signal processing knows no borders. I don't limit applications by categorizing effects as guitar- or studio-oriented. For example, producers often use amp simulators and/or distortion to "warm-up" synthesizer tracks during mixdowns. Unfettered applications embrace the "more for the money" axiom, which is why I proposed the GSP-7 alternative.—MM.

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1992 Frankfurt Musik Messe

Our European friends pondered prototype hard-disk recorders and viewed a variety of synths, drum modules, and software.

The Frankfurt Messe is an awe-inspiring site. Its landmark tower and fifteen large convention halls play host to several enormous gatherings, including the world's largest musical-instrument trade show, the Musik Messe. Because it usually falls less than two months after the Anaheim NAMM Convention, however, its importance for new product introductions doesn't always match its size. This year's Fair broke that tradition, with several manufacturers offering impressive new products. The Musik Messe is a European show, so some products displayed may not be available in the U.S., and their features and prices could vary.

Yamaha SY85 Synthesizer

DIGITAL RECORDING

Yamaha (tel. [714] 522-9011) made the biggest splash at the show with the "technical preview" of their **CBX-D5 4-track hard-disk recording system** (no price yet). The CBX packages analog and digital inputs and outputs, level meters, and SCSI connectors into a 3-rackspace box. It functions as a computer peripheral, sparing the host computer from the demanding task of processing digital audio. Because the computer simply sends commands to the CBX, the system can be run from less-powerful computers, such as the Atari ST or Mac Classic II. It's designed to be used with sequencing software that combines MIDI and digital audio and initially will be supported by Mark of the Unicorn's *Digital Performer* on the Macintosh and Steinberg's *Cubase Audio* on the ST. All recording and editing functions, including visual waveform displays, will be available from within these sequencers. The CBX can record only two tracks at once, but can play back four tracks. Available I/O ports include balanced analog, AES/EBU, CD/DAT, Yamaha's proprietary Y2 format, and digital word-clock input and output. The box's DEQ chips function as multiband parametric equalizers for each track, and a DSP adds reverb, chorus, and other effects to the digital audio, all within the digital domain. Yamaha hopes to offer the system by this fall.

The other new hard-disk recording system on display was an early prototype of the Anatek **RADAR** (no price yet; tel. [604] 980-6850). RADAR is a 3U rack-mount, 24-track, hard-disk recording system with a built-in DAT drive for mastering or backup. The entry-level system offers eight tracks on a single 660 MB hard drive, but a 24-track system can be built by adding two drives and more Anatek hardware. The unit offers balanced and unbalanced analog inputs and outputs and includes a multifunction remote control. RADAR responds to MIDI Machine Control messages and can be connected to Macs and PCs via SCSI and RS-422 ports.

SYNTHS

Yamaha unveiled several new synths at Frankfurt, including the **SY85** AWM synth and the **SY35** vector synth (no prices), which replaces the SY22. The SY85 offers 6 MB of 16-bit AWM2 samples, 512K of sample RAM (expandable to 3.5 MB), and all the digital filtering and effects processing of its SY predecessors, but it lacks FM. The 30-voice instrument also offers a 9-track sequencer, disk drive, and eight sliders for real-time parameter control or sequencer mixdown. The SY35 offers 128 AWM samples and 256 preset FM sounds that can be combined into a 4-Element Voice under the control of 50-step pitch and amplitude vectors. The 16-voice instrument offers sixteen built-in effects and can perform eight multitimbral parts. The **TG500** (no price) is a 1U rack-mount synth module with 8 MB of 16-bit ROM sounds, room for 1 MB of waveform RAM, 64-note polyphony, and the same programmable effects as in the company's SY99 synth.

One of the show's more pleasant surprises was Italian manufacturer General Music's new **Bachmann S2** (approx. $3,000) and **S3** (approx. $3,500) synths, distributed in the U.S. by GeneralMusic Corp (tel. [708] 766-7230). The 32-voice, 16-part multitimbral, sample-playback-based instruments provide digital filtering and onboard effects processing via two DSP chips. It can perform any operations, including sample-loading, in real time. Both synths offer a 16-track sequencer with 192 ppqn resolution; memory for 250,000 events; a built-in, 1.4 MB floppy-disk drive; and a 240 × 64, backlit display. The instruments also offer six polyphonic outputs, seven programmable sliders for real-time timbral control, 6 MB of 16-bit ROM, and 2 MB of

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sample RAM. Two sets of MIDI Ins and Outs allow MIDI merging and control over 32 independent MIDI channels. The S2 offers a 61-key keyboard, and the S3 has 76 keys. Both instruments generate polyphonic aftertouch and can support sixteen splits or layers.

Great Britain's Cheetah introduced the **Zeus** ($4,999), a 12-part multitimbral, digitally controlled, analog synth with real knobs, Curtis filter chips, portamento, an arpeggiator, and a stereo effects processor. The Zeus offers a total of 24 oscillators and can be used in 24-voice polyphonic mode, but it is designed to be a 12-voice synth with two oscillators per voice. It has 144 envelopes and 144 LFOs—twelve per voice in 12-voice mode—and includes eight independent polyphonic outputs in addition to the stereo outs. Cheetah also introduced the **MS800 Sampled Wave Synthesizer** ($399), a half-rackspace expander module. The 15-voice polyphonic, 16-part multitimbral, wave-sequencing synth is programmable from the front panel or via SysEx. Finally, the company showed the **Master Series 550 MIDI Controller Keyboard** ($849). The MS-550 offers 61 synth-action keys, but otherwise has all the functions of the 88-key, weighted-action MS770, including eight non-overlapping zones, each assignable to any of four independent MIDI outs, with four layers per zone. Controller assignments, velocity and aftertouch curves, and channel assignments are independent for each layer. Cheetah (tel. 011 44 [222] 867777) currently is setting up a new U.S. distribution network.

Over in the Waldorf booth (distributed in the U.S. by Russ Jones Marketing Group; tel. [818] 993-4091) resided **The Wave** (approx. $7,500), a wavetable-based instrument using an advanced version of the company's MicroWave technology. The Wave includes the equivalent of two MicroWaves for 16-voice polyphony and can be expanded up to 48 voices. The instrument allows you to create and edit your own wavetables and can extract wavetable spectra from sampled sounds. It also offers dedicated knobs and sliders for all parameters; a built-in, PC-compatible disk drive; eight programmable sliders; and the largest display on any musical instrument. Waldorf also showed the **Miniworks EQ-27** (approx. $325), a MIDI-controllable, stereo 7-band EQ.

DRUM MODULES

Cheetah also showed the **MD16RP Drum Module** ($849), an 8-voice, rackmount module with eight audio outputs and eight trigger inputs. The MD16RP features 700 16-bit sounds stored in 8 MB of ROM, all of which can be dynamically panned, tuned, and reversed. The unit has all the pattern and song-programming functions of a stand-alone drum machine but lacks drum pads; patterns can be played from the front-panel buttons, via the trigger inputs, or over MIDI. To complement this and their existing MD16 drum machine, the company debuted three new drum-sound cartridges: **Electro Kit** ($149), with analog drum machine and other electronic sounds; **Total Percussion +** ($249), with a variety of Latin and ethnic percussion; and **KSTH** ($249), with more kicks, snares, toms, and hi-hats, including octobans and rototoms.

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Craig Anderton, Sound on Sound

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Jim Aikin, Keyboard

"...logical and intuitive...a real powerhouse for the 90's."
George Petersen, MIX

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Scott Wilkinson, Electronic Musician

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Power Trio

Vision

Opcode's Vision and Studio Vision® are the premier sequencers for the Macintosh computer, and are used by professionals on today's top albums, film scores, and TV commercials. Version 1.4 features *revolutionary* real time editing of MIDI and digital audio, on-screen control of audio and video tape transport controls, input quantize, SMPTE locked markers, drum machine-style loop record/editing, auto locate, fast forward and rewind/shuttle, and more.

MIDI for the '90s: powered by the same kind of microprocessor as your Mac, the Studio 5 has more MIDI interface channels (240), more merging, more RAM patches (128), more processing, more live performance features, and more SMPTE synchronization configurations than any other interface available. And visionary software, OMS (Opcode MIDI System), ties it all together: create your custom OMS studio setup so Vision and Galaxy know what your MIDI connections are, and display your devices by name. You can forget about keeping track of all those cables—OMS does it for you. Version 1.2 with networking of multiple Studio 5 interfaces is the most *integrated* system at any price.

"The Studio 5 is a true monster... its immense processing power and ultra-hip Macintosh user interface sets a new standard of excellence."
Keyboard Magazine

Studio 5 Award Nominations:

"Hardware Innovation of the Year"
Keyboard Magazine

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MacUser Magazine

Studios everywhere use and depend on the standard of Opcode patch librarian and editing software. For the first time anywhere, Galaxy Plus Editors offers an integrated package of universal librarian with compatibility for over 140 synths, effects, mixers, modules and *comprehensive* editors for over 50 of them—and we're always adding new ones. Galaxy—The Universal Librarian is also available. Version 1.2 adds a Find command for databasing and searching sounds, plus the Yamaha SY77/TG77 editor.

OPCODE
SYSTEMS INC

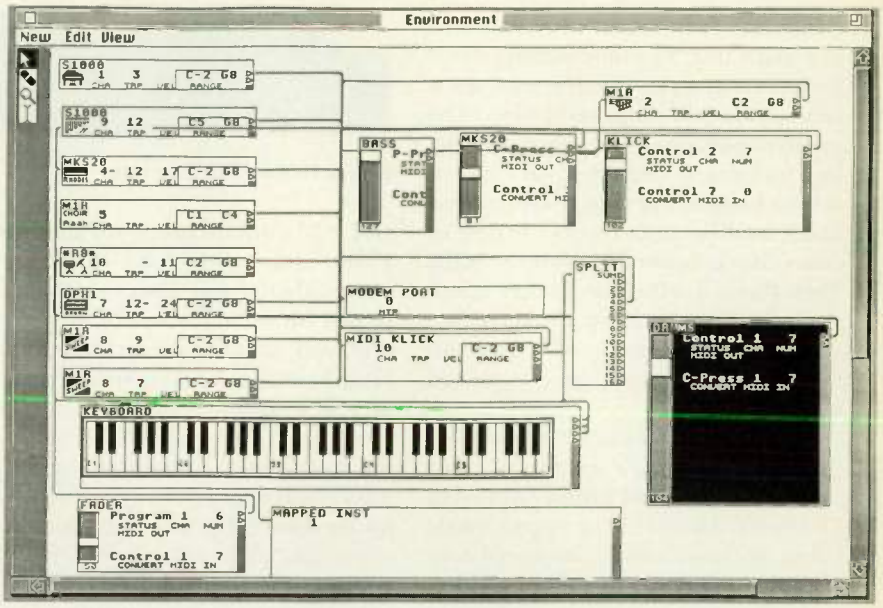
Opcode Systems, Inc. 3641 Haven, Suite A Menlo Park, CA 94025-1010 (415) 369-8131 FAX (415) 369-1747

Yamaha's **RM50** drum module is a 16-voice, 1U rack-mount unit with six individual outputs, stereo outputs, and six trigger inputs. The unit features 500 preset sounds (each with a variation), organized into 64 drum kits, and includes room for 100 user sounds and 64 more user kits. The instrument offers the digital filtering options of the RY30 drum machine and can read waveform cards for the RY30, SY55, and SY77. In addition to the three waveform card slots, the unit can hold an optional 512K of battery-backed user sample RAM.

SOFTWARE

In the world of software, the Atari ST still reigns supreme in Germany and several other European countries. But more affordable Apple Macintoshes and IBM PC-compatibles are eroding its top position.

Underscoring this point was the new Mac software from long-time Atari stalwarts C-Lab (distributed in the U.S. by Ensoniq; tel. [215] 647-3930). In addition to announcing Macintosh versions of their *Aura* ear-training and *MIDIA* MIDI-analysis programs ($149 and $99, respectively), the company debuted *Notator Logic* ($699), a powerful new Mac sequencer that incorporates many elements from the company's *Notator* sequencing/notation program for the ST but is not a Mac version of that program. *Notator Logic* allows you to define the elements of your studio as objects and select from those objects when recording and editing tracks. Its unique features include the ability to combine



C-Lab *Notator Logic* for the Macintosh

tracks into folders that can be treated as a single unit; real-time editing; direct links between sequencing and notation; and a 960 ppqn resolution. The notation portion of the program allows an unlimited number of staves, includes sophisticated page-layout functions, and permits direct editing of notes. The program supports the MIDI Time Piece, Studio 5, and other standard interfaces and is copy-protected via a hardware key on the ADB line. An ST version of *Notator Logic* is expected in the fall.

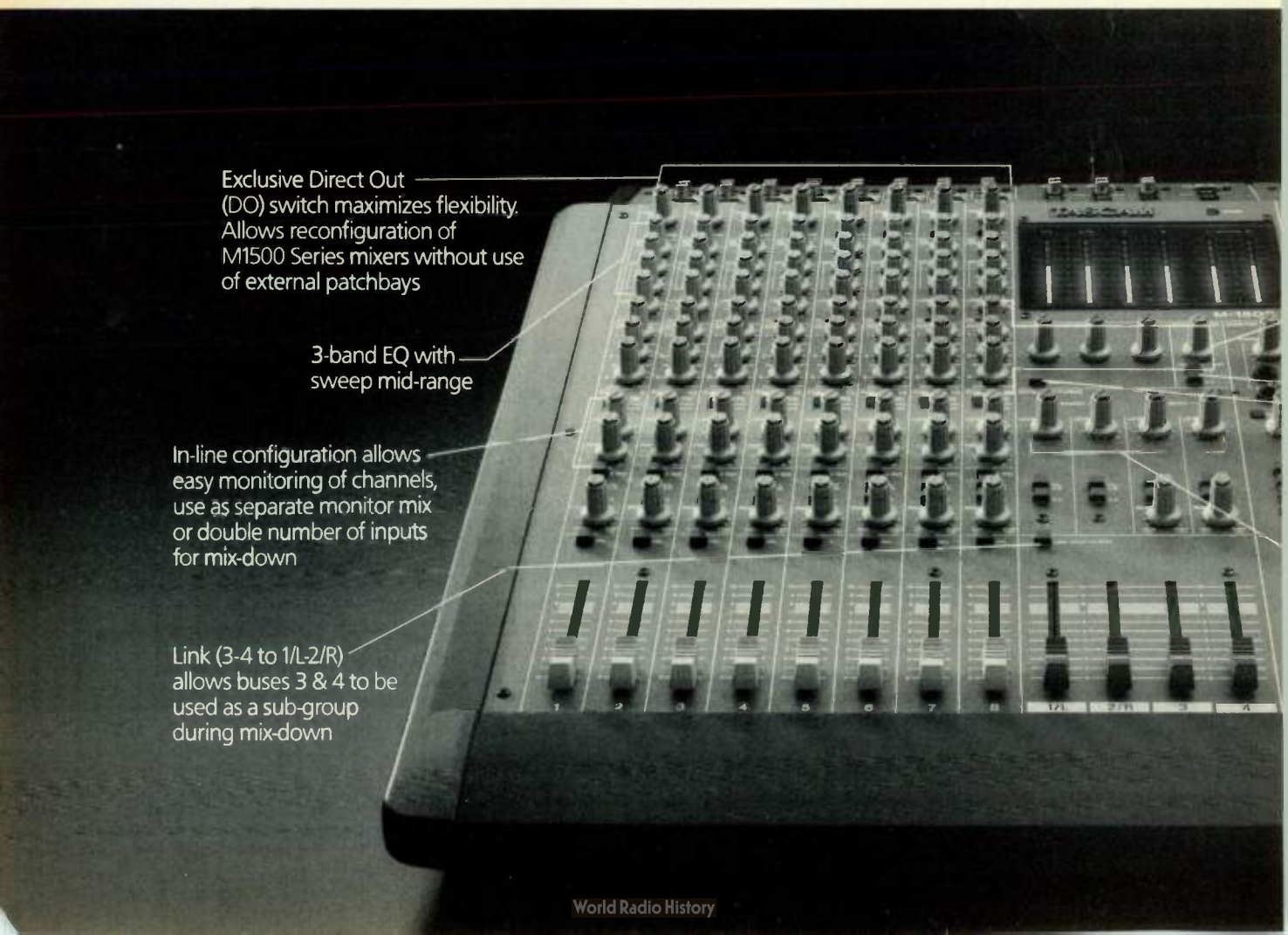
C-Lab also announced ***MonoFrame*** ($199), a lower-cost version of their *PolyFrame* universal editor/librarian for the ST. *MonoFrame* includes a single editor of choice and the universal driver for creating editors of your own.

Steinberg (tel. [818] 993-4091) announced a host of new Atari products. ***Cubase 3.0*** adds a complete notation-editing system, including page-layout functions; doubles the resolution to 384 ppqn; and adds Atari TT compatibility. The program now has a modular structure, allowing you to run it on computers with only 1 MB of memory and add functionality via modules. Three optional modules ($149 each) are available: ***Cue Trax***, which is designed for film composers and others who work with cue points; ***Style Trax***, a programmable accompaniment module; and ***Studio Module***, a universal librarian. ***Cubase Lite*** ($150) is a 12-track version that maintains some of 3.0's notation features. ***Cubase Audio for the Atari*** offers the same functionality as the previously announced Mac version, in conjunction with Yamaha's CBX-D5 hard-disk recording system. ***Masterscore II 2.0*** ($434) adds more sophisticated notation options and the ability to input scores via Standard MIDI Files, step-time, Quickstep, and ASCII command-line to the company's dedicated notation package. ***Synthworks SQ*** ($159) is a dedicated editor/librarian for the Ensoniq SQ series, and ***Panel Partner*** ($399) is a front-panel editor for the Akai S1000 and S1100 samplers. Finally, ***Tango*** ($399) is a MIDI-based, interactive, music-generation program that analyzes a melody you perform into it and creates up to six independent parts.

Opcode Studio 4 MIDI Interface

On the hardware front, Steinberg announced the **PC MIDI Board**, a simple, MPU-compatible, PC MIDI interface. The company also unveiled two Mac interfaces: the 1-in, 3-out **Mac MIDI 1** and 2-in, 6-out **Mac MIDI 2S**. (The latter has a SMPTE generator/reader.) Prices were not announced. The company also introduced the **SMP II** ($1,295), a 2-in, 4-out, rack-mount interface for the Atari ST and PC compatibles that offers a time-code generator/reader and a large SMPTE-time display.

Across the aisle, **Opcode** (tel. [415]



369-8131) displayed the **Studio 4** ($495), an 8-in, 8-out, Mac MIDI interface with SMPTE generator/reader. The single-rackspace unit comes with a special version of *OMS* software that allows it to filter, channelize, map, and modify MIDI messages within the Macintosh.

MIXERS AND CONTROLLERS

Fostex (tel. [213] 921-1112) demonstrated the single-rackspace **DCM1000 MIDI-controlled mixer** and companion **Mix Tablet MIDI controller** (under $1,000). The DCM1000 offers eight stereo inputs, 2-band fixed EQ, two stereo aux sends and returns, and a stereo bus input for combining multiple units. The fader- and knob-equipped Mix Tablet acts as a hardware controller for the mixer, storing up to 99 snapshots and using SysEx to control the DCM in real time.

BACK IN THE USA

While the products shown in Frankfurt may arrive at American and Canadian stores in the near future, plenty of cool new stuff already is here. The rest of this month's products were displayed in January at the NAMM show.

SYNTH CARDS/MIDI INTERFACES

Roland introduced the **SCC-1** ($499), a Sound Canvas and MPU-401-compatible MIDI interface on a PC card. Like the Sound Canvas, the SCC-1 includes 317 preset sounds and effects and built-in reverb and chorus. The card also offers stereo RCA and headphone outputs, and two mini-MIDI jacks with adapter cables to connect to regular MIDI gear. The SCC-1 conforms to Roland's GS standard and is MPC-401-compatible. Roland also introduced an enhanced version of its MPU-401 PC MIDI interface, the **Super MPU/AT** ($295), which offers two independent MIDI inputs and outputs for 32-channel operation, a SMPTE reader/generator, built-in MIDI processing, and hardware timing resolution of up to 960 ppqn.

Roland Corporation
7200 Dominion Circle
Los Angeles, CA 90040-3647
tel. (213) 685-5141

Key Electronics introduced a pair of new external MIDI interfaces for PC-compatibles. The **MIDIATOR MS-124** ($179), which replaces the MS-103, is a serial interface that offers one input and four independent MIDI outputs, for up to 64 MIDI channels. The **MIDIATOR MP-128** ($199) is a parallel interface that offers eight independent outputs. The MP-128 is intended to be used along with another interface, so a MIDI input is optional ($60).

Key Electronics
7515 Chapel Ave.
Fort Worth, TX 76116
tel. (800) 533-6434
or (817) 560-1912

Music Quest is shipping two new interfaces with SMPTE support: the **MIDI Engine Array** ($499) and the **MIDI Engine Laptop** ($199). The Array consists of an ISA card for any PC and a rack-mount hardware box with eight independent MIDI inputs and outputs for 128 MIDI channels, sync in/out, a metronome out, and a video input for genlocking the generated SMPTE to video. The Array offers MIDI process-

ing and hardware timing resolution up to 1,440 ppqn. The Laptop version offers similar capabilities (except for the genlock) in a stand-alone, 2-in, 2-out box.

Music Quest
1700 Alma Dr., Suite 260
Plano, TX 75075
tel. (800) 876-1376
or (214) 881-7408

MIDIMAN showed a new PC interface, the **MM-401** ($99), an MPU-401 compatible card that includes a generic system-exclusive archiver and other utility software. The company also displayed two MIDI interfaces for the Macintosh. The **Mac SyncMan** ($324) is a 2-in, 6-out interface that supports SMPTE, DTL, Smart FSK, and SMPTE regeneration. **MacMan** ($99) is a 1-in, 3-out interface with a serial through switch. Both units offer MIDI activity LEDs on the front panel.

MIDIMAN
30 N. Raymond Ave.,
Suite 505
Pasadena, CA 91103
tel. (818) 449-8838

ELECTRONIC PERCUSSION

KAT introduced several new percussion products. The **drumKAT EZ** ($799) is a simplified version of the drumKAT and uses the same 10-pad control surface. The biggest difference is that there are fewer programming parameters, and the device includes preprogrammed setups for most popular drum machines and MIDI sound modules. The pad controller has stereo trigger inputs, 3-note dynamic layering (crossfaded layers controlled by the player's dynamics), real-time hi-hat control, three inputs for mallet expanders, and footpedal and breath-controller inputs. KAT also showed two new pedals. The **fatKAT** ($219) is a weighted, beater-less, self-contained trigger pedal with two 1/4-inch outputs that let you chain two or more pedals. It comes with Velcro and adjustable spikes for stability. The **hatKAT** ($259) is a hi-hat trigger pedal designed to work with the drumKAT or drumKAT EZ. The hatKAT simulates hi-hat playing, with open and closed settings, and offers a velocity-sensitive trigger for foot-closed sounds, a footswitch output to designate open and closed positions on a pad, and a Continuous Controller output to show foot position.

KAT
43 Meadow Rd.
Longmeadow, MA 01106
tel. (413) 594-7466

Spike ($99.95) is an electronic drum trigger made of piezo transducers in a rubber-coated polycarbonate cylinder. The cylinder is designed to mount on a T-bar (optional) and take up minimal space, leaving audience sightlines open. The rounded surface can be played with the drumstick's tip or shaft, from any angle. Spike also can be easily integrated into a regular drum kit, as its shape keeps it from interfering with the acoustic setup. According to manufacturer Latin Percussion, Inc. (LP Music Group), the isolation system virtually eliminates false triggering due to vibrations.

Latin Percussion Inc.
160 Belmont Ave.
Garfield, NJ 07026
tel. (201) 478-6903

MIDI FOOTSWITCHES

DigiTech announced the **PMC 10 MIDI Foot Controller** ($299.95). The unit's nine footswitches can be programmed to send virtually any sequence of MIDI messages—Program Changes, Note On/Off, Continuous Controllers, Channel Aftertouch, etc.—to sixteen independent MIDI devices. Each switch can trigger two MIDI sequences (labeled "A" and "B"). In one mode, pressing a switch triggers A, and releasing it triggers B; in another mode, pressing the switch triggers A, and pressing it again triggers B. An on/off jack also can be configured per patch to control the momentary and on/off switch assignments. Two jacks accept volume-type expression pedals, which can send up to four separate Continuous Controller commands, with programmable range and polarity. You can step through patches incrementally, or in a preprogrammed chain. A large readout displays the 500 named user patches and 99 named bank patches. The unit can record a data dump (patch data, for example), which is stored in 32 KB of static RAM.

DigiTech/DOD
5639 South Riley Lane
Salt Lake City, UT 84107
tel. (801) 268-8400

Ground Control ($279), from Digital Music Corporation, is a programmable

footswitch box that sends Program Change and Continuous Controller messages to up to eight MIDI devices separately, or in preset combinations. In addition to sending program changes, Ground Control's footswitches (with indicator LEDs) provide all programming and configuration functions. The unit accepts two volume pedals (not included) and sends their values as Aftertouch, Pitch Bend, and Continuous Controller messages, assignable separately for each pedal and preset. A large LED readout displays a directory of up to 100 user presets and the names of the attached devices. Specific presets are selected by a single, preprogrammed footswitch, or you can step through presets one at a time. Unlike most MIDI footswitches, Ground Control sends Program Changes in real-time to named devices while in program mode. The optional rack-mount **GCX Expander** (price not announced) provides switches and audio loops to control non-MIDI devices and audio signal routing.

Digital Music Corp.
5312-J Derry Ave.
Agoura Hills, CA 91301
tel. (818) 991-3881

Elka's **DMP 18 Dynamic MIDI Pedalboard** ($699.50; distributed by Music Industries Corp.) provides a set of eighteen velocity-sensitive (defeatable), organ-style footpedals that send C to F Note On commands over a 7-octave range (-2/+5) on any MIDI channel. The pedalboard can operate monophonically or polyphonically and has a master volume wheel. Each pedal also can send a Program Change command. If in Hold On mode, holding down a pedal sends a Sustain message.

Music Industries Corp.
100 Fourth Ave.
Garden City Park, NY 11040
tel. (800) 431-6699
or (516) 352-4110)

REV UP

Ensoniq (tel. [215] 647-3930) unveiled three 32-voice SQ-series synths: the **SQ-1 Plus 32-Voice** ($1,595), **SQ-R Plus 32-Voice** ($995), and **SQ-2 32-Voice** ($1,795). In addition to the increase in polyphony, the new instruments include an extra megabyte of 16-bit ROM waveforms and an additional 80 programs in RAM. The new instruments are priced the same as the now-discontinued 21-voice versions, which can be upgraded.

Coda Music Software (tel. [800] 843-2066 or [612] 854-1288) introduced a *Windows* version of ***MusicProse*** ($249). The list price for the Mac version was dropped from $399 to $249. Like the Mac version, *MusicProse* for *Windows* handles scores of up to 32 staves and accepts input from a MIDI keyboard, mouse, or computer keyboard. It also imports Standard MIDI Files. The program is based on *Finale* and provides a full complement of features including automatic part-extraction and scrolling playback.

Interval Music Systems' ***Genwave 2.0*** ($349; $60 upgrade; tel. [310] 478-3956) adds several DSP functions and other enhancements to the company's Atari ST sample-editing program. The new DSP functions include time compression/expansion, pitch transposition with time correction, auto-looping with pitch detection, and time-variant digital filtering. *Genwave* now supports the Peavey SP, Kurzweil K2000, and Prophet 2000/2002 and can import *Sound Designer* files in Mac or ST formats.

Temporal Acuity Products (tel. [800] 426-2673 or [206] 462-1007) introduced ***MusicPrinter Plus 4.1*** ($595) for the PC, which features support for a wide variety of sound cards and MIDI interfaces. Along with removing copy-protection, TAP added three Page View options; automatic measure-numbering; PCX file-creation (for exporting to desktop publishing applications); multiple measure copying; multiple document printing; MIDI channel-filtering on playback; direct, hexadecimal, MIDI-message input; and panning.

Thoughtprocessors (tel. [718] 857-2860) released ***The Note Processor 2.3*** ($295). The scoring program includes several new features such as larger file capacity, figured bass, triplet support over MIDI, automatic user-defined tuplet markings, and support for up to 50 staves per page. Thoughtprocessors also announced they are now publishing the software titles from LTA Productions, including the *Forte II* sequencer ($149), *TrackGenie* algorithmic composition software ($99), and *FWAP!* rhythm-pattern generator ($59). ●

ANDREW FAULKNER

SOUND BYTES

Part 1: A sampling expert reveals some tricks of the trade.

By Jim Miller

The arrival of affordable sampling almost a decade ago allowed a greater number of musicians to explore this unique area of electronic music.

Today, sampling is commonplace. I receive calls regularly from people wanting advice on recording, looping, mapping, or some other aspect of sampling. In response, I compiled some useful tips to help musicians get the most from their samplers.

MICROPHONES

Producing a high-quality sample requires more than just sticking a microphone in front of a violin, flute, or guitar and saying "bow it, blow it, or pluck it." There are many variables to consider. For instance, violins typically transmit fundamental tones and upper harmonics from different areas of the instrument. In fact, different violins may radiate fundamentals and harmonics from different areas of the instrument body, depending on how the wood is carved.

Poor mic placement can produce a horrible, nasal tone. Harmonics that sound fine when mixed with other overtones sound awful when the mic is pointed directly at the area that produces these frequencies. Some

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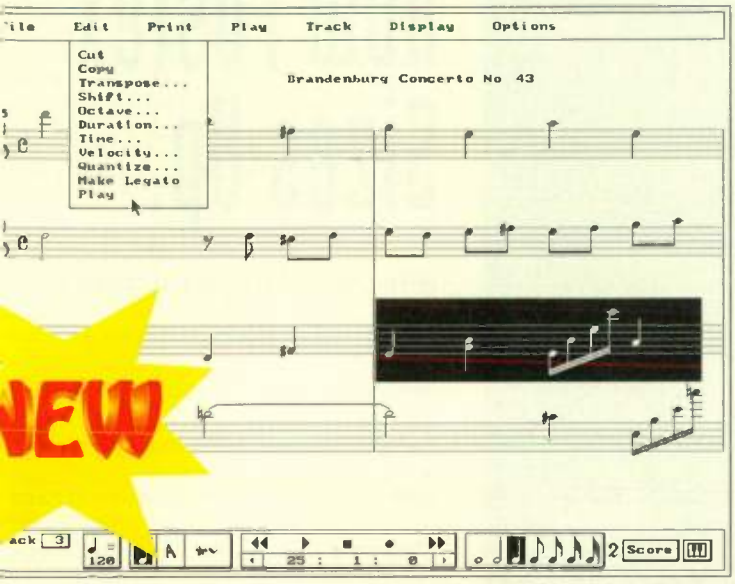

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C-64/128 MIDI INTERFACE ● ✻	$69
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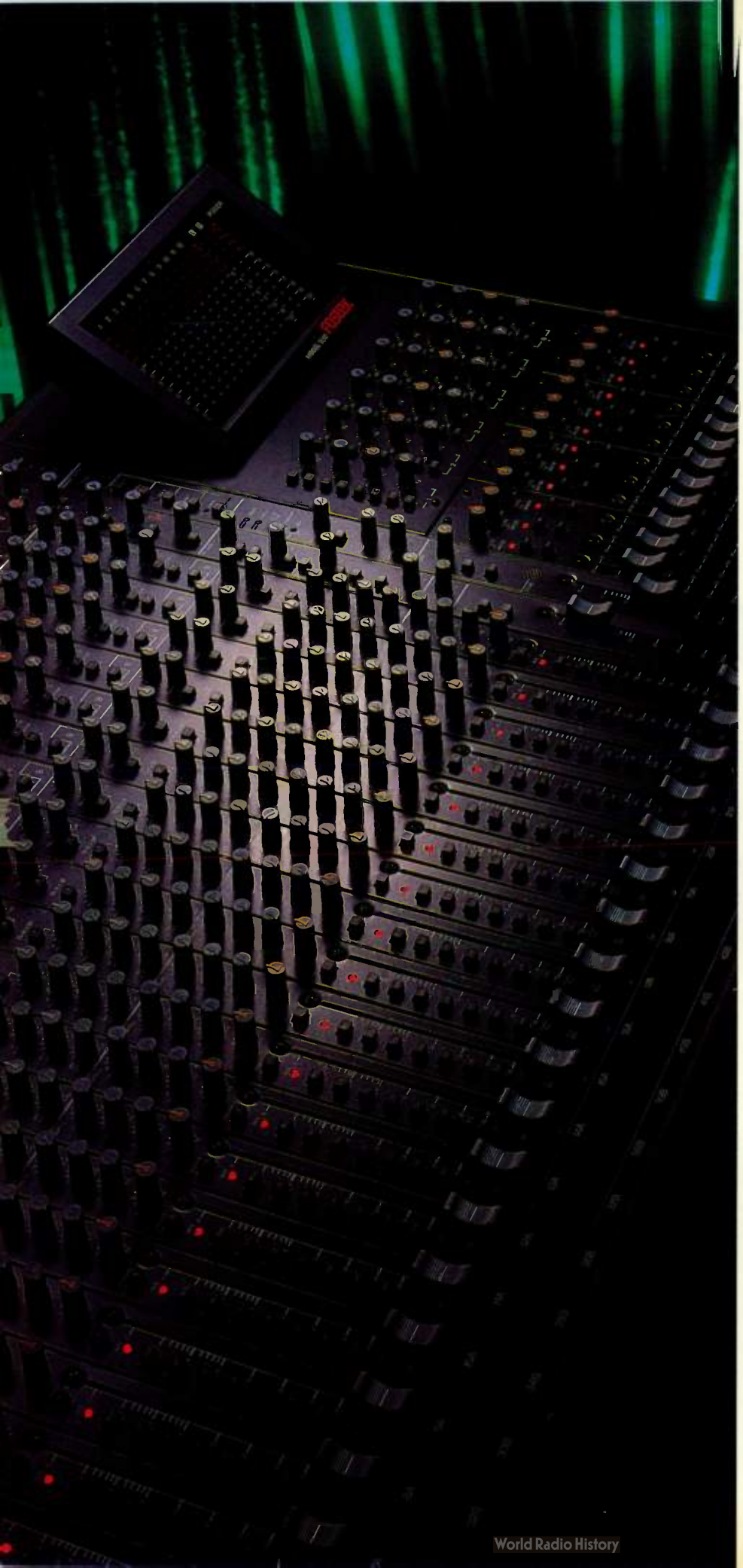

The compact new 2412 mixer from Fostex combines flexible functionality with efficient use of space. Designed for project studios and personal facilities, the 2412 represents a new dimension in creative freedom.

How Fostex Sizes Up.

NUMEROUS MIXING OPTIONS.

The 2412 is a 24x12x2 recording console that features multiple inputs and dual mixing paths in a chassis only 22" deep. Both mixes have EQ and effects processing. A total of 58 inputs can feed the stereo mix—a unique capability in such a compact console.

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SEE FOR YOURSELF.

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FOSTEX

violins, violas, cellos, and basses sample best when one mic is placed in front of the instrument and another mic is placed behind. Others sound best when the microphone is placed over the sound holes or directly over the bridge, facing the fingerboard of the instrument.

In just about every case, I suggest using two mics, one of which is likely to sound better than the other. (If both sound good, you'll have a stereo sample you can use sooner or later.) If possible, place the mics three to four feet away from the instrument, as this minimizes the possibility of pointing the mic at a location that produces a bad harmonic. In addition, maintaining some distance from the instrument results in a more natural tone (who listens to a trumpet with their ear six inches from the bell?) and reduces unwanted noises produced during performance, such as breath, bowing, etc.

After trying various mic placements for grand piano samples, I found the best position is in the center of the harp, five to eight inches above the strings, with the microphone pointed slightly toward the area where the hammer strikes the string. As you sample up the keyboard, the mic must be moved every perfect fifth or so. A second microphone can be placed about three to four feet away from the piano, pointing toward the open lid, to pick up the resonance of the piano body and the room. This often adds warmth to the sound (see Fig. 1). For a brighter "pop" piano sound, place the mic three to four inches directly over the area where the hammer hits the string.

Ultimately, you must determine the best placement by trial and error. A good starting point is to place one mic where your ear hears a good sound and another in a position where you've previously achieved satisfactory results. This helps ensure that one of the mics records a usable sound. Another general approach is to use one mic close up and the other farther away to capture the room's ambience. These signals also can be combined to accomodate a mono sample.

The type of microphone you use significantly affects sound quality. This is why recording engineers develop preferences for specific mics in certain situations. A mic that sounds great on vocals may be harsh on strings.

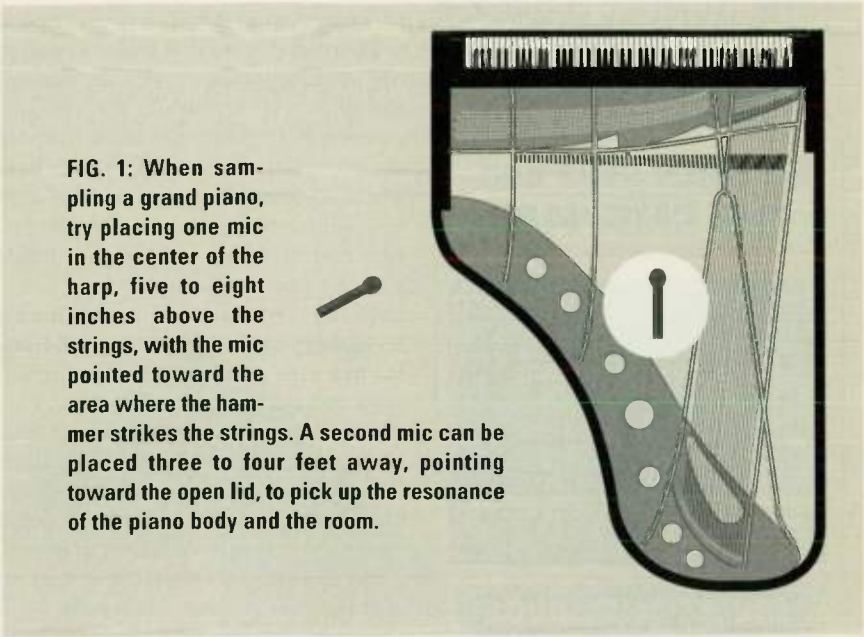


FIG. 1: When sampling a grand piano, try placing one mic in the center of the harp, five to eight inches above the strings, with the mic pointed toward the area where the hammer strikes the strings. A second mic can be placed three to four feet away, pointing toward the open lid, to pick up the resonance of the piano body and the room.

When studying frequency-response charts for different mics (particularly lower-cost models), be aware that certain frequencies vary up to 5 dB from one mic to another. If a particular mic emphasizes the most pleasing harmonics on the instrument, you're in luck. However, another mic may cut 4 dB in this area, ultimately making the sample sound dull or flat.

The weak link in the recording chain usually turns out to be the microphones. What's the sense of spending more than $1,000 on a DAT recorder and dropping a mere $100 on a mediocre microphone? Theoretically, you should spend as much on your mics as your tape deck to take advantage of digital's squeaky-clean recording capabilities.

TAPE RECORDERS

Many people demand that their source recordings be digital. However, a high-end cassette recorder with noise reduction produces terrific results. Just make sure your mics are good and you record a hot (but not *too* hot) signal.

I once recorded two vocalists on my Denon cassette deck, which I discovered (after the fact) was not holding a consistent speed due to a bad capstan motor. However, the end result was surprisingly good after I ran the recording through a Barcus-Berry 402 Maximizer. To this day, people often remark about how "Fairlight-like" the voices sound. If only they knew.

With modern noise reduction, any good, well-maintained analog machine is perfectly acceptable for sampling. Digital is useful for recording quiet musical passages, since there's no analog tape hiss to interfere with the sound. (However, remember that digital won't mask a noisy microphone preamp or mixing board.) But unless you're into sampling silence, you can sleep well knowing that most samples are just fine recorded on 1/4-inch analog tape. After all, the majority of samples are recorded well above the noise floor of your equipment.

THE HUMAN FACTOR

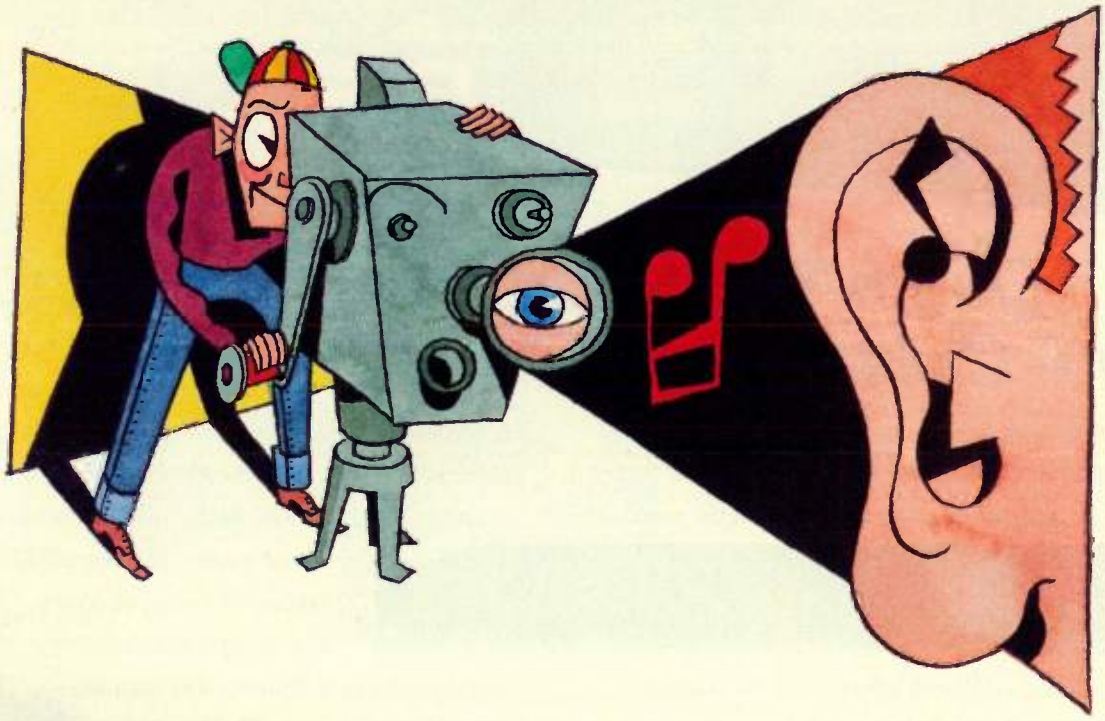
All too often, commercial samples produced by companies using state-of-the-art gear are lifeless. They do not capture the soul of the instrument.

The problem partly lies with the performance of the musician being sampled. Just because someone can bow a violin doesn't necessarily mean they can produce a clean, well-articulated note with clear tone. Unfortunately, world-class instrumentalists seldom participate in sampling sessions, feeling that samplers steal work from them. As a result, many manufacturers and third-party developers are forced to accept players with average talents.

Another problem is making the musician understand the methodology of sampling. A timbre shift between notes may be acceptable in performance, but this anomaly can result in uneven sam-

FRAME BY FRAME

Making a music video by the numbers.



Radio waves are immortal. Somewhere in the stratosphere, transmissions from WWII bomber runs mingle with the forgotten ghosts of rock 'n' roll radio. Out there, Alan Freed, Murray the K, Wolfman Jack, and others still swing with the hip swagger of ultimate power. In the 1950s and 1960s, radio was the altar of a restless generation, and deejays were the kings of the party. They built heroes and heroines from sound waves and picked hit songs with rebellious omnipotence. And out where the air is freezing cold and gossamer thin, their influence reigns for all eternity.

However, at sea level, mortality rules. Today, Top 40 radio is a decaying mansion, a relic of a time when the musical universe blasted from a 5 × 7 Ford Philco speaker (housed in a 100% American automobile that actually was constructed with real steel and chrome). The new revolution exploded from our television screens in 1982,

By Michael Molenda

ILLUSTRATION BY STEVEN GUARNACCIA

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when MTV became the music industry's premiere marketing tool. No one cares about babbling radio jocks anymore; today it's computer graphics, big hair, and wham-bam edits.

JOIN THE CLUB

So why, ten years after the hoopla, are so many musicians resisting video? It's no secret that marrying images to music is an intensely difficult, stressful, and expensive process. However, video is an ambitious musician's leading ally in the campaign for a pop recording contract. In addition, the expansion of arts coverage on cable networks makes video an attractive marketing option for jazz, ethnic, and classical musicians.

Even hobbyists can benefit from video, especially now that the medium is courting computers. (See sidebar "This Revolution Will Not Be Televised" on p. 36.) Despite the hardships, it's quite a thrill bringing music into the visual arena. And anyway, since when are multitrack recording projects a walk on the beach? A traditional audio demo session is more familiar to musicians, but it requires the same planning, patience, and paranoia as a video shoot.

Still unconvinced? The following step-by-step guide proves that shooting a music video is within the means of any disciplined creative mind. And the whole process begins with something even the most video-timid musician understands: a song.

THE AUDIO TRACK

The song is the foundation of a music video, but visual tricks can't make concrete from adobe. In other words, the song had better be good. Actually, it had better be so good that you can stand to hear it played hundreds of times during script meetings, pre-production meetings, the video shoot, and editing sessions.

Beware of reverb-washed sonics, muddy bass, and other mixdown anomalies that sabotage clarity. I recommend auditioning mixes by recording them to videotape, using the audio dub feature included on most video decks and camcorders.

Audio dubbing allows recording onto the audio track of a videotape without erasing the picture. Just hook the outputs of your cassette deck or DAT machine into the audio inputs of your video recorder (usually RCA connectors) and push the audio dub button. Then play the video on your television, listening critically to determine if the sound quality is sharp and well-articulated. If adjustments are needed, remix.

It's important, so I'll say it again. Make *sure* your audio track is absolutely brilliant. Few things are more pathetic than spending time and money on a video you can't bear to watch because listening to the audio is sheer torment.

THE GENRE

Once the audio track is selected, it's time to start thinking about visual conceptualizations. There are three main styles for music videos: live, conceptual, and hybrid.

Live. This often is the most comfortable style for the reluctant video musician. The artist performs a normal "live show," which is filmed from several angles and perspectives. *Recent examples*: just about any video on MTV's "Headbanger's Ball."

A close cousin to the live concept is the *faux live* shoot. This is a performance clip in which the artist mimes the song outside of a conventional stage set. Sometimes the musicians abandon their instruments, opting instead to jump around like lunatics or sulk coolly in the background. *Recent examples:* "Give It Away" by the Red Hot Chili Peppers and "Mysterious Ways" by U2.

Conceptual. This style is the most dangerous because it melds the song to a narrative line and raises the project to the status of "mini movie." A conceptual shoot is very expensive, requires several camera setups and locations, and some acting ability on the part of the musicians (often a frightening proposition). *Recent example*: "Into The Great Wide Open" by Tom Petty and the Heartbreakers (starring Johnny Depp and Faye Dunaway).

Hybrid. This video style incorporates conceptual and live footage. *Recent example*: "The Unforgiven" by Metallica.

A style of particular interest to hobbyists is *video collage*. This medium involves using "found footage" (previously shot visuals, such as old movies, documentaries, or commercials), and/or new footage, shot *sans artist*, to provide an image design for the soundtrack. This is probably the easiest and least-expensive style for the amateur videographer/musician. It also is a giddy thrill being an image pirate, so long as your found-footage collages are limited to private screenings. Unless you enjoy lawsuits, it's a bad idea to publicly display copyrighted material without permission.

THE SCRIPT

Screenwriter Joe Eszterhas received $3 million for his *Basic Instinct* script, and when the movie opened, critics blasted it. This real-life scenario says two important things about scripts: Controversy still sells movie tickets, and hotshot writers are not immune from churning out bat guano.

Don't become paralyzed with fear over developing a shooting script for your video. You may write something good, or you may write something bad, but you can't shoot a single scene until you write *something*. Keep your nerves in check by realizing that a music video doesn't merit a script rivaling *Citizen Kane*. All you have to do is develop a simple visual concept and preserve it on paper.

Scripts are necessary evils because they serve a number of purposes. A finely realized script implies camera angles, defines locations and costumes, determines possible camera setups, imposes a narrative structure (even if the plot structure is "artistically" nonnarrative, the script should offer a detailed map of chaos), and provides a

FIG. 1: Striking visuals are achieved by fearlessly stealing from the masters. This low-perspective shot was inspired by legendary film director Orson Welles (*Citizen Kane* and *Touch of Evil*).

tangible blueprint for estimating production costs.

Scripts can be rendered in a variety of ways. A script for a live shoot might establish only the set design, props, stage clothes, and featured instrumental or vocal passages. Conceptual scripts require complete plot scenarios, or a "scene" for every lyric line (if applicable).

Ambitious types often embellish scenarios with a *storyboard*. These "cartoon panels" tell the story with pictures rather than words. In the professional world, storyboards depict every single frame of onscreen action. Many storyboards are quite elegant, but you don't have to be an accomplished artist to utilize this visual aid. I've seen workable storyboards composed entirely of stickman and stickwoman scribbles. The important thing is establishing a pictorial narrative for the camera operator and/or director.

THE BUDGET

A budget meeting is the ultimate reality check. The greatest script in the world is shredder fodder if its scope is larger than your bank account. Although it's advisable to study professional music videos for ideas, it's ludicrous to plan an "MTV look" for a self-produced project. Professional clips often cost from $15,000 to $500,000 and are financed by huge record companies. Most unsigned artists and hobbyists have enough trouble affording videotape supplies, so scratch the helicopter shots, exotic locations, pyrotechnics, and other MTV staples.

▼

Don't dream about coming in under budget. It won't happen.

Unlike quick-and-dirty audio demo sessions, it's difficult to produce a cheap video. Depending on its complexity, a self-produced video shoot costs anywhere from $500 to $20,000. (For more on production costs, see sidebar "The Money Shot" on p. 114.)

The first draft of the script often is completed before budgets are discussed, to prevent funding issues from hampering creativity. However, once a script is in hand, it's time to unleash the red pencils. Review the scenario with the brutality of a Hollywood production accountant. Delete expensive props or locations, and rewrite scenes until they are cost-effective. Everything in a scene costs money, from the location to the labor (camera operator, lighting designer, production assistants, etc.), so ask yourself if a limousine really is necessary for the big love scene.

Unfortunately, the fiscal shocks aren't over yet. Now determine how much you can afford to spend on this monster. Don't be dismayed if allotted funds fall below the script's financial demands. Several rewrites may be necessary before creative and budgetary requirements meet. When all expenditures are tabulated, increase the total by 15 percent to

cover miscellaneous costs. And here's another tip: Don't dream about coming in under budget. It won't happen.

PRE-PRODUCTION

Because a video shoot involves cooperation from many people, it must be scrupulously planned to avoid emotional and financial turmoil. So many little details can slip out of control that a video shoot is like a row of upright dominoes. If one topples, all you can do is watch the rest tumble.

Here are some video survival tips.

People Power. Except for image collage and computer-generated projects, the video medium doesn't embrace loners. Don't try to "play all the instruments." It's a rare artist who can deliver a riveting performance while simultaneously controlling every aspect of the shoot. Also, whether you enlist a professional or a trusted friend, don't step into the lights without a director. In addition to offering an objective eye, a good director administers all creative and technical concerns, leaving you to concentrate on your charisma.

The minimum crew I recommend for a performance shoot consists of the following: director, cameraperson, lighting designer/tech, and two production assistants (one for audio/video record and playback, the other for carting gear).

Take a Meeting. Be sure to review the shooting script and discuss artistic concepts with your cameraperson and/or director before the shoot. It's extremely unproductive to have creative "debates" on the set. Make sure everyone agrees to any script changes and that the version existing on the day of the shoot is the final word.

Make a Schedule. You've got equipment to rent and people to coordinate; don't think for an instant this can be done without a written schedule. Plan to spend eons on the telephone confirming crew schedules, studio/location bookings, and equipment availability. Once the shooting day is set, work with the director to make an hourly schedule. Crew members appreciate knowing when their contributions are expected and hate sitting around with nothing to do. There's no reason for the makeup artist to arrive at 8 a.m. if the artist isn't expected until 10 a.m.

An hourly schedule (which an assistant should track) also forces the production team to think ahead. If you've rented a studio until 6 p.m., and you're three shots behind at 3 p.m., it's obvious that you need to speed up or consider deleting a shot.

Make a List. An equipment checklist is of paramount importance. There's no reward for flawlessly administering human resources if you forget the camera on the day of the shoot. The fundamental tools include: camera or camcorder, fluid-head tripod, video playback monitor, audio playback system, time-code generator (if applicable), necessary connectors and cables, heavy-duty power extension cords, lights, gaffer's tape, basic tool kit, towels, and so on. A video equipment rental facility can assist with comprehensive planning.

Conquer the Unknown. Video and live stage performances are two completely different languages. Broad movements that look great from the back row of a large club often appear silly on a television screen. In addition, musicians who can face a rowdy audience with inspired bravado often transform into shivering puppies on camera. It pays to borrow a camcorder and film the act through script and performance rehearsals.

Low-pressure camera rehearsals serve to familiarize the artist with the medium, making them more comfortable and confident video stars. Critique rehearsal tapes with an eye toward eliminating awkward movements, stiff or insincere delivery, and unattractive facial expressions. Also, make sure the artist's stage clothes (or costume) complement his or her body type and movement style.

AUDIO PLAYBACK

It should be obvious that you do not actually perform for the video cameras. The audio track is played through a sound system; the musicians mime their parts, and the vocalist(s) lip sync to the prerecorded performances. There is one exception in this scenario: the drummer. It's relatively easy for a vocalist to barely sing and yet convincingly match lip movements to the song lyric. However, it looks ridiculous if a drummer pretends to hit a snare drum or cymbal crash. Recording an effective video performance requires that the drummer actually play his or her

instrument.

Obviously, a drummer pounding at full performance tilt increases the volume level required from the playback system. Not only must the drummer be able to hear the prerecorded track above the din of his or her "live performance" (so drum hits can be matched to those on the recording), but the vocalist needs a clear lip sync reference. Satisfying these demands often requires a sound system capable of filling a small club, with the volume set slightly louder than actual performance levels.

Conceptual or faux live shoots often require much less audio muscle. If all you're recording is a lip sync performance, then anything that allows the singer to hear the vocal track is adequate. I've shot scenes with a cheap boom box.

THIS REVOLUTION WILL NOT BE TELEVISED

Rather than pursue pop stardom, I've enjoyed music-making as an outlet for my personal vision. Unfortunately, the "vision" aspect was conspicuously absent from my electronic studio. However, some recent innovations have transformed my computer into a video production house.

Apple's *QuickTime* (available free from the manufacturer) allows a color Macintosh with System 6.0.7 or higher to play video from a CD-ROM or hard disk directly on the computer monitor. That's the good news. The bad news is that the image fills only a fraction of the screen, resolution is marginal, and frame motion is jerky. Despite these limitations, I can create miniature music videos, and for far less money than I expected.

Several generic video clip collections already are available on CD-ROM, costing $50 and up. Freeware utilities such as Apple's *Simple Player* allow users to play back these clips and perform rudimentary edits.

If you want to record your own video clips, you'll need a camcorder and a video capture card, which acts as an image "sampler." The best-known is SuperMac's Video Spigot ($599), which records video into RAM or a hard disk. The Spigot has an RCA input for connecting a VCR, camcorder, or even the output of your cable TV box.

Unfortunately, sound is *QuickTime's* weakness, because it plays back via the Mac's 8-bit audio. Sound can be added to your video through the built-in audio input on newer Macs, or with external digitizers such as Macromind/Paracomp's *MacRecorder* ($200) or CEDAR's Sound Digitizer ($45 in kit form). However, help is on the way. Passport has announced *Producer*, which coordinates playback of *QuickTime* movies, MIDI files, 8- and 16-bit audio, and more. And there are rumors that future *QuickTime* versions will support MIDI directly.

One of the major benefits of *QuickTime* is that you don't have to rely on conventional video duplication and distribution to bring your creations to the public. Although it's possible to record the output of a Mac onto videotape (solutions run anywhere from a few hundred to a few thousand dollars), it's much easier to hand someone a disk or modem a file. *QuickTime* movies also can be placed in the middle of other documents, such as a letter or *HyperCard* stack. Think of it: The next big music video "channel" could be your personal network of Mac users.—Chris Meyer

Funnelling a member of Apple's *QuickTime* development team into an embossed still via Adobe's *Premiere* software.

Audio sources vary according to the type of shoot. Professional productions nearly always utilize SMPTE time code for synchronization of audio and video. These shoots require a 2-track, reel-to-reel deck with center-track time-code capabilities, or a SMPTE-fluent DAT recorder. Non-time-coded budget shoots can use anything from a cassette boom box to a conventional reel-to-reel deck to a DAT machine. However, because it's difficult matching audio cues to video when editing non-synched footage, I recommend using a DAT machine for its stable playback speed.

TIME CODE ISSUES

Because shooting with time code requires added equipment, production steps, and expense, I often shoot budget projects without it (see "Video for the Electronic Musician" in the July 1991 **EM**). The absence of time code commits me to "wild sync" final edits with control-track editing. This method, used on inexpensive editing systems, maintains edit accuracy by counting pulses recorded onto the videotape. Unfortunately, control-track editing is not frame accurate (error margins often vary ± 2 frames), which makes it difficult to achieve consistent matches between audio and video.

Synching involves watching lip movements (or snare drum hits) to align screen action with the audio track. It's a tedious procedure, and poorly synched edits must be corrected "from the top," because no time code exists to permit computer-assisted editing. Also, the slight tape speed fluctuations of differing playback systems can make wild synching a living hell.

Fortunately, since music videos usually involve one long audio edit (the song) and hundreds of video inserts, a good eye and a lot of patience produces great results. The added labor expended by wild synching is not a cost consideration for owners of basic video editing systems, or musicians who can cut a "sweet" deal with owner/operators.

However, if you hire a professional

(continued on p. 114)

FIG. 2: Utilizing organic light reduces technical expenses. This *film noir* effect was accomplished without artificial lighting rigs. Sunlight from the window bay was allowed to wash out the band. The silhouettes were intensified by mounting the camera atop a 20-foot ladder and having the cameraperson shoot from above the shadows.

MIXED COMPANY

By George Petersen

Penny wise, pound foolish," warns the old adage. That principle certainly applies to home studio engineers who reference music tracks on consumer stereo speakers. The sound from these speakers often is a far cry from audio reality. Although there's no law against mixing or recording in an aural fantasy world (some musicians prefer it), you should be aware of the fundamental differences distinguishing common hi-fi speakers from professional studio reference monitors.

The basic function of a studio monitor is to faithfully reproduce an incoming signal without adding coloration or changing the character or tonal balance of the sound. On the other hand, the average home stereo speaker is designed to make music sound as good as possible, often by emphasizing certain frequencies that make it stand out from the rest of the pack (especially during that all-important, five-minute audition in the sales showroom). A little zing in the high frequencies and some extra punch in the bass may sell speakers, but these so-called enhancements often sabotage audio accuracy.

And there's the rub. If your speakers don't provide an accurate reproduction of what's on tape (or coming out of the

Photograph by Peter Diggs

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console), it's difficult to make decisions concerning instrument or patch selection, equalization, or the balance of elements during mixdown. In addition, commercial playback systems range from 3-inch television speakers to elaborate audiophile installations. To ensure that overall instrumental and vocal balances remain consistent, it's essential your speakers "translate" well to any system, large or small.

ACOUSTICS

Consistent mixes require a critical listening environment. This doesn't mean wheeling 7-foot, 1,400-pound monster monitors into your studio, standing them against a far wall, and pumping up the volume. This live sound-system approach is a bad idea because as the sound source-to-listener distance is increased, a blend results as the original sound mixes with the acoustical effects of the room. Echoes and reverberation occur as sounds reflect off walls, furniture, the floor, and ceiling.

Psychoacoustically, this approach creates a number of problems, as the listener's brain attempts to sort out the differences between the direct sound and an endless *melange* of unwanted room reflections. Unless your studio budget includes a hefty allotment for studio designers and acousticians, you're stuck creating music in a less-than-perfect environment. An effective and inexpensive solution is listening to monitor speakers in the close- or near-field (approximately one meter away), which increases the ratio of direct-to-reflected sound, greatly reducing the effects of poor room acoustics.

However, not all studio monitors are practical for near-field applications. Since listening is done at close quarters, it's important that the combined image of the drivers be coherent at short distances. Systems designed for near-field applications have closely spaced drivers or employ a coaxial-type design, where the high frequency drivers are located on the same axis as the woofers. Another approach employs two small mid-/high-frequency cabinets (satellites) combined with one or two subwoofer enclosures that are located several feet from the satellites.

MONITOR PLACEMENT

Because near-field reference monitors can reduce unwanted acoustical effects within the listening space, speaker placement is critical.

Calibration Standard Instruments MDM-TA2

Position your speakers with the high-frequency elements at ear level and each monitor aimed slightly inward. This creates a sweet spot where the listener is precisely on-axis with the mon-

itor. The most accurate perception of sound is attained within this position, because the sonic character of many speakers changes dramatically when heard off-axis.

This phenomenon, known as off-axis coloration, can be demonstrated by referencing a sound while facing the monitor and comparing that to the sound heard after taking a step to either side of the same monitor. Typical symptoms of off-axis coloration are a loss of high-frequency information, or a change in the midrange characteristics. Since low-frequency information is largely nondirectional, bass response generally is unaffected by off-axis listening.

MONITOR DESIGN

There are any number of ways to mount speakers in a cabinet, but most enclosures designed for music reproduction fall into two basic categories: sealed and vented.

Sealed designs (usually known as acoustic-suspension types) mount speaker components on the outside of an airtight cabinet, which prevents the escape of air displaced by the woofer's rearward motion. Increased air pressure within the cabinet acts as a springboard to push the woofer's cone forward.

Vented systems (sometimes called bass-reflex systems) have one or more openings that create a small amount of phase cancellation at the woofer's resonant frequency, while increasing bass response at a lower frequency. (The resonant frequency is the point where a speaker's mechanical efficiency is at its highest level, as determined by the size, mass, and stiffness of the speaker cone.)

These openings (called vents or ports) can be mounted on the front or rear of the speaker enclosure. When rear-vented monitors are placed near walls or other sound-reflecting surfaces, the sound waves exiting the port are directed elsewhere in the room. Occasionally this creates an unpredictable situation in which the direct sound from the woofers reaches the listener's ears a few milliseconds earlier than the reflected signal, often resulting in emphasized bass frequencies. In some instances, the net effect can be a *loss* of bass response if the reflected signal is out-of-phase with the direct sound.

A number of speaker manufacturers employ coaxially mounted speakers, usually some sort of tweeter or other high-frequency unit mounted in the center of a bass reproducer. Coaxial speakers give the impression that sound is coming from a single point source, which improves coherence at close listening distances.

For more than 50 years, speaker designers have debated the question of the "right" number of components in a loudspeaker system, and still no apparent solution is in sight. Obviously, no single speaker faithfully reproduces the entire audio spectrum. The concept of dividing the load of audio reproduction among many specialized drivers is a good idea. However, each crossover network that routes sound to its respective driver introduces a certain amount of phase error. The physical realities of near-field monitoring limits the number of drivers that can be clustered together to produce a coherent sound image at a close listening distance. Therefore, most compact studio monitors are two- or three-way systems.

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ATC Loudspeakers
c/o Stellar Audio
58 Bearfort Rd.
West Milford, NJ 07480
tel. (201) 728-0438

Audix
19439 SW 90th Ct.
Tualatin, OR 97062
tel. (510) 463-1112

B&W Loudspeakers
PO Box 653
Buffalo, NY 14240
tel. (416) 771-6611

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

Calibration Standard Instruments
PO Box 2727
Oakland, CA 94602
tel. (510) 531-8725

Celestion
89 Doug Brown Way
Holliston, MA 01746
tel. (508) 429-6706

Digital Designs
100 North Quapah
Oklahoma City, OK 73107
tel. (405) 946-4500

Dynaudio Acoustics
c/o Group One Audio
100 Sea Lane
Farmingdale, NY 11735
tel. (516) 249-1399

Eastern Acoustic Works
One Main St.
Whitinsville, MA 01588
tel. (508) 234-6158

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

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

Genelec/GMI
15 Strathmore Rd.
Natick, MA 01760
tel. (508) 650-9444

JBL Professional/UREI
8500 Balboa Blvd.
Northridge, CA 91329
tel. (818) 893-8411

KRK Monitoring Systems
16462 Gothard St., Unit D
Huntington Beach, CA 92647
tel. (714) 841-1600

LM Acoustics
31133 Via Colinas, Suite 111
Westlake Village, CA 91362
tel. (818) 707-2621

Meyer Sound Labs
2832 San Pablo Ave.
Berkeley, CA 94702
tel. (510) 486-1166

Norberg
c/o Soundstage Electro Acoustics
10052 Babbitt Ave.
Northridge, CA 91325
tel. (818) 993-8717

Paradigm Electronics
569 Fenmar Dr.
Weston, Ontario,
Canada M9L 2R6
tel. (416) 749-2889

Peavey Electronics
711 A St.
Meridian, MS 39302
tel. (601) 483-5372

Quested/AKG Acoustics Inc.
1325 Alvarado St.
San Leandro, CA 94577
tel. (510) 351-3500

Radian
4520 E. Eisenhower Cr.
Anaheim, CA 92807
tel. (714) 693-9277

Smithline Audio
7766 Burnet Ave.
Van Nuys, CA 91405
tel. (818) 786-7324

Tannoy/TGI
300 Gage Ave.
Unit 1
Kitchener, Ontario,
Canada N2M 2C8
tel. (519) 745-1158

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

USCO Audio
2623 Canyon Dr.
Hollywood, CA 90068
tel. (213) 465-4370

Westlake Audio
2696 Lavery Ct.,#18
Newbury Park, CA 91320
tel. (805) 499-3686

Yamaha Pro Audio
6600 Orangethorpe Ave.
Buena Park, CA 90622
tel. (714) 522-9011

Yorkville Sound
4600 Witmer Industrial Estate
Niagara Falls, NY 14305
tel. (716) 297-2920

SPEAKER SPECS

The most important specification of a loudspeaker system is **frequency response** (see chart, pp. 44-47), a measurement of the range of frequencies a loudspeaker can reproduce. Unfortunately, this figure is virtually useless unless combined with some sort of **tolerance** specification (often expressed as something like ±3 dB). An ideal loudspeaker system offers "flat" response, which occurs when all frequencies are reproduced at a constant level.

However, keep in mind that a 3-inch transistor radio speaker theoretically could have a frequency response of 20 Hz to 20 kHz. What's left out is the fact that its *actual* frequency response could be -100 dB at the extreme ends of the scale. Since every 10 dB of change represents a doubling (or halving) in perceived volume, the amount of 20 Hz energy reproduced by the 3-inch speaker is infinitesimally small.

A speaker's overall efficiency is indicated by a **sensitivity** rating, which is expressed as the sound pressure level (in decibels) the speaker produces, given a 1-watt input, measured at one meter. Since console-mounted speakers usually are heard from a distance of one meter, the sensitivity rating is important. Sensitivity ratings for loudspeakers range from about 80 dB to more than 100 dB.

What does this all mean in *real* terms?

EM GUIDE TO COMPACT STUDIO REFERENCE MONITORS

Manufacturer/Model	Type	Frequency Response	Sensitivity (dB per 1w/1m)	Crossover
Acoustic Research 511	sealed	40 Hz to 25 kHz ± 3 dB	n/a	5 kHz
ATC SCM 10	sealed	100 Hz to 15 kHz ± 2 dB	80	2.8 kHz
ATC SCM 20	sealed	80 Hz to 15 kHz ± 2 dB	83	2.8 kHz
Audix HRM-1	vented	50 Hz to 18 kHz ± 3 dB	88	3 kHz
Audix HRM-2	vented	50 Hz to 18 kHz ± 3 dB	92	2.8 kHz
Audix HRM-3	vented	47 Hz to 19.5 kHz ± 3 dB	92	3 kHz
Audix MM-5	vented	50 Hz to 18 kHz ± 3 dB	87	3.2 kHz
Audix PH-3	vented	65 Hz to 22 kHz ± 3 dB	88	2.5 kHz
Audix PH-4	vented	60 Hz to 22 kHz ± 3 dB	88	2.5 kHz
Audix PH-5	vented	55 Hz to 22 kHz ± 3 dB	90	2.8 kHz
Audix PH-6	vented	50 Hz to 22 kHz ± 3 dB	91	2.8 kHz
Audix PM-5	vented	50 Hz to 18 kHz ± 3 dB	88	3.2 kHz
B&W Matrix 805	vented	45 Hz to 20 kHz ± 2 dB	87	3 kHz
Bag End TA12JR	vented	75 Hz to 19 kHz ± 3 dB	101	3.3 kHz
Calibration Standard Instruments MDM-4	vented	60 Hz to 17 kHz ± 3 dB	89	1.5 kHz
Calibration Standard Instruments MDM-TA2	vented	60 Hz to 20 kHz ± 3 dB	87	2.5 kHz
Calibration Standard Instruments MDM-TA3	vented	45 Hz to 20 kHz ± 3 dB	91	1.8 kHz, 7 kHz
Celestion SRi One	sealed	70 Hz to 20 kHz ± 3 dB	88	4 kHz
Celestion SRi Two	sealed	60 Hz to 17 kHz ± 3 dB	89	1.5 kHz
Digital Designs DD6a-S	sealed	68 Hz to 20 kHz ± 2 dB	86	4 kHz (high pass only)
Digital Designs DD161a-S	sealed	52 Hz to 20 kHz ± 2 dB	88	4 kHz (high pass only)
Digital Designs DD261a S	sealed	48 Hz to 20 kHz ± 2 dB	88	4 kHz (high pass only)
Dynaudioacoustics C2	sealed	40 Hz to 20 kHz ± 2 dB	n/a	-
Dynaudioacoustics M-1	vented	50 Hz to 40 kHz ± 2 dB	93	-
Dynaudioacoustics PPM-1	vented	50 Hz to 18 kHz ± 2 dB	88	-
Eastern Acoustic Works MS 20	vented	55 Hz to 18 kHz ± 2 dB	89	3 kHz
Eastern Acoustic Works MS 30C	vented	45 Hz to 18 kHz ± 2 dB	90	2.5 kHz
Eastern Acoustic Works MS 63	vented	50 Hz to 18 kHz ± 2 dB	95	350 Hz, 2.2 kHz
Eastern Acoustic Works MS 103	vented	40 Hz to 18 kHz ± 2 dB	95	300 Hz, 2.2 kHz
Electro-Voice MS-802	vented	45 Hz to 18 kHz ± 3 dB	91	2 kHz
Electro-Voice S-40	vented	85 Hz to 20 kHz ± 3 dB	85	3.5 kHz
Electro-Voice Sentry 100A	vented	45 Hz to 18 kHz ± 3 dB	91	2 kHz
Electro-Voice Sentry 100FI	vented	45 Hz to 18 kHz ± 3 dB	91	2 kHz
Fostex 6301 B	sealed	80 Hz to 13 kHz ± 3 dB	84	-
Fostex 6301 BEAV	sealed	80 Hz to 13 kHz ± 3 dB	84	-
Genelec S30C	vented	42 Hz to 25 kHz ± 3 dB	n/a	400 Hz, 4 kHz
Genelec 1031A	vented	48 Hz to 22 kHz ± 2 dB	n/a	2.2 kHz
JBL 809A	vented	50 Hz to 17.5 kHz ± 3 dB	93	-
JBL 4206	vented	42 Hz to 21 kHz ± 3 dB	87	2.8 kHz
JBL 4208	vented	38 Hz to 21 kHz ± 3 dB	89	2.6 kHz
JBL 4312A	vented	45 Hz to 20 kHz ± 3 dB	91	1.5 kHz, 7 kHz
JBL 4406	vented	25 Hz to 27 kHz ± 2 dB	87	3 kHz
JBL 4408	vented	40 Hz to 27 kHz ± 2 dB	89	2.5 kHz
JBL 4410	vented	35 Hz to 27 kHz ± 3 dB	91	800 Hz, 4.5 kHz
JBL 4412	vented	35 Hz to 27 kHz ± 3 dB	90	800 Hz, 4.5 kHz
JBL 4425	vented	40 Hz to 16 kHz ± 3 dB	91	1.2 kHz
JBL Control 1	vented	70 Hz to 20 kHz ± 3 dB	87	6 kHz
JBL Control 1 Plus	vented	60 Hz to 20 kHz ± 3 dB	88	6 kHz
JBL Control 5	vented	50 Hz to 20 kHz ± 3 dB	89	3 kHz
JBL Control 10	vented	35 Hz to 27 kHz ± 3 dB	94	1.1 kHz, 4.6 kHz
JBL Control Micro	vented	100 Hz to 20 kHz ± 3 dB	85	-
JBL Control SB Micro Subwoofer	vented	38 Hz to 260 Hz ± 3 dB	85	225 Hz
JBL Control SB-1 Subwoofer	vented	50 Hz to 200 Hz ± 3 dB	90	125 Hz
JBL SB-5 Subwoofer	vented	45 Hz to 175 Hz ± 3 dB	91	125 Hz
KRK Model 7000	vented	52 Hz to 15 kHz ± 3 dB	91	3 kHz
KRK Model 9000	vented	45 Hz to 19 kHz ± 3 dB	91	2.9 kHz
KRK Model 13000	vented	38 Hz to 19 kHz ± 3 dB	92	400 Hz, 4 kHz
LM Acoustics NF25	sealed	50 Hz to 22 kHz ± 2 dB	n/a	3 kHz
Meyer Sound HD-1	vented	40 Hz to 20 kHz ± 1 dB	n/a	1.6 kHz
Norberg BS16B	vented	42 Hz to 18 kHz ± 4 dB	88	1.8 kHz
Norberg BS28	vented	33 Hz to 18 kHz ± 4 dB	88	1.8 kHz
Paradigm 3se-mini	vented	70 Hz to 20 kHz ± 2 db	88	3 kHz
Paradigm Compact	vented	55 Hz to 20 kHz ± 2 dB	88	2 kHz
Paradigm Titan	vented	75 Hz to 20 kHz ± 2 dB	88	3 kHz
Peavey PRM-205A	sealed	79 Hz to 20 kHz ± 3 dB	85	2.5 kHz

KEY: CO=coaxial design CT=cone tweeter DFW=down-firing woofer DT=dome tweeter HCD=high-frequency compression driver HT=horn tweeter MS=magnetic shield

Woofer Size	Midrange Size	Tweeter Size	Cabinet Dimensions (rounded to nearest inch)	Weight (lbs.)	Price (per pair)	Notes (see key)
5.25"	-	1"	6x11x8	8	$449	MS, P
5"	-	1"	15x8x10	23	$1,999	-
6.5"	-	1"	18x10x12	50	$3,499	-
6.5"	-	1"	16x10x7	15	$499	DT
2x6.5"	-	1"	19x12x10	26	$649	HT
2x6.5"	-	1"	19x12x10	26	$799	DT
5.25"	-	1"	9x6x9	6	$249	DT
3.5"	-	1"	8x5x5	3	$199	DT, P
4.5"	-	1"	9x6x5	4	$229	DT, P
5.5"	-	1"	9x6x6	4.5	$259	DT, P
6.5"	-	1"	11x7x7	5	$289	DT, P
5.25"	-	1"	9x6x9	6.5	$389	DT, P
6.5"	-	1"	16x10x9	18.7	$1,600	DT
12"	-	1"	21x14x12	40	$1,092	HT
2x6.5"	-	3.5"	19x13x10	25	$1,390	CT
6.5"	-	.75"	16x12x9	20	$1,390	DT
2x6.5"	3.5"	.75"	19x16x12	35	$1,890	DT
6"	-	1"	15x9x8	10.4	$399	DT
2x6.5"	-	3.5"	19x13x10	25	$1,390	CT
6.5"	-	.75"	12x9x9	14	$365	DT, MS
6.5"	-	.75"	14x9x10	16.5	$520	DT, MS
2x6.5"	-	.75"	19x10x14	29	$698	DT, MS
6"	-	1"	16x9x11	25	$2,750	DT
6"	-	1"	8x18x12	31	$2,650	DT
6"	-	1"	11x7x9	13	$1,850	DT
6.5"	-	1"	15x10x9	16	$570	DT
8"	-	1"	14x17x13	30	$690	DT
12"	7"	1.25"	16x24x13	87	$2,180	DT
15"	7"	1.25"	20x24x17	103	$2,590	DT
8"	-	1.5"	17x12x11	27	$650	DT
5.25"	-	1"	10x7x6	5.7	$336	DT, MS
8"	-	1.5"	17x12x11	28	$668	DT
8"	-	1.5"	17x12x12	33	$1,384	DT, P
4.5" (full range)	-	-	7x5x5	6	$370	P
4.5" (full range)	-	-	7x5x5	6	$430	MS
8"	3"	2" ribbon	19x13x11	46	$4,199	P
8"	-	1"	15x10x12	26	$2,998	DT, P
12"	-	1.75"	23x17x14	60	$1,790	HT
6.5"	-	1"	15x9x10	15	$395	DT
8"	-	1"	18x11x9	20.5	$525	DT
12"	5"	1"	24x14x12	43	$1,150	DT
6.5"	-	1"	15x9x9	17	$500	DT
8"	-	1"	17x12x12	26	$650	DT
10"	5"	1"	24x14x11	43	$990	DT
12"	5"	1"	14x24x11	47	$1,500	DT
12"	-	1.75"	16x25x15	57	$2,190	HT
5.25"	-	.75"	9x6x6	4	$250	DT
5.25"	-	1"	9x6x6	5.5	$295	DT
6.5"	-	1"	15x10x9	10	$394	DT
12"	5"	1"	24x17x12	32	$1,150	DT
4.5"	-	-	6x6x6	3.5	$160	-
8"	-	-	8x20x12	13	$195 (1)	-
4x5.25"	-	-	7x22x12	25.6	$295 (1)	-
4x6.5"	-	-	13x23x12	42	$375 (1)	-
7"	-	1.5"	12x11x10	25	$989	-
9"	-	1.5"	16x14x13	45	$1,750	-
13"	5"	1.5"	28x16x17	90	$2,699	-
5.5"	-	.75"	14x9 (cylindrical)	8	$695	DT, MS, P
8"	-	1"	12x16x16	51	$4,550	DT, P
6.5"	-	piezo	17x10x10	20	$695	-
2x6.5"	-	piezo	12x17x13	35	$1,495	-
6.5"	-	1"	15x8x10	18	$259	DT
6.5"	-	1"	16x9x12	22	$599	DT
6.5"	-	.75"	13x8x10	13	$199	DT
5.25"	-	1"	8x12x7	7	$300	DT

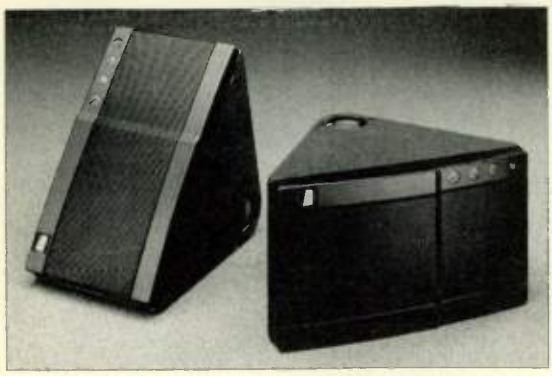
P=powered

EM GUIDE TO COMPACT STUDIO REFERENCE MONITORS

Manufacturer/Model	Type	Frequency Response	Sensitivity	Crossover (dB per 1w/1m)
Peavey PRM-208S	sealed	68 Hz to 20 kHz ± 3 dB	92	2.5 kHz
Peavey PRM-308S	vented	45 Hz to 20 kHz ± 3 dB	88	300 Hz, 3 kHz
Peavey PRM-308SV	vented	45 Hz to 20 kHz ± 3 dB	88	300 Hz, 3 kHz
Peavey PRM-310S	vented	44 Hz to 20 kHz ± 3 dB	88	300 Hz, 3 kHz
Peavey PRM-312A	vented	42 Hz to 20 kHz ± 3 dB	89	300 Hz, 3 kHz
Quested H108	vented	70 Hz to 18 kHz ± 4 dB	90.5	1.3 kHz
Quested H208	vented	50 Hz to 17 kHz ± 4 dB	91	550 Hz, 2.5 kHz
Quested H210	vented	50 Hz to 17 kHz ± 6 dB	91.5	600 Hz, 2.8 kHz
Quested H405	vented	40 Hz to 17 kHz ± 4 dB	92.5	2 kHz
Quested HSB115 Subwoofer	sealed	15 Hz to 100 kHz ± 4 dB	92.5	60 Hz
Quested Q108	vented	40 Hz to 18 kHz ± 6 dB	n/a	1.2 kHz
Radian MS8I	vented	35 Hz to 25 kHz ± 3 dB	89.5	1.8 kHz
Radian MM8	vented	40 Hz to 22 kHz ± 3 dB	89.5	1.8 kHz
Radian MM8L	vented	40 Hz to 25 kHz ± 3 dB	89.5	1.8 kHz
Radian MS8	vented	35 Hz to 22 kHz ± 3 dB	89.5	1.8 kHz
Radian MS10	vented	40 Hz to 22 kHz ± 3 dB	91.5	1.8 kHz
Smithline Audio 2x4S	vented	70 Hz to 20 kHz ± 3 dB	87	3.6 kHz
Smithline Audio MM1	vented	60 Hz to 20 kHz ± 3 dB	90	100 Hz, 3.6 kHz
Tannoy CPA-5	vented	60 Hz to 22 kHz ± 3 dB	90	7 kHz
Tannoy PBM 6.5	vented	57 Hz to 20 kHz ± 3 dB	90	2.6 kHz
Tannoy PS 88 Subwoofer	sealed	38 Hz to 110 Hz ± 3 dB	93	-
Tannoy System 8	vented	48 Hz to 25 kHz ± 3 dB	93	2.3 kHz
TOA 22-ME-AV	sealed	100 Hz to 17 kHz ± 3 dB	90	-
TOA 265-ME-AV	vented	60 Hz to 20 kHz ± 3 dB	88	3 kHz
TOA 200-ME-AV	sealed	60 Hz to 20 kHz ± 3 dB	89	1.5 kHz, 14 kHz
TOA 312-ME-AV	vented	40 Hz to 20 kHz ± 3 dB	91	500 Hz, 5 kHz
USCO Audio DB-2N1 Subwoofer	vented	27 Hz to 120 Hz ± 3 dB	89	100 Hz
USCO Audio DB-10A Subwoofer	vented	27 Hz to 180 ± 3 dB	88	180 Hz
USCO Audio DFW-3	sealed	60 Hz to 15 kHz ± 3 dB	91	280 Hz, 4.7 kHz
USCO Audio SP-2	vented	70 Hz to 15 kHz ± 3 dB	89	4.7 kHz
USCO Audio TRKS	vented	27 Hz to 15 kHz ± 3 dB	89	200 Hz, 4.7 kHz
Westlake Audio BBSM-4	vented	65 Hz to 20 kHz ± 3 dB	89	1.5 kHz
Westlake Audio BBSM-5	vented	63 Hz to 18 kHz ± 3 dB	90	1.2 kHz
Westlake Audio BBSM-6	vented	60 Hz to 20 kHz ± 3 dB	91	600 Hz, 6 kHz
Westlake Audio BBSM-8	vented	65 Hz to 18 kHz ± 3 dB	93	600 Hz, 5 kHz
Yamaha NS10MC	sealed	60 Hz to 20 kHz ± 3 dB	90	2 kHz
Yamaha NS10MS	sealed	60 Hz to 20 kHz ± 3 dB	90	2 kHz
Yamaha NS40M	sealed	50 Hz to 20 kHz ± 3 dB	90	1.3 kHz, 5.5 kHz
Yamaha S8M	vented	50 Hz to 20 kHz ± 3 dB	90	2.3 kHz, 13.4 kHz
Yorkville Sound YSM-1	vented	40 Hz to 20 kHz ± 3 dB	90	2.5 kHz
Yorkville Sound YSM-2	vented	80 Hz to 20 kHz ± 3 dB	90	2.2 kHz
Yorkville Sound YSM-4	vented	50 Hz to 18 kHz ± 3 dB	88	3 kHz

KEY: CD=coaxial design CT=cone tweeter DFW=down-firing woofer DT=dome tweeter HCD=high-frequency compression driver HT=horn tweeter MS=magnetic shieldir

Let's say your monitor has a sensitivity spec of 90 dB. Since each 10 dB volume increase requires ten times more amplifier power, we can determine your monitor provides 100 dB from a 10-watt input or 110 dB from a 100-watt input. (Because the scale is based on a logarithmic progression, we also know that each volume increase of 3 dB requires a doubling of amplifier power.) By combining this knowledge of sensitivity with a monitor's maximum power-handling capacity, you can tell if a given monitor is loud enough to suit your needs.



Acoustic Research AV511 Professional Partner

OTHER FEATURES

Removable front grilles are a plus. While many grille materials are "acoustically transparent," other problems stem from diffraction effects and edge reflections caused when sound from the high- and mid-frequency drivers bounces off the wood or plastic grille frame.

On the rear of the speaker, input terminals range from screw fasteners to gold-plated, 5-way binding posts. The latter accommodate banana plugs, spade lugs, test prods, and bare wire bent to go around the post (as well as holes in the post itself for inserting various gauges of speaker wire). If you frequently change speakers in your studio, banana connectors make a lot of sense, as they provide a solid and easily removeable connection.

Computer and video monitors are commonplace in today's electronic

Woofer Size	Midrange Size	Tweeter Size	Cabinet Dimensions (rounded to nearest inch)	Weight (lbs.)	Price (per pair)	Notes (see key)
8"	-	1"	10x15x8	16	$440	DT
8"	5.25"	1"	12x18x12	26	$640	DT
8"	5.25"	1"	12x18x12	28	n/a	DT, MS
10"	5.25"	1"	21x14x11	40	$720	DT
12"	6.5"	1"	25x16x13	58	$860	DT
8"	-	1"	10x16x10	26.4	n/a	DT
2x8"	3"	1"	17x21x11	62	n/a	DT
2x10"	3"	1"	31x23x14	110	n/a	DT
-	4x5"	1"	21x12x11	46.2	n/a	-
15"	-	-	21x41x17	101.2	n/a	-
8"	-	1"	13x17x12	50.7	$4,995	DT, P
8"	-	1.75"	12x19x11	33	$1,596	CD, HCD
8"	-	1.75"	10x16x8	23.5	$858	CD, HCD
8"	-	1.75"	17x11x8	25	$1,458	CD, HCD
8"	-	1.75"	12x19x11	32	$996	CD, HCD
10"	-	1.75"	15x25x12	42	$1,196	CD, HCD
2x4"	-	.75"	14x10x6	13	$700	DT, MS
8"	2x4"	.75"	16x14x14	38	$1,600	DT, MS
5"	-	1"	9x6x5	6.3	$345	CD, DT, MS
6.5"	-	.75"	13x9x8	5.2	$375	DT
2x8"	-	-	14x15x14	35	$825 (1)	P
8"	-	.75"	18x12x9	26.4	$1,095	CD, HT
5" (full range)	-	-	7x7x6	5.1	$164	MS
6.3"	-	1.2"	14x8x10	11.5	$412	DT, MS
7.9"	-	1.2"	16x10x10	15.4	$538	DT, MS
11"	5"	1.2"	23x13x12	35.7	$902	DT, MS
10"	-	-	12x12x12	30	$300 (1)	-
10"	-	-	12x12x15	24	$300 (1)	-
6.5"	5.25"	1"	10x10x8	17	$600	DT, DFW, MS
5.25"	-	1"	7x8x10	10	$310	DT, MS
10"	5.25"	1"	11x17x12	35	$1,750	DT
2x4"	-	.75"	8x15x10	25	$1,358	DT
2x5"	-	1.25"	11x18x10	35	$1,478	DT
2x6"	3.5"	1"	11x22x13	60	$2,198	DT
2x8"	3.5"	1"	13x26x17	90	$2,648	DT
7"	-	1.5"	15x9x8	14	$510	DT
7"	-	1.5"	15x9x8	13	$430	DT
2x7"	2.5"	1.25"	12x24x12	37.5	$850	DT
8"	5"	3"	19x11x9	16.5	$180	CT
6.5"	-	1"	10x16x9	18	$280	DT
5.25"	-	.75"	7x13x8	9	$200	DT
4"	-	.75"	6x6x9	5.5	$138	DT

P=powered

music studio. Because of this, many reference speakers provide internal magnetic shielding to reduce or eliminate the picture distortion that occurs whenever a large magnetic structure is placed near a video display. The degree of protection varies widely. Some models must be placed three to six inches away to avoid picture degradation, while other speakers can be placed flush against a video or computer monitor without ill effects. Incidentally, I've tested a number of non-shielded monitors that didn't have any deleterious effect on video monitors.

Monitor mounting accessories yield numerous opportunities regarding monitor placement. Some manufacturers offer optional mounting brackets for their speakers, while third-party suppliers provide a wide range of versatile, high-quality mounting systems. Wall-mount brackets with ball swivel joints are especially useful in the small studio environment.

THE FUTURE

What lies ahead for studio monitors? One noticeable trend is internal amplification. Once designed mainly for convenience (monitor/amp combinations have been popular with broadcast users for years), recent designs have taken the notion of the powered speaker to the next step. Models such as the Genelec 1031A, Meyer HD-1, and Quested Q108 incorporate state-of-the-art biamplification and active crossovers that precisely match on-board electronics to loudspeaker components for optimum performance.

Expect to see more evolved approaches to this system, with a greater degree of electronic control over a once-exclusively electro-acoustic environment. I'm awaiting a computer-controlled system that inputs data from a hearing test of your own ears, combines it with an intelligent algorithm of your favorite mix room and/or engineer, and electronically creates the monitoring environment of your choice.

George Petersen *lives with his wife and two musical dogs in a century-old Victorian house on an island in the San Francisco Bay.*

PATTE WOOD

FIG. 1: Max Mathews and his Radio Baton controller.

produced, but on how we control them. Much of this work involves interactive relationships in which musicians and machines share responsibility for the performance. These researchers seek the answers to three questions: What do we control; how do we control it; and, perhaps most intriguing, how do we know we are controlling it?

WHAT DO WE CONTROL?

In the mainstream approach to keyboard synthesizer performance, the right hand plays the notes, and the left hand works the controllers. (This doesn't work quite as well for MIDI guitarists, percussionists, and wind players.) The sacrifices are obvious: You can play only half as many notes, and you must use closer voicings than a 2-handed keyboardist can. Many synth programmers build as much expression into Velocity and Aftertouch as possible, allowing the musician to keep both hands on the keyboard. This still gives you only two means of control, however, and only one for changing the timbre of a single note over time. Acoustic wind and string instruments can do better than that.

You also can use other parts of your body for expressive gestures, including breath controllers and footpedals. But there are limits to the skill a single human can bring to bear in real time. Using both hands, pressure, breath control, and pedals at the same time gives you a lot to think about, probably too much. I'm not suggesting it's pointless to perform on synthesizers, or that Velocity and Aftertouch can't be used to create an expressive line. It's just that a vast amount of untapped potential and new dimensions of control remain unavailable to performers on conventional electronic instruments.

Fortunately, researchers are working on this problem and have made some interesting conceptual leaps. For instance, with the mainstream keyboard approach, the player plays half as many notes to gain more control over the sound. What if you gave up playing *all* the notes?

A simple example of this idea is Max Mathews' *Conductor* program, which runs on a PC-compatible. Mathews, a researcher at Stanford University's Center for Computer Research in Music and Acoustics (CCRMA, pronounced "karma") and one of the founding fathers of computer music, has been working for over four decades on the concept of real-time performance with synthesizers.

On the subject of control, he points out that, at least in traditional Western music, a piece of music can be separated into two parts: those aspects dictated by the composer (usually including pitch) and those left up to the expression of the performer. Mathews suggests that a computer can make the composer-dictated, fixed parts happen, while the performer is left with only the expressive parameters to worry about.

With *Conductor*, which he uses in conjunction with his Radio Baton 3-dimensional controller (see Fig. 1), the computer plays the notes of a piece while the performer dictates tempo, triggers each note, and controls volume, timbre, and other parameters over MIDI. Mathews points out that this allows amateurs to interact with a piece of music, shape it, and make it their own without learning a complex technique or playing a wrong note.

The same concept also can be taken in the opposite direction: With freedom from playing notes, how much more attention could a virtuoso apply to expression? It would be possible to do much more individual note-shaping and dynamic, continuous control. In fact, many sequencer users apply these concepts when recording a passage and then overdubbing Aftertouch, Mod Wheel, etc.

These techniques assume that the performer is working on a note-by-note basis, a concept that may be slightly antiquated, at least with regard to the potential of electronic control. Some of the work on the leading edge of interactivity is challenging this idea.

David Wessel, of the University of California at Berkeley's Center for New Music and Audio Technologies (CNMAT, pronounced "senn-mat"), is an aficionado of Don Buchla's (tel. [510] 528-4446) Thunder controller. Using Thunder's pressure- and position-sensitive strips and Opcode's (tel. [415] 369-8131) *Max* software on the Macintosh, Wessel uses small gestures to shape entire phrases. For instance, the phrase's tempo might be determined by the speed of finger movement, while pressure controls the dynamics. The time frames of the gesture and phrase can be different, so a brief gesture could define a much longer phrase.

Another pioneer in this area is Tod Machover. Working at the Massachusetts Institute of Technology (MIT) Media Lab, Machover has developed a series of "hyperinstruments" that expand the results of a musician's hard-won skills using real-time computer processing.

Acoustic instruments, MIDI controllers, and other gestural sensors such as the Dexterous Hand Master (which monitors left-hand conducting gestures) are used as input devices. The sound and/or performance gestures from these devices are sent to one or more Macintosh II computers running one of several programs written in Hyperlisp, which monitors the input stream and generates a musical output based on its particular algorithms. The output might be in the form of a musical phrase, a new orchestration, a tempo or timbre change, or any

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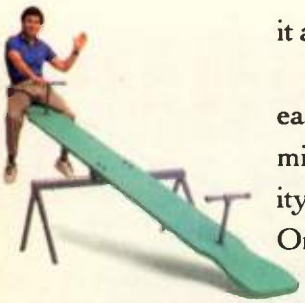

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Located in Paris, France, IRCAM (Institut de Recherche et Coordination Acoustique/Musique) is one of the world's leading centers for research in acoustics and computer music applications. Ariel Corporation (tel. [908] 249-2900) is marketing a new, powerful musical workstation consisting of hardware and software designed and developed at IRCAM. The IRCAM Signal Processing Workstation (ISPW) provides real-time signal processing and event processing, with special emphasis on interactive composition and performance algorithms.

The main processing engine of the ISPW is a NeXTBus coprocessor board for the NeXT computer. The advantage of the NeXT is that it includes a high-speed communication data path. This allows direct communication between multiple Intel i860 DSP boards and the NeXT's main processor, avoiding the expense of developing additional high-speed bus interconnects.

The board includes two Intel i860 DSP chips running at 40 MHz, each with 16 MB of onboard RAM, expandable to 64 MB. Running in parallel, these powerful processors are capable of performing the lightning-fast number-crunching essential for real-time processing of CD-quality (44.1 kHz) digital audio.

A Motorola DSP56001 chip handles data-routing for MIDI and digital audio I/O connections as well as data transfers between multiple i860 boards. (As many as three i860 boards can reside in one NeXT.)

Since the ISPW uses a general-purpose DSP chip, its signal-processing potential is limited only by software. It can perform standard DSP functions such as digital sampling, delay, reverb, multiple pitch-shifting, gating, synthesis, resynthesis, enveloping, filtering...you name it. Centralizing control of all sound sources and processing in one computer eliminates the machine boundary between signal- and control-processing, effectively bypassing MIDI and many current communications and bandwidth problems.

Currently, the ISPW comes bundled with a variety of software. A NeXT version of *Max* (which looks like the familiar Opcode program for the Macintosh but actually is its antecedent) operates as a front end for the ISPW. DSP objects such as analog-to-digital converters, digital-to-analog converters, Sample Read/ Write, and Fast Fourier Transforms allow the user to control the ISPW in an iconic programming environment.

An object-oriented program called *ANIMAL* (*Animated Language*) allows creation of detail-oriented, graphic applications for editing samples, synth patches, musical event lists, etc. In general, this program can be used for any application that requires graphic manipulation of large structures or parameters.

The powerful *Signal Editor* allows graphic editing of audio signals in the time and frequency domains, as well as access to a set of signal-processing tools. Using this program, an opera singer can be totally removed from a musical excerpt, even with full orchestral accompaniment. Finally, the *Universal Recorder* stores and retrieves musical events.

The main strength of the ISPW is its combination of control and signal processing in a single, general-purpose environment. The user can simultaneously sample and transform audio signals with no discernible time delay. All this power doesn't come cheap, though. The NeXTcube computer that hosts the ISPW—the less-expensive NeXTstation lacks the required expansion slot—retails for approximately $10,000. The ISPW multiprocessor board with 16 MB of RAM is priced at $14,995, with a 20% discount for universities.—Joel Krantz

number of musical events.

These techniques can be applied to live interaction in which the performer plays, and the computer responds to the input in real time. For example, Jean-Claude Risset created his "Duet for One Pianist" using a Yamaha Disklavier MIDI piano and Opcode's *Max*. As the pianist plays, the notes are sent over MIDI to *Max*, which processes them and sends new MIDI notes back to the same Disklavier. The effects range from inverting around a specified pitch to altered arpeggios and harmonic "stretching" of the performer's chords.

HOW DO WE CONTROL?

A macro controller that affects multiple parameters at once is another way to handle the flood of synth parameters. For instance, CCRMA's Perry Cook has developed *SPASM* (*Singing Physical Articulatory Synthesis Model*) on the NeXT computer, a complex software model of the human voice. He has developed models for other acoustic sounds (see Fig. 2). Physical modelling synthesis is explained in the September 1991 "Computer Musician" column.

SPASM features a large number of programmable parameters that make an accurate model but are not optimized for real-time control. To achieve real-time control, Cook developed tools to control many related parameters with a single gesture. For example, Cook's tools provide the ability to crossfade between different vowels and consonants, which involves many separate parameters.

The most impressive tool is a slider labeled "Effort," which simultaneously controls brightness, volume, vibrato depth, and the level of randomness in the vibrato. Moving this slider up on a sustained note creates an amazingly realistic crescendo effect that sounds like the singer is working harder. Defining this kind of musically useful grouping is a critical part of macro controllers.

When learning to play a new instrument, a musician typically has to practice a whole new vocabulary of gestures. Wouldn't it be great, asks CNMAT's Wessel, if the instruments molded themselves to the musician's gestures? He calls this concept "instruments that learn," and he is working on implementing it using neural net technology (explained in the January 1991 "Computer Musician").

The nets "learn" a mapping between specified inputs and desired outputs. For example, the nets could follow the gestures of a specific conductor and recognize the difference between a

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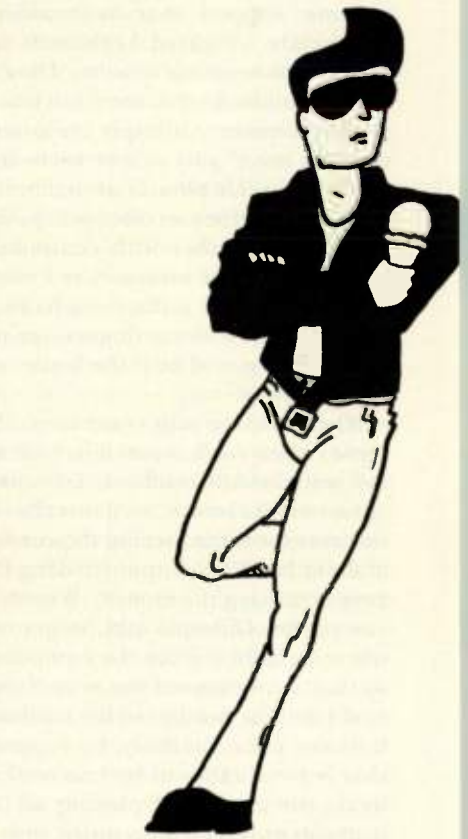

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it is resonating particularly well, something the performer can feel and use to help find and hold the "sweet spots."

CCRMA's Chris Chafe has put together a lip-simulator device to control Perry Cook's physical modeling software, which can be used to reproduce a brass instrument sound. The physical controller is a narrow, metal bar mounted on top of a small speaker driver. The bar is pressed by a fingertip while the output signal created by the brass-instrument model plays through the speaker. Because the bar is connected directly to the speaker, you can feel and hear the output, simulating the kind of feedback a real trumpet player uses to identify partials.

As you simulate lip tension by pressing down on the bar with your finger, it controls the pitch of the model along its harmonic overtone series. Between each harmonic, the model breaks up, making a blatty noise just like a real trumpet. To play the instrument well, you have to avoid settling on the break points and pass through to the stable harmonics. Fortunately, the breaks generate a number of transients, which are much easier to feel than the normal brass tones, so they are as apparent to your fingertip as to your ear. With the two senses working together, it's much easier to play well than when you depend on hearing alone.

How would this approach work on a piano-stye keyboard? As Gillespie puts it, "You don't just play it; it plays you." When you press down on the keys, they press *back* according to programmable parameters. For instance, if you were playing a harpsichord patch, the keys might depress relatively freely down to a point, and then give a "pluck" sensation. If you were playing a pad layered with a bell sound that came in only at high velocities, the response might be relatively mild unless the bell were played, at which point the keys would give the sensation of hitting something. With an acoustic bass sound, the key might push or vibrate slightly with a "woof" as the string settles. The old question of when Velocity ends and Aftertouch begins would finally become self-evident. The key might begin to vibrate slightly when you apply Aftertouch. If Aftertouch were activating an LFO, you might even have the key vibrate at the LFO frequency.

Gillespie points out that our physical reflex time is often significantly faster than our mental response time. After some practice, a tactile-feedback controller might allow fingers to respond directly to some stimuli, such as avoiding the unwanted application of aftertouch. As sensory input is increased, learning is reinforced; in such instances as the brass model, one could become a better player faster.

More wild and futuristic applications of tactile-feedback systems might eventually involve extensions of touch-screen systems. CCRMA's Julius Smith suggests that improvements in piezoelectric film, a material that changes shape when electricity is applied (and vice-versa), eventually may allow a finely varied, configurable surface texture, allowing you to "feel" virtual (i.e., onscreen) windows, buttons, sliders, etc. Such improvements could lead to virtual mixing boards and synth control panels that actually provide the tactile sensation of physical controls.

A wide variety of alternative controllers are under development, including both experimental and commercial products. When these design efforts reach fruition, electronic musical instruments finally may approach acoustic instruments in expressive capability.

(Special thanks to Julius Smith, Atau Tanaka, and Craig Harris.)

Dan Phillips *does user-interface design, documentation, and assorted other stuff for Korg Research and Development.*

EM ON ALTERNATIVE CONTROLLERS

At one time, any controller that wasn't a keyboard was labeled "alternative." Today, enough electronic musicians play MIDI guitar, percussion, and wind controllers that these instruments can be considered mainstream. The term "alternative" is open to constant reinterpretation.

In the last few years, **EM** has covered a variety of commercial and experimental controllers that still are considered alternative. Here's a reference list:

EXPERIMENTAL CONTROLLERS

"Into New Worlds: Virtual Reality and the Electronic Musician," the July 1990 issue of **EM**

REVIEWS

Buchla Lightning, October 1991
Buchla Thunder, August 1990

"WHAT'S NEW" COVERAGE

Baldoni MIDI Accord (accordion), May 1992
Big Briar Theremin (with MIDI option), February 1992
Sensor Frame VideoHarp, July 1990
Starr Datapump 620 and Magnatar 1223, May 1992

—Steve Oppenheimer

FURTHER READING ON CONTROLLERS

Avid control freaks should investigate the following sources for current research in the area of user interfaces and controllers for music performance using computer-based instruments:

Computer Music Journal Volumes 14/1 and 14/2 are devoted to new performance interfaces. These issues represent the works of such pioneers as Xavier Chabot, Michel Waisvisz, Max Mathews, Barry Vercoe, Roger Dannenberg, Paul McAvinney, David Rosenboom, and others. The *Computer Music Journal* is available from MIT Press Journals, 55 Hayward St., Cambridge, MA 02142-9902; tel. (800) 356-0343 or (617) 625-8569.

Another source is the *Proceedings* from the International Computer Music Conferences. The most-recent conference devoted several sessions to interactive performance systems. Contact the International Computer Music Association, 2040 Polk St., Suite 330, San Francisco, CA 94109; tel. (817) 566-2235.

A perspective by David Rosenboom entitled "Extended Musical Interface with the Human Nervous System" is available through *Leonardo*, the International Society for the Arts, Sciences and Technology, 672 South Van Ness Ave., San Francisco, CA 94110; tel. (415) 431-7414.

—Craig Harris

Music Contracts

By Michael A. Aczon, Esq.

An awareness of legal agreements prevents your career from being a bad deal.

PAMELA HOBBS

Ask any musician about their current plans and most will answer, "I'm shopping for a deal." The deal, the holy grail of ambitious dreamers, is a music-industry term defining the bond between an artist and the company that exploits the artist's work for mutual profit. For those struggling to make a living playing music, the "deal" represents a catapult to pop stardom and summer villas in Cannes.

But business deals have a dark side, and what you don't know can hurt you. A bad contract sidetracks a career faster than a record without hits. Fortunately, there's no reason to be ignorant of contractual law. If you can figure out sequencing software, or solo in all twelve major and minor keys, you can understand simple legal agreements. In business, knowledge is power. An artist oblivious to the ramifications of deal-making is an artist with no control over his or her career.

LET'S MAKE A DEAL

Let's review some basic contract law. A deal is an agreement; an agreement is a contract. In order for a contract to exist, it must exhibit three main components: an *offer*, an *acceptance* of the offer, and what is known in the legal field as *consideration* (the thing or promise being exchanged). A contract need not be in writing to be binding. Lawyers often are required to ascertain the merits of alleged verbal agreements.

I separate novices from experienced artists by asking them to name the specific deal they are seeking. Musicians innocent of business acumen never provide an intelligent answer. (Any deal is fine; they just want to be signed.) This attitude is no way to develop a career. Serious artists must be aware of the different types of deals available. While limited space prohibits a comprehensive explanation of each deal (entire books are written on the subjects), I can offer basic definitions of the three major music industry agreements.

EXCLUSIVE ARTIST AGREEMENT

The terms *record deal*, *production deal*, *development deal*, *all-in deal*, and *sign-here-and-we'll-make-you-a-star deal*, usually are associated with exclusive artist agreements. These deals have a number of variations, depending upon the party (major label, independent label, independent producer, etc.) with whom the artist signs the contract. What is being traded is the artist's exclusive recording services for the purpose of making records. One of the major deal points is the length of the agreement. This is specified in terms of time (one year, plus four one-year options) or delivery of minimum recording commitments (five LPs, with option periods commencing six months after each LP is delivered).

Another major point is artist compensation. This is where artist royalties (and advances against those royalties) enter the picture. In exchange for the exclusive services of an artist, record companies pay a royalty based on units sold. Usually, this is a percentage of the record's suggested retail price. These figures, which differ greatly from deal to deal, are based on a number of variables ranging from the commercial stature of the artist to the willingness of the record company to bet on an artist's future sales. Although these variables make it difficult to ballpark standard figures, a new artist may be offered a royalty of less than ten percent of retail, while a superstar can

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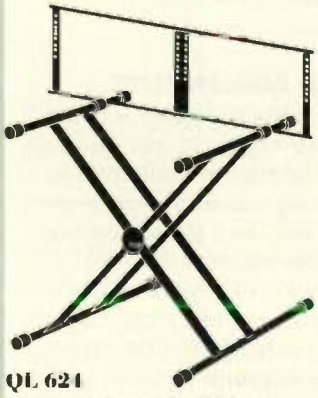

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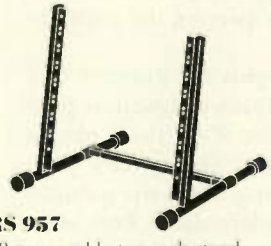

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Artist advances are royalty payments made up front (before a record even exists) and are recoupable by the record company from accrued royalties. In effect, the advance is a loan secured by the artist's future royalties. The recoupment (by the record label) of other costs, such as recording and video budgets, tour support, and promotional budgets, are subject to negotiation. Again, the outcome of these negotiations depends upon the relative bargaining positions of the parties. A deal offering a $50,000 artist advance, a $100,000 recording budget, a $75,000 video budget, and $25,000 in tour support, logs $250,000 in recoupable funds. Assuming a ten percent royalty on albums listing at $10, an artist selling 200,000 units remains in debt to the record company and therefore is not entitled to royalty payments.

PUBLISHING AGREEMENTS

Songwriter rights probably are the most valuable rights in the music industry. At the root of multi-million dollar publishing and record company acquisitions are the up-and-coming songwriters who trigger the entire process by writing a cool song (see "Working Musician: Comprehending Copyright" in the February 1992 EM). However, until the songwriter grants rights to a third party, he or she is self-published. This means the writer is the sole person who can pitch the song, or grant other parties the right to exploit it.

As soon as rights are granted to a third party, various songwriter/publisher deals arise. Publishers obtain songs from writers for a specific period of time, during which the publisher attempts to place them. For example, a publisher might try to get your song cut by a current hit artist, or included on a movie soundtrack. In exchange for these services, publishers are entitled to a portion of the royalties generated by the song.

There are variations on this theme. Single-song deals limit the ties between the writer and publisher to a specific song. Sometimes the writer is paid a minor advance to cover demo costs, and the publisher is given a deadline to place the song. (I advise my clients to secure a reversion of all rights granted to the publisher if the song is not

covered within the specified time.) Long-term publishing deals are subject to many of the same negotiating points as an exclusive artist deal, except the artist is bargaining with songs, rather than phonograph records.

In recent years, high-profile deals have gone to artist/writers or producer/writers who guarantee a publishing company cuts because of their track records in the industry. It is not unusual to see seven-figure publishing deals signed by successful artist/writers. When evaluating a publishing deal, artists should research their current market value and set contract demands based on the enthusiasm of company representatives.

MANAGEMENT AGREEMENTS

Behind every successful artist is a strong team consisting of a personal manager, business manager, lawyer, and booking agent. Agreements for personal and business management services are critical to an artist's career, as a personal manager is the cornerstone of a successful business team. The personal manager's agreement usually is multi-year, with compensation based on a percentage of the artist's income.

In the early, no-income stages of an artist's career, the manager often is inexperienced and assumes multiple roles in return for future compensation. During this embryonic period (based almost solely on trust), care must be taken to negotiate fair agreements between the parties that set forth realistic goals, expectations, and objective standards of performance. These can include dollar incentives ("artist will be making $10,000 a year in the music business within one year") or specific goals ("artist will be signed to a major record label within one year"). It is difficult to negotiate these agreements because they require protection of both sides. For instance, if an artist outgrows a manager's capabilities, a settlement must be based on an intangible estimate of how far the artist would have gotten without the manager's efforts.

A business manager is enlisted when the artist begins to make money and major accounting and tax advice is needed. Legal counsel is required from the very beginning, as issues ranging from the formation of a musical group to reviewing all of the aforementioned agreements require the guidance of a lawyer who (hopefully) knows the business and cares about your music. The final member of the management team is the booking agent, who negotiates the artist's personal-appearance agreements.

SUMMATION

This column only begins to discuss business deals. It takes extensive study to understand the legal elements of music contracts. Leaving these "non-creative" machinations to your business team can be trouble. A premier inspiration killer is artist paranoia over whether his or her career is being properly handled. It's tough to write great songs when you're worried about money. The bottom line of a business relationship is the element of trust between the artist and those charged with courting success. Why live in the dark? Educating yourself about major deals puts you on even ground with the executive on the other side of the table.

Michael A. Aczon *is a San Francisco-based entertainment lawyer.*

Tweaking Synths, Part 1

By Scott Wilkinson

Begin creating your own synth patches by adjusting the oscillators, filters, and amplifiers.

ANDREW FAULKNER

In the early days of electronic music, most performers also were sound programmers. Synths didn't have patch memory, so synthesists had to create their own sounds before performing or recording. Often, electronic performers hired sound programmers to assist them in the studio and onstage.

With the advent of patch memory, these two roles began to diverge. Today, few performers create their own synth patches or hire sound programmers; instead, they use factory presets, buy third-party patches, and settle for an undistinguished sonic signature.

Sound-programming is highly intimidating, even for seasoned pros. Nevertheless, it can be one of the most rewarding aspects of synthesis, as it helps you develop a unique sound. Best of all, it's fairly easy. You need not start from scratch, staring at a blank display waiting for inspiration: The factory presets provide an excellent starting point.

DON'T WORRY, BE HAPPY

First and foremost, don't be afraid to enter the edit mode of your synth and muck around with parameter values. You can't damage the instrument; at worst, you'll lose some of the factory presets. This is unlikely, however, since most synths include memory protection that you must intentionally disable in order to save any sounds. Even if you do save a new sound in the memory location of a factory preset, many instruments have the presets backed up in ROM and let you recall them by reinitializing the memory. (This often wipes out any new sounds you may have stored there, however.) To be safe, save the factory presets to another medium—a RAM card or cartridge, internal floppy disk, external MIDI data-storage device, or computer running a patch-librarian program—before you begin to create your own sounds.

It's a good idea to use a patch-editor program when developing sounds. No matter how large the display on a synth might be, a computer screen is larger, which makes it far easier to see what you're doing.

Modern synths usually include two basic operational modes that go by different names: Voice, Single, or Play mode, and Performance, Multi, or Combi mode. In Voice/Single/Play mode, a single patch is played across the entire keyboard. In Performance/Multi/Combi mode, several patches are assigned to different regions of the keyboard. This mode often is used for multitimbral sequencing with each patch responding to a different MIDI channel. It also can be used to layer several patches together for a bigger overall sound.

Each of these operational modes has a corresponding Edit mode in which parameter values are set to achieve a certain result. If you're not using a computer-based patch editor, start from the desired operational mode and press the Edit button to enter the corresponding Edit mode. Once in the desired Edit mode, you probably will navigate through several "pages" of parameters. These pages usually are organized in a more or less logical manner, grouping related parameters together.

As you progress, you will develop the ability to predict the effect your actions will have on the sound. You can foster this ability by using the Edit/Compare button found on many synths. After changing one or more parameter values, pressing this button restores the original values and lets you hear the sound as it was before your changes.

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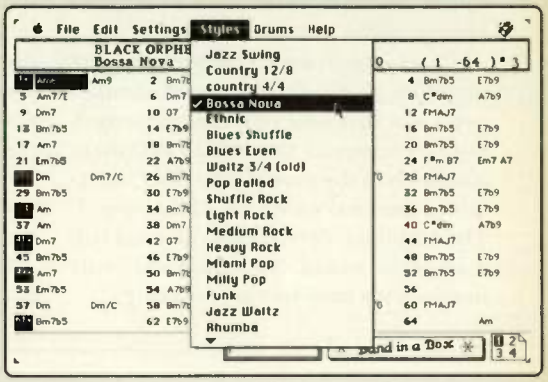

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Pressing it repeatedly toggles between the edited and unedited sounds. Use this button often.

Most modern synths are based on the signal flow used in earlier designs. An oscillator generates a signal that is sent through a filter to alter its waveform, after which it passes through an amplifier to control its volume (see **Fig. 1**).

This architecture is known as *subtractive synthesis* because the filter removes, or subtracts, certain harmonics from the oscillator signal. As a result, the waveform of the signal is altered in a manner that depends on the exact nature of the filter settings. While early synths used simple waveforms, such as sawtooth, triangle, and square, modern instruments use complex sampled waveforms.

It's so important to understand the functions of the three primary components that they bear repeating. The oscillator determines the initial waveform and pitch of the sound. The filter determines the final waveform of the sound. The amplifier determines the final volume of the sound. With these concepts in mind, it's time to start tweaking.

OSCILLATORS

One of the most basic parameters is the waveform produced by the oscillator. By changing this selection, you can create an entirely new sound instantly. Of course, this new sound may be better or worse than the original, but it's important to try different waveforms to discover their contribution to the sound.

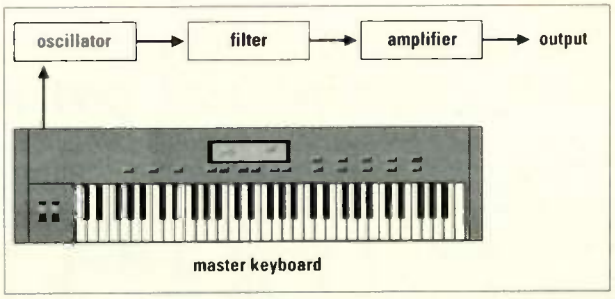

FIG. 1: Basic subtractive synth architecture. The oscillator produces a waveform at a pitch that is controlled by the keyboard. This waveform is sent through the filter, which changes the harmonic spectrum by removing certain harmonics and boosting others depending on the type of filter, the cutoff frequency, and the resonance. The amplifier determines the final volume of the sound.

If you want to improve a factory preset without radically changing it, try different waveforms from the same family. For example, there probably are several bass samples to try in a bass patch; one of them may sound more to your liking than the one in the preset. You also might try a synth waveform such as triangle or sawtooth in place of a sampled acoustic sound.

Most modern synths have the ability to combine two or more oscillators in a single patch, although this sometimes reduces the polyphony of the instrument. This architecture often incorporates the entire signal path, allowing you to combine two or more oscillator/filter/amplifier groups.

Combining different waveforms in a single patch provides an almost unlimited potential for interesting sounds. You also can assign the same waveform to several oscillators and detune them slightly for a chorusing effect. Detuning

can be effective with different waveforms, as well. Try transposing one of the oscillators up or down by a larger interval such as a fifth to create a parallel harmony; transposing one oscillator by an octave creates a fatter sound.

The frequency of the oscillator can be modulated using various control sources (discussed next month), including a built-in keyboard. Keep in mind, however, that the synth is a sound source, and a keyboard is only one of many possible controllers.

FILTERS

The filter removes certain frequencies from the harmonic spectrum of the oscillator's waveform. As you may recall, all waveforms (except sine waves) consist of several sine waves at different frequencies. For more information about this vital subject, see "From The Top: Making Waves" in the January 1992 issue of **EM**.

Some synths let you select the type of filter through which the oscillator's signal will pass (see **Fig. 2**). By changing the filter type, it is possible to create wildly different sounds from the original source. The most common type is the *lowpass filter*, which allows frequencies below a certain threshold to pass unaltered while reducing or eliminating higher frequencies. Similarly, a *highpass filter* attenuates frequencies below the threshold and allows higher frequencies to pass.

The most common filter tweak is changing the threshold frequency, which is called the *cutoff frequency*. Lowering the cutoff frequency of a lowpass filter lets fewer high harmonics through, making the sound duller, while raising it makes the sound brighter. Raising the cutoff frequency of a highpass filter trims off the low and mid frequencies, producing a thin sound, while lowering it lets more of the sound through.

A *bandpass filter* lets through only a specified range (band) of frequencies, rejecting all others. The cutoff frequency is at the center of the band and is more properly called the *center frequency*. Changing the center frequency affects the character of the sound in different ways, depending on the initial waveform. It also may be possible to broaden or narrow the range of the frequencies passed (the bandwidth).

A *band-reject* filter is the opposite of a bandpass filter; it passes everything *but* a specified range of frequencies around the center frequency. The most common kind of synthesizer band-reject filter is a *notch* filter, which stops a very narrow band of frequencies.

In analog synthesizers, most filters include a parameter called *resonance*, or *Q*. Increasing the resonance value amplifies the frequencies near the filter's cutoff or center frequency, regenerating them in a feedback loop. This produces a peak in the filter's response close to the cutoff frequency (see **Fig. 3**). In a notch filter, increasing the resonance narrows the notch.

With most resonant filters, you can increase the resonance to the point that it goes into self-oscillation, creating its own waveform at the cutoff frequency. Until recently, the digital filters found on most modern synths had no resonance, but many now offer a resonance control.

AMPLIFIERS

The amplifier controls the volume of the sound, usually after the signal leaves the filter. The amplifier's behavior, like that of the oscillator and filter, generally is determined by a *modulator* such as an envelope generator,

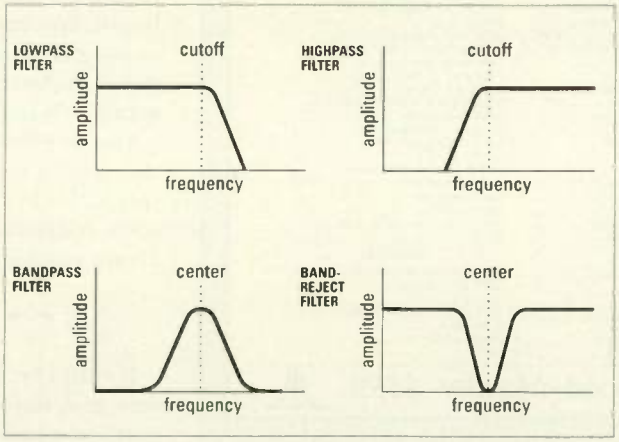

FIG. 2: Filter behavior can be represented graphically. A lowpass or highpass filter lets frequencies on one side of the cutoff frequency pass through unaltered while attenuating frequencies on the other side. A bandpass filter only lets through frequencies within a defined range around the center frequency, while a band-reject filter attenuates the frequencies near the center frequency.

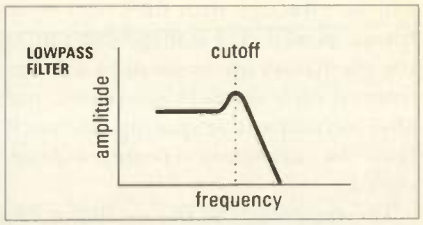

FIG. 3: Adding resonance to this lowpass filter produces a peak in the filter's response near the cutoff frequency.

which we'll get to next month. The only direct control parameter is the *overall level*, which determines the maximum volume of the sound. This parameter is useful when mixing two or more sounds in a single patch, as you can balance their levels to taste. It's also useful when certain waveforms and/or filter settings result in an overall level that's too hot.

PATCH LAYERING

As mentioned earlier, many modern synths provide the ability to combine several sounds in Performance, Multi, or Combi mode, *layering* several patches together much like combining oscillators in a single patch. In this application, the patches often are assigned to the same part of the keyboard so they all sound together. It's important to remember that this technique reduces the polyphony of the instrument. Try layering entirely different patches or several detuned copies of the same patch. Transposing one or more patches also is quite effective. Try assigning one patch across the entire keyboard while another patch is active only in one part of the keyboard. For example, you might want to assign a string section sound to the entire keyboard while a flute sound is active only in the upper third.

The possibilities seem endless, but they aren't as daunting as you might think. With a little knowledge and some common sense, you can learn to create sounds that will set you apart.

• • • • • • •

It could be said that oscillators, filters, and amplifiers form the heart of synth programming. Next month, we'll dive into its soul when we discuss modulator and controller tweaking.

Scott Wilkinson *tweaks as many parameters as he can find just to see what happens.*

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By its nature, MIDI implies a distributed studio: individual pieces of equipment working together to form a system. Another approach is the workstation model in which several studio functions are combined in one box. Fortunately, both options are available to the computer musician. Computers can provide the interface for controlling external gear, an all-in-one system, or a bit of both.

Several systems put more capability inside your computer without limiting your options when it comes to using external gear. This article covers three types of applications—synthesis, sampling, and signal processing—on as many platforms: Digidesign's *Turbosynth* on the Mac, Steinberg's *Avalon* for the ST, and Spectral Synthesis' SynthEngine on the PC. We'll also hear from several people who use these tools.

SYNTHESIS

"The basic idea behind *Turbosynth*," says Digidesign's Mark Wilcox, "is to provide modular synthesis in software." The program offers a collection of sonic building blocks, or modules, that are connected with graphic "patch cords" on the screen. In contrast to the modular synths of yore, these blocks operate digitally. *Turbosynth* (reviewed in the November 1988 EM) allows you to use samples in addition to synthetic waveforms while providing time-delay and waveshaping effects and the more traditional filters, envelope generators, and noise sources familiar to analog synth devotees (see Fig. 1). Once a sound is created, it can be output as a file to Sound Tools, loaded into SampleCell for playback, or dumped to an external sampler.

"I design sound effects with it," says sound designer Bill Koepnick. "Not many musical sounds, but mostly futuristic noises. I used it on the *Back to the Future* cartoon series last fall [now in reruns]. The little zips and beeps were all done with *Turbosynth*."

In some cases, simply tweaking the program's internal oscillators does the job, while external samples are used as the starting point at other times. "It really depends on what I'm trying to create," says Koepnick. "Things that sound like machines—electronic readouts and things—almost always are done with the internal oscillators. When I'm trying to make something that's more organic or larger, I'll start with a sampled sound.

"We did the effects creation and editing for a show called *Nightrider 2000*, a pilot movie on NBC last year," recalls Koepnick. "The director wanted a lot of noises that didn't sound like anything you'd ever heard. I dove into *Turbo* and came out with all kinds of button pushes and little readout sounds. They also had this sonic stun gun that the police were using. I started with the attack portion from the sound of an implosion as a TV tube was smashed. I truncated that and did some pitch and envelope weirdness with it." Then he began assembling modules, playing with the sound, and using the resulting sound as the source for the next module. "You can get really deep by doing that kind of thing," he says.

Another sound designer who uses *Turbosynth* is Harry Snodgrass of Visiontrax, Inc. "In the past, I've used it for voice resonation—making a computer voice out of a human voice. We did some voice processing on *Predator 2;* the voice of the Predator went through it. I use it to process and filter, almost like a piece of outboard gear."

He also has used the program in conjunction with Sound Tools, but in an unexpected way. "I'd use the scrubbing [manually scrolling through a sound

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file] in Sound Tools and actually record what I scrubbed to a DAT. I'd then take that back into the computer and put it through *Turbosynth*." This gave him a quick way to get the pitch-bend effect he wanted, without having to draw a complex pitch envelope. "A lot of times, the obvious methods aren't the fastest," says Snodgrass.

"Like most instruments," says Koepnick, "*Turbosynth* has 'a sound,' which definitely is distinctive. You can get beyond that sound easily by importing other sound files, which is good; you're not locked in. But when you're looking for a new sound, it's nice to have an instrument like that to go to." Finally, Koepnick views the integration with the rest of his tools as a definite plus. "It rounds out the Mac as a production platform," he says. "Using it with SampleCell, Sound Tools, and *Q-Sheet*, I can do almost all my work on the Mac."

SAMPLING

Atari users find similar capabilities in Steinberg's *Avalon* (reviewed in the May 1992 **EM**). While most people use *Avalon* as a sample editor, it has found favor among sound designers as well. It is designed to dump tweaked sounds into external samplers, but it also plays through the speaker in the SM124 monitor or the stereo audio outputs of the newer ST computers. For higher sound quality without a sampler, there is another alternative. "Some people want to hear 16-bit audio," says Steinberg's Bill Black, "so we created the Steinberg D/A board for that purpose. They can be editing sounds and audition them before they ever go back to the sampling device."

According to Black, "Some of *Avalon*'s main features include the ability to view stereo samples and switch between multiple banks, as well as time compression and expansion and Fast Fourier Transforms. It offers additive and FM synthesis as well as the ability to process a sample through different modules and other operations you would tend to associate with synthesizers. We have a program called the *Switcher*, which allows you to have multiple Steinberg programs running on your computer. You could be editing a sequence in *Cubase*, switch to *Avalon*, edit a sample, and then see how that sample fits with the *Cubase* sequence."

Musician and **EM** author Jim Pierson-Perry is a long-time user of *Avalon*. "I like using bizarre sounds," he laughs, recalling one project in particular: an electronic music adaptation of Roger Zelazney's *Nine Princes in Amber*. "That project used a lot of non-periodic rhythms, so I was looking for unusual sounds that changed over time. *Avalon* gave me exactly what I needed. It gives me the opportunity to take pieces of things and combine them together to come up with new timbres."

One feature he found particularly useful was the program's frequency-domain editor (see **Fig. 2**). "You can take sounds apart, work on harmonics and their envelopes, and do all sorts of bizarre things within the frequency domain," says Pierson-Perry. "Sometimes I operate on each half of a stereo sample differently; I work on the odd harmonics of one side and the even harmonics of the other. Then, I resynthesize it and play it in stereo."

Pierson-Perry notes that the program's speed makes it easy to experiment. "The program is much faster than I expected. I was only running on a Mega 4 for the Zelazney project, and the longest it took to crunch the numbers was about two and a half minutes. The algorithms are pretty well optimized," he says.

For PC users, Spectral Synthesis covers similar,

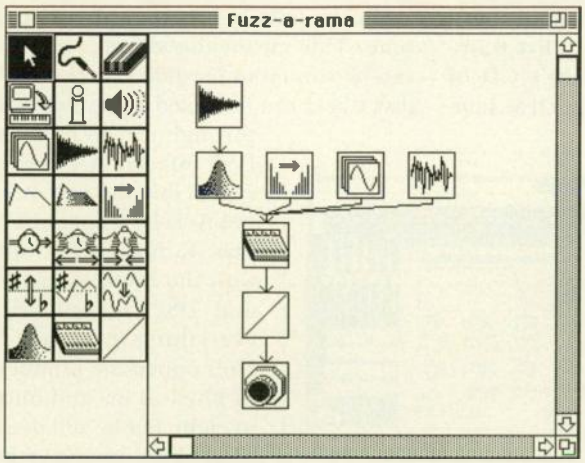

FIG. 1: Digidesign's *Turbosynth* software for the Mac allows you to create sounds using samples and synthetic waveforms. These sources are processed through a variety of modules and transferred to an external sampler or internal SampleCell card.

but not identical, territory. The company's SynthEngine (reviewed in the September 1990 EM) is an integrated computer music system consisting of various software programs and one or more SynthCards (full-length AT boards), each containing 4 MB of RAM and two TI 320C25 DSP chips. Depending on which software you buy, SynthEngine performs sampling and digital signal processing, both of which work in conjunction with the company's multitrack hard-disk recording system.

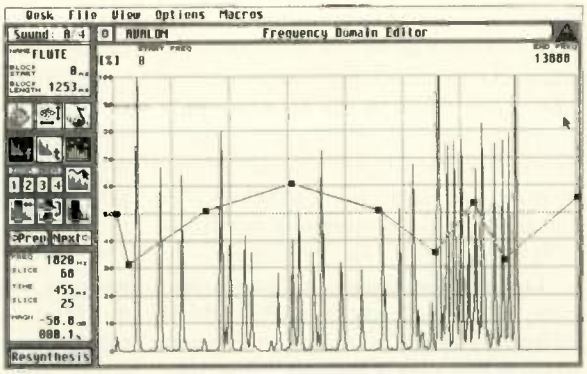

FIG. 2: Steinberg's *Avalon* for the Atari ST provides sample editing and synthesis. *Avalon*'s Frequency Domain Editor is particularly useful.

In every Spectral Synthesis system, a FlyBy bus controller card is required, which links all other Spectral cards. The FlyBy bus is so named because it allows digital audio to travel apart from the congestion of the regular motherboard bus, already laden with the tasks of running the computer. "Real-time digital integration is what our FlyBy architecture is all about," says Spectral's Mark Doenges.

One user of the system is Brian Konzelman of Heart Song, a private-use studio located on a ranch near Dallas. Konzelman does album production and film soundtrack work with the system and also teaches in a two-year recording program at nearby McLennan Community College.

"I use the sampler as the ultimate drum machine," Konzelman says. "I've got a lot of different boxes that produce drum sounds, but I found that I needed really great samples. I've transferred Bob Clearmountain's CD of drum samples into my Spectral sampler. We took them straight off a CD player with digital outs into the S/PDIF inputs on the Spectral board. Different velocities trigger one of three samples, and different samples are triggered by alternate events. All my samples are stereo, and cymbal samples are each seven to ten seconds long.

"I used the Spectral system because it has enough internal memory to handle anything I want to do with it. You've got to have a big system if you really want the big sounds," adds Konzelman. He uses two SynthCards for a total of 8 MB of RAM. "Because the software runs under *Windows*," he continues, "I was able to come up with macros that made my sampling really simple." One of his macros searches for the start and end point of each sample, truncates it, and performs a crossfade at the end point to remove any lingering DC offset.

SIGNAL PROCESSING

The system's FlyBy bus allows digital audio to pass between cards in real time. This means the sampler output can be routed to hard-disk tracks, and disk tracks can be mixed and processed through SynthEngine's DSP effects. "I got the system initially with only two A/D-D/A channels," says Konzelman, "but with the internal mixer and DSP, I could do everything internally." He's upped the number of physical ins and outs to eight, but he still does most of his mixing within the system. "I just finished a project in which I did 60 vocals and 112 guitar parts. They're all

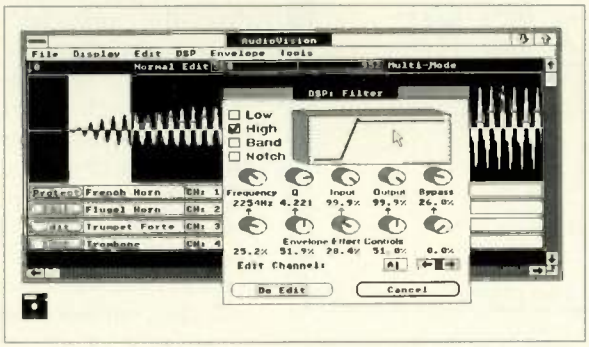

FIG. 3: Spectral Synthesis' *AudioVision* software for PC compatibles provides DSP functions that are carried out by the SynthEngine card.

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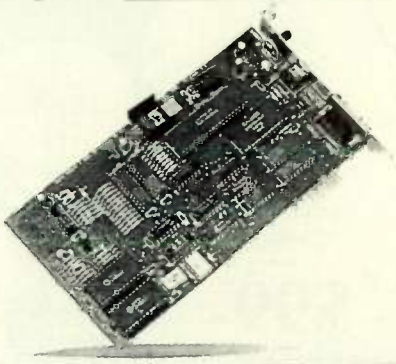

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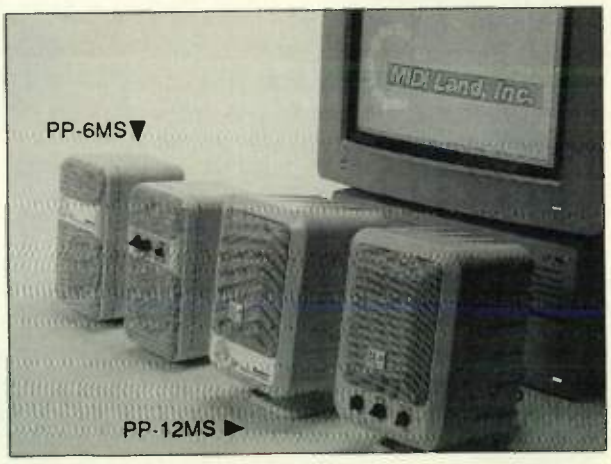

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available independently for cutting and pasting. Then I blend that down to the stereo pair I want."

Although he still has a favorite outboard reverb unit, Konzelman makes extensive use of the system's DSP EQ and filtering capabilities (see Fig. 3). "I love the tone control," he says. "When you boost the high end, it doesn't boost

▼

"I use the SynthEngine sampler as the ultimate drum machine."

the noise. It just increases the clarity at the frequency you've selected. I use the EQ on everything. I've gotten rid of almost all my outboard delay and EQ devices."

Even though he uses a large collection of external MIDI sound generators, the tight integration of the digital audio capabilities within his computer has proved to be a successful solution for his needs. "My hard-disk recording system paid for half of itself the first year in tape savings alone," he explains, comparing tape costs for the 2-inch 24-track tape deck he sold to buy his Spectral system.

Spectral also offers a synthesis software package called *AudioCAD*, but it has not yet been updated to run under *Windows 3.0* and is currently unavailable. However, that upgrade is due later this year, and it will work with all existing SynthEngine-equipped systems.

AND SO...

While integrated systems may not fulfill all the varied needs of electronic musicians, they do provide the right solution for specific tasks. And, as manufacturers build more and better digital audio, video, and MIDI capabilities directly into their computers, integration will increase, as the growing number of all-in-one multimedia products attest.

David (Rudy) Trubitt *has been experimenting with computers and audio since 1977.*

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Digital Fluency

By David Miles Huber

Old analog habits may fall to digital methodology, but a clean signal is still a beautiful thing.

PAMELA HOBBS

Although it's doubtful (at least as of press time) that significant numbers have shipped, affordable digital multitrack recorders are destined to change the production habits of project and professional recording studios. A home studio equipped with digital multitrack capabilities can produce masters that rival tapes recorded anywhere. The lines of distinction between the small studio and the large commercial studio are disintegrating, thanks to the sonic parity bestowed by this new generation of digital multitracks.

But added power means added responsibility. Reaping maximum benefits from digital multitrack requires that you familiarize yourself with the medium. A little knowledge guarantees that your home projects sound as pristine as big-budget productions.

MEET THE NEW BOSS

There are a number of practical differences between digital machines and their analog counterparts. Foremost among these differences is the recording media. For example, Alesis adopted an S-VHS videotape transport for ADAT, while Tascam is going with 8mm. These tape formats are less expensive than conventional reel-to-reel varieties and offer more recording time. (A 10-inch reel-to-reel tape played at 15 ips runs approximately 30 minutes, while ADAT's S-VHS tape runs 40 minutes.) Also, digital multitrack decks eliminate routine tape machine alignments. Modern digital converters are extremely stable and don't require traditional bias adjustments, so you can kiss your test tapes and alignment screwdrivers goodbye.

Another concept the digital recordist must kiss goodbye is the old analog practice of recording signals as hot as possible. Generally, a digitally recorded signal is clean up to its clipping point, but audio mayhem results once that point is reached. For this reason, peak amplitude levels when recording should max out at approximately -6 dB to -3 dB. Reducing overall signal level to avoid clipping does not compromise sonic quality (as it might when dealing with analog tape), since the digital noise floor typically is -90 dB to -80 dB.

DIGITAL MIRRORS

Digital clarity is every recordist's dream, but this same clarity allows every hum, buzz, and rumble to shine through your mixes. Holding your analog engineering chops up to the digital mirror provokes a few shocks. The relatively high noise floor of the analog medium shrouds many audio blemishes. Going digital means watching your Ps and Qs (production and quality control).

For instance, the analog medium often forgives punching in guitar solos played through noisy amplifiers (the amp hiss hides amidst the tape hiss). However, that pristine digital mirror reflects all the ugliness of a solo crackling from a sputtering amp. Obviously, it is critically important that every piece of your gear exhibits crystalline sonic quality. In addition to professional mixers and signal processors, a few high-quality microphones (condenser or otherwise) are excellent investments.

Getting acquainted with noise gates and single-ended noise-reduction

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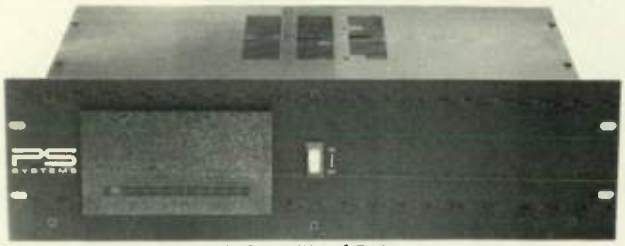

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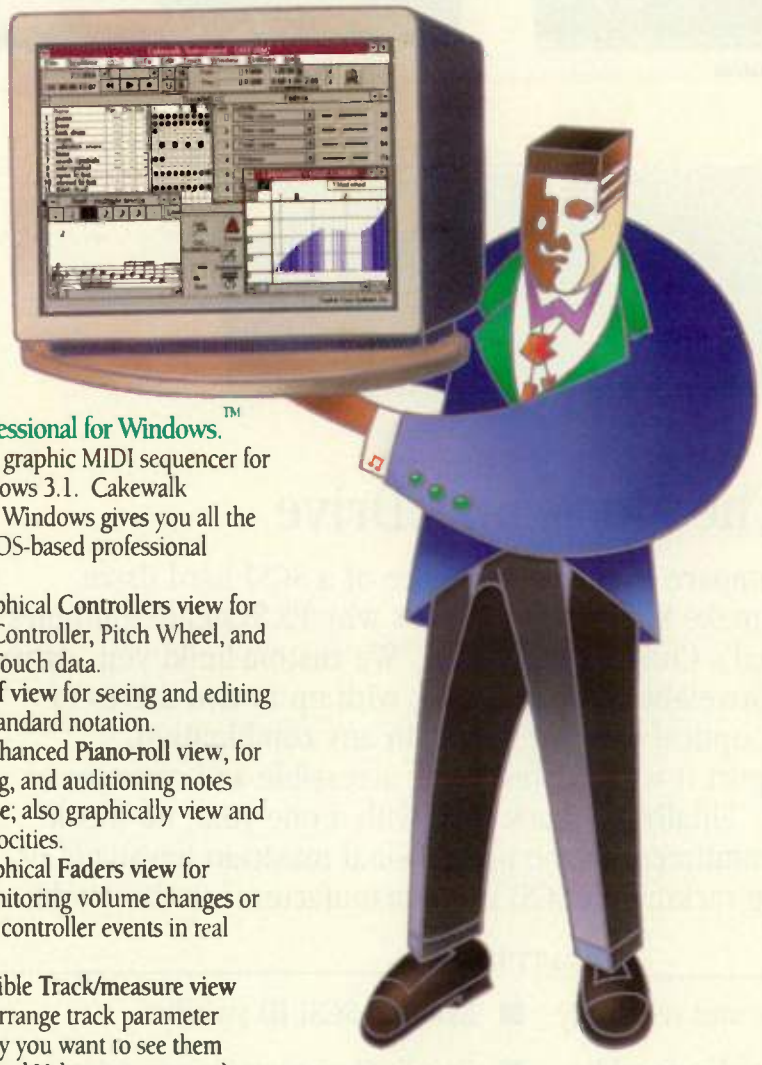

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processors also helps your tracks survive the digital "white glove" test. Any signal sent to digital tape should be sparkling clean. To continue our guitar solo example, the noisy amplifier can be tamed by running the signal through a noise gate before going to tape. This shuts down the track until a signal louder than a preset threshold is present. Since the roar of the guitar solo is much louder than the hiss of the amp, it's easy to dial in a setting that silences the track until the guitarist lets it rip.

Most single-ended noise-reduction systems diminish audible hiss using sliding dynamic filters (which reduce "unused" treble frequencies) and downward expansion (which reduces low-level audio signals). These processors are invaluable for signals that are noisy during performance and therefore unsalvageable by noise gating. Some processed guitar sounds are washed in enough hiss to compromise the sound, even when "seated" into a rhythm track. (And remember, digital hears everything.) In these situations, a noise gate *and* a single-ended noise-reduction unit are essential.

Of course, the most valuable noise fighters are your ears. Be tenacious about signal clarity. Listen critically to all signals routed to tape. Make sure that microphone placement, equalization, and gain staging are optimum for both signal enhancement and audible noise. Don't let poor signals slide; digital recorders gladly broadcast errors in audio judgement.

TRACK MULTIPLICATION

One of the biggest advantages of digital is its ability to be copied (or re-recorded) without any loss in audio quality. This holds true when copying from one machine to another or track-to-track within the machine itself. This age-old production trick, known as bouncing, makes it possible for previously recorded tracks to be erased and opened up for additional instruments or vocals (see Fig. 1).

Another way digital multitrack recorders provide added tracks is with a unique form of synchronization that is new to affordable digital audio. This capability, known as *word sync*, allows digital multitracks of the same type to be synchronized with a code imbedded in the digital bitstream. This allows the slave recorder to lock to the exact

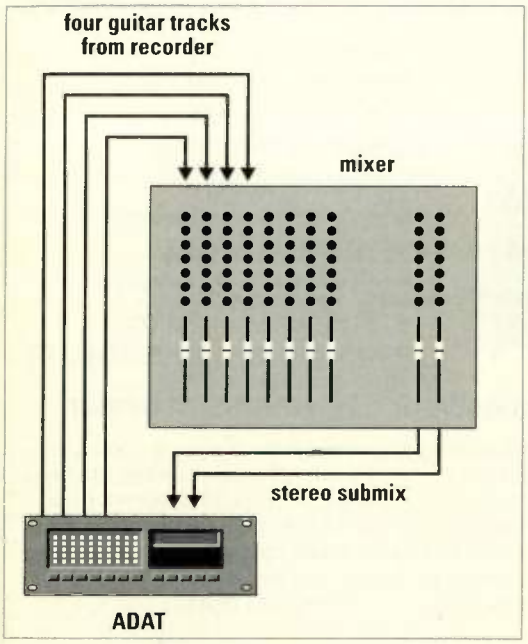

FIG. 1: Digital clarity allows submixing of multiple tracks without compromising audio quality.

position of the master recorder with single-sample accuracy (1/48,000th of a second at 48 kHz). The simple port connection required for this operation negates the necessity of surrendering a tape track to SMPTE. Should you wish to open your tracking options by adding additional machines, all you need to do is bring in one or more additional machines, connect the sync ports, and continue building tracks.

THE DAW CONNECTION

Rumblings are being felt throughout the computer world as manufacturers of existing digital audio workstations (DAWs) contemplate teaming up with affordable digital multitracks. Synching hard disk-based workstations and digital multitracks offers new production capabilities.

Both DAWs and digital multitracks bring individual strengths to the partnership. The multitrack, of course, provides additional tracks without commandeering valuable disk space. The computer-based DAW allows audio to be cut, copied, processed, and reassembled directly from the hard disk. This type of sonic manipulation offers a number of advantages. For example, final mixdowns can be transferred to hard disk and edited, faded, reversed, and/or extended to create entirely new versions. Also, you could copy a number of guitar solos from the multitrack to the DAW, assemble them into a single killer take, and re-record this composite solo onto an open track (or simply play back the edited version directly from the hard disk).

If the DAW is locked to the multitrack using word sync, SMPTE, or MIDI Time Code, it can trigger audio files directly from the hard disk. For example, that same guitar solo could be "automatically" played at the song's solo cue point, or background vocals could be triggered at every chorus. Also, sound designers can store audio effects libraries on the DAW for precise synching to multitrack projects. Obviously, adding a time-locked

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THE STUDIO CONNECTION

The anticipated proliferation of digital multitracks in home and project studios may force professional facilities to recognize and service these formats. Soon, a musician or producer may take working masters or digital copies into a large recording studio and track instruments best-suited to that environment (live strings, grand piano, etc.). Once the expensive work is completed, the tapes can be brought home for additional tracking and refining. The final master also can be taken to a professional facility for mixdown.

▼ Holding analog engineering chops up to the digital mirror provokes a few shocks.

These options make the proposition of tracking in professional facilities a viable and cost-effective option. In addition, the sound quality of the digital medium and the decreased requirement for big studio equipment may annihilate the gap between semi-pro and pro productions.

For these ideas to work, however, a standard tape and encoding format must be developed as quickly as possible. The adoption of a universally compatible format by all manufacturers has obvious advantages, and would ensure the unfettered growth of a cutting-edge technology. Consumers must voice their opinions to manufacturers, either in writing or by using the loudest voice of all, their purchase dollars, to tell the industry that a single format benefits us all.

David Miles Huber, *author of* The MIDI Manual and Modern Recording Techniques, *is currently working on his latest book,* Random Access Audio.

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Reviews

Digital Audio Lab The CardD

By David Miles Huber

DAL's PC-based digital recorder offers quality sound and basic features.

Pick a card, any card—a hard-disk recording card, of course. It's tough to decide which to choose, as new cards aimed at all segments of the recording market appear at a furious pace. In the middle of the lineup is the CardD system for PC-compatibles, a 2-track, 16-bit, tapeless mastering system from Digital Audio Labs (DAL). It takes a no-frills approach to hard-disk recording and editing and offers some useful features, including a handful that are unique. The CardD system is an affordable ($1,340 complete) system made up of three components: the CardD, the I/O CardD, and *EdDitor,* which are sold separately.

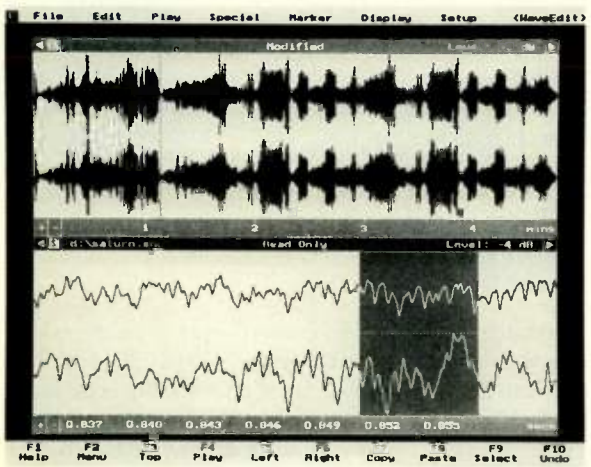

FIG. 1: The *EdDitor*'s main screen contains a Read-Only window (bottom) and a Modified window for editing (top).

The CardD requires an 80286-, 80386-, or 80486-based, AT-compatible PC with a minimum CPU speed of 12 MHz. (I used an 80286 machine.) For best results, however, DAL recommends at least a 16 MHz 80386. The *EdDitor* software supports EGA, VGA, and Hercules graphics.

The system requires a minimum of 640 KB RAM, but its processing speed improves with extended memory. DAL recommends 2 MB of RAM and an expanded memory manager such as *QEMM.* You can use MS-DOS 3.3, but its maximum disk-drive partition size of 32 MB can put a serious cramp on overall recording time. Under DOS 4.1 or higher, recording time is limited only by the size of the hard disk. The CardD is not compatible with Microsoft's *Multimedia Extensions,* but the manufacturer expects to provide *MME* compatibility later this year.

As with any hard-disk recorder, the CardD works best with a fast controller/hard-disk combination (24 ms or faster). For computers with on-the-edge access time, the system can be configured in software to reduce demands on the bitstream rate. Because the samples can fill up over 10.5 MB of disk space per minute of stereo sound, and the system often requires two copies of the file being worked on, a large hard drive is a necessity.

THE CARDDS

The CardD fits into any 16-bit, AT-bus card slot. It contains the analog-to-digital and digital-to-analog converters and transfers digital audio to and from the computer's hard disk at sample rates of 32, 44.1, and 48 kHz. Four RCA jacks mounted directly onto its edge plate provide stereo analog inputs and outputs. Hardware jumper-pins set the input and output gain to any of three levels: +4 dBm, +8.7 dBs (a consumer CD level I didn't know existed), and -10 dBV.

On the recording side, analog audio is converted to digital using dual 16-bit, 64X-oversampled, sigma-delta converters, while dual 8X-oversampled, 18-bit DACs are used for playback. The CardD's best selling point is its overall sound quality; the converters are as good as some of the best I've heard. The manufacturer claims a dynamic range of 92 dB across a frequency range of 20 Hz to 20 kHz.

One fact that sets this system apart from almost any other professional-quality system on the market is that it doesn't contain an onboard co-processor (such as the Motorola DSP56001), but instead makes use of

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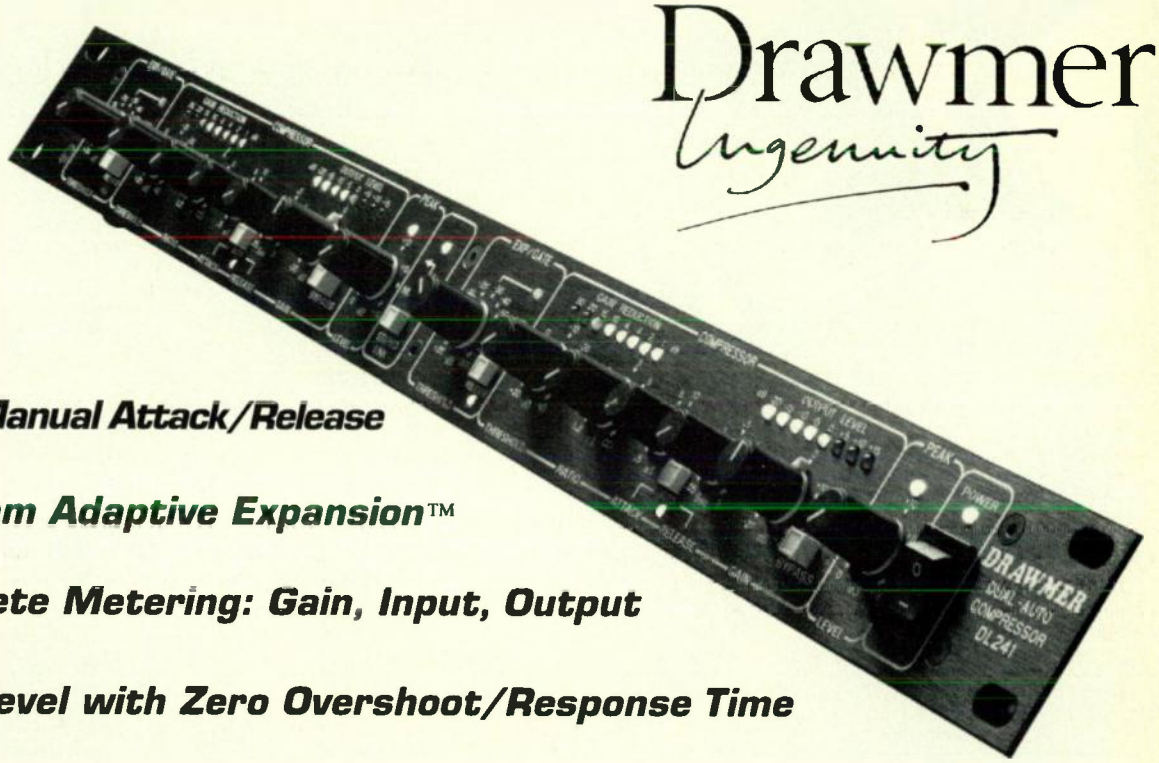

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HEADROOM!

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Babe Pace, C+C Music Factory, on stage with the CR-1604.

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3-band EQ with really useful, musical frequencies: 80Hz bass, 2.5kHz mid and 12kHz treble.

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High headroom and low noise. Mixers that make you set levels by increasing gain until overload and then backing off a bit are trading headroom for more impressive noise specs. The CR-1604's metering system, Unity Plus faders and overall gain structure allow levels to be set properly so the console can be run at 0dB, resulting in **22dB of headroom** and noise-free operation.

4 stereo AUX returns with enough gain to work at all levels.

ALT Preview solos all muted channels.

A Polaroid of Pat Mastelotto in the studio with his CR

Another key to maximum headroom: SOLO electronically switches metering to the channel being soloed so you can accurately set trim levels, or monitor operating level at any time.

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Mix amps with twice the headroom. In any mixer, the mix amp stage combines signals from all inputs. The more channels in simultaneous use, the higher the operating level* until at some point, conventional mix amps give up and distort. Drummers aren't the only ones who can induce this in most mixers pretty fast. If you use percussion samples with your keyboards, you know what we mean. The CR-1604 uses a proprietary mix amp architecture that eliminates this mix amp overload bottleneck. Cram it with 16 hot signals and it still has more headroom than a conventional mixer running just 8 inputs. Plus it just plain sounds

*Each time the number of inputs is doubled, it adds 3dB to the non-correllated operating level. Thus 16 channels running all at once is 12dB hotter than the same mixer with *just one* channel operating

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the PC's internal processor. This feature simplifies the CardD's design and keeps its price down. The disadvantage of this feature is that when the system is operating, it has complete control of the CPU and cannot work in tandem with other internal computer applications, such as MIDI and multimedia. I know; I tried to run the CardD in the background in Microsoft *Windows*' switching environment and blew up my computer's CMOS microprocessor. Don't even *think* of trying this, even with adult supervision.

In addition, the CardD does not support MIDI triggering, nor does it synchronize with external devices. There's no MTC, SMPTE, etc. Digital Audio Labs promises version 3.0 will include MIDI support via an MPU-401-compatible interface card.

The I/O CardD is an optional AT-style card that adds S/PDIF-format digital inputs and outputs, communicating digital audio to and from the CardD by way of a flat ribbon cable. The card's edge-plate mounts two RCA jacks for connecting the system to an external DAT machine or CD player. The I/O CardD worked without any problems when connected to the S/PDIF ports of my Sony TCD D-10 Pro DAT machine.

THE EDDITOR

The *EdDitor* program provides recording, waveform display, non-destructive editing, and playback capabilities. All the adjustable parameters—including the sampling rate, recording source (analog or digital), and amplitude display—are set within the program.

The program displays onscreen stereo waveform data in a Read-Only window located in the lower part of the screen and a Modified window in the upper part (see Fig. 1). The F1 to F10 keys on the AT keyboard access command functions for help, soundfile playback, screen scrolling, region definition and copying, and the ever-useful Undo command. The F2 key activates a series of pull-down menus, offering additional system commands (e.g., File, Edit, Play, Special, Marker, Display, and Setup). Almost every option also can be accessed from the computer keyboard, but Record must be selected from the pull-down menu.

All waveform data, whether just recorded or read from disk, appears in the Read-Only window. Data in this window cannot be changed until it is copied and moved to the Modified window, where all the editing action takes place.

The CardD offers a multiple undo option that accesses ten previous versions of a file. Selecting View Edit History from the Display menu calls up a list detailing the last ten edits (see Fig. 2). Simply move the cursor to the desired edit and press Enter, and the top window displays the soundfile at the point where the edit occurred. Although I didn't need this feature for my project, it could prove a real session-saver.

EDITING

The editing process is straightforward, so it's probably best understood by using an example. Let's say you have a DAT mixdown of five songs that need to be placed in sequence for final mastering as a CD single.

The first task is to copy the DAT tape onto hard disk. After selecting the source (digital input) and sampling rate, you select the record function from the menu and begin the transfer. The Record window includes two horizontal, bar graph-style, peak-level meters and indicators that display elapsed time and available recording time in minutes and seconds.

With the data transferred, the system begins building a Metasample file

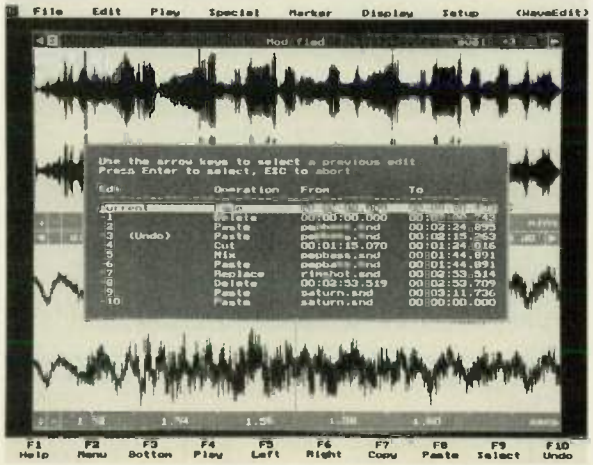

FIG. 2: The Edit History List provides up to ten levels of Undo.

containing graphic information for accelerating the waveform-display drawings. Depending on the length of the program material, this process could last anywhere from a fraction of a minute to a reasonably short coffee break. (According to DAL, with adequate RAM and processing speed, there is no waiting time.) This process only happens once; the file then is written to disk for future access.

When the Metasample process has run its course, the entire soundfile displays in the Read-Only window, and the program's playbar appears in the middle of the soundfile. (The playbar is the vertical cursor that scrolls across the screen during playback and marks the point from which playback begins.) You can play the soundfile from the playbar position by pressing the spacebar; pressing it again pauses playback. F4 plays the entire window or a highlighted region (if there is one) from the start, and the Audition Edit feature plays a short segment across an edit point. Another option plays the entire soundfile regardless of what's in the window.

By moving the L/R arrow buttons, you can move the playbar in either direction. When you press the control and arrow buttons simultaneously, it scrolls at a faster rate.

Product Summary

PRODUCT:
The CardD hard-disk recording system

PRICE:
The CardD $795
The I/O CardD $295
EdDitor software $250

SYSTEM REQUIREMENTS:
80286-, 80386-, or 80486-based PC-compatible; at least 640 KB RAM; MS-DOS 4.01 or higher; fast-access hard drive

MANUFACTURER:
Digital Audio Labs, Inc.
14505 21st Ave. N., Suite 202
Plymouth, MN 55447
tel. (612) 473-7626

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

DEFINING A REGION

Let's fast-scroll to a point near the beginning of the fourth song. You define a region to be pasted to the upper Modified window by locating the song's beginning and pressing the Select button (F9). Use Select to define a highlighted region for further editing. Once activated, scroll the playbar to the end of the now-highlighted song. Pressing F7 non-destructively copies this region into a clipboard, allowing it to be copied anywhere within the upper window at a point immediately following the playbar position.

The *EDditor* program offers a number of functions that make the region-definition process a bit easier. These functions include Alt-keys that provide functions such as waveform zoom in/out, Cut Region, and View Region, which shows the entire defined region onscreen for fine-tuning edit points.

One important feature that keeps the region-definition process from being clumsy is the ability to place unnamed markers (labeled A to Z) at any point in either waveform window. This lets you mark a segment's beginning and end point. You can drop in markers at any time (including while a file is playing back or recording) and can move forward or backward to successive markers by hitting the tab or shift-tab keys, respectively.

Thereafter, waveform data between marked boundaries can be placed into the clipboard by locating the beginning and pressing Select and the tab button (which automatically highlights a marked region to the next marker). In a mastering project, you can define areas of silence between songs, mark each song's in and out points, and copy-and-paste them into the Modified window in their new, edited order.

That's about it; you can't jump to a non-contiguous marker (or to an arbitrary time point, for that matter), nor can you give relevant names to the markers. On the other hand, it's easy to move or delete markers, and jumping to the next or previous splice point is a simple proposition.

CROSSFADES

Let's say that, as an afterthought, you feel like creating a long crossfade between songs 2 and 3. Non-destructive manual and automatic fades and

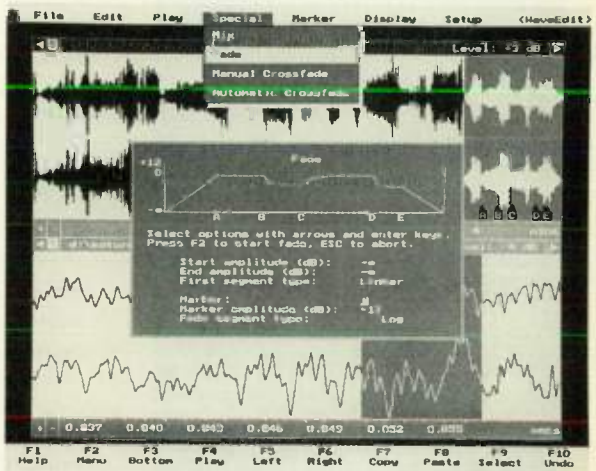

FIG. 3: Non-destructive fades and crossfades can be customized by the user.

crossfades are flexible and easy to perform (see Fig. 3). Just cut the silence between the songs and crossfade the files at the active edit point. The Manual Crossfade function is selected from the Special menu. Type in a total duration and a curve type (linear or logarithmic), and the system overlaps the fade-out of the first segment with the fade-in of the second. If you want to customize the crossfade, you can override the default settings by specifying independent fade-in and fade-out times for the segments. Pressing F2 begins the process of writing the crossfade to disk as a separate, tagged file. If you don't like the results, you can press Undo and begin again. The same process holds true for fading a segment in or out.

Automatic crossfades, if enabled, will be performed whenever you join two segments, whether by pasting, cutting, or other means. With both types of crossfades, user-defined parameters can be saved as default values. The Mix function mixes a specified amount (in decibels) of any waveform region in the clipboard memory with the segment in the Modified window. The operation can be performed at any point following the playbar.

THE PLAYLIST AND THE CATALOG

You can save soundfile data to disk in a number of ways. Should you wish to leave the original, unedited soundfile data intact but save one or more edited versions, it is possible to save the data in the Modified window as a Playlist. This saves edit-point, marker, crossfade, and fade information to disk. Unlike the playlist in most hard-disk recording systems, Digital Audio Lab's Playlist doesn't contain an editable list of regions to be triggered. Instead, it's a non-editable list that stores edit parameters. (According to DAL, a user-editable list is slated for the next release.) If enough room exists on the hard disk, the entire edited Playlist can be written to disk. Alternatively, individual selected regions can be written to disk as separate soundfiles for later retrieval.

The *Catalog* is a separate sub-program that organizes soundfiles into definable groups and triggers them directly from the computer keyboard. Using this feature, it is possible to define and name soundfiles recorded and edited in the *EdDitor* on a setup screen. Once they are defined, the soundfiles appear as a series of named boxes that can be selected by moving the arrow keys and played by pressing the Enter (Return) key.

This sub-program can't be triggered from time code, and its trigger time, although fast, is not instantaneous. It is useful for such applications as triggering soundfiles when transferring audio to a sampler; placing sound effects for video, live stage, and radio; and triggering radio identifiers.

MY TWO CENTS WORTH

Operating the system is relatively easy. At present, it doesn't support a mouse, but mouse support is promised in the near future. Although I'm a real Mousketeer, I picked up the keystrokes for most of the routine functions (such as copying a region and pasting it into the upper window) without major pain. You end up using a lot of keystrokes during the course of a production, though. *EdDitor* comes with online help that gives quick and simple definitions of any selected menu functions when you press F1. A detailed booklet does a good job of outlining general system functions.

Clearly, the CardD isn't for everybody. Other than the fades and editing features already described, it has virtually no signal-processing functions; there are no EQ or time-compression/expansion features. The system isn't capable of multitasking, it only supports two tracks, and it doesn't support MIDI. As such, it isn't for those who want to integrate digital audio into their MIDI system.

But the sound quality is great, and the system's performance is extremely stable, with no hitches or glitches in the hardware or software. It is a useful tool for those who simply need a straightforward soundfile editor that is equipped with basic editing functions, particularly those who must arrange 2-channel material into a final, edited master.

If you need more features, especially MIDI and sync, this is not the system for you. However, if your projects require basic, 2-channel digital editing and archival functions, the CardD is a cost-effective, high-quality system for PC users.

(Special thanks to Dennis Miller.)

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Roland Sound Brush and Sound Canvas

By Daniel Kumin

Roland's General MIDI boxes offer ease-of-use and good sounds.

The recent development of MIDI devices has followed a divergent path. Some of these devices have become extremely complex, offering sophistication and lots of features. On the other hand, there is a definite trend toward simplicity in certain segments of the MIDI marketplace. The birth of General MIDI demonstrates the importance of this trend in MIDI consumer products.

Spearheading the effort to bring MIDI to the masses, Roland has designed two integrated products that allow just about anyone to get creative with music. The SB-55 Sound Brush Standard MIDI File player and recorder and SC-55 Sound Canvas multitimbral sound module form the heart of a MIDI system that doesn't require an advanced degree to operate. In this regard, Roland seems to have hit its target, since these products are primarily aimed at recreational and semi-pro musicians.

Built in identical half-rack cases, the pair stack up to the size of a good paperback dictionary, or rack up (with an optional adapter) to form a single-rackspace system. Either way, the value is obvious: At under $1,500, the pair's portability, power, and features are hard to match.

SOUND BRUSH

The Sound Brush is a floppy disk-based hardware sequencer/data recorder that reads, writes, and formats 3.5-inch, 720 KB, DOS disks. The 90,000-note capacity accommodates up to 99 songs. Tracks are recorded directly to disk, which means no separate "save" operation is required. Similarly, songs are played directly from disk, requiring no load time.

The Sound Brush plays and records Standard MIDI Files (SMFs) in a manner similar to a home cassette deck. Transport keys such as Record, Play,

Stop, Pause, Fast Forward, and Rewind are accompanied by Song and Tempo Up/Down buttons. Random, Program, and Repeat functions shuffle the song order just like a CD player. In another nod to hi-fi-like operation, the 2-digit display shows the current Track (song) number and counts down the seconds between selections. The readout also displays measure numbers or a tempo setting. The Sound Brush even comes with a credit-card-sized, infrared remote controller.

Connection is simple. Rear-panel jacks for MIDI In, Out, and Thru are joined only by a power-supply input and a 1/4-inch jack that accepts an optional normally-closed Play/Stop footswitch such as the Roland DP-2. (Solo lounge acts take note.) A second MIDI In port on the front merges data with the rear-panel port. This second MIDI In also can be assigned Soft Thru status independently, an uncommonly handy arrangement.

SMFs in Format 0 (all channels on one track) and Format 1 (one channel per track) can be played back, but recording is in Format 0 only. The resolution is selectable between 96, 120, 192, and 240 ppqn. Recording is simplicity itself: Press Pause and Record to enter Record-Ready mode, and the Sound Brush automatically begins recording data at the first incoming MIDI event. There are Pause and Resume functions as well as a manual record mode. The Sound Brush is a straight-ahead, real-time recorder without overdubbing, quantizing, or step-editing capabilities.

Practically speaking, this means the Sound Brush is first and foremost an SMF player. Its recording capabilities are best-suited to providing a quick sketchpad. For the professional, the Sound Brush provides an unusually compact portable device into which sequences for gigs or studio sessions can be downloaded. Files are downloaded in real time only, but they also can be copied from disk to disk. (In the case of large files, this may require some laborious disk swapping.) The floppy drive can read MS-DOS disks directly for convenient file management on a PC or Atari ST.

The Sound Brush doubles as a MIDI disk drive for backups, copies, and similar humdrum chores. It records MIDI messages and assigns them to any of several controls for easy dumping to the Sound Canvas or other modules, providing one-touch setup. An auto-packet mode immediately dumps at power-up.

The Sound Brush synchronizes to its own internal clock by default, but it also can automatically recognize external MIDI clock messages and immediately sync to them. You even can

Product Summary

PRODUCT:
SB-55 Sound Brush
PRICE:
$695
MANUFACTURER:
Roland Corporation
7200 Dominion Circle
Los Angeles, CA 90040-3647
tel. (213) 685-5141

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

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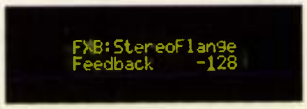

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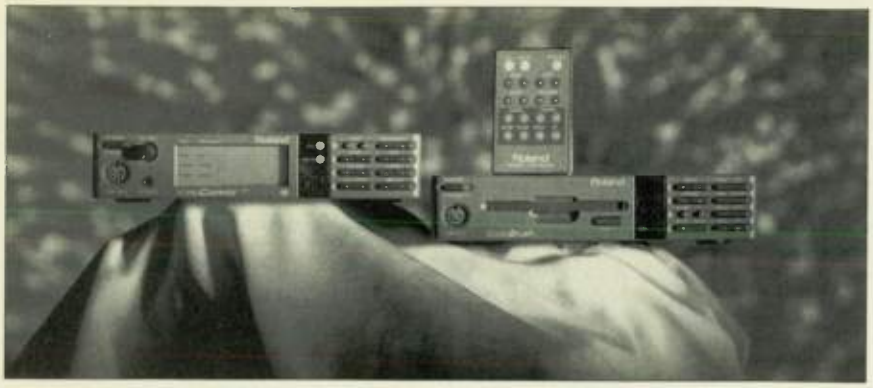

PETER DIGGS

The Sound Canvas and Sound Brush form the heart of a General MIDI system that doesn't require an advanced degree to operate.

specify whether the Sound Brush will respond to incoming MIDI clock messages from Port 1 or 2.

A disk of thirteen sequences comes with the Sound Brush. These selections range from pop, jazz, and new age originals to arrangements of classical chestnuts by Beethoven, Debussy, and Vivaldi. The disk is designed to show off the Sound Canvas and gives a good indication of the Canvas/Brush pair's capabilities.

In short, the Sound Brush provides everything needed by travelling or working MIDI musicians. Whether or not it also proves attractive to consumers as a home-entertainment component remains to be seen.

SOUND CANVAS

The Sound Canvas is a 16-part multitimbral, sample-based sound module with 24-voice maximum polyphony. Using Roland's RS-PCM data format, the Sound Canvas features 16-bit output conversion and 3 MB of onboard samples. The design incorporates the now-expected virtues of dynamic voice-allocation, simple onboard effects, and extensive percussion samples.

The front panel is dominated by a nice, large, amber, electro-luminescent display that shows the current Instrument name, level, pan, effects, and MIDI channel status, as well as a matrix of sixteen bar graphs—one for each Part—that indicate volume level (with selectable peak hold). Controls include power and an overall volume knob, plus Up/Down keys for the major operations. Deeper functions are accessed in the familiar Roland fashion by holding down one or more buttons while pressing another.

The back panel has MIDI In/Out/Thru, a power-supply input, and four RCA jacks. Two of these RCA jacks provide an output for the Sound Canvas' stereo mix, while the other two are line inputs that mix with the outputs. This is handy for portable setups or truly minimalist MIDI studios, but an auxiliary assignable stereo output would be nice. Like the Sound Brush, the Sound Canvas features a second merging MIDI In jack on the front panel, with selectable Soft Thru. Also included is a remote controller identical to the one that comes with the Sound Brush. Either remote can be used to control both units.

The Sound Canvas' voice architecture is quite simple (see Fig. 1). Each of its sixteen Parts can be set to any MIDI channel, and any of the 317 Instruments (ROM sounds) can be assigned to each Part. These Instruments are organized into sixteen families: piano, pitched percussion, organ, guitar, bass, strings, ensemble, brass, reed, pipe, synth-lead, pad, FX, ethnic, percussive, and sound effects.

The maximum polyphony is 24 voices, which can be allocated dynamically, or assigned to each Part. Most Instruments use a single multisample ("Partial" in Rolandese). A few Instruments use two partials, which cuts down on polyphony. This arrangement works well; doubling Parts is quick and easy, as is creating gargantuan, 16-instrument, one-finger pads. While the Sound Canvas' 24-voice polyphony is less than that of some modules, its practical voice abilities are quite good. Although user settings for the sixteen Parts are retained in static RAM, there is no onboard patch storage; multiple setups of Instrument and effects settings must be stored and loaded with

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JUNE 1992

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MIDI Manuals

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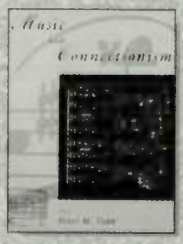

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• SOUND BRUSH/CANVAS

SysEx dumps to and from the Sound Brush or other MIDI storage device.

Ten drumset Instruments also can be assigned to any Part. The primary sets (Standard and Jazz) provide about 60 samples each, including a decent assortment of trap sounds and a generous helping of hand and exotic percussion. The remaining eight sets (Room, Power, Electronic, TR-808, Brush, Orchestral, SFX, and CM-64/32L) substitute from six to 24 of their own sounds, keeping the balance of the Standard set samples. For example, the Orchestral set replaces most of the toms and cymbals with a nice timpani scale spanning a full octave.

A majority of the Instruments have variations that use more, (or different) partials, or different settings for the programmable envelope, filter, and vibrato. There are about 61 variations, plus an entire set of 128 variations that establish Instrument assignments to mimic the MT-32. This set of variations is called up with a few keystrokes for plug-and-play compatibility with most existing MT-32 software or sequences that use MT-32 factory presets.

There is no way to load new ROM or RAM samples. But even without touching a modifier, the Sound Canvas provides several hundred available sounds, plus extensive drum and percussion samples. Parts are programmable, including vibrato (rate, depth, and delay), ADR envelope, and filter (cutoff frequency and resonance). You also can edit velocity sensitivity and offset, pitch bend range, and the keyboard range over which a Part will respond. It's certainly not power

Product Summary

PRODUCT:
SC-55 Sound Canvas
PRICE:
$795
MANUFACTURER:
Roland Corporation
7200 Dominion Circle
Los Angeles, CA 90040-3647
tel. (213) 685-5141

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

programming, but it's easy to forget just how much you can accomplish with even these simple tools.

CANVAS SOUNDS

Patch quality is perhaps the Sound Canvas' strongest suit. While some Instruments (pianos, strings) are less impressive than others, the overall quality and realism of the emulative samples is quite good. Several first-rate synth sounds are present, as well as a few of the inevitable silly ones.

The drum sets include enough respectable whacks and thumps that you reasonably might save the expense of a dedicated drum machine if you can live with the unit's single, stereo output. Another point in its favor is a good supply of attractive new age textures and pads. Several of the brass sounds are excellent, too.

Owners of earlier Roland sample-based boxes will recognize a few samples and discern a kinship to several others. More alien, however, is the utter absence of noise: Even the most exposed samples fade to black with virtually no hiss or grunge. Overall, the technical quality of the samples is superb, with few audible loops or artifacts for a sound module in this price range. Musical quality is good to excellent, depending on where you fall on the nitpicker scale.

Although basic, the onboard reverb and chorus give the Sound Canvas an enormous advantage over earlier designs. Not only is the level of each effect independent for each Part, they are independently assignable. Each Part can be treated with reverb, chorus, or both. (Chorus is always pre-reverb.) This capability makes it easy to create multitimbral mixes such as heavily chorused organ *and* non-chorused piano, or one drum Part with lots of reverb for snares and cymbals and another entirely dry drum Part for the kick drum. (By getting down in the hexadecimal grass of SysEx and fooling around, you could design a custom drum Part with different effect-send levels for individual samples.)

The effects generally are good, with acceptable basic algorithms among the eight variations of each effect. Reverbs include five rooms and halls and one plate, all of which are decent. Also lumped under the reverb menu is a single delay and a fast, ping-pong, stereo delay. The choruses include a

selection of classic effects in addition to a flanger, short delay, and feedback delay.

There are no parameter adjustments on the front panel except the depth (wet/ dry mix) of each effect for each Part. Inherent weaknesses, such as the flanger's excessive level of feedback, are not repairable. But once again, you can do a lot in hex.

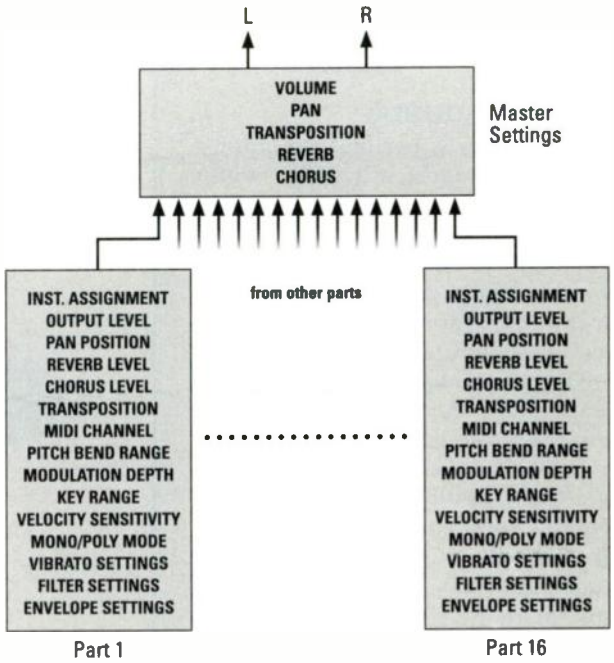


FIG. 1: The Sound Canvas provides sixteen multitimbral Parts, each with its own Instrument assignment and reverb and chorus levels.

MIDI

The MIDI implementation of the Sound Canvas is surprisingly comprehensive. The unit responds to all the basic controllers, including Pan, Expression, Soft Pedal, Portamento, and both Channel and Polyphonic Aftertouch. Controllers 91 and 93 are hard-wired to control the onboard reverb and chorus depths, respectively.

MIDI-controller assignment is limited, but Controllers 16 and 17 can be assigned to several important parameters, such as the filter cutoff and LFO rate and depth. This is accomplished with a special Micro Edit feature. The merging front-panel MIDI In jack represents a genuine boon, for my money.

A quick perusal of the MIDI implementation chart in the owner's manual reveals rich ground for the MIDI hacker. Dozens of deeper parameters are available for tweaking with System Exclusive, so brush up your hexadecimal and get to work. The Micro Edit feature provides front-panel access to SysEx for all parameters, if you have the patience as well as the finger dexterity. SysEx dumps can be global or selected Parts only.

Finally, among Sound Canvas's *raison d'être* is Roland's GS format, a superset of the General MIDI Standard (discussed in "MIDI for the Masses" in the August 1991 **EM**). Briefly, General MIDI specifies standard names, program number assignments, and MIDI channel assignments for various types of synth sounds. It also guarantees 16-part multitimbral operation and 24-voice (or more) polyphony. The GS format includes these specifications and standardized access to Instrument variations, extra drum sets, and basic editing parameters.

General MIDI and the GS format are designed to allow device-independent playback of Standard MIDI Files, with no additional configuration. Even inexperienced users can easily hear elaborate performances, assuming they own some good GM or GS sequences.

THE BIG PICTURE

The Sound Canvas and Sound Brush are useful and flexible as a fixed sample player and SMF player. In several weeks of testing and use, neither module so much as hiccupped, and both worked precisely and reliably, as predicted by the documentation. Speaking of which, the manuals are more intelligible than earlier Roland manuals, although they still leave much room for improvement.

The layout and user interface are well-suited to many audiences, even those who generally are not proficient with MIDI devices. The ergonomic value of placing all the most-used controls on the front panels is beyond question.

Speaking of ergonomics, I must mention two new versions of the Sound Canvas that take this concept one step further in different directions. The SC-155 Sound Canvas ($895) is virtually identical to the original SC-55, with the addition of eight programmable sliders. These sliders provide easy control of MIDI volume and other parameters and allow you to sequence their movements for automated mixing and other effects. The new SCC-1 ($499) is a Sound Canvas on a PC card, which provides easy access to the Sound Canvas directly from any PC program written to take advantage of it.

Perhaps of paramount importance, the sounds of the Sound Canvas are excellent in some cases, less so in others, but there are hardly more than a handful of real klinkers among a few hundred candidates. If Roland's goal for the Sound Brush and Sound Canvas was affordability, configurability, and musical power-per-dollar in a genuinely easy-to-use format, the pair must be considered an unquestionable success.

Dan Kumin *writes from his New Hampshire abode about consumer and pro electronics. He still awaits the string-quartet commission from Count Esterhazy that will take him away from all this.*

Big Noise Cadenza for Windows 1.08 (PC)

By Allan Metts

A graphics-oriented sequencer joins the Windows revolution.

Computer rivalry and user loyalty are nothing new. Macintosh users assert that their computer's friendly, graphic user interface is better-suited for musical creativity than PC compatibles. PC users counter that the abundance of PC clones gives them more computing power for their money.

Recently, Microsoft *Windows* blurred the distinction between the Macintosh and IBM environments by providing a graphic, mouse-based user interface for PC compatibles. Big Noise Software

has taken advantage of this development with the introduction of *Cadenza for Windows*.

JUST ANOTHER SEQUENCER?

Like many of today's sequencing packages, *Cadenza for Windows* includes a Track Sheet for manipulating your song in its entirety and a Song Editor for viewing and editing a measure at a time. A Note Editor displays notes in piano-roll notation, and an Event List is provided for those who like to edit individual MIDI events in excruciating detail.

But that's where the similarity to many other PC sequencers ends. Unlike some sequencers, *Cadenza* makes extensive use of graphics. It fully utilizes the powerful *Windows* environment and makes it easy to be creative without bogging down in complicated commands or cryptic keystrokes.

Let's say you're working with two separate tracks in a song. In many sequencers, you would go into the Note Editor and change some notes in one track, go back to the Song Editor to transpose the entire track down an octave, and go back to the Note Editor to alter a few notes in the other track.

In *Cadenza*, all these functions are available on one screen that can be customized to meet your needs. You can open the Song Editor window and two Note Editor windows simultaneously, with each addressing a different track and location. In fact, it's possible to open multiple copies of all windows except the Track Sheet, Song Editor, and Tempo Map. Add these capabilities to a friendly, graphical, mouse-driven user interface, and you have some serious creative power.

As you enter *Cadenza for Windows*, a Track Sheet appears (see Fig. 1). For each of the program's 64 tracks, you can use the Track Sheet to specify track names, play/mute status, looping, soloing, transposition, MIDI interface port, channel, volume, and panning.

The transport controls are easy to work with. They appear at the top of the screen, making them accessible no matter which windows are open. Fast Forward takes you through the song at twice the specified tempo, and the Rewind button can be programmed to rewind to any point in the song. Also at the top of the screen are Song tempo, meter, and song position indicators in both SMPTE and measure/beat/tick format.

Cadenza's mouse buttons alter tempo and meter settings, or change the song position indicator to move quickly to any point in the song. The program only supports meter changes across all tracks at once, though, so those who love to play polyrhythms should look elsewhere.

One interesting feature is the program's ability to store a list of all your instruments on a disk file. For example, if your favorite string sound is stored as patch 37 in a module set to channel 12 and connected to port 2 of the MIDI interface, you can specify that information in the instrument file. When you're ready for the string sound, simply select it from the instrument file, and its port, channel, and patch settings appear on the track sheet. *Cadenza* comes with an instrument file conveniently preprogrammed with the General MIDI specification.

Like many sequencers, *Cadenza* can record, edit, and play back SysEx data. The program has a nice SysEx editor, but it's hidden so deep in the program, you may never find it. *Cadenza* also supports both linear sequencing and

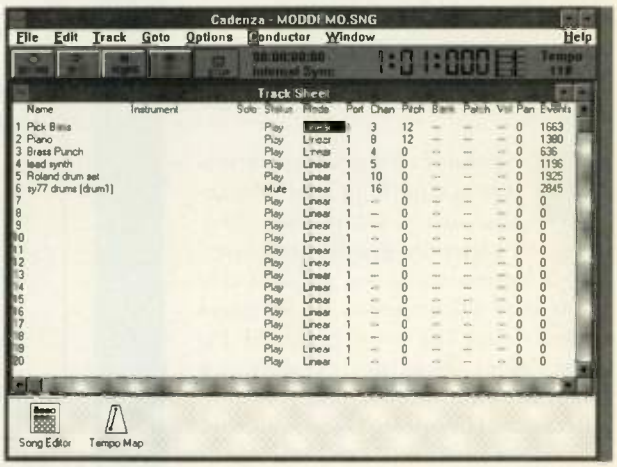


FIG. 1: *Cadenza*'s Track Sheet allows you to specify track names, play/mute status, looping, soloing, transposition, MIDI interface port, channel, volume, and panning for each of the 64 tracks.

Linked mode. Linked mode behaves much like a drum machine, allowing you to specify a list of linked tracks that are played one after another. Linear tracks always play from start to finish. Unfortunately, *Cadenza* lacks a song list feature, which would let you chain-play a number of songs one after another.

YOU'RE THE EDITOR

Cadenza's excellent Note Editor allows you to alter a note's pitch, start time, and duration, using the mouse. A click on the right mouse button brings up a toolkit that lets you set the parameters of new notes to be entered. Step entry from a MIDI keyboard also is supported, including triplets.

I wish the Note Editor displayed MIDI note numbers in addition to note names. This would facilitate note-mapping on drum machines. I also would like the ability to name each note to correspond to drum voices.

Cadenza includes a number of editing commands that work on up to 100 separate regions at once, a feature I found quite useful. For example, you can mark the regions with the mouse, or manually by typing measure/beat boundaries into a Block List. Unfortunately, the region-editing commands affect all the regions in the list. I'd like the ability to specify multiple regions, name them (verse 1, chorus 2, etc.), save the list as a file, and choose any or all for editing.

A powerful event filter lets you specify and modify MIDI data within a marked region. For example, you can alter Aftertouch data that has values between 32 and 53. Unfortunately, *Cadenza* doesn't display the data selected with the event filter in a different color or pattern on the screen.

Once you've specified the regions and selected the MIDI data to work on, you are ready to use the region edit commands. *Cadenza* provides a comprehensive palette of commands, complete with Undo. You can quantize to the nearest tick, randomize, shift data forward or backward in time, and alter the length of notes, as well as compress, expand, and reverse musical passages. The program includes pitch

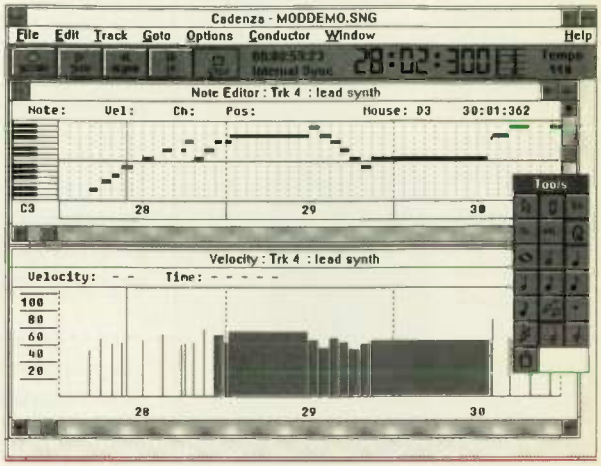


FIG. 2: The Velocity window depicts each note as a vertical bar. Lining up a Velocity window under a Note window provides a great overall view of a musical passage.

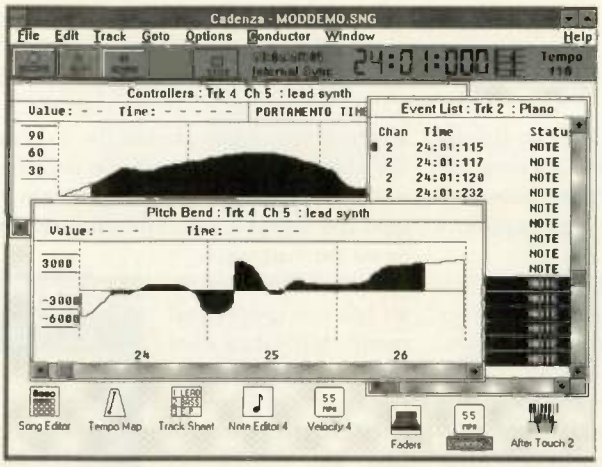


FIG. 3: You can put multiple windows on the screen simultaneously. The Pitch Bend and Controller windows display the data graphically, and you can redraw the graphs using the mouse.

of what was happening in a track (see Fig. 2). All these windows can be reduced to small icons when you want them out of the way.

There also are Pitch Bend, Aftertouch, and Controller windows that display the corresponding MIDI data graphically (see Fig. 3). It's easy to redraw these graphs using the mouse. A toolbox in each window lets you limit the data to a particular range, invert it, scale it by a percentage, shift it up or down, erase it, transposition, inversion, controller mapping, and data channelizing.

Missing from the list of editing commands is the ability to transpose or invert notes while maintaining a specific key. (Some programs call this feature "harmonic" transposition and inversion.) Also missing from the program is the ability to randomize pitch and support for Release Velocity messages.

Cadenza has cut, copy, and paste functions that let you move or copy MIDI data. The event filter can cut or copy only those MIDI events that fall within a certain range. In addition to replacing old data, the paste command merges new and existing data. This allows you to combine portions of two tracks into one. Cutting-and-pasting from one song file to another is allowed, although it's not mentioned in the manual.

add events to smooth it out, or remove events to thin it.

Some of these operations also can be done in the Tempo Map window, which graphically displays the tempo map. The map can be changed by redrawing the display with the mouse. One particularly useful feature for film, video, and broadcast types is the ability to fit any section of the song to a particular span of time. *Cadenza* also includes a Tap Tempo feature that lets you specify tempo changes after a performance.

The Faders window (see Fig. 4) provides sixteen onscreen faders, one for each MIDI channel. The faders can be configured to send any MIDI Control Change message to any available ports. You can open several Fader windows simultaneouly, so you are not limited to only one type of message per channel. When recording, any fader movements are recorded into the sequence (e.g., you can assign a bank or two of faders to MIDI Controller 7 to automate your

WHAT ELSE IS NEW?

Cadenza's capabilities don't stop with note, event, and song editors; there are five other editing windows, each with a specific function. The Velocity window depicts each note as a vertical bar. The height of each bar corresponds to the velocity of each note. I found that aligning a Velocity window underneath a Note Editor window provided a great picture

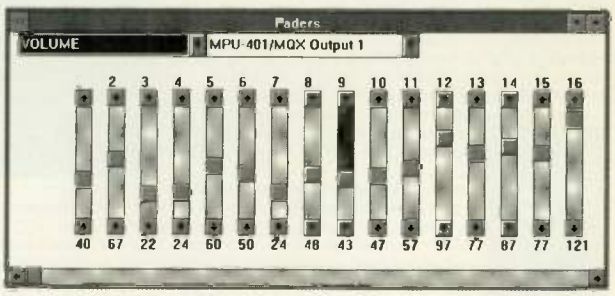


FIG. 4: The Faders window provides sixteen onscreen faders, one for each MIDI channel. The faders can be configured to send any MIDI Control Change message to any available ports. You can open several Fader windows at the same time, so you are not limited to one type of message per channel.

levels). In a future release, I'd like to see the ability to put a comment under each fader, sort of like electronic masking tape.

THE MIDI DIRECTOR

Big Noise bases their MIDI *Windows* programs on their MIDI management system, *MIDI Director*. This program serves as a traffic cop between the various applications that support it, managing all low-level MIDI hardware functions, synchronization, and metronome functions.

The biggest advantage of this scheme is MIDI multitasking. Although it has been around for a while on the Mac and Atari, MIDI multitasking is relatively new on the PC. *Windows* and *MIDI Director* allow you to run several editor/librarian programs, as well as multiple copies of *Cadenza*, at the same time. These programs perform their functions simultaneously, which increases your productivity immensely.

MIDI Director provides extensive control over all the MIDI interfaces installed in the same computer. For example, you can mask certain kinds of data or channelize all MIDI information that enters a particular port. Status and error windows are provided, along with excellent note and Program

Product Summary

PRODUCT:
Cadenza for Windows 1.08
SYSTEM REQUIREMENTS:
80286 or 80386 PC with 2 MB RAM; Microsoft *Windows 3.0; Windows*-compatible video adapter (VGA recommended); hard disk; Roland MPU-401, Music Quest, CMS 401-2/444, Key Midiator MS101/103, or Sound Blaster MIDI interface
PRICE:
$299.95
MANUFACTURER:
Big Noise Software, Inc.
PO Box 23740
Jacksonville, FL 32241
tel. (904) 730-0754

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

Change mapping features. *MIDI Director* can synchronize to an internal clock, Song Position Pointer, MIDI Time Code, or SMPTE, depending on the capabilities of the installed interfaces.

WRAPPING UP

When I tested version 1.06 on a 33 MHz, 80386 computer with 2 MB of RAM, I experienced a few program crashes and "Unrecoverable Application Errors." The people at Big Noise sent me the latest version of the program (1.08), which appeared much more stable, but I still had a few problems, especially in 80386 Enhanced mode. (To be fair, Microsoft recommends at least 4 MB of RAM to run *Windows* in 80386 Enhanced mode.) It's entirely possible that *Windows 3.0* was to blame, in which case an upgrade to *Windows 3.1* is recommended as soon as it's available. I'm sure these problems will be solved as *Cadenza* and *Windows* mature. In the meantime, remove all your TSR programs, keep *Windows* in standard mode, and save your work frequently.

If you have problems, Big Noise is ready and willing to help. Bug fixes are free, and program updates are sent to registered users for a nominal material and handling fee. The company automatically sends you the latest version of the program upon receiving your registration card, and updates that are released within 60 days of purchase are free.

Cadenza's manual is divided into two major sections: a User's Guide and Reference Manual. Although the User's Guide is said to present the most-used functions first, followed by the advanced features, I found this section poorly organized in a seemingly random order. For example, the introduction to the program screens appears at the end of the User's Guide. The Reference Manual is organized better, covering all features and functions window-by-window and menu-by-menu. However, the entire manual is written in short, choppy sentences, making it hard to read. On the plus side, the online help is quite good.

Overall, I think you'll find *Cadenza for Windows* a wonderful addition to your musical PC. I enjoy having this much power in a program that enhances, rather than hinders, the creative process. Big Noise has taken a giant step into the world of MIDI multitasking.

Allan Metts *is an Atlanta-based MIDI consultant, musician, and electrical engineer. He wants the world to know that it was his wife, not he, who named the dog "Midi."*

Mind Over MIDI Slave Driver 2.0 (ST)

By Jim Pierson-Perry

MIDI mapping and system control for live performance.

Scene from MIDI Hell: The vibes are great, the crowd is wild, and your band is smoking through the current set. The guitarist signals for an inspired solo, but you're stuck with a prerecorded sequence and don't dare switch it off to play live. You frantically scream "no," cower from the evil looks of other band members, and wonder if you'll have a job after the show.

Sound familiar? If so, you need *Slave Driver,* Atari software designed to meet the needs of performing MIDI musicians. It integrates a sequence player and bulk SysEx librarian with a comprehensive, flexible MIDI mapper. *Slave Driver* was written by a MIDI musician specifically for live use. It provides maximum real-time control of your MIDI system without getting in the way of your playing.

The program is a major upgrade of the earlier *UltraMIDI* program, which is no longer supported. Owners of *UltraMIDI* or older releases of *Slave Driver* can (and should) upgrade to version 2.0 for $45.

SETUP AND DESIGN

Slave Driver runs on any Atari ST or STe computer, including the STacy portable, with either a color or monochrome monitor. The program is not compatible with the new TT computer or large-screen monitors. Stock 520 ST users need a double-sided floppy drive to read the program disk. I found no compatibility problems with common

desk accessories or system enhancements.

Version 2.0 uses a peculiar type of copy protection that writes to the key disk. You must insert the key disk within 25 seconds of loading the program, or the computer freezes and must be rebooted. Fortunately, the company has just released version 2.02, which has no copy protection.

A separate performance version of the program also is included. The main program is used to create and test your setups, but you only need to take the performance module to a gig. This feature dramatically cuts down on program memory requirements, freeing up more memory for your music files.

The manual is comprehensive, but it suffers from an incredible number of typographical errors. A new manual should be available by the time you read this. The program disk includes several well-documented example setups and files, and an impressive demo lets you watch a "ghost user" operate the program. The demo also is available from the Atari and MIDI libraries on the GEnie BBS.

YES, MASTER

At heart, *Slave Driver* is a software MIDI mapper. It sits in your MIDI datastream and monitors the messages, rerouting or transforming them according to your wishes. Beyond that, it plays Standard MIDI Files and sends SysEx messages, both of which can be triggered by incoming MIDI events. Virtually all standard MIDI messages are supported, with the annoying exception of Polyphonic Aftertouch.

All program operations are based on "Master/Slave" relationships. A Master is a user-defined MIDI event for which *Slave Driver* watches. When this event is detected, the program sends a predefined set of up to 255 substitute events (Slaves) in its place.

Master and Slave events have three user-definable components: MIDI Channel, Event Identification, and Value Range. Any or all of these components can be altered in the relationship by direct substitution or scaling. For example, Note On/Off events include a pitch range that extends from a single note up to the entire keyboard, although the range must be contiguous. MIDI controllers are defined by ID numbers, and the more common ones also are identified by name (MIDI Volume, Sustain Pedal, etc.)

The Value Range provides a variety of selection criteria for Master events and scaling for Slaves. For example, several Masters can be created for a single Note On event, each active only within a certain velocity range. Scaling can be additive (which also is called "Bias"), or multiplicative, using positive or negative values.

For example, let's say you define a Note On event from a keyboard synth on channel 2 as a Master. You might create a set of Slaves that sends corresponding Note On events to synths on channels 2 through 5, transposing the pitch and scaling the Velocity independently for each. The result is a fat multitimbral chord when you play a single key.

LEVELS OF CONTROL

Slave Driver uses a structured hierarchy of increasing power to give you as much control as you need. Up to 255 Master/Slave relationships can be active at any time; this ensemble is called a Map. Switching from one Map to another activates a new set of relationships, with corresponding changes in how *Slave Driver* processes the MIDI datastream (e.g., change split points and volumes during a song).

Product Summary

PRODUCT:
Slave Driver 2.0
PRICE:
$249
($169 until June 30, 1992)
SYSTEM REQUIREMENTS:
Any Atari ST or STe computer with a double-sided disk drive; standard-size color or monochrome monitor.
MANUFACTURER:
Mind Over MIDI Productions
PO Box 56522
Lougheed Mall Postal Outlet
Burnaby, B.C.
Canada V3J 7W2
tel. (604) 444-4424

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

In addition to the activating relationships, Maps can perform additional operations: Send, Reset, and Trigger. Send stores up to 255 commands for *Slave Driver* to execute when the Map is activated (set initial volumes, send a SysEx patch bank, etc.). Reset restores nominal settings and performs other cleanup tasks when you exit the Map. Trigger lets you define a unique message, such as a Program Change that activates the Map over MIDI rather than from the Atari keyboard.

Up to 255 different Maps are contained within a Song, which is saved to disk. At the next level of hierarchy, a Set holds up to 255 Songs. All Maps within a Set draw from a common pool of sequence and SysEx files (up to 99 of each) that is associated with the Set. Only the file directory paths are saved with the Set file, rather than the actual data. This lets you use the same sequence and SysEx files in different Sets without taking up redundant storage space.

After loading a Set, you can use simple Atari keyboard commands (or Trigger events, if they're defined) to move between Maps and Songs as you play. Notes depressed while a Map is active continue under its influence until released, even if you change Maps in the meantime. This allows you to drive sustained notes with one Map, then use another Map to govern a lead line.

BASIC MAP-MAKING

The workscreen for creating and editing Maps, Songs, and Sets is illustrated in Fig. 1. The main display shows one Map at a time, selected for the desired Song in a Set file. The windows at the lower right indicate the sequence and SysEx files used in the current Set. Scroll arrows in the Master/Slave windows select different relationships.

The editing interface is well-designed and easy to use. Map entries are selected using the Atari keyboard, onscreen graphic controls, MIDI input, or any combination thereof. The keyboard and value input controls are particularly cool. You click-and-drag to define the Master range, then move the display, or click-and-drag again to define the Slave range. If you want to use the existing range definition, just click on it, and the values are entered automatically.

The interface isn't perfect, however. For example, you cannot try out a Map from the edit workscreen. I found it awkward to keep flipping between Edit and Play modes to tweak the Maps.

At every stage, *Slave Driver* provides aids to simplify editing and validation. Trigger events are checked automatically to prevent duplicates, and relationships are checked for compliance with MIDI protocol. Copy, paste, and delete functions operate at the relationship and Map levels to facilitate repetitive editing tasks. Other editing aids let you reorder Song files and edit the sequence and SysEx file pool.

My biggest problem was keeping track of what my Maps did and which sequence and SysEx files were being used. I'd like to see *Slave Driver* provide an optional text field within a Map so you could view or print it for documentation. Another improvement would be the ability to print a list of Song Triggers, as well as the sequence and SysEx files used in a Set. Currently, only the Song titles in a Set can be printed.

SEQUENCES AND SYSEX

One of *Slave Driver*'s strongest features is the ability to trigger the playback of sequence or SysEx files. Sequences must be in MIDI File Format 0 (single

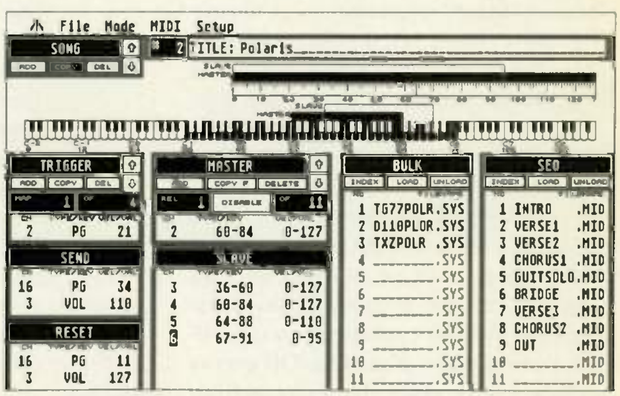


FIG. 1: *Slave Driver*'s main editing screen for creating Maps. The Trigger, Send, and Reset windows are grouped at the lower left, while the sequence and SysEx file pools (common to all Maps in a Set) are at the lower right. The keyboard and range icons simplify the creation of relationships and give visual validation of the settings.

SLAVE DRIVER APPLICATIONS

With so many options and capabilities to explore, *Slave Driver* can seem a bit intimidating at first. Here are a few ideas to get you started.

Keyboard Splits I: Define a Master to detect notes played in a keyboard region and use a Slave to redirect those notes to a synth on a different MIDI channel. Repeat this for as many voices as you like, using different timbres for each region. Create a different zone setup to change synth parts and/or ranges while playing. Try inverting the keyboard in some zones while keeping it normal in others.

Keyboard Splits II: Why limit yourself to splits based on note numbers? Split the keyboard by note for major timbre differences (e.g., bass and strings), then use the value range to do velocity-switching. For strings, send soft notes to a legato patch and loud notes to a pizzicato patch. With brass, you can use Velocity to switch between muted and stab effects. Instead of abrupt split points, you could overlay sounds with a crossfade.

Controller Chaos: Map Aftertouch from your master keyboard to control a positive pitch bend on synth 1, negative pitch bend on synth 2, modulation on synth 3, and pan position for the whole sound through a MIDI mixer. All variations and extensions of this idea are fair game.

Fat Pedal: Remap a sustain pedal to provide octave and/or interval doubling of the Master sound, preferably across multiple timbres. Play a lick, then repeat it with the pedal down.

Sequence Playback: Use the Send function in the first Map of the first Song to load MIDI and SysEx files so there are no pauses later on. For each Song, use Send to set playback tempo, pan positions, volumes, and patch-bank data to your instruments before playing. Put erase commands in the Reset window to clear files from memory after use and restore nominal instrument settings. As you switch Songs, *Slave Driver* automatically preps the music files and your system setup for you.

track). I'd like to see the program trigger Format 1 files, too, although you can use Hybrid Arts' *MIDIMOVR* program (available on GEnie and other BBSs) to convert Format 1 files to Format 0. Remember that *Slave Driver* only can play sequences; you need a separate sequencer program to create or edit MIDI Files.

Slave Driver includes Load/Erase commands to maximize the efficient use of computer memory. Opening a Set file activates the sequence and SysEx file indices used by Maps within the Set. Actual data isn't loaded until called for by a Map.

A sequence can be played once or looped continuously. To prevent the scene from MIDI hell depicted earlier, divide a song into several parts (verse, chorus, bridge solo, etc.), and play them as needed. Loop a background sequence while your guitarist takes an extended solo, then trigger the next sequence to continue on with the song.

Slave Driver treats playback tempo as a mappable event. You can default to the base tempo from the sequence file, set a new fixed tempo, or control the tempo in real time with the mod wheel or other controller.

SysEx files are created and stored as Standard MIDI Files using the program's bulk librarian. A dialog box lets you create SysEx messages, called *prefixes*, that direct target devices to download patch or other SysEx data to *Slave Driver*. These prefix files can be saved to disk and reused.

Some devices include the MIDI channel within their SysEx data, which might become a problem if you later operate the device on a different channel. If *Slave Driver* recognizes the SysEx format, it can change the channel as needed when sending the file. A utility program updates *Slave Driver* to work with new devices in this way, although it only works with a monochrome monitor. If you have an unrecognized synth that channelizes its SysEx, and you're running *Slave Driver* on a color system, make sure not to change that module's channel.

ADDED ATTRACTIONS

Slave Driver offers some additional features for developing Maps and using them on stage. A Chain command lets you run another Atari program, then return to *Slave Driver*. This feature is useful with a word processor to document Maps as you develop them. Automatic file backups, extensive support for command keys instead of the mouse, and a free memory indicator are other welcome aids.

A user-configurable MIDI panic button provides a safety net to turn off stuck notes and reset controllers. A special version of the playback module sends program messages to the LCD displays of Yamaha DX7 or Roland D-series synths, allowing you to leave your computer monitor at home and save space on stage.

BOTTOM LINE

Slave Driver is an excellent piece of work. Well-designed and well-implemented for its niche, it gives musicians the degree of control they want over their MIDI systems without compromising creativity or spontaneity. Despite its impressive capabilities, the program sets up quickly and is easy to use. It provides a wonderful environment for MIDI hacking, musical experimentation, and just plain fun.

▼

At heart, *Slave Driver* is a software MIDI mapper.

On the horizon is a new revision of *Slave Driver*, written completely in assembly code to boost speed and provide compatibility with the Atari TT and large-screen monitors. Major enhancements include support of C-Lab's MIDI Export (an interface with multiple MIDI Outs) and the ability to run either by itself, or as a desk accessory along with other MIDI software.

Jim Pierson-Perry *has been using and writing about Atari computers for almost ten years. He recently bought a Mac and can't wait to duplicate his software library and explain the cost to his family.*

JBL 4200-Series Studio Monitors

By Neal Brighton

These Buddha-bellied speakers reflect on sonic truth.

Hollywood is big on conspiracy movies this season, but the secrets of great recording are not buried in covert government files; they're sitting in front of your mixer. Precise reference monitors are essential for the critical listening required to record and mix transcendent sound.

Near-field monitors are a good choice, since the proximity of the listening area (usually one meter) minimizes unwanted room acoustic effects, such as reverb and echo. Few small studios or home recordists can afford control rooms professionally designed for optimum acoustics, so the near-field concept allows cleaner, more consistent mixes from less-than-perfect environments.

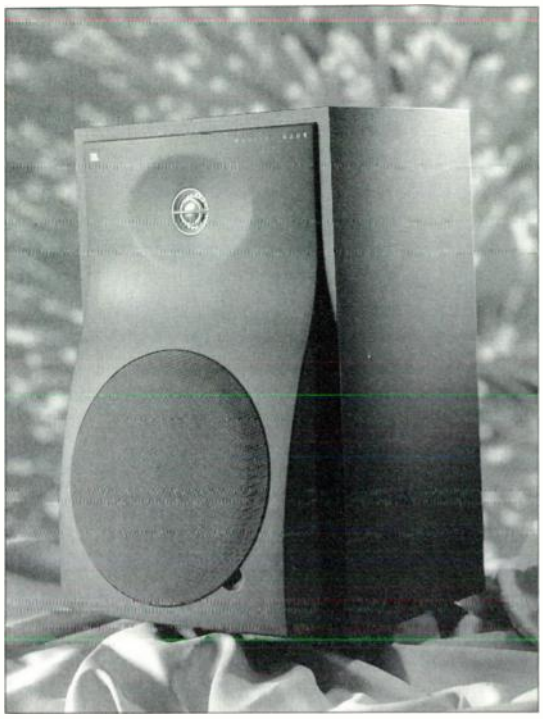
In a bid to further enhance the accuracy of near-field listening, JBL designed their 4200-series reference monitors with a "pot belly" that reduces phase cancellation caused by sound reflections from the mixing console.

SPECS

JBL's 4200 series includes two models, the 4206 and the 4208. These console-top monitors are characterized by a multi-radial, sculpted baffle that aligns the transducers so that lows, mids, and highs arrive at your ears simultaneously. Besides evoking the profile of Alfred Hitchcock, this design also reduces phase distortion and improves stereo imaging. A rear vent is added to further minimize low-frequency distortion as long as the speakers are placed at least six inches from a rear (reflecting) wall.

The 4206 is a 2-way monitor with a 6.5-inch woofer and a 1-inch, titanium-dome tweeter. Frequency response is claimed at 65 Hz to 20 kHz (±2 dB), with the crossover frequency set at 2.8 kHz. Sensitivity is rated at 87 dB for a 1-watt input measured at one meter. Power capacity is 75 watts and nominal impedance is 8 ohms. (For more specs, see "Mixed Company" on p. 38.) The

4208 shares tweeter configuration, power capacity, impedance, and a matte-gray finish with the 4206. However, the 4208 has an 8-inch woofer, a claimed frequency response of 60 Hz to 20 kHz (±2 dB) with a 2.6 kHz crossover, and a sensitivity rating of 89 dB (1W/1m).



PETER DIGGS

The bizarre Buddha-belly shape of JBL's 4200-series monitors helps reduce phase distortion.

EAR TEST

The initial test was a casual listen to a popular CD in the control room. First I ran the CD through our Yamaha NS-10M and Tannoy SGM 10B speakers to establish my normal listening perspective. When I switched to the 4206s, I perceived a slight dullness in sound quality. The sharp midrange reproduced by the other speakers was missing from the 4206s. When the 4208s were auditioned, the clear midrange returned.

Since I don't like mysteries, I borrowed a spectrum analyzer and shot our room. Our Yamaha and Tannoy speakers tested with the 2 kHz dip that has plagued our studio since its construction. When the 4206s were tested, the dip started at 600 Hz and continued through 4 kHz, confirming my ears' perception. As expected, the 4208s checked out fine. (Another pair of 4206s, auditioned at Audio Images' San Francisco showroom, produced a clearer timbre than my review models. However, articulation remained inferior to the 4208s).

While both speakers produced remarkable stereo imaging and clean bass tones, I found myself using the 4208s exclusively due to their clearer sound. The 4208s possess a sharp but gentle sonic personality that minimizes ear fatigue during long mix sessions. (Remember it's both smart *and* safe to take periodic "ear rests.") Also, the strange sculpted design delivered the goods: No phase cancellation was evident from console reflections.

CONCLUSION

If you're a JBL fan, the 4200 Series is certainly worth a listen. The expected timbral richness is present and the unique design increases articulation. Although I was uncomfortable with the "covered" quality of the 4206s, the 4208s possessed every bit of the sonic sharpness I need to feel confident of my critical listening. I would certainly add the 4208s to my list of friendly reference monitors.

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

Product Summary

PRODUCT:
JBL 4200-series studio monitors

PRICE:
4206 $395/pair
4208 $525/pair

MANUFACTURER:
JBL
8500 Balboa Blvd.
Northridge, CA 91329
tel. (818) 893-8411

4206

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

4208

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

video editor, time code becomes a critical issue. Most editors hate working with non-time-coded footage, because chasing edits is a frustrating chore. If an editor takes the gig, his or her hourly rate often reflects the extra labor.

SMPTE-coded footage ensures "repeatability" in the editing suite, which saves time and money. For example, your double snare hit always occurs at a SMPTE reading of 00:02:25:10 (hrs:mins:secs:frames), allowing a computer editing system to consistently sync the audio bam-bam to the video drumsticks. The editor simply enters the SMPTE number into the computer and watches it all happen.

Obviously, you'll make fast friends with video editors if you bring in time coded footage. Unfortunately, recording time code during the shoot increases costs and logistics. One method involves striping your audio master with SMPTE as it's transferred to a reel-to-reel deck with center-track time code, or to a DAT machine with time-code capabilities. Keep in mind you'll have to acquire a like machine for playback during the actual shoot. The transfer should be done at a professional recording studio to ensure time code consistency.

On professional shoots, time code from the playback deck is routed to a SMPTE slate, which looks like a futuristic version of the clapboards used to cue early sound films. The SMPTE slate displays time code readings on an LED screen and is filmed before each scene as a reference.

This visual time-code confirmation is important, as it establishes the "offset" time between the video footage and the audio track. Current professional video decks record time code as they film. The camera timing will be different from the soundtrack because audio and video are not recorded simultaneously with SMPTE. In the editing suite, the editor need only mark the start times of the video and audio tracks, and note the time difference (the offset) between the two media. The offset is entered into a computer editing system, which reconciles the timing to permit accurate editing.

Projects shot with consumer camcorders can be "post-striped" with SMPTE at a professional video facility. After the shoot is completed, time code is recorded onto one of the videotape's two audio tracks. To facilitate easy referencing in the editing suite, it's important that live sound is recorded during the shoot through the camcorder's onboard microphone. Although one track is erased to accommodate the time code signal, the remaining track

THE MONEY SHOT

Trust me on this. Some night after committing to a video project, you'll dream about a giant camcorder that sucks every last penny from your bank account. This is what's called a premonition.

The average video project is a nightmare of expenses, unless you're willing to persuade friends to work like dogs and accept pizza and beer as their sole compensation. It also helps to cash in favors, borrow equipment, and nag professionals for tips and guidance. If your conscience won't allow such behavior, the following chart of average video production costs displays the price of moral fortitude.—MM

Item	Day Rate (8 hrs)
S-VHS Camcorder	$75 to $150
Fluid Head Tripod	$15
Location/Studio	$75 and up
Light Pack (two 600-watt focus spots/two 1,000-watt broad lights)	$45
Professional Audio Playback System	$75 and up
Color Video Monitor (Playback)	$30
Director	$350
Pro Cameraperson	$300
Tape/Playback Operator	$150
Pro Lighting Designer	$200
Production Assistant	$75
Costumes	costs vary
Props	costs vary
Catering/Location Food	$30 and up
Makeup Person	$160
Hair Stylist	$160
S-VHS Editing Suite (A/B roll, NewTek Video Toaster, engineer)	$280
Tape Duplication	costs vary

provides an audible reference to cue the time code readings. For instance, you can *hear* that the first snare hit occurs at 00:00:07:01. In the editing suite, the combined audio/time code references facilitate alignment of video footage to the audio master track.

LIGHTING

Well-designed lighting does more than illuminate a scene; it evokes a mood. Unfortunately, the nuances of light and shadow are far too mysterious to unveil in a single article. In addition, most self-produced videos are not budgeted for talented lighting designers. In these cases, it's more important that the lighting render clear video images than tricky ambiences.

As a rule of thumb, video requires a lot of light. I'm sure every videographer has examples of grainy footage from shots attempted in low-light situations. Sometimes this look can be artistically exploited, but more often it betrays the work of an amateur.

If you can't afford specialized illumination, rent a professional soundstage that offers a full lighting rig and blast the act with light. For the most part, there's no such thing as "too bright." (This is where a makeup artist is handy, to control the effects of massive illumination upon the artist's face.) And remember, the sun offers its services for free. I've shot many budget projects outdoors in full sunlight to save lighting costs.

THE SHOOT

This is it. Show time. There's nothing to do now but let it all happen. Well, almost. Few people walk onto a set with transcendental calm. While precise planning ensures a survivable video experience, it doesn't guarantee that a million things won't go wrong. But don't ever lose control; that's the director's job.

Camera setups take forever, so bring a book or some magazines to occupy your mind (and distract attention from performance anxiety). Do *not* spend idle time reading and re-reading the script. Let the director agonize over details. During the shoot, your only job is delivering a natural performance.

At this point, the best way to ensure a successful project is to shoot tons of material. Videotape is cheap. Once the props, lights, and crew are set, it's a good idea to film a few "safety" shots. What looks good today may not look good tomorrow.

Numerous editing options can save a clip, so be sure to shoot close-ups, medium shots, full-length shots, and (if time allows) unusual perspectives. Don't worry about mistakes. The great thing about video is that you can see results almost immediately. If something is wrong, it can be adjusted, deleted, or reshot. Remember, one take in music is inspired; one take on video is stupid.

EDITING

This is literally where it all comes together. All the scenes and shots must be edited to compose a finished master. Besides consulting the script to piece together the final product, the video editor must sort through all the footage to get the good stuff onscreen. The editor also decides which image transitions are to be straight cuts, dissolves, wipes, fade-ins or fade-outs, and whether computer-generated effects are appropriate.

In self-produced projects, often it's the artist and/or director who view the complete footage. Using the script as a guide, each scene is auditioned to determine which take looks the best. Once a shot is chosen, it is written on an *Edit Decision List* (EDL). This log charts desirable shots, with their SMPTE time or tape-counter number (if you're wild synching) and establishes a sequence of edits.

In time-coded projects, the EDL is assembled by viewing *window dubs*. These are work copies of the original video masters that have SMPTE numbers burned into an onscreen box. The SMPTE numbers allow exact mapping of desired shots, down to a single frame.

In many ways, video editing is analogous to audio mixing. Both disciplines enhance a product by bringing its strengths to the foreground. In audio, killer tracks can be mixed up and decorated with effects, and poor tracks buried in the mix or muted. Video editing allows only the best shots to comprise your master tape, provided you've critically prepared your EDL. Bad shots (poor focus, poor framing, artist mistakes, inelegant movements, etc.) never make it to the screen, while great shots can be intensified with computer graphics or inspired editing transitions (dissolves, wipes, etc.). In both audio mixing and video editing, costs can run amok if time is spent agonizing over details or dialing in special effects.

Two basic editing systems are available to the videographer: cuts only and A/B roll. Cuts-only systems are standard in inexpensive editing suites (usually $15 per hour and up) and limit visual transitions to direct "splices." If you envision trickier segues, such as images dissolving into each other, you'll need an A/B roll suite. A/B roll editing systems control and route signals from two (or more) preview decks into one master assembly deck. These suites usually start at twice the hourly rate of cuts-only facilities.

The number of options provided by a well-equipped editing suite are astounding, so sticking to your game plan helps avoid cost overruns. Don't amend the scenario in the editing suite or go overboard on costly computer manipulations. The EDL is a freebie because it can be assembled by watching rough footage on your home video deck. If you do the job right, editing-suite charges are limited to cutting your preselected shots together. If you *can* budget a little time for inspiration—perhaps one shot dissolving into another is better than a direct cut—all the better.

Since you've worked with a script and encapsulated footage into an EDL, the finished master tape should be a pleasant surprise. So now sit back and watch the fruits of your labors. Hopefully, the pictures on the screen infuse your work with brilliance and inspire one hell of a "wrap" party.

THE FINAL EDIT

Anyone seduced by the magic of film should find that music video production is the real field of dreams. Video does not limit the musician's imagination to lyrics, chord progressions, and sonic manipulation. The visual empire forms an alliance with the musical domain.

This added sensory plane empowers a composer to expand the perceptual impact of his or her work. No longer is the auditory creator at the mercy of individual interpretations triggered by psychoacoustics. If it's important to an appreciation of the work, the composer can *show* the public images that define the work's musical intent. But images also can be vague and mysterious, which is another benefit of the medium. Beautiful or tragic scenes can imply creative subtexts or simply adorn a composition with "video art." Like a choreographer sometimes uses limbs and space to humanize melody, a composer can use video images to fuse theatrical drama with sound.

The crux of all this is an improved emotional dialog between artist and audience. Passionate artists never cease the quest for transcendent moments. Whether it's the sensual power of a guitarist displayed in full roar, or the exotic beauty of computer-generated graphics, video bestows the creative musician with yet another path to a stranger's heart.

(Many thanks to Otis Bess [NFL Films, MTV], Herb Ferrette [PBS], and John Martin Video.)

EM *associate editor* **Michael Molenda** *wanted to be a film director, but he looks ridiculous in baseball hats, hates espresso, and is incapable of yelling "cut."*

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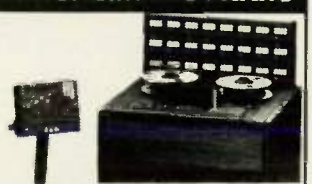

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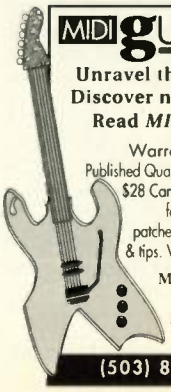

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Put the Musician Back Into Music Technology

Visionary artists are important components of successful product development.

By Bryan Bell

MARTIN COHEN

I have been creating technological solutions for entertainers for almost twenty years. In the past, if an artist had an interesting idea, I created tools that allowed them to make that dream a reality. Sometimes music manufacturers turned to cutting-edge musicians for technical input when developing a new product. This open communication was extremely rewarding for everyone involved, and consumers benefitted from improved products.

Today, when I remind manufacturers how valuable artistic input was to their success, they remark that today's larger market is different and creating high-end systems for music professionals is a waste of money. They claim that the expanded consumer base restricts the risktaking of yesteryear and such experimentation can't increase market value.

I disagree. I believe that a parallel evolutionary process exists between the general consumer and the needs of great artists, writers, poets, and scientists. The drawing tools that once could only be used by Michelangelo have become standard fare for beginning art students.

Another example is desktop publishing. A mere decade ago, only professional typesetters possessed the capability for setting type. Now, millions of people who never dreamed of designing a page layout before these tools became available are bonafide desktop publishers.

Here's an example closer to home. While working for Herbie Hancock in 1978, our team proposed connecting all of his synthesizer voices to a central set of controllers. This was an early hardware attempt at multi-vendor interfacing, and several engineers and manufacturers contributed expertise. While working on a solution for standardizing control and tuning issues, we came up with the idea to totally integrate Herbie's instruments with tape machines, mixing consoles, and video decks.

This addendum greatly complicated the project, but the end result was well-worth the trouble. In addition to being able to store Note-On and -Off information to floppy disk (a feature not included on any of the instruments), we synchronized Herbie's synthesizers to drum machines, multitrack tape machines, video recorders, and mixing consoles (including fader automation). We also developed a universal voice librarian that included text processing for lyrics and notes. All data was stored on a central computer.

Then came MIDI. When Dave Smith first proposed MIDI, his vision was that the music equipment market would expand if end users could easily interface products, regardless of brand. (And without having to "do it yourself," as Herbie did.)

Well, Dave was right. In its fledgling years, MIDI was far inferior to Herbie's hardware interface. But as more powerful and affordable personal computers emerged, MIDI attained professional performance standards. More importantly, MIDI was exactly what *consumers*—not just high-end professionals—wanted. Musical instrument sales skyrocketed. The custom, high-end tools we created for Herbie more than a decade ago are now the everyday system for pros, semi-pros, and hobbyists.

Manufacturers and standards organizations are currently pondering the future of multimedia. Whether it's a pro delving into real-time video editing or a student adding music to a *QuickTime* movie (see "This Revolution Will Not Be Televised," p. 36), multimedia cries for a universal interface and protocol that includes audio, music, video, and graphics.

Unfortunately, I've observed that the solid relationships between pre-MIDI manufacturers and major artists do not exist in the infancy of multimedia. Few manufacturers seem interested in collaborating with artists during product development.

The time difference separating the functionality of high-end tools and consumer tools is becoming shorter and shorter. The advent of computer-aided design and rapid product-development cycles has made the gap almost nonexistent. In a time of dwindling markets, the companies that listen to the true visionaries—whether they are painters, sculptors, graphic designers, animators, filmmakers, poets, composers, or performers—will succeed. The ones that listen to their focus groups and business plans will generate products that miss the true evolutionary timeline. Manufacturers who put the musician back into music technology will endure.

Producer, engineer, and programmer **Bryan Bell** *is president of Synth-Bank, a computer-music design firm. He works with various artists, including Branford Marsalis, INXS, Herbie Hancock, Santana, Neil Young, and Fine Young Cannibals.*

The other guys missed the bus. Actually, 2 of them.

Why waste your money on a 2-bus mixer when you can get the new 1642 from DOD? It's the only 4-bus mixer for under $1300.

	DOD 1642	YAMAHA MV 1602	TASCAM M-1016	MACKIE CR 1604
Price	$1099	$1299	$1295	$1099
Bus	4	2	2	2
Discreet mix bus out	4	2	2	2
Mic Inputs (Bal)	8	8	8	6
Line Inputs	16	16	4 Stereo	16
Phantom Power	Yes	No	Yes	Yes
Sends	6 Pre or Post, configurable.	2 Pre 2 Post	2 Pre 4 Post	1 Pre/Post 5 Post
Sub groups	2	2	None	None
Console convertible	Yes	No	No	Yes
Solo to mains	Yes	No	No	Yes

The 1642 boasts 16 line and 8 balanced mic inputs. High-precision, monolithic preamps ensure ultra-low noise and distortion, and extremely-high input bandwidth.

The console may be used as a 16X4 for recording or a 16X2X2 for sound reinforcement. For recording, four discrete outputs (Sub 1, Sub 2, Left and Right) can be assigned, or each input may be routed through the 2 sub groups to the mains. That means the 1642 delivers more sound options than any other mixer in its class.

Each channel in the 1642 has a 3-band EQ with Adaptive Q circuits for a contoured response that adds clarity to the highs and warmth to the lows.

We're so confident you'll love our new 1642, that we'll back it with a 2-year warranty.

If you want a killer mixer for a low fare, don't miss the bus. Check out the 1642 from DOD.

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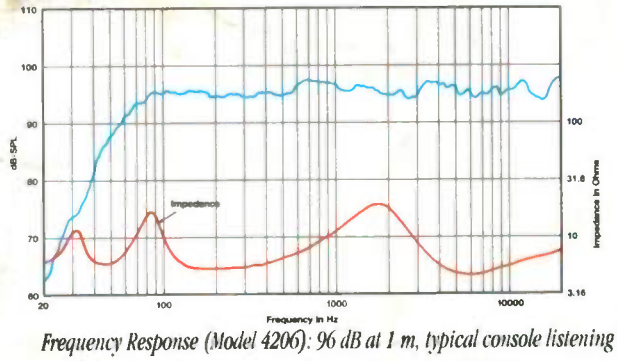
Today's recording studio has evolved into a multi-function facility which simultaneously addresses the specialized needs of music recording, film and video post, and radio production. In this environment, where the most critical listening often occurs in the final mix, close proximity monitors are often more important than the mains. The problem: most console top monitors, unfortunately, were designed for the living room not the control room. Until now.

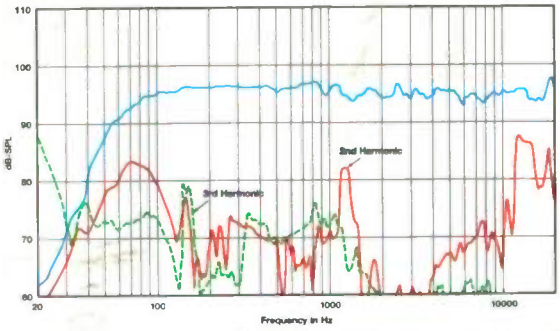
With the 4200 Series we're taking our stand from where you sit: right where you work at the console. Designed, engineered and tested from this position, the 4200 Series is the first console mount monitor created specifically for the professional recording environment.

Both models give you pin-point imaging by delivering high and low frequency information to your ears at precisely the same instant. By virtue of their symmetrical design the 4200 Series monitors are mirror imaged. And so nothing gets in the way of your music, the 4200 Series introduces our uniquely sculpted Multi-Radial™ baffles incorporating newly designed pure titanium tweeters and low frequency transducers. The combination of these technologies successfully corrects time arrival anomalies and eliminates baffle diffraction distortion.

4200 Series: console top monitors designed in the studio, for the studio, with sonic performance rivaling much more expensive monitors. 4200 Series: the shape, and sound, of things to come. Available at your local authorized JBL Professional dealer.



Frequency Response (Model 4206): 96 dB at 1 m, typical console listening levels



Distortion vs. Frequency (Model 4208) 96 dB at 1 m, typical console listening levels (distortion raised 20 dB)

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