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July 1992

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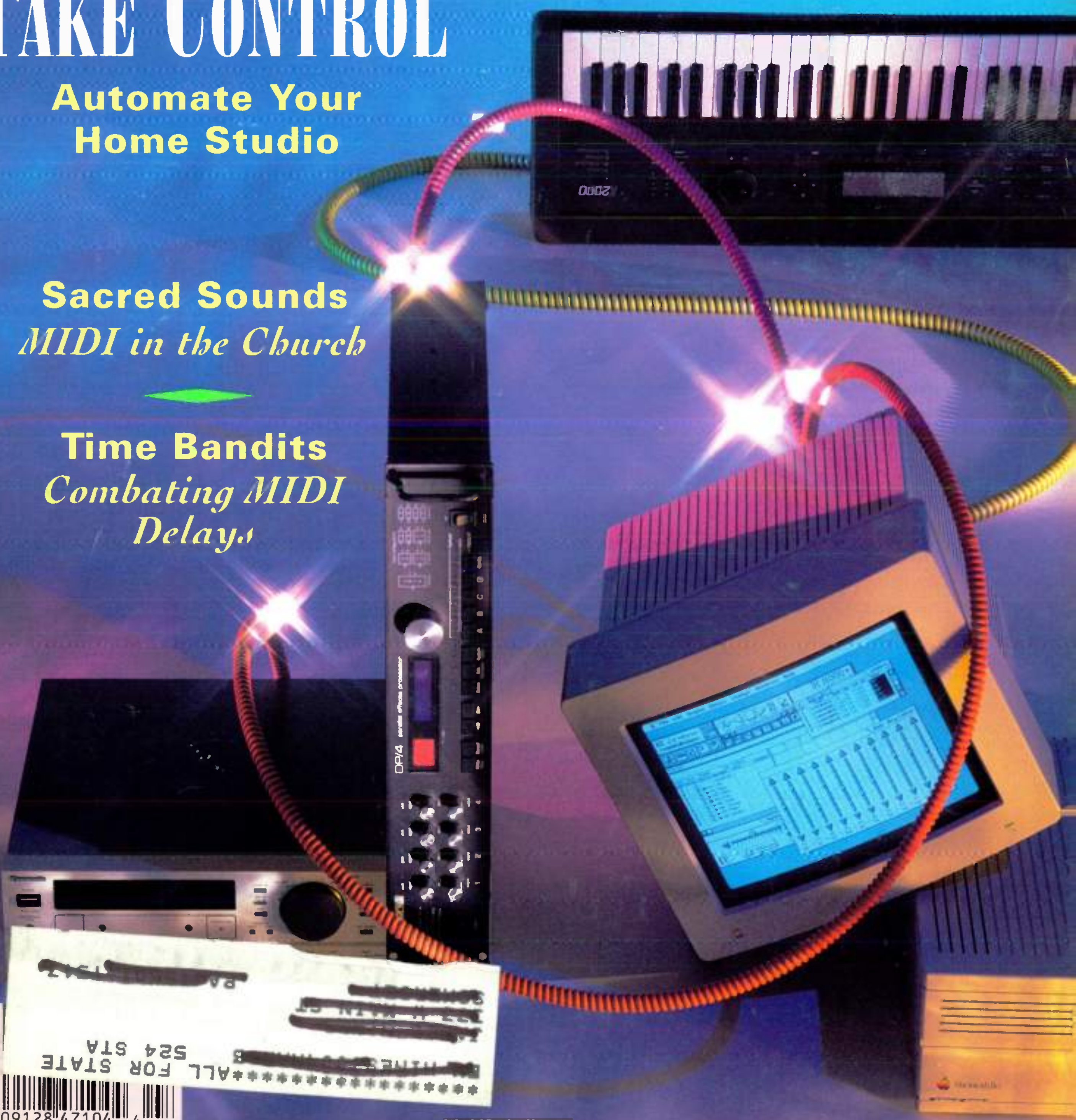

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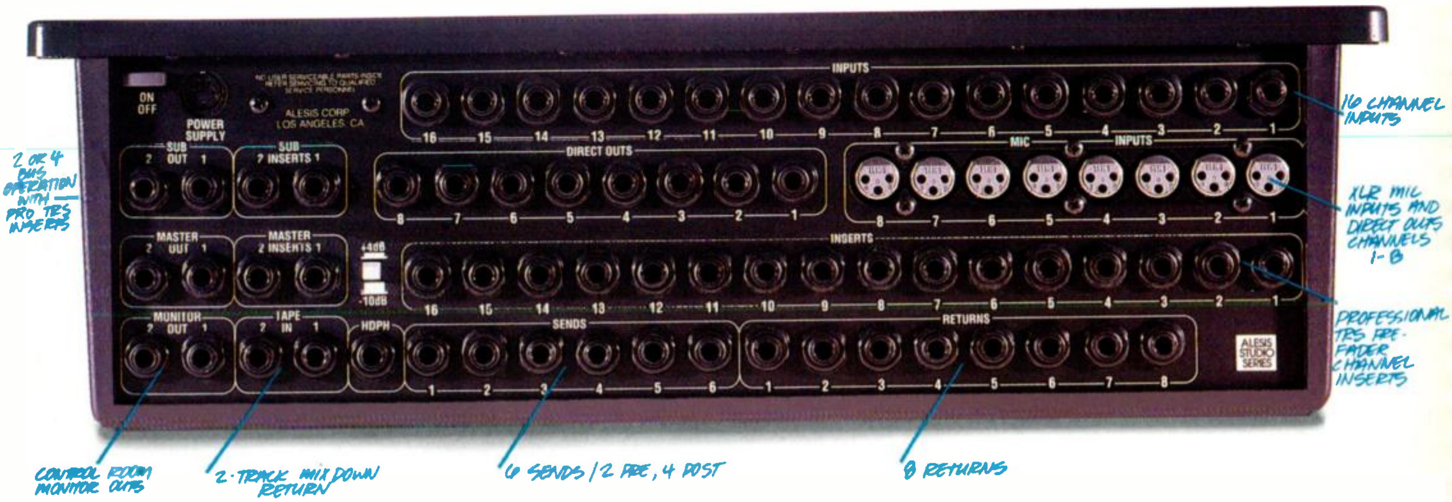
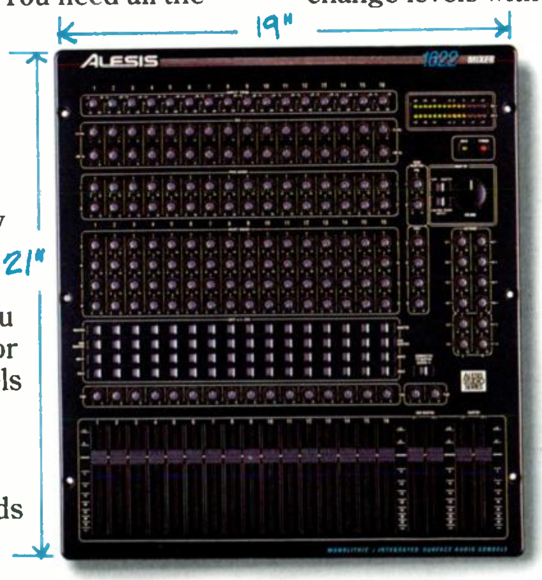



Flexibility is the horsepower behind any professional recording mixer. You need all the channels, sends, returns and inserts you can get your hands on in the heat of a mix. Check out these front and rear panel shots of the Alesis 1622 and you'll see professional features that make other mixers pale by comparison.

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**Keyboard Magazine July '90*

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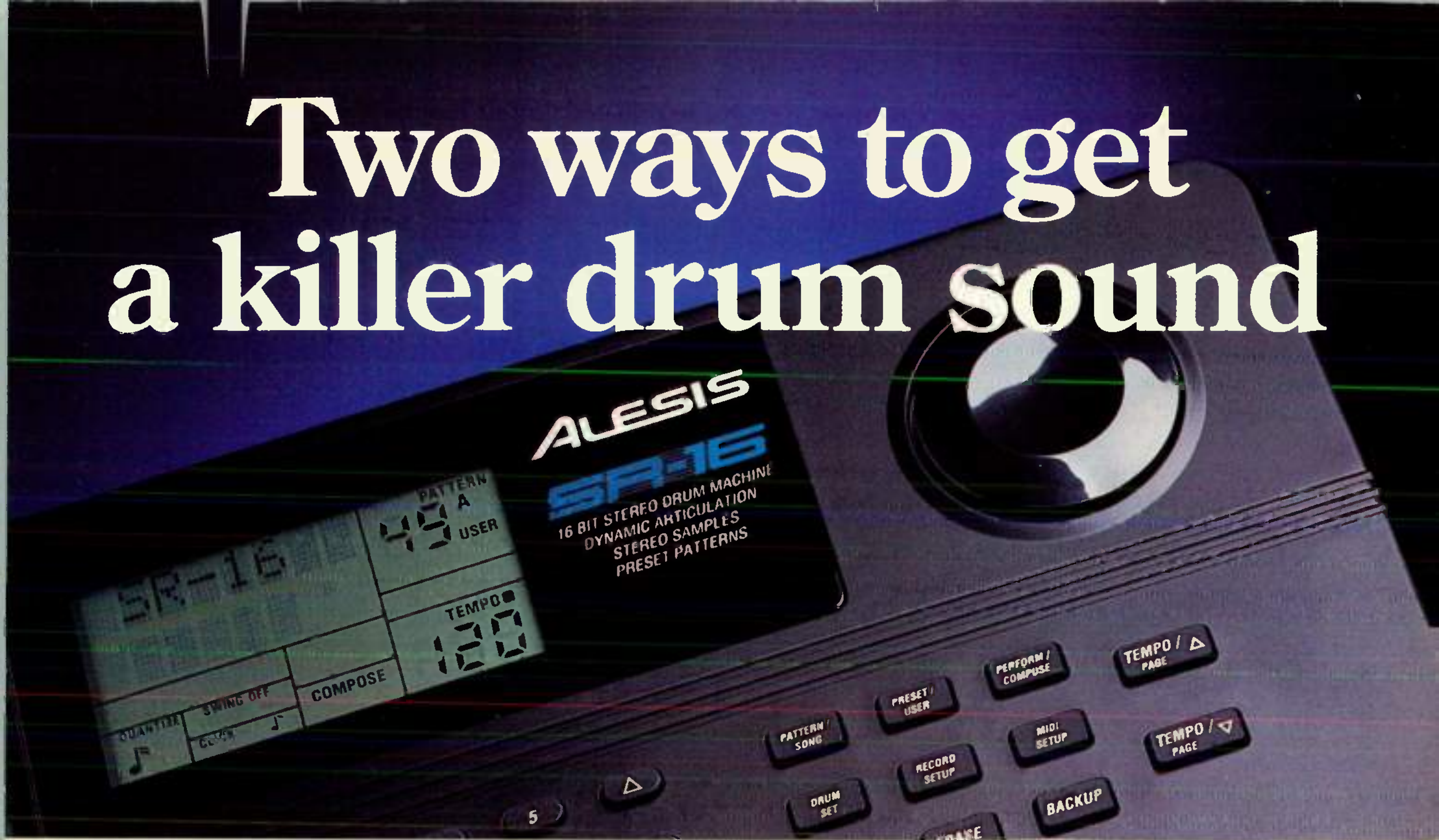


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## REVIEWS



## DEPARTMENTS



Cover: Photo by Scott Peterson.

THE FRONT PAGE

# Intelligent MIDI

It's time to add advanced networking to the MIDI specification.

ANNE HAMERSKY

Making music with electronic instruments can be a pain. It requires spending generous outlays of cash to buy the necessary gear; suffering through abysmal instructions on how to use it; and wasting inordinate amounts of time hooking all the pieces together and keep them working. Dealing with cumbersome, hassle-filled procedures like synching a sequencer to a multitrack tape simply adds insult to the existing injury.

Why should we have to put up with all of this? Why can't all the pieces of a typical electronic music studio work together in a coherent way so that we can worry less about how everything's connected and spend more time making music?

Think how productive you'd be if assembling a computer-controlled, integrated tape and sequencing system required simply hooking together a few cables. If "intelligence" were built into each of the different pieces of gear and the computer software running the show immediately configured itself for the components available to it, reconfiguring and rewiring your studio would become a thing of the past.

Imagine if by sending a query and receiving a response your sequencer could sense that you added a new synth with built-in effects to your system. Imagine further that the sequencer allowed immediate access to a window with effects parameters. That way, you could play back a sequence on the new instrument, adjust the reverb decay or chorus rate from within the sequencer and record your tweaks in real time, without worrying about the appropriate SysEx codes, or which data was routed where. Voice-editing, of course, also could occur in the same way. An intelligent synth would know, and be able to communicate, its polyphony and voice-stealing method too, so that the sequencer could tell you when you exceeded the instrument's polyphony and route any extra notes to another synth in your system.

The final mixdown of taped, hard disk-recorded, and sequenced tracks also could be made more immediate and intuitive. Why not offer a Mix mode within the sequencer? Upon entering it, a bank of faders would appear that control levels for each of the different track types and parameters for all signal processing power within the system, both from stand-alone boxes and the DSP chips built into synths or digital audio boards. Any adjustments would be recorded so that you could have a completely automated mix.

The ability to do these applications in a limited form exists today. To discover some of the possibilities, check out this month's cover story, "Beating the System," on p. 38. At the moment, however, setting up a system that incorporates these capabilities is expensive and difficult. Ironically, it takes some of the hairiest studio reconfiguring you'd ever want to see. What we really need is an expanded, more networkable form of interconnection: an "intelligent" MIDI.

A few steps have been taken in this direction, notably the Device Inquiry message added to the MIDI spec, Opcode's *OMS* software, and the MediaLink concept Lone Wolf has been touting for several years. But the time has come for the MIDI Manufacturers Association to consider a significant upgrade to MIDI itself, one that incorporates higher-speed, bi-directional communication on a single cable (two of the five pins remain unused, after all).

Even an updated MIDI, by itself, won't permit the types of applications I've outlined, however. Synth and software manufacturers must be willing to incorporate the required intelligence into their products, and consumers must be willing to pay for these capabilities. If all parties participate, the result could be a lot less hassle and a lot more music.

Bob O'Donnell


# Electronic Musician

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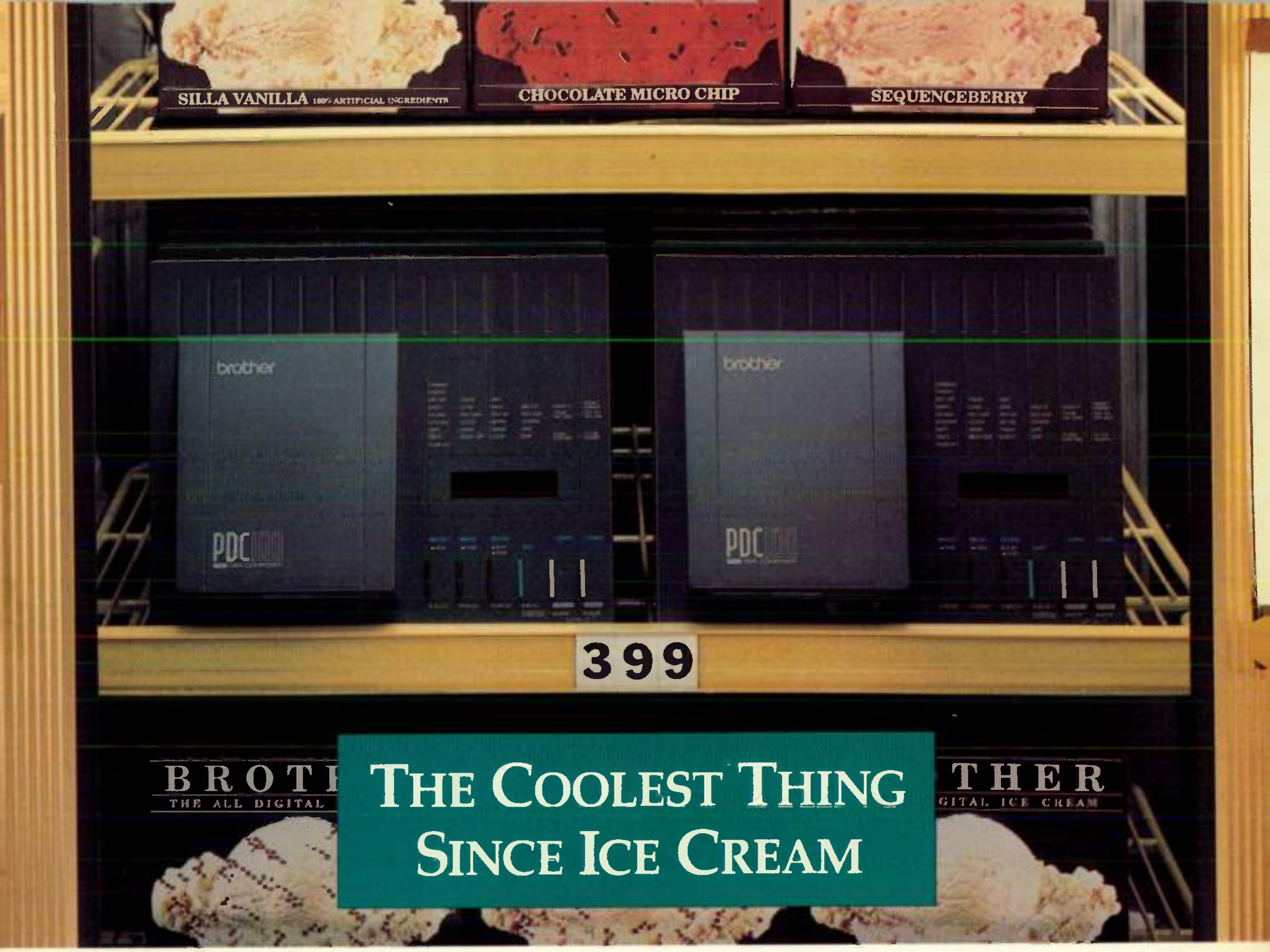


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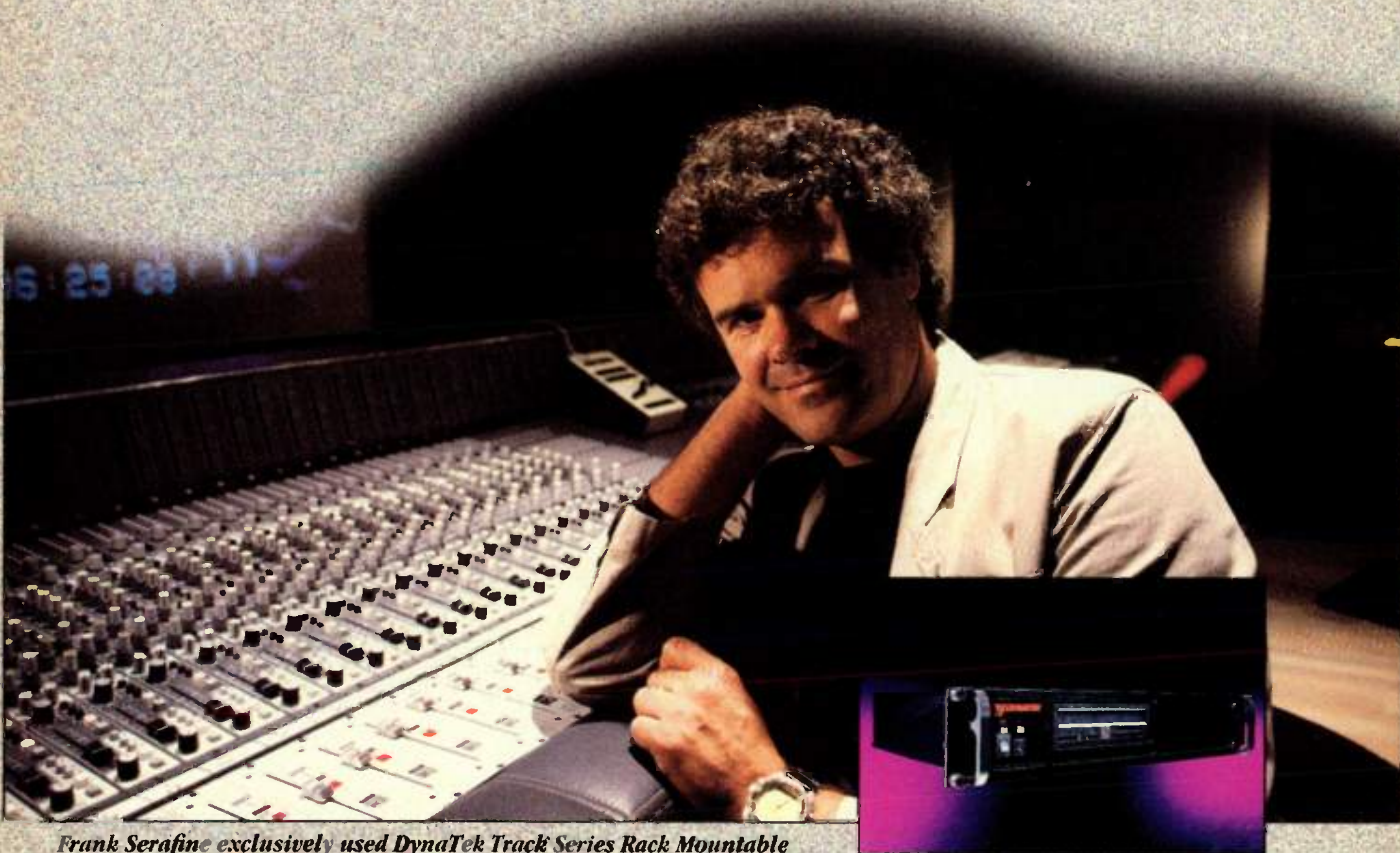

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*"The Lawnmower Man" image courtesy of Allied Vision Lane Pringle Productions and New Line Cinema Corporation. "CyberBoogie" created by Angel Studios.*

LETTERS

SUSAN GROSS

### BAD NEWS BEARER

I would like to say a few things in response to the "Future of Analog," by Brent Hurtig (May 1992).

I am a digital audio and recording consultant for a pro music retailer, with many years of studio experience in my own facility. I found Mr. Hurtig's statements a series of misinformed responses and unfounded assumptions. The article was based on the premise that the Alesis ADAT (among other affordable digital recorders) would be the "end-all" of the structure of the pro recording market as we know it today. The ADAT is not even available at this time (either dealers have not received them, or the waiting lists are long). Wouldn't it be better to make statements like "The future of analog is grim" after such products have been circulating in the market for a little while?

First, the digital technology of today does not support the fullest frequency responses that the average human ear can detect. Second, the inherent problem in marketing and supporting new products like the ADAT will be monstrous for a company inexperienced in tape-machine manufacturing. It will be interesting to see how they do this and how they sell.

Most of my customers are *not* impressed with the capabilities of digital media over the excellent sound of Dolby S- or SR-equipped tape decks. Most studios could have switched to all-digital systems long ago, but they remain dedicated to analog multitrack mediums, or use a combination of analog and digital.

The differences between analog and digital have become subjective. Both have their advantages. Digital's advantages are not overwhelming enough to make analog obsolete anytime soon.

**Arn Johnson**
**address unavailable**

Author Brent Hurtig responds: *Some years ago I also sold pro-audio equipment, so I sympathize with your concerns. However, I feel you've chosen to slay the messenger of news you may not wish to hear. Barring any major social calamities, digital recording will supplant analog recording. The evidence is plentiful. Hollywood now uses hard-disk recorders to post-produce films and videos cheaply and quickly. MIDI mavens who copy-and-paste music data can't wait to do the same with audio tracks. Furthermore, commercial studios must confront competitive realities once musicians have digital multitracks in their garages and bedrooms. And the ultimate evidence: Serious analog multitrack R&D is practically finished around the globe.*

*These facts don't go away if we dislike them. Nor did I say that affordable digital recorders represent an "end-all," though as harbingers, they will, as I stated, "change the very nature of the recording business." So the ultimate future of analog recording is grim.*

*Regarding your points about analog's advantages and digital's pitfalls, the article supports this statement. None of this makes current analog technology obsolete. The article offers many reasons to buy analog gear, and I hope to get a few more good years from my own. The article's closing words may be useful with your pro-audio customers: "We should make the most of what we have today, not counting on tomorrow's technology to spur today's creativity."*

### MIXUP

Since I am in the process of upgrading my studio with a new mixer, I looked forward to Larry Oppenheimer's column on "Maximizing Your Mixer" ("Recording Musician," April 1992). I was impressed with its noncontent.

The article states, "avoid putting the mixer near any (EMF) source." How far away should it be? Forty miles? I guess his advice rules out near-fields, since they usually are placed "near the top of the channel strip."

Next, he advises a listening test to assess what part of the mic trim is the noisiest. What do you do with the resulting information? By the way, what does "70%" mean on a fader? Zero dB? Four parsecs?

I feel it would have been a better column if he stuck to the basics on readying the mixer.

**Bob Vandiver**
**Portland, OR**

Author Larry the O. responds: *The point of the column is to give home studio owners general tips on getting the best sound quality from an inexpensive mixer. Specificity is not practical given the length of* EM*'s "Recording Musician" column and the variety of circumstances that* EM *readers embody in their studios. For instance, how far a mixer should be from a source of EMF depends on the sensitivity and shielding of the mixer's circuitry, the field strength of the EMF source, and the amount of space available. Speakers placed on top of the mixer typically have relatively small magnets on the woofers and usually are placed on the meter bridge or otherwise elevated somewhat from the face of the mixer. Many models are shielded, too. As such, they do not usually present a problem, but conceivably, they could.*

*With regard to fader settings, with a few exceptions, most mixer manufacturers recommend setting the gain structure so that nominal operating level occurs at between two-thirds and three-quarters of the fader's throw, or approximately 70% of its travel. The idea is that you more often lower a signal below nominal level than raise it into the headroom above, so you should have more fader travel below nominal. Specs such as 0 dB, or unity gain, depend on variables such as the input signal's level, mixer design, and trim settings.*

### TEACHER TIPS

After I finished reading your many insights into the MIDI needs of music educators ("MIDI

Enters the Classroom," April 1992), I felt compelled to share my perspective.

I am a traditionally trained music educator whose major instrument was classical guitar. My experience tells me that MIDI's slow-paced integration into the music curriculum stems primarily from educators' lack of desire, not from a lack of educationally oriented MIDI products. Many of the "MIDI-based, computer-assisted instruction tools" you mention currently exist! Products such as *Take Note, MIDI Music Lessons,* and Temporal Acuity's software directly address "the development of basic musical skills," including ear training, rhythmic development, and music literacy. Instrumental practice can be enhanced through the use of Roland's Intelligent System of Music (ISM) and *MiBAC* (jazz lessons), to name a few.

I agree that instrument design could be modified to create a more intuitive operating environment for the classically trained musician. For example, velocity levels could be identified as *ppp-fff,* as opposed to the current system of using a number between 0 and 100, or 0 and 127. (This modification has already found its way into the Kurzweil K2000 synth velocity- and pressure-mapping tables). Transposition intervals could be displayed as using major, minor, augmented, or diminished as labels, instead of the awkward practice of identifying intervals by number of half-steps. Also "the ability to produce a sustained legato from note to note following an initial phrase" has most recently been addressed through the creation of a new controller number (68), which was designed to provide "MIDI legato."

Lastly, the "orchestra-in-a-box" synthesizer you relish sounds like a "real" string player's worst nightmare. Subtlety, nuance, and other non-empirical elements of the art of music can never be quantified—and therefore captured—by electronic instruments. The development of a product with the exacting specifications that you enumerate has as much chance of being created as an algorithm in a composition program that effectively eliminates the need for "real" composers and composition instructors.

**R. G. Rhoades**
**Mechanicsburg, PA**

Author Ed Tywoniak responds: *Thank you for your comments. We are much closer in philosophy than you suggest. Within the article, I specifically state that "electronic instruments will never replace acoustic instruments." I didn't mean to suggest that electronic instrumentation will "eliminate" the need or desire for "real" (i.e., acoustic) instruments. To suggest that gestural subtlety and nuance can "never be quantified by electronic instruments" is forgetting that we are witnessing the beginning of an industry that already has made great strides in a short period of time. It is not difficult to envision an electronic instrument with the depth and breadth of nuance that you suggest.*

*Finally, I do not relish the orchestra-in-a-box as a substitute for more traditional orchestras. Electronics are just another genus in the overall family of musical instruments.*

**PARDON ME, PROFESSOR**

As I was reading Jack Jarrett's article ("The Back Page," April 1992), I was thinking, "This guy needs an E-mu Proteus/2." He later mentions this very instrument, but laments what

he thinks are limitations.

I use the Proteus/1, 2, and ProCussion every day, primarily for "orchestral" applications. Mr. Jarrett, as coauthor of *MusicPrinter Plus*, should realize that any successful implementation of traditional orchestral voices on samplers or synths requires some voice editing by the user. Yes, the strings on the Proteus/1 have a down-bowed attack, but they can be smoothed out by editing the Alt envelope. I edit voices and save them under different names. This is the only way to achieve believable and musically satisfying instrumentation. Mr. Jarrett's hope for a factory-direct box full of every possible orchestral execution is—pardon me, Professor—a bit naive.

**Joe Cox**
**Los Alamos, NM**

## SASSY READERS

Thankfully, you have such knowledgeable readers as Bill Palmer ("Letters," April 1992) who spell out for your more ignorant audience what is necessary to make good music.

Imagine how shocked I was when I realized that not only am I proliferating the dreaded "solitary type of music," but I don't get paid for it! And to think I was enjoying it!

**Peter Kata**
**New York, NY**

## WHERE'S THE APPLE?

I noticed in "Music Boxes" (March 1992) that the Apple IIGS was accidentally omitted. This mistake is surprising since the Apple IIGS has an Ensoniq 5503 digital oscillator chip with 32 independent oscillators. When it plays an instrument, it sounds like that instrument, even through the little 3-inch built-in speaker. Plug in an amplifier and bigger speakers, and WOW! Not only that, it does a great job of digitizing audio.

The Apple IIGS is far from technologically obsolete. It's the best kept secret in the computing world.

**John R. Majka**
**Louisville, KY**

*John—The IIGS intentionally was omitted because of the lack of serious music software for that platform. Yes, the internal 8-bit sound chip was very good for its day, but unfortunately, the IIGS is a little closer to technological obsolescence than you let on. In fact, recently published reports suggest that the IIGS will be discontinued in October.—Bob O'D*

## ERROR LOG

**June 1992**, "What's New," p.12: The correct telephone number for GeneralMusic Corp. (U.S. distributor of Bachman keyboards) is (708) 766-8230. **May 1992**, "Computer Musician: Multimedia Sound," p. 80: The sidebar "CD Formats" was written by Terry Barnum, whose name was inadvertently omitted.

*Address correspondence to "Letters,"* Electronic Musician, *6400 Hollis St. #12, Emeryville, CA 94608. Published letters may be edited for space and clarity.*

*Corrections to articles are listed at the end of "Letters." We compile these published corrections annually; to receive a copy, send an SASE to "Error Log Listing" at the above address.*


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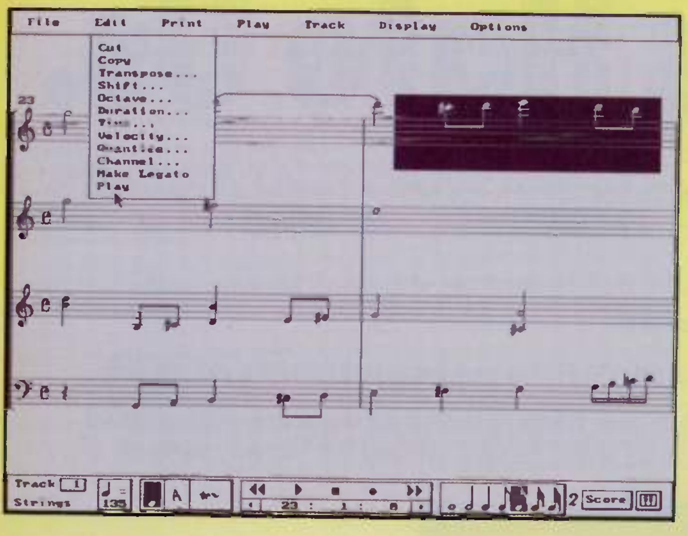


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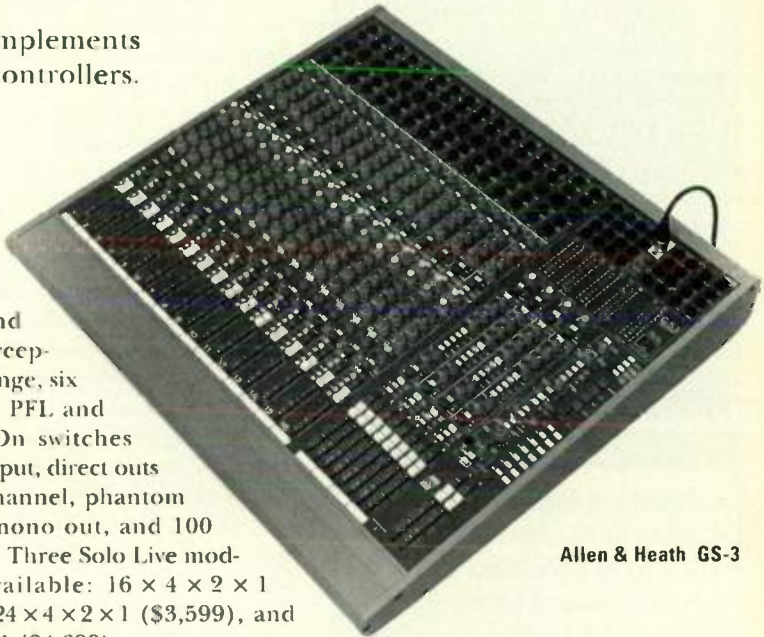


Allen & Heath GS-3

### MIDI-CONTROLLED MIXERS

Allen & Heath's in-line **GS-3** series offers MIDI automation of channel, monitor, and effects-send mutes in 16×8×2 ($4,595) and 24×8×2 ($6,499) mixers. A 32×8×2 configuration can be assembled from either console via 8-input expander modules. (Hardware is included to maintain cosmetic uniformity.) All models feature direct-to-tape switches; dedicated EQ controls for channel and monitor paths; six aux sends; inserts on all channels, groups, and the stereo mix; dedicated EQ and sub-group assignment on the four stereo effect returns; a 2-frequency alignment oscillator; +48V phantom power; and 100 mm faders. Automation is controlled by seven "F" (or soft) keys that can be configured to operate as simple mutes or access program change information. A "learn" function enables the keys (via MIDI control messages) to run tape transports or hardware/software sequencers. "No hands" punch ins/outs also may be MIDI controlled through a console-mounted footswitch jack assigned to the appropriate "F" key.

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

MIDI mute automation is the key feature of the Soundtracs **Solo MIDI** console. An onboard data keypad assigns MIDI mute commands to all inputs, monitors, groups, stereo returns, and aux masters. The Solo MIDI offers in-line monitoring; 4-band EQ; six aux sends; PFL and solo-in-place; four stereo returns with 2-band EQ, pan, and level controls; and a 3-frequency (selectable) oscillator. Three configurations are available: 16×8×16×2 ($4,299), 24×8×24×2 ($5,999), and 32×8×32×2 ($8,699). Soundtracs also is offering a sound-reinforcement mixer, the **Solo Live**. Features include 4-band EQ with sweepable midrange, six aux sends, PFL and Channel On switches for every input, direct outs on each channel, phantom power, a mono out, and 100 mm faders. Three Solo Live models are available: 16×4×2×1 ($2,699), 24×4×2×1 ($3,599), and 32×4×2×1 ($4,699).

**Soundtracs**
**485-19 South Broadway**
**Hicksville, NY 11801**
**tel. (516) 932-3810**

### MID-SIZED MIXERS

Mackie Designs introduced a line of **8-bus mixers**. Available in 16×8×2 ($3,000), 24×8×2 ($3,700), and 32×8×2 ($4,300) configurations, these consoles offer in-line monitoring (effectively doubling the inputs during mixdown), a 116 dB dynamic range, two assignable headphone monitors, stereo solo, six aux sends, 100 mm faders, a built-in talkback microphone, and +48V phantom power on all channels. The consoles operate at a professional +4 dBu level (-10 dBV conversion for tape ins/outs) and offer semi-parametric EQ (±15 dB boost/cut) with a 75 Hz lowcut filter and an EQ in/out switch. Mackie also released an **internal MIDI controller board for the CR-1604 mixer** that provides full fader automation and muting for all sixteen inputs, the master outputs, and the four stereo aux returns. The internal board ($700) can be installed in five minutes by a qualified technician. Once in place, the board interfaces with any MIDI hardware or software and offers basic "snapshot" operation, as well as continuous control via multi-port MIDI systems.

**Mackie Designs**
**16130 Woodinville-Redmond Rd. N.E., #2**
**Woodinville, WA 98072**
**tel. (206) 487-4333**

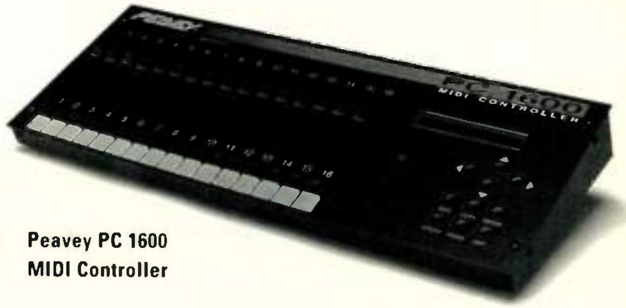
Biamp Systems introduced a 24-channel version of their **Newport** console ($3,383). The Newport's compact design sits on just five square feet of table space and all connectors are front-mounted to allow flush placement against walls. Features include 3-band EQ, four aux sends, a stereo input channel (for tape decks or other stereo line-level systems), insert points on all channels, 100 mm faders, phantom power, and solo switches for all channels, submasters, and aux sends.

**Biamp Systems**
**14270 N.W. Science Park Dr.**
**PO Box 2160**
**Portland, OR 97208-2160**
**tel. (503) 641-7287**

### MIDI PREAMPS

Rane extended the scope of MIDI control with the **MAP33 MIDI/Programmable Acoustic Instrument Processor** ($1,995), a rack-mount instrument preamp with an impressive array of features. Each of the three instrument inputs accepts two pickups, which can be any combination of magnetic pickup, piezo, internal mic, and external mic, with or without phantom power. Each pickup has independent lowpass filter, notch filter, invert switch, direct output, 7-band graphic EQ, insert loop, level control, and pan. Combinations of two pickups have a separate send and tuner out. The vocal mic input has 48V phantom power, a 7-band EQ, insert loop, level control, pan, and send. The stereo line input has a mono switch, L/R level controls, and a send. A stereo effects loop is provided, with noise gate, mono switch, level controls, and balance control. The footpedal jack can be assigned to any level control in the User menu. A separate programmable monitor out has its own 7-band EQ, invert switch, and independent mix of inputs. The MAP33's entire configuration is programmable and can be stored in 64 user memory locations, which can be recalled from the front panel, a footswitch, or via MIDI. Another footswitch jack controls the mute.

**Rane**
**10802 47th Ave.**
**W. Everett, WA 98204-3400**
**tel. (206) 355-6000**



Peavey PC 1600 MIDI Controller

## HARDWARE CONTROLLERS

Peavey released the **PC 1600 MIDI Controller/Universal Editor** ($350), a tabletop box with sixteen 60 mm sliders, sixteen button switches, and a data wheel, each of which can transmit almost any MIDI command. Two control voltage inputs supply CV-to-MIDI conversion for use with pedals and other CV sources. A MIDI setup string can be sent with each preset. With the Scene function, you can save and recall "snapshots" of slider positions in a preset, and sliders can be grouped with one slider as the master controller. Incoming MIDI data can be filtered and merged with PC 1600 data, then routed to the MIDI Out port. Named presets can be saved via SysEx.

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

JLCooper is shipping the **Media Control Station** ($269), a low-cost alternative to the CS-1 without the latter's programmable F-keys and arrow keys. The device, which connects to a Macintosh computer via the ADB port, features an optically encoded jog/shuttle wheel and five programmable function keys and two modifier keys, for up to twenty key combinations. The function keys usually operate as tape-recorder-style transport buttons for controlling sequencers and other computer-based recording devices. Presets are provided for Opcode's *Vision* and Mark of the Unicorn's *Performer*. A MIDI version that supports MIDI Machine Control and an RS-232 version for non-Mac computers also are available.

**JLCooper**
**12500 Beatrice St.**
**Los Angeles, CA, 90066**
**tel. (310) 306-4131**

New from Opcode is the **Studio AV** ($1,495) and the **Studio AVx** ($995), a video-transport controller with accompanying Mac software. The single-rackspace Studio AV functions as a machine synchronizer and remote transport system that allows you to control a video deck's transport (or certain audio decks) from the Macintosh. The half-rack AVx expander allows you to control additional decks. The Stu-

Rane MAP33 MIDI-Controlled Acoustic Preamplifier dio AV supports VITC; locks to house sync; generates window dub, black-and-white streamers, and onscreen text for markers; and can be controlled from within *Vision* via Opcode's *OMS*.

**Opcode Systems**
**3950 Fabian Way, Suite 100**
**Palo Alto, CA 94303**
**tel. (415) 856-3333**

Ariel Corporation's **DAT-Link** ($3,995) is a 1U rack-mount device that allows any Macintosh or UNIX-based computer with a SCSI or SCSI-2 interface to communicate with and control a DAT recorder and many models of CD players. The device can transfer stereo audio from DAT to disk and vice-versa and can control the DAT's transport and program-select functions (or the functions of any other device with an infrared remote or a serial interface) using its infrared remote control and DAT-Link's infrared transceiver. The device can record and play back 16-, 20-, or 24-bit digital audio at 32, 44.1, or 48 kHz. The onboard floating-point DSP converts the output from the DAT recorder to a user-selectable sample rate. The unit also lets users transfer or modify the DAT subcode information, including compensation settings, real-time record counter, and index marks. Up to seven DAT-Links can be handled by a single SCSI board, and multiple SCSI boards can be used, limited by the hard disk's size and speed. Each DAT-Link can be synched to an external sample clock, or slaved from another DAT-Link for synchronized, multi-channel recordings.

**Ariel Corp.**
**433 River Rd.**
**Highland Park, NJ 08904**
**tel. (908) 249-2900**

## AUTOMATION

CM Automation's **MX-816** (eight channels $489, sixteen channels $779; 8-channel expander $289) is a single-rackspace, 8-channel (expandable to sixteen), MIDI-controlled, mixer-automation device. The unit has 28 internal pre-programmed autofades (up or down) and 100 user memory locations to store and recall snapshots. Channel mutes are assigned to MIDI note numbers, and patches can be assigned to a separate MIDI receive channel. A Mix/Send out carries the sum of all eight channels. Attenuation is said to be better than 98 dB at 1 kHz,

# Good Sound Advice.

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**Voyetra**
V-4000, V-22, V-22m, V-24s, V-24sm
**Music Quest**
PC MIDI Card
MQX-32M
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**CM Automation**
**402 Museum Dr.**
**Los Angeles, CA 90065**
**tel. (213) 224-8048**

## ENHANCERS AND EQ

Roland's Boss Pro line has grown to include the **EH-50 stereo enhancer** ($260), a half-rackspace device with independent stereo in/out jacks. Each of its five preset enhance modes are unique and designed to work within specific frequency ranges for use with an assortment of instruments, including low-frequency ones. Three of the modes utilize dynamics-sensitive enhancement. The half-rackspace **PQ-50 parametric equalizer** ($260) also joins the Boss Pro line. The PQ-50's four discrete, fully parametric bands allow ±20 dB adjustment between 20 Hz and 20 kHz. Peaking and shelving curves can be selected for the low- and high-frequency bands. Also new from Boss Pro: The **TU-50 chromatic tuner** ($350) has a large, 27-segment LED bar display for onstage tuning. The half-rack box detects pitches over the 8-octave range from B0 to B7 and is adjustable in 1 Hz increments between A=438 and A=445.

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

## AUDIO INTERFACING

Lexicon attacks some familiar problems of digital audio interfacing with its **LFI-10 digital audio format interface** ($1,995). The LFI-10 converts between AES/EBU, S/PDIF, and SDIF-2 digital audio formats and operates in unidirectional and bidirectional modes. Bidirectional mode allows data to pass in both directions through the interface to allow, for instance, a digital signal processor with SDIF-2 I/O, such as a Lexicon 480L, to operate between two DATs with AES/EBU. Bidirectional communication requires that one device has SDIF-2. The LFI-10 allows viewing and modification of embedded auxiliary data, including all 24 bytes of the channel status and user blocks in the AES/EBU and S/PDIF datastreams and the emphasis and dub-prohibit bits in the SDIF-2 datastream. Input and output word clocks can be phase-adjusted relative to the input and output serial data on the SDIF-2 interface. Connectors for AES/EBU and S/PDIF include balanced (XLR), RS-422, single-ended RCA, and fiber-optic interfaces. SDIF-2 inputs include BNC and DE-9 480L digital I/O connectors. Sampling rates of 48, 44.1, 44.056, and 32 kHz are supported.

**Lexicon**
**100 Beaver St.**
**Waltham, MA**
**tel. (617) 736-0300**

## MISCELLANEOUS

The Musitech **Tube Cooler** is a circular heat sink that slides over a vacuum tube to keep the tube cool, prolonging its life. Tube Coolers are available in three sizes to fit 6V6, EL84, and 12AX7 ($14.99/pr.); 6L6GC, EL34, and 5U4 ($22.99/pr.); and 6550 tubes ($22.99/pr.).

**Musitech Electronics**
**110-4040 Blackfoot Trail S.E.**
**Calgary, Alberta**
**Canada T2G 4E6**
**tel. (800) 487-0668**
**or (403) 243-8952**

**FineTune Pro** ($350), from MIDIMAN, is a rack-mount, stereo guitar tuner with separate LED displays for tuning and setting parameters. The device includes a 1 × 4 MIDI Thru box, and its audio mute can be controlled with a MIDI footswitch. In Manual mode, FineTune Pro can be recalibrated by selecting a specific frequency, while in automatic mode, it is recalibrated to any tone played into it.

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

## REV UP

Passport Designs (tel. [415] 726-0280) announced *Master Tracks Pro 4.5* ($495) for *Windows*. New features include a combined track and song editor, recordable volume faders, event-list editor, automated punch-in, and real-time access to many of the editing functions. The program now supports Microsoft's *Multimedia Extensions*.

Opcode's *Vision* and *Studio Vision 1.4* ($495 and $995, respectively; upgrades $49.95; tel. [415] 856-3333) offer real-time editing, loop play and record, locked markers for SMPTE, quantize on input, compatibility with Digidesign's Pro Tools (*Studio Vision* only), and a redesigned control bar with fast-forward, rewind, and autolocate buttons. Opcode's *MAX 2.2* (upgrades $35) is 32-bit clean for Apple's System 7.0 and adds improved *OMS* compatibility and support for the SMIDI SCSI sample-transfer format introduced by Peavey. Along related lines, ***MAXplay*** ($99) is Opcode's new run-time program for playing *MAX* patches. It has over a dozen pre-programmed patches, including a front-panel editor for the Roland Sound Canvas and a patch editor for the Lexicon LXP-5.

Lexicon (tel. [617] 736-0300) is shipping software version 4.0 for the **MRC MIDI Remote Control** ($399; upgrade $99). The MRC now can operate bidirectionally, so it can request parameter information directly from LXP-series devices. The info can be edited and stored in the MRC or transmitted back to the LXP for storage. The upgrade also adds ten new presets for the LXP-1, LXP-5, and LXP-15; a mode for controlling LXP-15 parameters; and more Generic MIDI (GMIDI) setups for controlling non-Lexicon devices.

Dr. T's (tel. [617] 455-1454) showed ***Tiger Cub 2.0*** ($139) for the ST. The new version doubles the number of tracks to 24, supports MIDI Song Pointer synchronization, SysEx recording and editing, and a Quantize Percentage function that moves quantized notes a certain percentage toward their selected location.

KAT (tel. [413] 594-7466) announced a version 3.0 software upgrade for the **drumKAT** ($1,099; upgrade from version 2.5 $15), which now has four notes per pad in all modes, an 8-note alternating mode, new hi-hat modes, assignable foot and breath-control inputs, and an Interaction Suppression Matrix designed to eliminate crosstalk between triggers. A new Power Chip ($49.95) was announced for the **midiKITI**, adding a variable delay mode in which each hit causes four independent notes to play separated by 25 to 400 ms; a pattern generator that records up to four patterns of up to 64 notes each; and a Buzz Roll mode that toggles preprogrammed drum rolls on any trigger. ❂

# 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

**"Best Music and Sound Product"**
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.

Trademarks: Macintosh, Apple Computer, Inc.; Galaxy, Galaxy Plus Editors, Studio 5 and Studio Vision, Opcode Systems, Inc.

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TECHNOLOGY PAGE

# A Brief History of the Microprocessor in Music

## Or, How I Missed the Boat and Ended Up Taking the Train Instead.

*By Gary Hall*

I recently read an article in *Byte* by Frederico Faggin, the designer of the 8080 and Z80, in which he gives his account of the invention of the microprocessor some twenty years ago. It led me to think about how the "micro" first became a part of electronic music, which coincided with my education in the subject. Although my experiences weren't as central as Faggin's, they intersected with the events of the time in interesting ways.

In 1975, I indulged a long-simmering interest by enrolling in the Boston School of Electronic Music. In those days, it was all modular control-voltage technology, but digital control was starting to make its influence felt.

Attending the school brought out nascent interests in technology that had been dormant since I turned hippie. As my musical career was going nowhere, I became increasingly intrigued by the workings of the equipment I used. Also, it seemed like a way to get a "straight" job, something of increasing concern.

**The E-mu Model 4060 keyboard was the first commercial electronic music instrument based on the microprocessor.**

At this time, I started hearing about microprocessors, which I understood would become very important. The problem was, I had no idea what they were. I came across a couple of books, but they only increased my perplexity. No matter how I stared at diagrams of RAM, ROM, and CPUs, or read descriptions of how microprocessors executed instructions, I just couldn't get it. Direct experience was the missing ingredient.

Part of the curtain pulled back when I moved in with Jim Noxon, another electronic-music crazy who had a little money from an insurance settlement. His priority was to spend it on the biggest, beefiest, most state-of-the-art synth he could find. Months before, he placed an order with E-mu for a product that didn't even exist.

So one day, fifteen years ago, a truck pulled up to my door and unloaded what was, to the best of my knowledge, the first commercial microprocessor-driven electronic-music product.

The E-mu Model 4060 Microprocessor Keyboard/Sequencer was a wonder of its time, a self-contained, 16-voice polyphonic controller and multitrack sequencer. There wasn't much to see other than a generic numeric keypad, a 5-octave keyboard, and a panel with 32 ¼-inch jacks, half for control voltages and half for gates.

The Z80 based instrument proved remarkably unstable. Within a month of delivery, its software had disintegrated into randomness. The designers had overestimated the maturity of non-volatile memory technology and put the entire operating software into battery-backed RAM (later replaced with an EPROM). The only thing to do was send it back to the factory for reprogramming. Jim and I went our separate ways that summer, and I never saw that instrument again. But the E-mu keyboard showed me how a single circuit could perform multiple tasks.

Later that year, luck came my way when I answered an ad from an obscure company called Lexicon. I knew they were one of a few companies making digital audio delay lines.

As I settled into the job of troubleshooting variable-speed tape recorders (who remembers Varispeech?), the winter of 1977-78 was turning out to be one of the snowiest in memory. Right after a big snowfall, I wandered

# MIDI on High

*MIDI instruments have found a haven in the hallowed halls of churches.*

Praise the Lord and pass the MIDI cables.

From Gregorian chant through contemporary Christian rock, music has played a vital role in the worship services of all denominations. Indeed, Christianity has commissioned much of the Western world's most inspiring music.

Over the centuries, churches also have witnessed great innovations in instrumentation: Pipe organs, reed organs, and tone-wheel organs were once the expensive, newfangled music machines of their day. It's not surprising, then, that today's electronic instruments are making an impact on modern congregations. Synthesizers, samplers, and other MIDI-based gear are adding their own colors to the rich tapestry and tradition of church music.

## CHURCH TYPES

To the uninitiated, one big building full of well-dressed people may seem the same as the next. In reality, each church has its own history and its own special traditions that determine the range of musical styles deemed appropriate for services.

While the wide variety of modern Christian churches can be classified only in the most general terms, it is helpful to distinguish three basic types of churches to understand how electronic music is used in different settings.

1. High Church: Churches that feature some vestiges of traditional liturgical practice. This includes the "Big Five" denominations (Catholic, Episcopal, Lutheran, Methodist, and Presbyterian) and their

*By Brian Gould*

ILLUSTRATION BY LAURA TARRISH


AVE MARIA

offshoots (Congregational, Covenant, and the like).

2. Denominational: Basically non-liturgical but having a distinct denominational affiliation. This includes many large Evangelical (e.g., Baptist) and Pentecostal (Assembly of God, Foursquare) groups.

3. Independent: Non-liturgical, non-denominational churches. This includes small congregations that first met as home Bible study groups and later grew, as well as large churches that sprang from the outbreak of the charismatic movement, which began in the 1960s (e.g., Calvary Chapel, Vineyard Fellowship).

In referring to the size of individual church congregations, I distinguish between small churches (500 members or less), large churches (500 to 2,000 members), and mega-churches (2,000 to 10,000 or more).

Certain patterns in the musical aspects of the services can be discerned within these general types. For example, High Churches are "keepers of the flame," the staunchest guardians of a rich musical heritage compiled over the past 2,000 years. When size and budget permit, these churches feature a custom pipe organ installation as their main instrument. The musical program usually is dictated by the liturgy and Church Year cycle, with choirs performing most of the music and the congregation contributing with hymns and musical responses. The use of electronic instruments often is restricted.

Denominational churches also maintain a certain progression of events in the service, although there usually is less formality or strict order. The primary instrument is either an electronic church organ (e.g., Allen, Rodgers, or Hammond), a grand piano, or both. Choirs abound, with choral literature ranging from High Church to gospel/spiritual. Programming commonly is determined by the senior pastor's tastes or weekly sermon topic, rather than any prescribed rules.

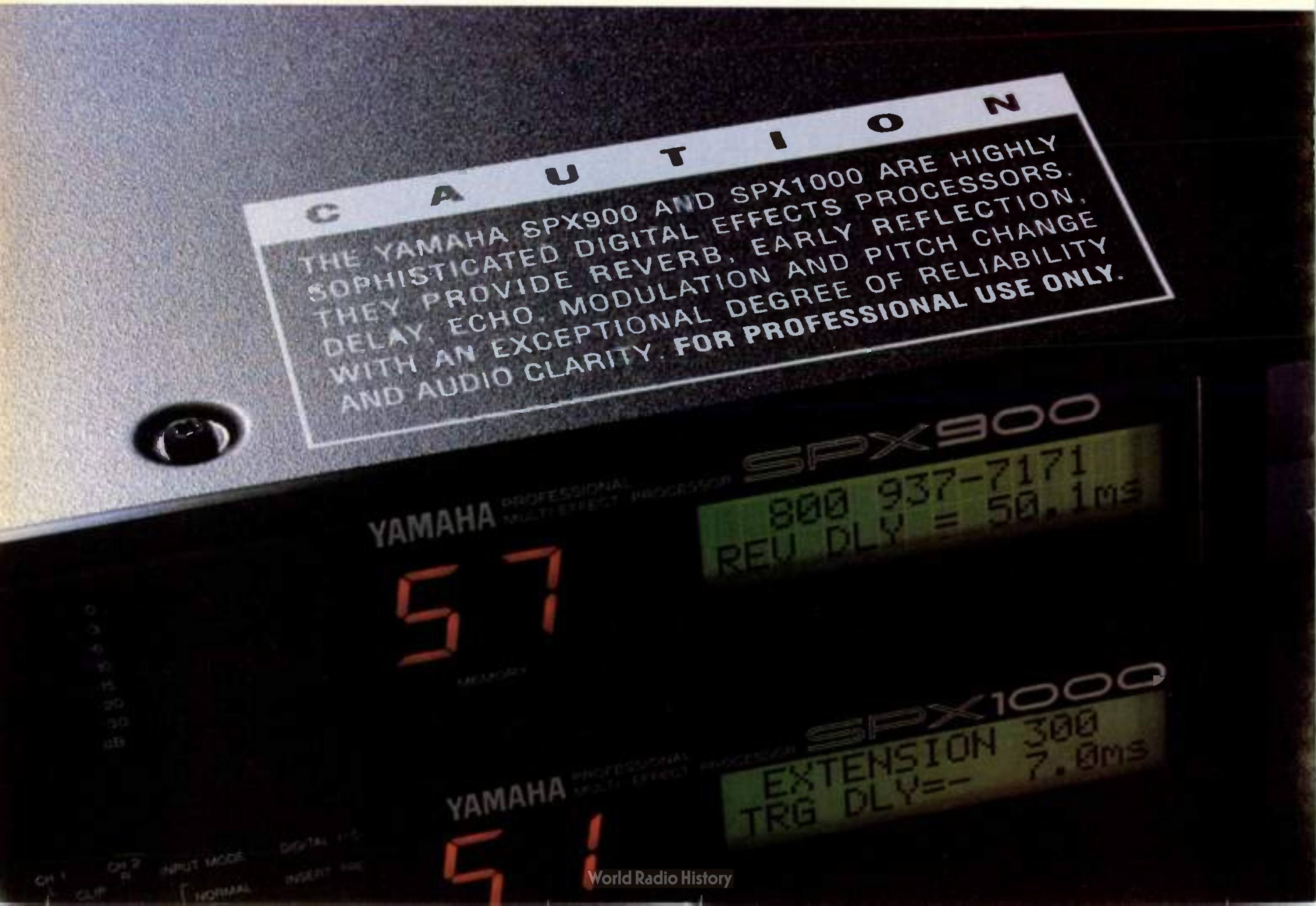
In churches of this type, the debate over electronic instruments began three generations ago, leading to a gradual acceptance of electronic organs. Having won this support base, today's MIDI instruments are welcomed and enjoy growing acceptance.

While sharing many of the same tenets of faith as the previous two types, Independent churches often are consciously non-traditional. Choirs and a grand piano are still staples, but some churches of this type have neither, opting instead for a more contemporary setup. The praise band or worship ensemble may consist of guitar, bass, drums, brass, etc. In these settings, the use of electronic instruments is not only prevalent, but an integral part of the musical ensemble.

## APPLICATIONS

Peter Wright is the music director at a large High Church of about 700 members. At his disposal are a small Rodgers organ, a grand piano, and several voice and handbell choirs. As with many church musicians, he borrows his modest MIDI setup from other sources because the church has not yet bought any MIDI gear.

His borrowed setup includes a Macintosh SE equipped with Passport's *Master Tracks* sequencing software, a Korg M1 workstation, and a Kurzweil



## WHERE DO I BEGIN?

For those who work in church environments that allow the use of MIDI instruments, the natural question is, "Where do I begin?" Here are a few ideas I learned the hard way:

1. If you don't own MIDI equipment, don't rush out and buy any yet. It is amazing how much impulsive buying goes on without a proper evaluation of needs. First, develop a clear vision of what you're trying to do. For instance, do you just need some nice accompaniment sounds, or are you planning to record your own sequenced tracks? Then, see how much you can access or borrow others' equipment. This sounds like leeching, but I've found most musicians are willing to help.

2. Learn all you can about what you already have. Know your equipment and get all you can out of it before investing in more. Your musical needs often can be accommodated by a modest studio.

3. Listen to other musicians' work. This is probably the best piece of advice I can give. I have learned a great deal by watching others work in the studio and live performances. For me, the greatest value in this process is seeing the labor and the end result. Just listening to a performance or tape only gives you half the picture; attending rehearsals and recording sessions will teach you immeasurably more.

As far as books about church applications of MIDI are concerned, none exist. Yamaha has written a book entitled *A Guide to Sound Systems for Worship*, which is available from Mix Bookshelf ([800] 233-9604 or [510] 653-3307), but it doesn't cover MIDI gear. If you're new to music technology, I suggest you go to the library and review back issues of EM, particularly the "From The Top" columns (that's how I got started).

K1000. "I use the Kurzweil mainly to add timbres," he says, referring to samples such as a string pad or Rhodes piano. He notes that whenever funds allow, the church prefers to hire live strings, brass, and so on.

To Wright's credit, he has managed to keep the praise band alive. Although they are uncommon, these ensembles do exist in High Churches. However, they often are relegated to a less-attended time slot in the schedule of services (in Wright's case, the Sunday evening service). Even then, many members object. "Some older people here never want to see a guitar in the church again," says Wright.

When asked about his vision for the future of electronic instruments in churches, Wright emphasized that they should be used properly. He explains, parties go nuts. The church is also set up for outdoor receptions; with MIDI gear, the music goes wherever the action is."

Archuletta has delved into multimedia applications and hopes to expand his existing setup to include a complete MIDI and audio/visual recording studio. Having already worked on other albums as both artist and producer, he hopes to renew this activity in the church.

## MEGACHURCH

While all music directors feel the pinch of recession, directors at Independent mega-churches—with their swelling numbers and larger budgets—probably have the most freedom to incorporate electronic instruments and MIDI into the church service. This type of church usually is located in cities or suburbs with large populations, where the churches target specific demographic groups with an informal, contemporary approach to worship.

This characterization aptly describes Saddleback Valley Community Church in Mission Viejo, California, which enjoys an average weekly attendance of 4,500 and a membership of over 10,000. Saddleback's music director, Rick Muchow, oversees a worship ensemble that is distinctively contemporary.

"We rely on MIDI to help create a '90s sound," says Muchow. "We use a Korg T3, Roland P-330 Piano Module, Roland D-70, and a Yamaha DX7 in our live setup. Our keyboards supplement our orchestra on alternate weeks, and they are featured on the weeks when the orchestral players are off."

The church has sponsored a number of different projects within the music ministry, among them a series of recordings entitled *Saddleback Praise*. These recordings feature original praise music performed by the worship ensemble, much of it written by Muchow. Here, the applications of MIDI are different. "On our recordings, we only use synths for layering. We use acoustic players for the instrumental tracks," says Muchow.

With *Saddleback Praise*, the music of the church has spread far and wide, creating an increased demand for supplementary materials. Using MIDI, Muchow has found a novel way to accommodate these needs. Through an informal network of music directors who use the Korg T3, he provides musical resources to other churches. Muchow explains, "We use the T3 a lot. And with Standard MIDI Files, we can record accompaniments to disk and let other churches use our music." In this way, disk-based recordings are made available as accompaniment tracks for congregational singing at other churches.

Muchow's ideas for uses of MIDI in church go even further. He foresees the day when one person controls everything—music, lighting, video, the entire acoustical/visual environment—from a single keyboard station.

Gene Roberson of Calvary Church in Santa Ana, California, just finished a custom organ installation at the church's recently completed sanctuary, the largest in the state. The facility holds 3,200 people; active attendance at the church is over 10,000.

In Roberson's setup, a Baldwin electronic pipe organ is supported by a Kurzweil K250, Technics AX5, and a Kurzweil K1000. The 250 is connected via MIDI directly to the organ so that sounds can be accessed in both directions. As the organist, Roberson sequences and records new music each week. After playing live for two morning services and the beginning of a third, he is through for the day. At the end of the third service, another musician triggers the sequence at the appropriate time, so that the organ plays on its own for the final hymn and the postlude.

At Calvary Church, synths primarily are used to augment the orchestra, filling in spots as needed, particularly when musicians are difficult to find (double bass, contrabassoon, etc.). Roberson points out that MIDI also enables keyboardists who are not trained as organists to call up pipe organ sounds on their keyboards.

## CONCLUSION

MIDI instruments are here to stay, and music in churches will never be quite the same. Whether you see them as a welcome innovation or an unwanted sacrilege, electronic instruments are likely to remain an important element in church worship.

*Besides his church work at Mission Hills Christian Center in Rancho Santa Margarita, California,* **Brian Gould** *teaches music and scores for video/TV productions in Southern California.*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# BEATING THE

**Turn your MIDI and recording gear into an integrated studio.**

Many of us once believed using MIDI and personal computers would make it easier to manage our studios and the music-making process. Instead, we often wasted hours repatching equipment, making sure everything was set up properly, training an octopus to ensure the right buttons were pushed at the right moment, and taking copious notes so we could re-create it later. And then we wondered if we really got it right.

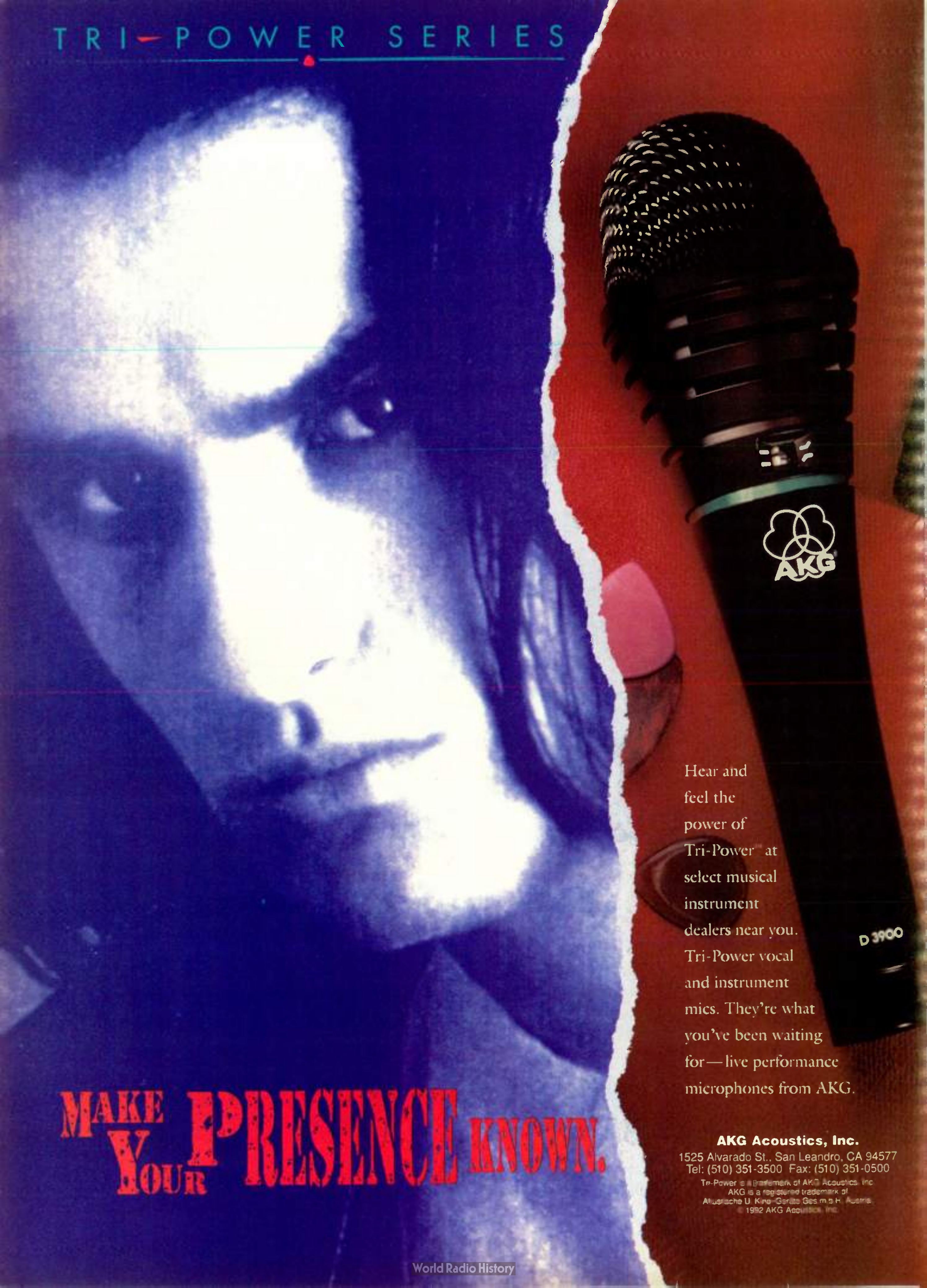
It needn't be that way. The recent addition of MIDI Machine Control (MMC) to the MIDI spec makes it possible to control virtually every piece of gear in a typical MIDI studio from a single place. That's heady stuff. By turning your independent pieces of gear into a giant meta-studio under computer command, you can turn sync problems into a distant memory, seamlessly integrate analog tape tracks with MIDI sequences, remotely control tape decks, automate your mixes, utilize the full capabilities of your signal processors, turn EQ into a dynamic extension of your sound-shaping capabilities, and make quick adjustments to a mix without worrying about rewiring or who's controlling what.

Of course, not everyone can take advantage of these capabilities, but everyone should be able to make use of certain elements. In addition, this type of structure provides a good indication of where and how studios are evolving.

SCOTT PETERSON

# SYSTEM

By Chris Meyer with Steve Oppenheimer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Studio integration requires organization. You need to route and process MIDI data, audio signals, and machine-control code. The lynchpin is your computer, which must route data between programs and between the computer and the rest of the world. But before moving onto the fancy stuff, you have to deal with the basics: signal routing.

### MIDI PATCH BAYS

The primary reason for MIDI's existence is to allow remote control of a musical instrument, typically from a second instrument or a sequencer. In other words, one device generates messages, and another receives them. As soon as a MIDI studio grows to a moderate size, however, you discover situations in which you must change which devices are controlling and which are being controlled. A programmable MIDI patch bay gives you the ability to make these changes without having to unplug and replug cables.

All devices are plugged into the patch bay (both in and out), and then routings are created and stored, either within the unit, or via computer software. When I set up a studio, the first thing I do is create default data routings. Each controller, including the computer, must play everything. The controllers also must transfer data to and from the computer in a separate "closed loop." Once these routings are created, it's easy to switch to the one you need by using a Program Change command.

If you've got several pieces of MIDI gear receiving data, whether synthesizers, MIDI-controlled mixers, or what ever, you'll probably need to run multiple discrete MIDI cables (each of which carries sixteen MIDI channels). This ensures you'll have enough channels and prevents data-clogging on the more active lines. It helps if you divide musical information (notes, etc.), transport control, mixing and signal-processing commands, and perhaps synchronization signals onto different ports or cables. (MIDI wiring and channel-assignment strategies are discussed in "MIDI Systems Great and Small" in the February 1991 issue.)

To achieve this, you'll need a multiport MIDI interface such as Opcode's Studio 4 for the Mac, Music Quest's MIDI Engine Array for the PC, or C-Lab's Export for the ST. The best of these devices combine the functions of a MIDI patch bay/processor, computer interface, and SMPTE time code generator/reader.

You may want to consider Lone Wolf's MidiTap, a 4-in/4-out MIDI interface and processor that converts MIDI messages into the company's proprietary MediaLink format and back. The MediaLink protocol (discussed in "The Local Area Network: MIDI's Next Step?" in the November 1989 issue) goes a step beyond regular MIDI interfaces. It is a high-speed local area network capable of carrying many different types of data over twisted-pair wire or fiber-optic cable. The speed of MediaLink eventually will allow hundreds of data channels to carry MIDI, SCSI, digital audio, and other digital signals over distances of two kilometers or more. At present, however, MediaLink only carries MIDI data.

### AUDIO PATCH BAYS/SWITCHERS

Once MIDI data is streaming between the appropriate devices, you can turn your attention to control over routing, processing, mixing, and recording audio.

MIDI-programmable audio patch bays, like their MIDI brethren, can change routings when they receive Program Change commands. This is handy if you need to share an EQ or specialized audio enhancer and don't feel like manually repatching. It's also useful for automatically reconfiguring your effects order and routings, or switching signals that could go any number of places. For example, you may want your sound modules to go directly to the final mix, or to a couple of tracks for later mixdown.

Although few products of this type exist, I have had success with an Anatek SMP-16, which not only has a 16 × 16 audio patcher, but a 7 × 8 MIDI patcher, clocking and sync circuits, a Macintosh interface, and even a fader box for sending out MIDI signals to other devices.

Smaller switchers of high quality are available from several sources. Uptown Technologies' Flash (reviewed in the February 1991 issue) is a bidirectional, stereo, 4 × 1 audio switcher with MIDI-controlled routing, levels, and muting. Akai has the MB76, a MIDI-controlled 7 × 6 matrix mixer. Sound Sculpture's

MC-8 MIDI Crosspatch, a MIDI-controllable, 8 × 8 audio patch bay/matrix switcher, also has two relay-operated switch outputs so you can replace momentary switches with MIDI triggering.

While we're on the subject, several dedicated boxes let you trigger analog switches via MIDI. An old standby in this category is Scholz R&D's MIDI Octopus (reviewed in the September 1989 issue). Designed to remote control stomp boxes, MIDI Octopus provides eight MIDI-controlled analog switches. Lake Butler Sound's Micro Mitigator MSI-8 MIDI switch interface and Rolls Corporations's MP1288 MIDI Wizard offer similar capabilities.

## LEVEL CONTROL

Integrating the parts of your studio under computer control involves more than routing and program changes. Your reach can extend to controlling audio levels, too. Fortunately, most MIDI instruments allow you to control output level via Continuous Controller 7 (Master Volume). Many allow panning with Controller 10 and setting the balance between two layered sounds with Controller 8, too.

But controlling instrument output levels via Controller 7 can disrupt your gain structure, adding noise to the audio chain. In setting up your mixer, you adjust levels at various points to optimize the signal-to-noise ratio. (Setting gain structure in a mixer is explained in the April 1992 "Recording Musician" column.) To maintain clean sound, you need to keep input levels relatively constant and adjust mix levels with the faders. If you change levels at the instrument outputs with MIDI, the mixer receives fluctuating input levels, and your painstakingly constructed gain structure goes out the window. In addition, your instruments may not have smooth MIDI Volume control. (Listen for zippering or glitching.) Besides, instrument outputs aren't the only audio levels that need to be controlled.

One answer is MIDI-controlled VCA boxes such as the Niche ACM and JLCooper MixMaster, which can vary the level of any audio signal passing through them. You can use these devices on MIDI instruments or non-MIDI sources. By adding the VCA box at the mixer's insert points, you can automate level changes after the mixer's critical gain stages; adding VCAs at the mixer channel direct outs can control track levels going to multitrack without affecting the console's gain structure. You also can use a VCA box to control the levels of your tape tracks.

## MIDI MIXERS

You'll need to mix the audio at some point, too. If you take the modular approach, where everything goes through MIDI-controlled processors and a VCA box, all you need is a multiple-input line mixer and good headphone amp for monitoring (see **Fig. 1**). But for complete studio automation, your best choice might be a MIDI-controlled mixer that places level, panning, EQ, and effects sends under computer command.

MIDI-controllable mixers integrate multiple functions. One of the earliest and most ambitious attempts was Yamaha's DMP7. This 8 × 2 digital mixer offers three onboard signal processors, MIDI control over everything, and motorized faders that constantly show

the current parameter values. The $4,000 price tag chilled its reception among semi-professionals, but many are still in use. Other notable efforts include the digitally controlled Zeta/Akai mixer and Yamaha's slimmed-down DMP11.

Some less-expensive MIDI mixers also are available. The expandable Peavey PLM 8128 MIDI-controlled mixer has been around for several years. Mark of the Unicorn's MIDI Mixer 7s sells for less than $600. It features seven stereo inputs (plus an eighth auxiliary channel) and two sets of stereo effects sends, and it allows virtually everything to be MIDI controlled. In one studio, I set up five user-programmed banks on an 8-slider JLCooper FaderMaster to control the 7s' volume, pan, low and high EQ, and effects sends. (MOTU jams the effects sends for bus 1 and 2 on the same MIDI controller number, reducing the number of fader banks required.) I preset the mixer's other parameters, such as smoothing and noise-gate envelopes, ahead of time.

Fostex intends to release a MIDI-controlled mixer, the DCM1000, in the immediate future. The new mixer offers eight stereo inputs, 2-band EQ, and two stereo aux sends and returns. It also comes with the Mix Tablet, a hardware MIDI controller with faders and knobs that stores up to 99 snapshots and controls the mixer in real time via SysEx.

## SIGNAL PROCESSORS

As with synthesizers, most modern signal processors respond to MIDI Program Changes and controllers. Applications can be as simple as remotely changing the wet/dry mix or as radical as timing a reverb's gate to drum hits.

Equalization provides a more subtle (and underused) method for altering timbres. Roland, Rane, Yamaha, DigiTech, Peavey, and Akai (to name a few) make, or have made, programmable equalizers that respond to MIDI program changes. Some allow individual bands to be dynamically changed using MIDI controllers, either for remote-control tweaking, or a musical effect in the middle of a song.

Another useful signal-processing beast you can tame via MIDI is the MIDI-controlled preamp. Most folks probably consider these strictly guitar gadgets, but they can provide timbral

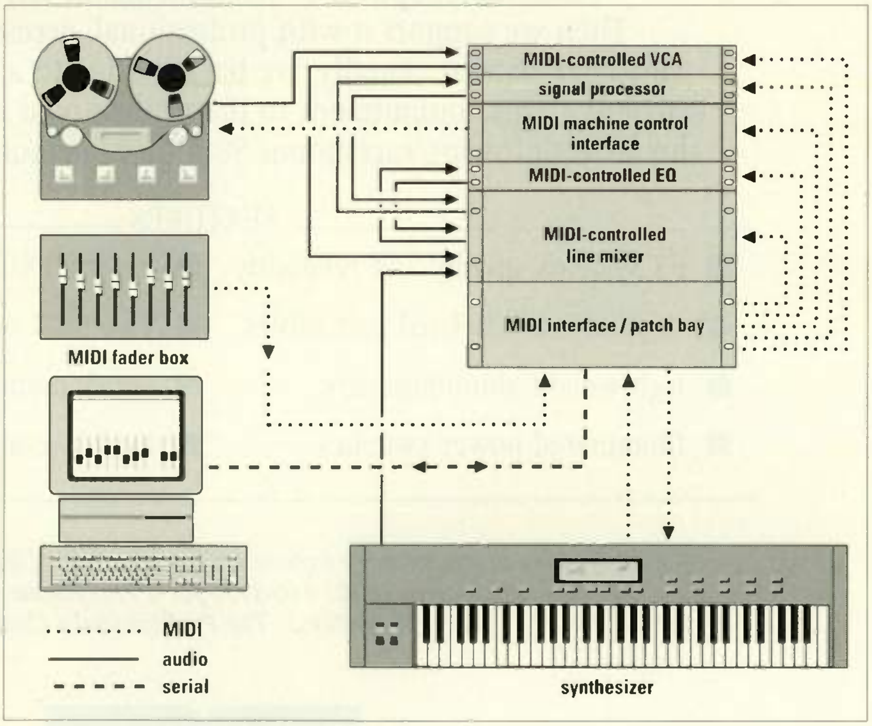


FIG.1: A hypothetical mixer-less MIDI-controlled studio system. The computer-based sequencer stores information generated by the synth and MIDI fader box and sends the appropriate control signals to the tape deck, VCA box, programmable EQ, programmable signal processor, and MIDI-controlled line mixer.

Akai's PEQ6 is a programmable, 7-band, fixed EQ that supports MIDI Program Change commands and accepts parameter changes via SysEx.

flexibility and muscle for many applications. At the high-end, Hughes & Kettner's Access (reviewed in the June 1991 issue) includes MIDI-controlled tube and solid-state preamps, three effects loops, EQ, noise reduction, and a few MIDI bells and whistles. You can explore far less-expensive options from companies such as Rolls, ADA, DigiTech, Rocktron, and Marshall. Rane recently introduced an impressive-looking MIDI-controlled preamp for acoustic stringed instruments (see this month's "What's New"), extending your computer's reach to banjos and flat-top guitars.

As with MIDI instruments, MIDI-controlled preamps, effects, and EQs usually can download and save their patches via SysEx.

## MACHINE CONTROL

So far, we've talked about MIDI control over patch changes, parameter settings, signal processing, and signal-routing (see the example in **Fig. 2**). But music technology also is taking large steps toward computer-controlled machines, especially tape recorders.

MIDI Machine Control (MMC), one of the most recent additions to the MIDI spec, is a universal set of commands designed to control any type of transport—audio, video, or MIDI—from within a sequencer or controller. It includes messages that control Play, Stop, Rewind, and Record, but also can punch tracks in and out of record; provide location information; and even select what you hear while recording and playing back. MMC was approved just days before last January's NAMM show, but booths in Anaheim already were populated with MMC-capable software and hardware. (For more on MMC, see "In Control" in the February 1992 issue.)

On the hardware side, the early lead seems to have been taken by Fostex and Tascam, with Fostex coordinating promotion of MMC-capable devices with Atari Computer, Steinberg, C-Lab, and Dr. T's. Steinberg's *Cubase*, for example, coordinates tape transport and level control along with its sequencer functions. Opcode's new Studio A/V rack-mount synchronizer offers computer control over a wide range of audio and video decks. It is controlled via Opcode's *OMS* for the Mac (described shortly), which eventually will support MMC, too.

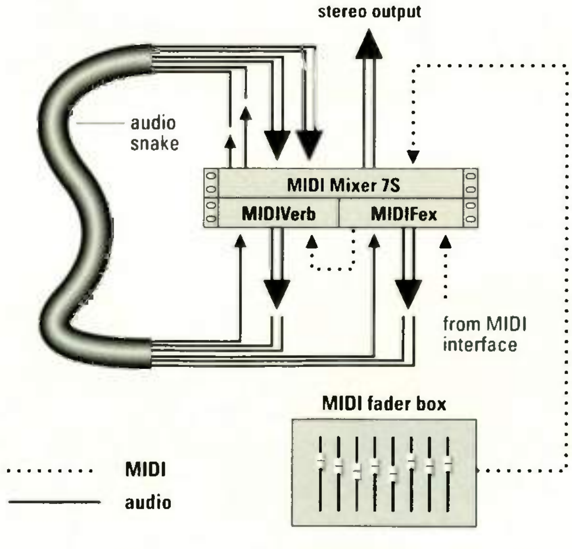


FIG. 2: The lean approach to a MIDI-controlled system can be achieved with a MIDI fader controller, a programmable MIDI mixer, and two preset MIDI-controlled effects processors.

## THE SEQUENCER

In many MIDI studios, the sequencer is the heart of the enterprise. It's where you store not only the note data,

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**In the future.** There will be four more puzzles at $2.00 and one tie-breaker at $1.50. You will have three weeks to solve each puzzle which will arrive by mail. We have no idea how many people will enter, but typically 47% will have the correct answer to phase 1, 30% to phase 2, 25% to phase 3, and 20% to phase 4. The tie-breaker determines the winner. There is a separate elimination for each prize package. In the unlikely event that players are still tied, they will each get the grand prize they are playing for. *So what are you waiting for...*

## ENTER AND PLAY TO WIN!

### Mystery Word Grid

| | | | | | MYSTERY WORD |
|---|---|---|---|---|---|
| | | T | | | |
| H | E | A | V | Y | I |
| | | | | R | |
| | E | | | | |
| M | | | | | |

**WORD LIST & LETTER CODE CHART**

| | | |
|---|---|---|
| HEAVY.............I | VOCAL............O | SPOIL..............L |
| ABOVE.............R | ENTRY.............V | MAJOR............T |
| TRILL...............D | METER.............P | CORAL.............B |
| LEAVE.............C | MODAL...........A | MUSIC............H |

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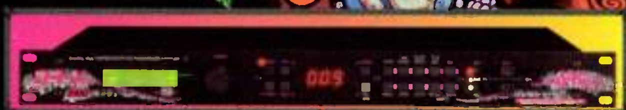
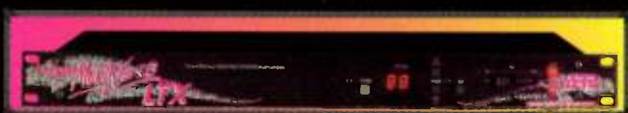


DRX 2100 Offering all the effects and the same 24 bit V.L.S.I. engine of the ALPHA 2.0, the all new DRX-2100 includes a full function dynamics processor. It features a Compressor, Limiter, Exciter, Expander, Noise Gate, Digital frequency routing and will perform 12 simultaneous audio functions with perfect fidelity at 20 KHZ bandwidth.



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but the controller data, program changes, and MMC machine instructions.

When shopping for a sequencer, select a program that lets you look at multiple MIDI ports and has onscreen "faders" and graphic controller editing. Although I prefer using a hardware fader box, it's nice to see software counterparts onscreen for reference. Graphic controller-editing is important for easily checking out information already recorded. Build up some fader palettes dedicated to various functions: one for the main volume of all your instruments, one for dynamic control of parameters in your multi-effects, and one to control your programmable EQs. It also is useful to have onscreen sliders or other controls for changing programs on all your devices.

Incidentally, when controlling tape-track levels within a sequencer, don't split them off on a separate virtual-fader palette; you'll confuse the issue by thinking too much about where the physical control is happening. Just think about the onscreen faders as the means for adjusting levels, and hopefully you'll forget (after initial setup) exactly where that level change is taking place. The same goes for controlling EQ and effects, whether onboard an instrument, or in a rack. From your control station, it should be all one meta-studio to you.

Pick a sequencer and tape recorder that speaks MMC. In addition to integrating the recording process, this leaves the door open for expanding the number of tracks in your studio. A few sequencers, mostly on the Mac, have hard-disk recording integrated into them, and several Mac and PC systems address digital audio and sample playback cards inside the computer as if they were merely components of your MIDI system.

More MMC sequencer support is coming; don't underestimate the power of combining a few tracks of random-access digital audio under sequencer control with several linear tracks on an MMC-capable tape machine. (For more on integrated MIDI sequencing/digital audio recording systems, see "When Worlds Collide" in the December 1991 issue.)

### SOFTWARE UTILITIES

To streamline control of your environment, try adding a number of utilities directly to your computer. Since I'm a Macintosh user, I'll focus on that environment. Every power-user by now has adopted some form of "macro" program that will perform complex actions in response to a single keystroke. Some use voice-recognition systems such as the Voice Navigator for hands-off operation. Programs and operating-system extensions such as the *HyperMIDI/HyperCard* duo and UserLand's *Frontier* for the Macintosh allow you to write your own programs and control the linkages between them.

Adventurous Macintosh users should consider Opcode's *Max*. Besides allowing you to write custom MIDI applications, this iconic programming environment includes hooks to let you control a *QuickTime* movie or a CD-ROM player. It even accepts input from a Mattel/Nintendo Power Glove by way of Transfinite's Gold Brick Nintendo-to-ADB adapter. I have acquired *Max* and Ear Level's *HyperMIDI* to create my own software controllers and translators. For example, you have to send a complex MIDI System Exclusive message to remotely alter Akai MB-76 matrix mixer parameters because they don't allow a separate continuous controller to be assigned to each knob.

If you want custom MIDI processing but don't need the low-level control of *Max*, Dr. T's *Interactor*, a similar iconic programming language for the Macintosh, could be a good choice. Many *Interactor* patches already are set up for higher-level MIDI functions, so it's easier to learn than *Max*.

### SOFTWARE INTEGRATION

Another part of integrating your hardware is routing data to, from, and between computer programs. Routing data within the computer—Interapplication Communication, or IAC—makes it possible to, say, route sequencer data to trigger sounds played back by a computer sound chip or card, or let multiple programs, such as a sequencer and media integration program playing digital audio files, share the same internal time base.

Macintosh users have had this capability for awhile. Apple's *MIDI Manager* system extension presents an onscreen "patch bay" that lets you interconnect every compatible MIDI program that is running. You just click-and-drag virtual "wires" between the programs' onscreen input and output ports. (*MIDI Manager* was explained in the May 1991 "Computer Musician.")

PC users don't have a system-level utility for IAC, but *Windows 3.1* offers a standardized MIDI driver protocol which, if expanded upon, could offer functionality similar to *MIDI Manager*. The *MIDI Mapper* utility included with version 3.1 is a specialized driver that maps MIDI Program Changes to a General MIDI set and relieves programs of having to worry about which type of MIDI interface is installed, but it does not perform IAC. *Windows 3.1* also includes a system-level time base that can be shared by several multimedia programs running at once.

On the Atari, Steinberg's *M.ROS*, C-Lab's *SoftLink*, and Dr. T's *MPE* offer capabilities somewhat similar to *MIDI Manager* for programs written specifically for those environments. The Amiga has built-in multitasking and by utilizing *ARexx*, or writing a bit of extra code, Amiga programmers can allow multiple MIDI programs to share the serial ports and interchange data. *MPE* also operates in the Amiga environment. (*ARexx* was discussed in the October 1991 "Computer Musician." *MPE* for the Amiga was explained in the "Multiple Multitasking" sidebar on p. 124 of **EM**'s February 1992 issue.)

One step beyond IAC systems such as *MIDI Manager* is *OMS* (the Opcode MIDI System, discussed in the March 1992 "Computer Musician"). This Macintosh program extends the reach of the computer by allowing you to name all MIDI devices in your studio and identify the MIDI port and channel where each is located. An *OMS*-compatible program (such as Opcode's *Vision*, *Max*, or *Galaxy Plus Editors*) uses this information to route data to the appropriate devices. This may entail sending a Program Change message to your MIDI patch bay, or perhaps addressing a specific port of a multiport MIDI interface.

Opcode has extended this idea, linking its *Galaxy* librarian and *Vision* sequencer for the Mac via a proprietary Publish-and-Subscribe feature. Instead of the user typing in a name for each *Vision* track, *Galaxy* automatically supplies the name for the specific patch you want. (For more info, see the review of *Galaxy Plus Editors* in the May 1992 **EM**.)

## HARDWARE CONTROLLERS

At this point, you have MIDI devices interconnected to automatically route and process MIDI and audio data, control instrument parameters and patches, audio levels, EQ, effects, mixing, and tape transports. Your computer programs are cooperatively processing, sharing, and distributing the MIDI data. But you still need to control these various parts with a computer user interface.

Although pointing devices such as mice and trackballs are a big improvement over the four cursor keys found on most computer keyboards, they are not always the best control-input options. It's hard to perform a mix by grabbing one onscreen slider at a time

with a mouse, or to quickly shuttle transport controls by moving an arrow swiftly across the screen and clicking. You may want to add some extra hardware to get a better grip on your newly integrated studio.

A growing number of MIDI hardware controllers are available. On the simple side, several companies make remote MIDI program changers and footswitch controllers, some of which can send a respectable packet of MIDI messages at the stomp of a foot. There also are a growing flock of MIDI fader boxes by JLCooper, Lexicon, Peavey, Niche, and others. These devices allow you to assign any MIDI message to a set of hardware sliders.

Straddling the line between MIDI and computer controller surfaces are JLCooper's Control Stations, the CS-10 and CS-1 (reviewed in the November 1991 **EM**). These devices offer a handful of programmable buttons and a hardware "jog wheel" that can be used to continuously scroll through windows on the computer's screen. Pre-programmed button and wheel assignments make it easy to control *Vision*, *Performer*, or Digidesign's Sound Tools from a CS-1, or you can program your own. The Control Stations come in different configurations, with MIDI, RS-232, or Apple Desktop Bus outputs. The upscale CS-10 also includes a number of sliders and knobs that can be programmed to act as mixer controls.

Aside from button, fader, and knob controllers, plenty of creative user interface possibilities are developing. For instance, the aforementioned Mattel/Nintendo Power Glove and Don Buchla's Lightning (reviewed in the October 1991 **EM**) permit gestural input. There also are many commercial MIDI instrument and pad controllers, such as Buchla's Thunder or KAT's drumKAT, that can be creatively adapted to a variety of MIDI control functions.

**Lexicon's MRC fader box is most useful to owners of Lexicon's LXP-series signal-processors, but Generic MIDI (GMIDI) setups also are provided for controlling non-Lexicon devices.**

## CONCLUSION

Recent software developments indicate that integrated software control of multiple media will continue to spread. Passport Designs is currently developing *Producer*, which coordinates multiple tracks of MIDI sequences, 8- and 16-bit digital audio, *QuickTime* movies, and VCRs compatible with Sony's VISCA protocol. Even more significant is the support several computer companies give MIDI in their multimedia plans. MIDI is part of Microsoft's *Windows 3.1*, IBM's OS/2 can play back a MIDI file, and Apple has announced that MIDI sequence-playback controls will be added to *QuickTime*. Plainly, integrated studio systems are the wave of the future.

But you don't have to wait for tomorrow. You can achieve a high level of integration with today's tools. It sounds complicated, and admittedly it's a chore to initially plan and set up. But after everything is in place, the level of integration and control can be scary. Best of all, many technological concerns seem to disappear, allowing you to make music again.

Insane? Maybe. Exhilarating? You bet!

(The author wishes to thank David Oren of Fostex, Jim Cooper of JLCooper, Russ Jones of Steinberg/Jones, Marsha Vdovin of Opcode, and Steve Ellison of elliSonics.)

**Chris Meyer** *is the technical chairman of the MIDI Manufacturers Association. Having mastered (or so he thinks) music and MIDI, he's now starting all over again with video and* QuickTime.


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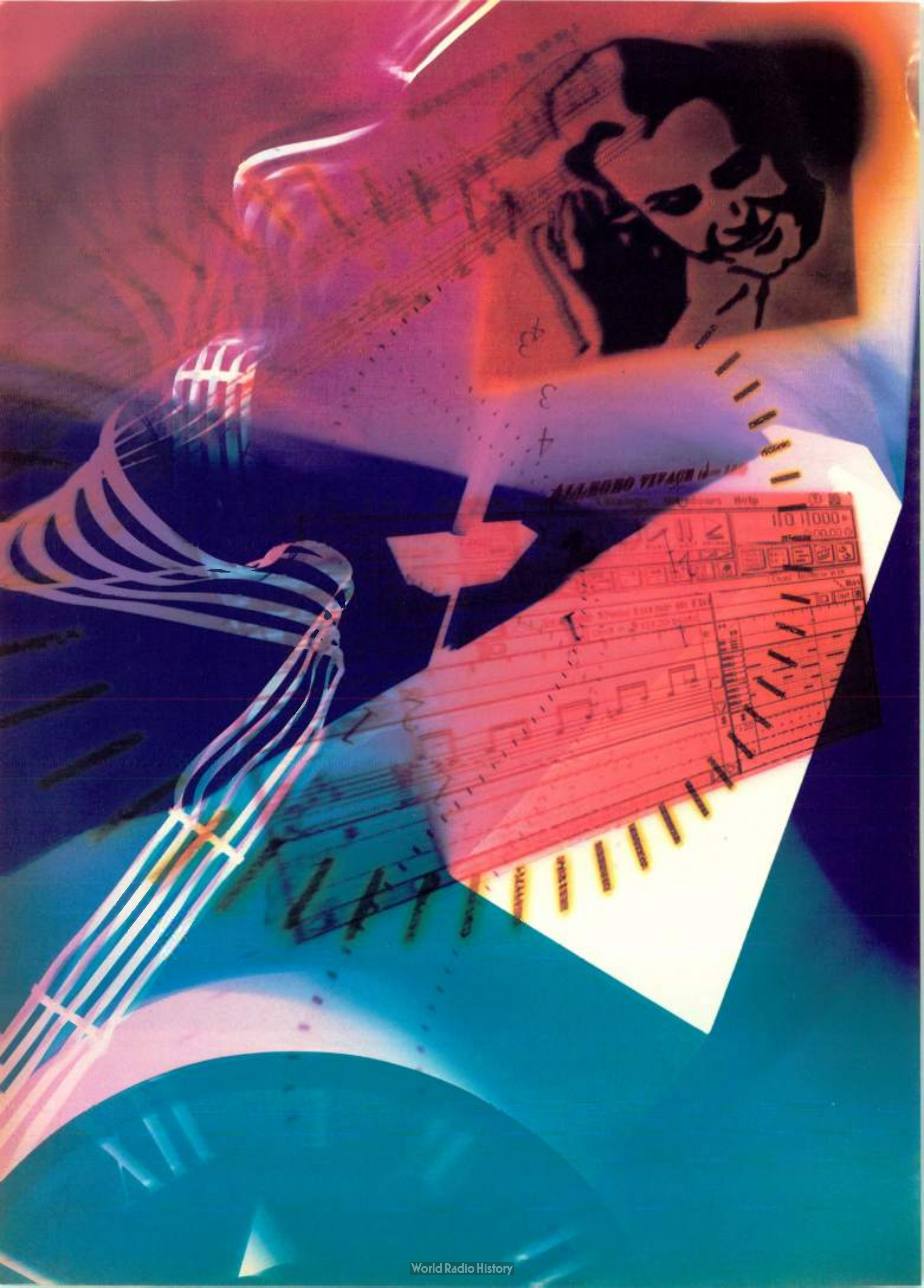
ALLEGRO VIVACE
Help

# a matter of time

By Chris Meyer

photo illustration by Carol Drobek

**It's time to debunk some of the myths about musical timing and "feel."**

We've all heard it many times. "This drum machine has really great feel." "That sequencer is sloppy." "Doesn't that groove?" "What's your resolution, man?" People talk about timing in music—especially when it involves the use of machines—but there aren't many definitive discussions about how to make music feel good.

To develop a sense of the perception of musical feel, I spoke with a number of people, both in one-on-one conversations and in open forums on computer bulletin-board systems. I expected to compile a list of instruments or sequencers that felt good or bad and the amount of shift each instrument required to guarantee a certain feel. Instead, I heard many anecdotes that led to the same conclusions:

- Absolute accuracy of the beat is not as important as general agreement on where the beat is;
- Timing may not be as important to feel as accent.

Let's start with the science and work our way to the art of feel.

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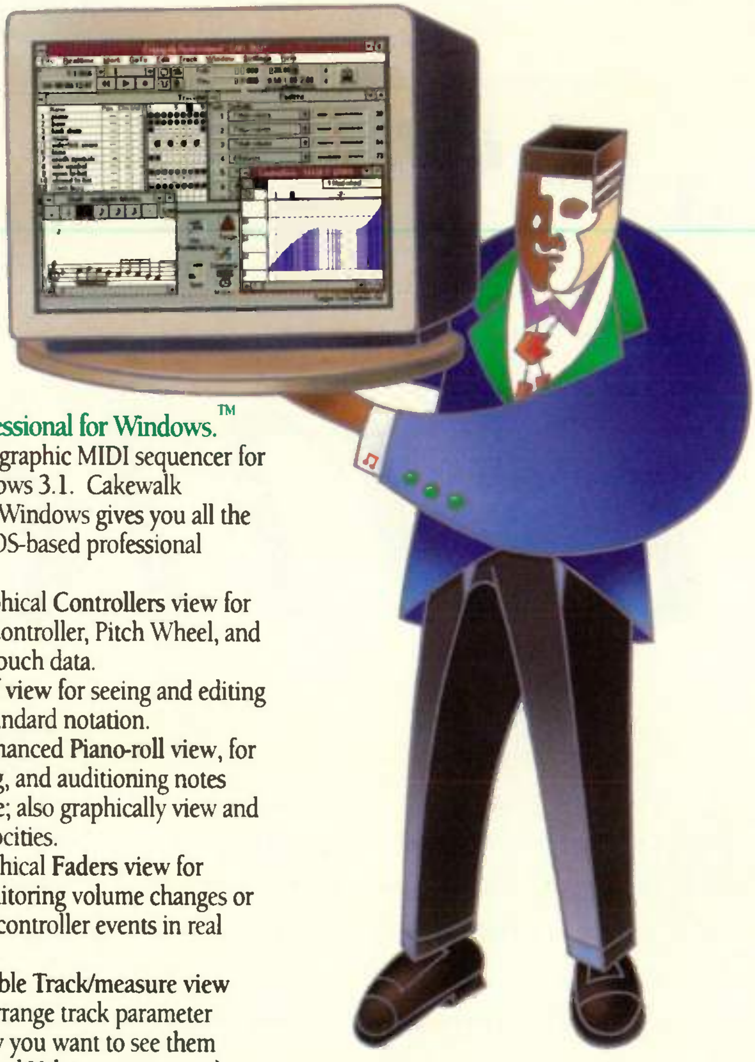

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## SCIENCE

Questions about timing and feel stem from the concepts of simultaneity and accuracy. Under what conditions will two or more notes sound simultaneous? How accurately must a computer trigger notes in order to sound "on time" or "in the pocket"? The answers to these questions depend on the way in which we perceive sonic events.

Our ability to perceive the timing of sonic events is believed to be in the range of 10 to 30 milliseconds (ms). In other words, if the attacks of two notes fall within this range, we hear them as simultaneous. As a result, some people argue that a computer must be accurate enough to play a note within 10 to 30 ms of the intended rhythmic position in order to sound on time.

Yet people claim they can hear timing differences of less than one millisecond. How can that be? As we will see, this threshold of perception depends not only on the time between events, but the nature of the sound and the person hearing it.

The 10 to 30 ms range comes from the science of psychoacoustics. This timing window, known as the Haas Effect, derives from experiments in which various human subjects listened to two identical sounds with a slight delay between them. The delay was increased until the subjects heard them as two distinct sounds instead of one. Stephen St. Croix of Marshall Electronics replicated these tests under controlled conditions and found the critical delay to vary from 3.5 to 25 ms, depending on the sound and the subject. These numbers are useful for understanding some of the timing tricks discussed later.

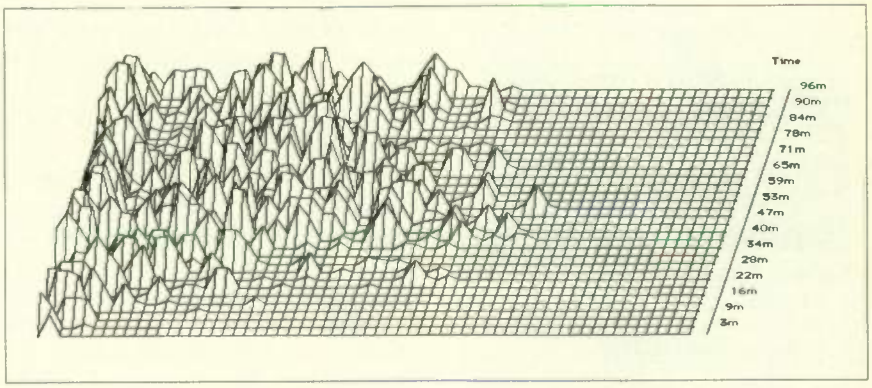


**FIG. 2a: FFT of hi-hat hit before snare.**

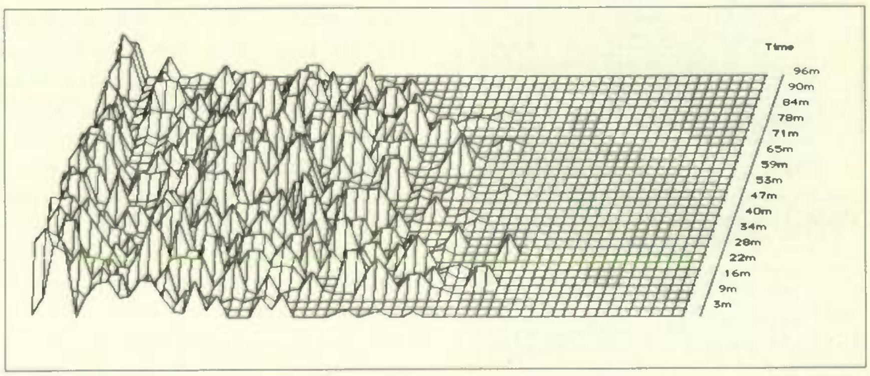


**FIG. 2b: FFT of hi-hat and snare hit together.**

Just because we hear two sounds that start within the Haas range as simultaneous doesn't mean the result is identical for different delays inside this range. Mixing two sounds with different offset delays results in different overall timbres; different harmonics add or cancel, and the overall amplitude profile is different depending on the delay time.

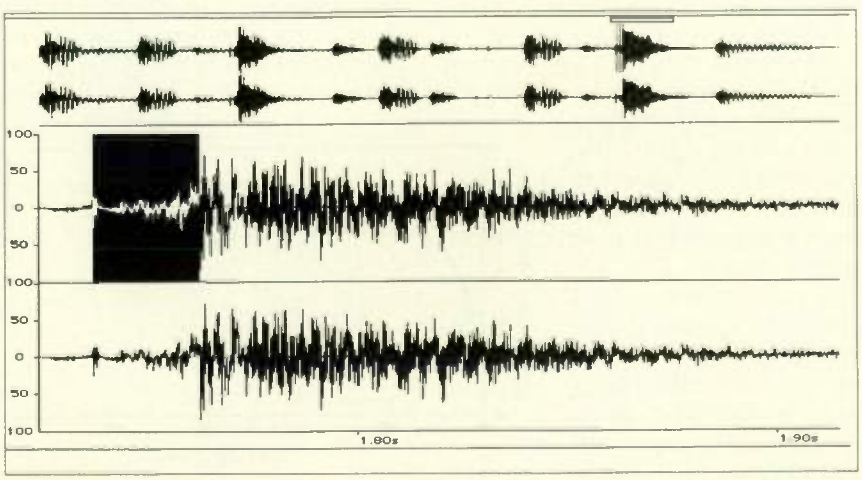


**FIG. 1: Hi-hat leading into a snare hit. An overview of the entire loop appears along the top.**

**Fig. 1** represents a drum loop. In the expanded region, the highlighted hi-hat strikes just before the snare. Even though there is nearly 20 ms between the two events, it sounds like one percussive event. But instead of a sharp snare crack, the overall sound slurs into the hit.

As an experiment, I cut the hi-hat from the front of the hit and placed it to start at exactly the same instant as the snare. The hit sounded different, although it still sounded like one event. In **Figs. 2a** and **2b**, the Fast-Fourier Transforms (FFTs) of these two sounds illustrate this effect. The axis from left to right represents increasing frequency; the axis from front to back represents the time from the start of the sound. The humps indicate the level of each frequency band for each segment of time. As you can see, the profile of each version is decidedly different, even though both of them sound simultaneous.

Some people claim they can detect delays smaller than the Haas limit. However, this probably is due to a change in timbre rather than the perception of two distinct events. Another contributing factor is the change in the attack of the overall sound as the two events are shifted around. As I'll explain in a moment, the attack profile influences our perception of when a sound begins.

A consequence of the Haas Effect is the influence of loudness on the perception of delays. Our brain does not always perceive things exactly in the order they occur. Instead, it seems to group events together and sort them out later, using both timing and loudness, along with other factors such as harmonic content, to determine what just happened.

For example, there are two ways to fool the brain into thinking a sound came from one side of the head instead of the other: loudness and timing. You can make the sound louder in the near-side ear, which is the function of a pan pot. Or, you can make the sound arrive at the near-side ear before the far-side one, which is easily accomplished with a delay line. Of course, there are other factors to consider, such as tonal changes, as real sounds travel across the face and head to get to the other side. However, these two cues seem to be enough to convince most brains.

What happens when timing and loudness disagree? A common Haas test sends a signal to one ear before the other while increasing the volume of the later signal until the sound appears to be coming from the center, indicating that the brain thinks the two signals are arriving simultaneously.

Haas' original curve (see **Fig. 3**) suggests that you need to boost the late signal (called the echo) by about 10 dB at a delay time of 10 ms in order to perceive the sounds as simultaneous. This 10 dB boost also compensates for delays up to about 25 ms. St. Croix's tests showed volume compensation peaking out in the 1 to 4 ms range in a curve that is otherwise similar to Haas'. Apparently, the ability of volume to affect perceived timing is more significant than most people suspect.

If volume can make a late sound appear on time, can more volume make it appear early? Albert Bregman, author of *Auditory Scene Analysis*, apparently has discovered that it is possible for the brain to swap the order of sounds at different volume levels. In essence, this effect makes some music almost impossible to transcribe at normal speed because the accents fool the ear. It also has interesting applications for sculpting the feel of a musical sequence.

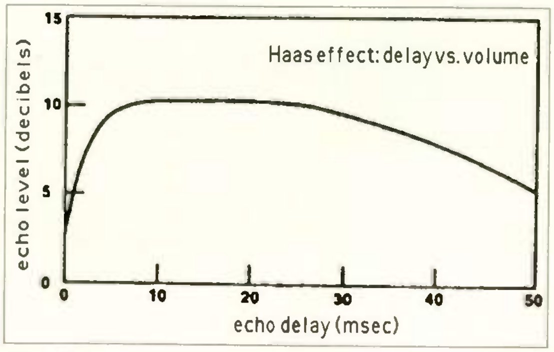


**FIG. 3: The Haas loudness vs. delay curve.**

## MIDI

MIDI is a favorite whipping-boy for all problems in electronic music, particularly those related to timing. Everyone seems to think it's slow and stupid, but that's not really the case.

There are two possible sources of timing problems within MIDI: how quickly it can start a sound, and the accuracy and stability of its synchronization messages (MIDI Clocks and MTC).

A MIDI Note On message takes 960 microseconds to transmit (640 microseconds—$^2/_3$ of a millisecond—if MIDI Running Status is employed). A six-note chord takes less than 4 to 6 ms to send. This is equivalent to a string of 1/192 notes at a tempo greater than 1,250 bpm, and falls well below the Haas threshold for fusing the chord into one sound. Therefore, the speed of MIDI itself should not be a factor in these discussions (apart from the change in timbre when six sounds play in a staggered fashion).

However, dismissing the MIDI data rate as a source of timing problems assumes that the transmitter doesn't pause between bytes of a message. This may not always be true because MIDI is asynchronous, which means that there is no specified time interval between bytes. It also assumes that no other messages, such as Pitch Bend or Aftertouch, occur between Note Ons and that the receiving instrument plays these notes as fast as it receives them. These assumptions are not always valid.

Both MIDI Clocks and MTC have relatively low resolution compared to the time intervals mentioned so far. Clock messages are sent every 1/96 note (62.5 ms to 10 ms as the tempo varies from 40 bpm to 250 bpm); MTC messages occur four times per SMPTE frame (41.7 ms to 33.3 ms as the frame rate goes from 24 fps to 30 fps). If a receiver requires higher resolution, it must interpolate finer increments of time between these messages.

However, the theoretical accuracy of these messages is very high. Given a typical MIDI UART master clock rate of 500 kHz, it is possible to fire off one of these messages within a window of 2 microseconds. Again, their real-world accuracy depends on the diligence of the device sending the messages and whether or not other MIDI messages are jostling them out of the way.

In other words, MIDI's not a bad kid at heart, it just gets mixed up with a bad crowd: namely, MIDI instruments and sequencers.

### INSTRUMENTS

Life would be a lot simpler if MIDI instruments played notes the instant they received the corresponding Note On messages. Alas, this is almost never the case. The path followed from MIDI In to Sound Out is a twisted one. Typically, the instrument must read the message into a data buffer, realize there is something in the buffer, pull it back out of the buffer, check to see if the message must be addressed, figure out what to do in response to the message (such as deciding which sound to play with what parameters of pitch, loudness, filter cut-off, etc.), load another routine to play the note, and wait for the routine to kick-start its hardware into sounding the note.

In the meantime, the instrument usually is busy doing other things, like sustaining other notes and checking to see if you're doing anything at the front panel. I have measured instruments that do all of this in as little as 1 ms and as long as 11 ms. Others report that certain instruments take over 40 ms to do the same thing.

More importantly, a MIDI instrument rarely takes the same amount of time to play each note it receives. For example, one of the instruments I measured took from 2 to 11 ms to do the same job. Also, instruments tend to slow down as they try to play more notes at the same time. This occurs when layering different patches (some instruments seem to slow all the voices down a lot, but equally) or when lining up notes in a chord (the first note may get out fast, but the last one may wait until tomorrow). Layering a randomly slow instrument with a faster one should improve the apparent timing, although the timbre of each note still will seem slightly different.

The point at which we perceive a sound's beginning depends on several factors in addition to MIDI response. For one thing, we usually perceive a note landing or arriving at a rhythmic position when the attack portion of its envelope reaches maximum amplitude. A snare crack may do this immediately, while other sounds, such as bowed or blown instruments, take some time. The cello waveform shown in **Fig. 4** is a good example. This particular note has well over 50 ms of attack time before the meat of the sound.

Now consider a sampling instrument that stretches one sound over several pitches. As the pitch changes, the attack time changes in length, which in turn changes the delay between the performance of a note and the meat of the sound. As you play one sample in a downward scale on a multisampled keyboard, you get a longer delay with each note until you cross over to the next sample's keyboard zone. At this point, the new sample transposes up in pitch to reach the seam between samples, and you suddenly hear a much shorter attack-time delay.

Musicians can compensate for both MIDI and sound attack delays if they remain constant. After all, many real instruments have similar delays, and there is a general intuition that lower-pitched notes take longer to "speak." However, sequencers don't know about delays that might be waiting downstream when they're trying to quantize notes to play on time. Both musicians and sequencers are at a loss when these delay times vary.

## SEQUENCERS

There are two commonly held myths about sequencers. One maintains that the higher the clock resolution, the more accurate the sequencer. The other insists that software-based sequencers are inherently less accurate than hardware-based sequencers.

A lot of high numbers get tossed around with respect to sequencer resolution—anywhere from 24 pulses per quarter note (ppqn) to 480 ppqn and higher. Unfortunately, this number only indicates how accurately the sequencer knows when it is *supposed* to play a note. It does not guarantee that it will *play* that note at precisely the marked time, or even within several ticks of that time. Likewise, many people expect the time values tagged onto recorded notes to be a perfectly accurate indication of when the MIDI message got to the sequencer. The time value only indicates when the sequencer got around to looking at the message.

The second myth is based on the assumption that a software sequencer also is busy being a computer. As such, it is more preoccupied, and therefore less accurate, than a dedicated hardware sequencer. This is true in some cases, and removing other simultaneous tasks on your computer sometimes helps. On the other hand, the computer might have a microprocessor that is a decade more advanced and more powerful than the one found inside the hardware unit. (Also, anyone can

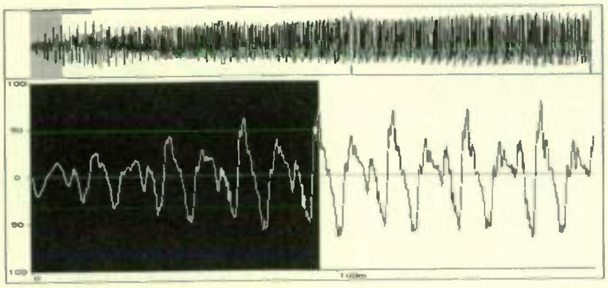

FIG. 4: The slow attack of a bowed cello.

create a bad sequencer.) Dedicated hardware sequencers tend to have a lower resolution than their occasionally less-accurate software counterparts.

A sequencer's job is more difficult when it doesn't control its own timing. It's far easier to count to yourself than to wait for someone to tell you when to go. An advertisement for a hardware sequencer used this fact in claiming that at least one user judged the unit to be more accurate than any software-based sequencer.

In reality, the test demonstrated how accurately the sequencers were able to follow an *external* MIDI clock. Indeed, the hardware sequencer was closer, but only with respect to the 1/96 notes of the MIDI Clock messages. Unlike many of the software sequencers, the hardware sequencer was incapable of hitting the finer rhythmic increments between these messages. On the other hand, the software programs were busy interpolating finer units of time between the Clocks, which caused them to wander slightly while guessing. This is the sort of tradeoff involved in sequencer accuracy.

In the pursuit of perfect timing, there's something ironic in the occasional complaint that a sequencer or drum machine can sound too stiff or mechanical: in other words, too perfect. These devices have sprouted "human feel" functions that all too often simply randomize the rhythmic playback slightly. I spoke about this with Roger Linn, who developed a reputation for creating drum machines that "feel good." He shrugged it off, saying all he ever tried to do was create drum machines that were accurate, but also had good control over the dynamics of the sound.

## CLICKS

To train humans to play with machine-like precision, someone invented the metronome. With time and technology, it evolved into the click track. The goal in this evolution was perfect time, in which all you do is play along with the clicks. This concept works well to ensure that the overall tempo doesn't change. However, many people believe that clicks indicate exactly where each beat should fall.

Trying to play right on a click can be a paralyzing experience. At least one study suggests that click-trained drummers play tighter when the click is removed. Joe Zawinul has commented about the tendency of some musicians to "slalom" around the beat (get a little bit ahead, realize it, adjust, end up a little behind, realize it, adjust, etc.). More than one musician mentioned how much easier it is to play between or around clicks than dead on them:


# LASTING POWER

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

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

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

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

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It's like trying to balance on the edge of a knife.

Jeremy Roberts, musical supervisor for composer Frank Wildhorn, has hired musicians he thought had fine rhythmic feel, only to find them thrown "into outer space" when he asked them to play to a click track. Roberts' best story concerns playing piano on a session with an 85-piece orchestra while trying to follow the most ambiguous of clicks: a conductor's baton. The pianist was in a separate room to get a clean recording. As he watched the baton and listened to the cue mix, he was always ahead of the orchestra. The only solution was to put him in the same room with the orchestra so that they could hear each other, after which they finally agreed on what parts of the conductor's gestures constituted the "click."

Another problem can be the stability of the click. Marius Perron, who developed the Russian Dragon (see the review in the March 1991 issue of **EM**), found that mechanical metronomes are off by as much as 60 ms on alternate beats. More recently, sounds from drum machines or sequenced instruments have been used to provide clicks. But these are the same culprits that introduce random timing errors when playing normal notes. Perron found that the busier some of these instruments are, the more random the click becomes. If you think it's hard to balance on the edge of a knife, try it on a moving one.

During my conversations, Motown came up repeatedly as the rhythm pilgrim's Mecca. Bob Olhsson, who was a staff recording and mastering engineer at Motown from 1965 to 1972, had an interesting story to share.

"Back around 1967, we began doing 'one-man band' 16-track productions. The first thing we realized was the time had to be rock-solid or we could spend weeks trying to overdub a single song. We investigated metronomes, rhythm machines, and so on, looking for a solution. The only thing that finally worked was a tape loop. All the other options available at that time were not solid enough and resulted in tense, mechanical-sounding music."

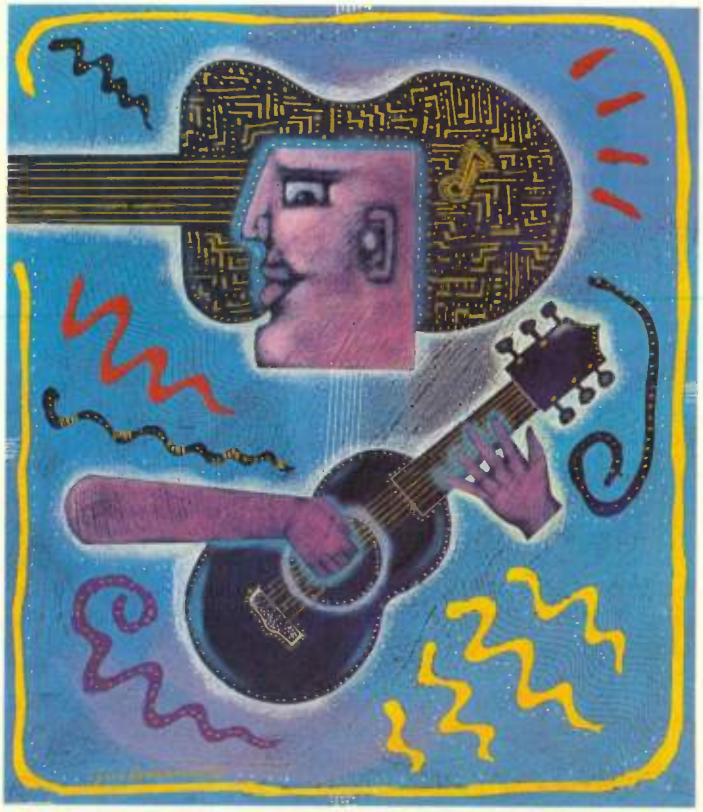
This isn't the first time the perfection of machines has been accused of resulting in mechanical music. Maybe the time has come to study an alternate approach.

### HUMANS

Many believe that machines may never replicate the complexity and finesse of human beings. So, the hunt for feel turns to the accuracy of real people. How tight are we?

For example, all of the notes in a chord played on a piano should sound at the same time. However, this takes some practice. Keith Snyder, keyboardist with the Afro-pop/reggae band Kadara, found that he was spreading the notes in 3- or 4-note chords by as much as 15 ms. (This is still within the Haas limit to fuse into one sound, although perhaps with a blurred attack.) After practicing the Hanon finger exercises on a real piano and then returning to his synth's keyboard, he could land chords within the finest resolution of his sequencer, although his little finger occasionally lagged by

(continued on p. 116)



JOËL NAKAMURA

Samples have become the primary source of sounds for many electronic musicians, and with good reason. They provide a reasonable facsimile of acoustic sounds and can be sequenced without taking up valuable tape tracks. Of course, it takes skill, patience, and experience to make good-sounding samples.

Last month, I offered some tips and tricks to help you achieve the best possible results while recording acoustic sounds for a sampler. This month, I will concentrate on massaging samples within the sampler or computer to create sounds you'll be proud of. But first, there's one more aspect of recording I want to mention: acoustic artifacts.

### ACOUSTIC ARTIFACTS

Many electronic musicians use the word "artifact" to describe digital problems within a sampler, such as aliasing, but these problems are reduced greatly in the newer machines. I use the term to

# SOUND BYTES

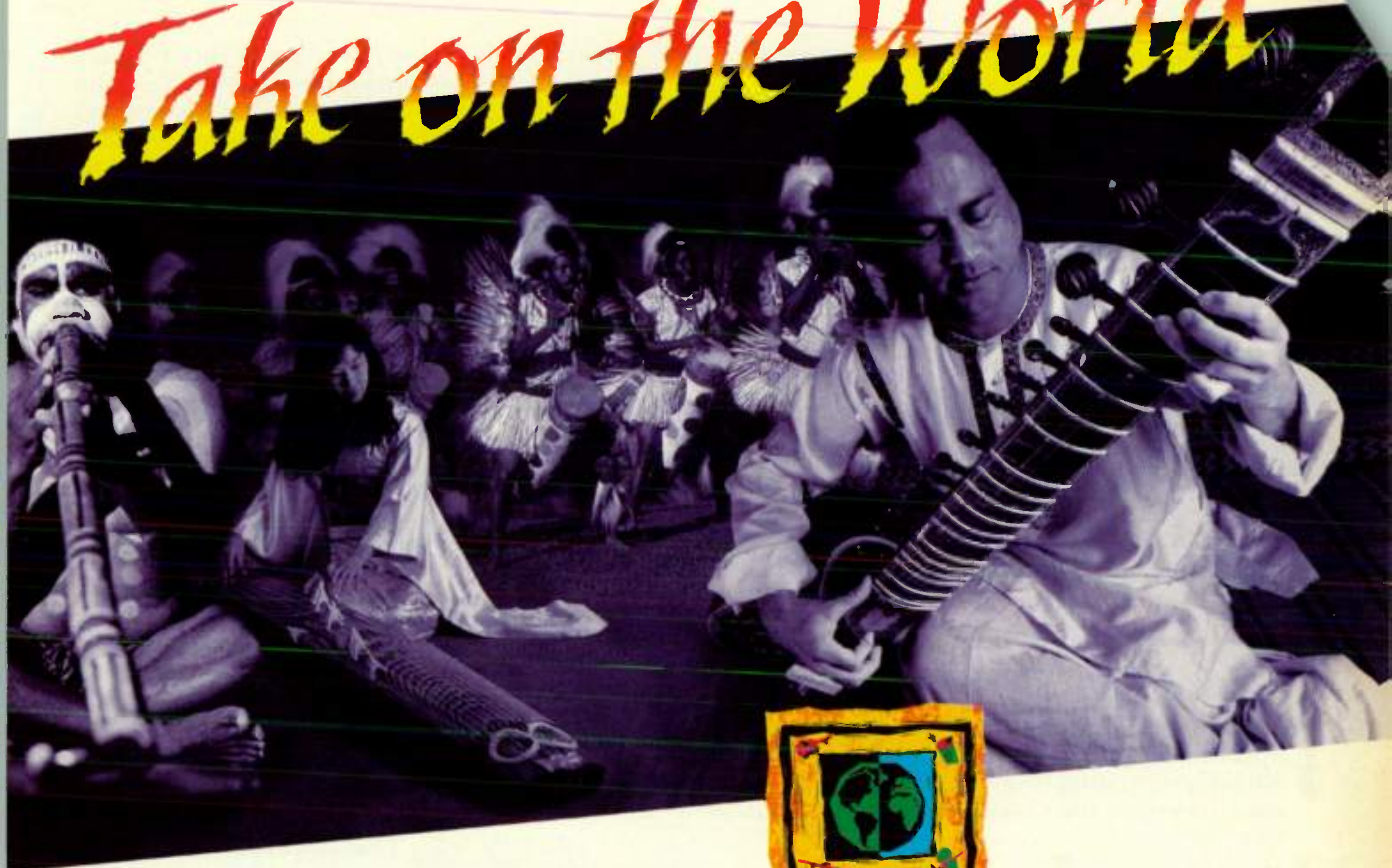
**Part 2: Learn to employ artifacts and stay in the loop.**

describe the anomalies that are present in all acoustic instruments and the problems they present to good sampling.

The dictionary defines an artifact as "an object produced by human workmanship." Each instrument made and played

**By Jim Miller**

# Take on the World



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*The World of Music Arts and Dance was founded in 1981 with the help and inspiration of Peter Gabriel. WOMAD sponsors wordwide festivals, performance events, music recordings and educational projects.

by humans exhibits characteristic sounds or noises: the breath across the mouthpiece of a flute, the scrape of a bow on a string, the resonance of the acoustic guitar's body when plucked. All these instruments sound natural as we listen to them being played. But when they are transposed on a sampler, the inherent noise is transposed too, which usually sounds unnatural. For example, the body resonance of a plucked classical guitar contributes significantly to its tone. This resonance is centered around several frequencies, one of which is primary, (i.e., at a much higher amplitude than the others). The resonance stays fairly constant regardless of what note is played on the instrument. However, as a sample of this note is transposed, the resonance also is transposed.

Artifacts occur whenever there is contact or impact between the player and the instrument itself. For example, when the sustain pedal of a grand piano is held down and a hammer strikes a string, there are sympathetic vibrations in the strings around it and some resonance from the wooden piano body in addition to the string's sound. You can sample pianos without the sustain pedal, but the finished product does not sound as good when played normally. Although there are fewer potentially annoying artifacts without the sustain pedal, the character of the sound is compromised.

To address this problem, some people move the microphone farther away from the instrument, reducing the resonant component of the overall sound. Others filter or EQ the resonance out. I find resonance and other artifacts to be valuable sonic information and try not to overly diminish their effect. By sampling at smaller intervals, the unwanted side effects are kept to a minimum. Also, sampling at particularly "sweet" spots on an instrument results in a more pleasing interaction between the fundamental tones, the harmonics, and the resonance. This type of sound tends to transpose better.

Once you are aware of acoustic artifacts, you won't listen to instruments in the same way. Artifacts contribute greatly to the difference between real and synthesized instruments, or good and bad samples. Experimentation and your ears are the best guides to making artifacts less noticeable or even making them work to your advantage.

## LOOPING

It's amazing how many people judge the quality of a sample by the sound of the loop points. Whenever they audition samples, they hold down individual notes for a few seconds and gleefully search for the loops. But how often do you hold down a single note for a few seconds in any piece of music? For polyphonic music that uses sixteenth, eighth, or even whole notes, this microscopic evaluation of loops is rather meaningless.

I'm not suggesting that anyone accept a truly bad loop in a sample, or loud clicks and pops. We've all heard piano samples that sound more like a flexatone by the time they hit their loops. To be fair, acoustic pianos are probably the most difficult instrumental sounds to loop well, followed closely by pipe organs.

If you loop a piano note around a single cycle of the waveform, about two to three seconds into the sample, you get an abrupt shift from an evolving set of harmonics to a static, lifeless, often buzzy waveform. It usually is necessary to crossfade across a half-second-long segment located toward the end of the sample, after the sound has stabilized. This creates a slight shifting, or "rolling," effect, depending on the amplitude of the sample around the loop points. The effect can be good—it simulates the natural, shifting harmonics of real piano strings, adding a slight animation to sustained chords—however, it isn't audible when the sample is played in a musical context.

Another option is to compress the sound, which keeps the sample at a more constant level throughout its entire length. Unfortunately, this removes much of the punch in the attack portion of the sound, resulting in a wimpy sample. The attack portion of most sounds lets us identify the instrument, so anything that diminishes the attack removes much of the instrument's character. Compression can introduce some noise into the sample, depending on the environment in which the sample is recorded. In just about every instance, I go for a good crossfade loop rather than compression.

The waveforms of most brass and woodwinds played without vibrato (with the exception of the flute) tend to stabilize about a half-second into the sample. This makes it relatively easy to create a single-cycle loop or short crossfade loop that works well (see **Fig. 1**), provided the sample is not "breathy."

As I mentioned last month, the other approach is to loop these sounds after they are recorded with natural vibrato. This also is fairly simple to do, because the vibrato provides a cyclic event around which to loop (see **Fig. 2**). These samples can be less than a second long, provided the player has not used delayed vibrato.

When sampling with vibrato, sample every second or third note in the chro-

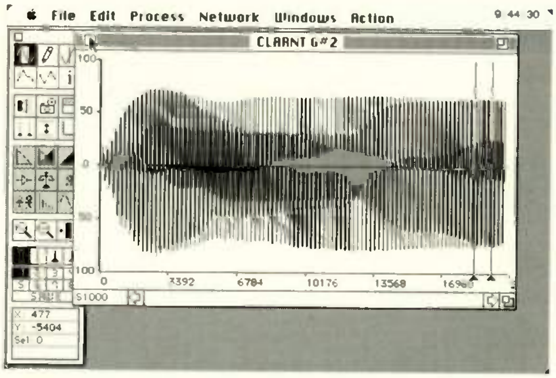


**FIG. 1a: A clarinet sample without vibrato. The loop points are close together and located well after the sound has stabilized.**

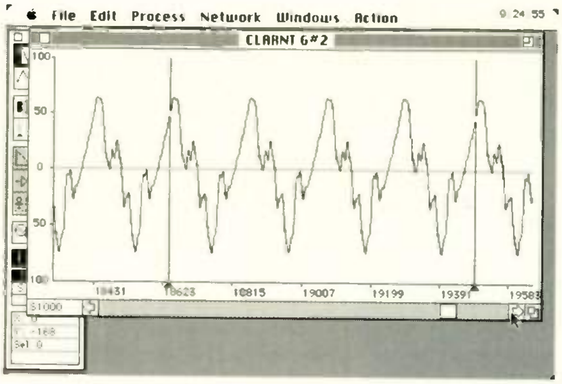


**FIG. 1b: A close-up view of a clarinet sample with a short crossfade loop.**

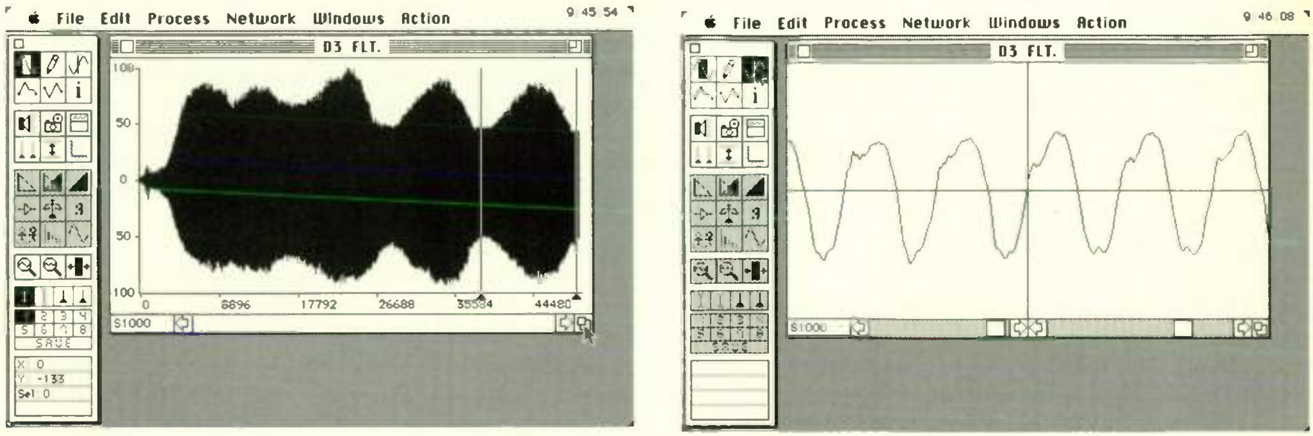


**FIG. 2: (a) A flute sample with vibrato. Notice that one cycle of vibrato is looped. (b) A close-up view of the flute sample with loop points.**

matic scale. This prevents the vibrato from getting too fast or slow as the sample is transposed up or down. If you really are limited in terms of available sample time, you can transpose a note with vibrato up or down as much as two semitones without sounding too unnatural, although I prefer to limit transposition to no more than one semitone in either direction.

Most strings sampled with vibrato loop easily, but looping is more difficult without vibrato. When sampling strings without vibrato, it may require between 1.5 and 2 seconds of sampling time to find a loop region that sounds natural, and the sample usually needs a lot of crossfading. This also applies to flutes and other instruments with a lot of breathiness or harmonic motion.

As you may recall from last month, samples with vibrato sound more natural than using the mod wheel to invoke LFO. However, if you are a die-hard mod-wheel user, have the player you are sampling use a very slow and subtle vibrato. This allows you to loop around a natural cyclic event in the sample and still use the mod wheel to engage a deeper, faster vibrato. Once you crank up the LFO, the natural vibrato is quickly masked. As a bonus, the same sample can be used to play chords without LFO, which sounds much more natural because there still is some subtle animation in the sound. On the down side, this procedure requires longer sampling times.

The newer 16-bit machines seem to be less forgiving of single-cycle loops, which betray themselves more readily with the greater resolution of these instruments. The same master recordings on 8- or 12-bit machines are quite acceptable. In general, the lower the resolution of the sampler, the easier it is to mask the loop points.

With machines of higher resolution, try taking a larger chunk of the sample, half a dozen cycles or more, and crossfading the end points heavily to create a smoother transition from the unlooped section to the looped region. It may take several attempts, but changing the length of the loop and the amount of crossfade often results in a very good loop.

Even with advanced graphic-editing software such as Digidesign's *Sound Designer*, Steinberg's *Avalon*, or Passport's *Alchemy*, few sounds allow a completely undetectable loop. Ensemble sounds, synth sounds, and any instrument with a decaying envelope are tough to loop because the end of the sample is rarely at the same amplitude, phase, or exact pitch as the start. Even the best loop of these sounds is audible to some degree.

Here's the bottom line: Until we have dirt-cheap megabytes of ROM and RAM, we must accept looping as a fact of life. If a piano module or sample disk can be played in a normal manner and it sounds bright, rich, and full, what's the point of worrying about a part of the sound that the average listener will never hear?

## THE TAIL END

Typically, a sample is looped in the sustained part of the sound. But many instruments, such as the guitar and harpsichord, exhibit distinct sounds when the note is released. When a finger is lifted from a plucked string on a guitar, there usually is a small buzz at the tail end of the sound. There also may be a squeak as the fingers slide up the string to the next note. Harpsichords make a distinct click when the finger releases the key, and the plectrum falls back over the string to its resting position.

In the past, I have been frustrated in my attempts to create a good jazz guitar sample. One day, as I was noodling on the guitar after changing the strings, I suddenly became aware that the releases are one of the major elements of the tone. The more I played, the more I became aware of this particular element of the sound. As a result, I am adding a string buzz to the release portion of my guitar samples. Unfortunately, two voices must be used to accomplish this. One voice is required for the sustained sound, while the other provides the release.

For this procedure, a good graphic-editing package is essential. First, sample a note with a good release, then cut and loop a region of silence to paste at the start of the release. The best releases are recorded when you sample a few notes ahead of the final release, then chop out everything but the sound of the finger lifting from the string.

## THE END

We've come a long way since wrestling with hexadecimal values on the Ensoniq Mirage. When you compare today's instruments to those of just five years ago, the improvements are remarkable. This historical perspective points toward a future in which samplers can achieve much more subtle variations in tone and texture than anything as primitive as analog or digital filters and envelope generators.

We will have a staggering amount of sampling power in the next few years. But it's the music that counts first and foremost. No one buys tapes or CDs because the samples sound good. They buy them because the music sounds good. Samples help make music sound better, but they can't make bad music sound good.

**Jim Miller** *is co-owner of Stratus Sounds, a third-party sample developer based in Sacramento, California. Stratus Sounds donates one-half of its profits to environmental and animal rights groups.*

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# Tweaking Synths, Part 2

*By Scott Wilkinson*

*Modulators such as envelope generators and LFOs let you customize sounds.*


DAVE EMBER

Synthesizers have a reputation for being difficult to program, and with good reason. Early synths soon became a confusing tangle of patch cords as new sounds were created. Newer digital instruments offer a plethora of parameters in "pages" many layers deep. No wonder most people avoid programming their own sounds.

But creating your own patches isn't as difficult as it might seem. In fact, it's relatively easy to start by tweaking the factory presets. Last month, we examined some of the basic parameters in the primary signal path of most synths, from the oscillator through the filter to the amplifier. This month, I'll focus on the components that control the operation of these three elements. These components are called *modulators* because they modulate, or change, elements of the sound. They come in two varieties: *automatic* and *manual*.

Before we begin, a disclaimer is in order. It seems that each manufacturer feels compelled to invent its own vocabulary, so the specific terms used to identify various parameters differ widely from one instrument to the next. The terms used in this article are as generic as possible, but they may not match those used in your instrument.

## AUTOMATIC MODULATORS

There are only two automatic modulators that are universally applied to all types of synthesis: *envelope generators* (EGs) and *low-frequency oscillators* (LFOs). The signals from EGs and LFOs are programmed by you and sent to the *control inputs* of the oscillator, filter, and amplifier (see **Fig. 1**). These signals automatically control the behavior of the oscillator, filter, and amplifier over time. In some cases, their effects are quite immediate and subtle, while in others they are slower and more pronounced.

All acoustic sounds have a beginning, middle, and end. All sounds start from silence and vary in level until they return to silence. The profile of this behavior is called the sound's *amplitude envelope*. For example, a piano note reaches its maximum level very quickly and decays slowly until the key is released, after which the sound falls to silence almost immediately (see **Fig. 2**).

In synths, this fundamental aspect of all musical sounds is simulated with an EG. By applying the control-signal output of an EG to the amplifier at the end of the primary signal path, the volume of each note follows the pre-programmed profile determined by the EG parameter settings. As each key on the keyboard is pressed, the EG output goes from a value of 0 up to a certain level, after which it varies according to the parameter settings and falls to silence in a user-specified length of time after the key is released.

Modern EGs let you specify the *rate* at which the envelope moves from one level to the next as well as the *levels* themselves. For example, **Fig. 3** illustrates an EG with four rates and four levels, all of which are specified by the programmer. The first rate determines the attack time of the sound from the moment a key is pressed until the first level is reached. The second rate determines the time it takes to reach the second level, while the third rate determines how long it takes to reach the third level. The EG stays at the third level until the key is released, after which it moves to the fourth level in the time determined by the fourth rate. The fourth level almost always is set to zero; otherwise, the sound never


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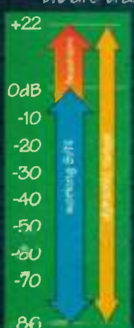


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*Each time the number of inputs is doubled, it adds 3dB to the non correlated operating level. Thus 16 channels running all at once is 12dB hotter than the same mixer with *just one* channel operating

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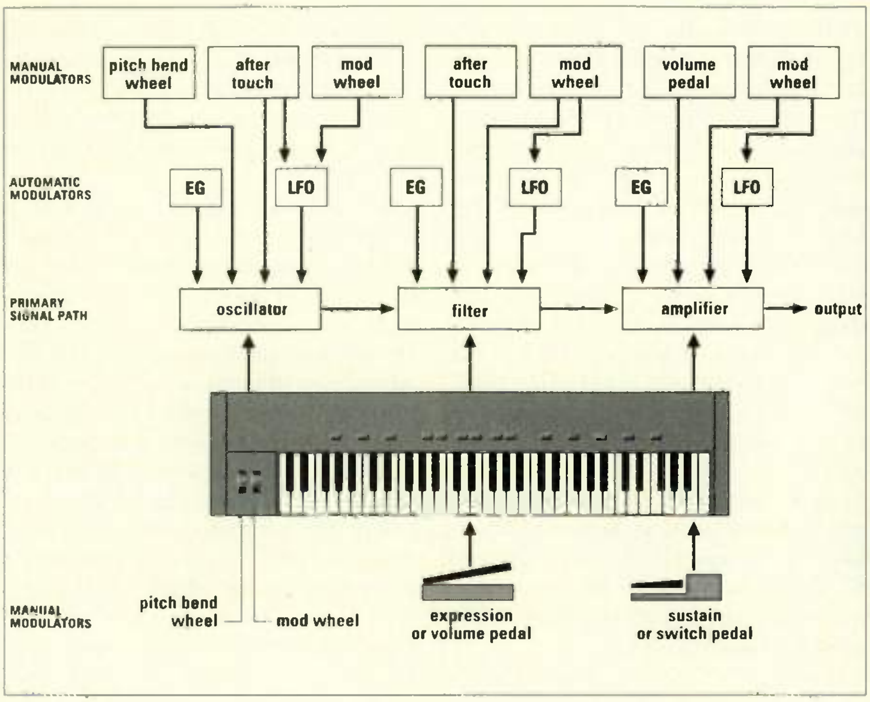



**FIG. 1: The architecture of many modern synths includes the primary signal path from an oscillator through a filter to an amplifier. These components are controlled by various automatic and manual modulators.**

completely fades away.

As you can see in Fig. 4, this type of envelope generator can simulate a piano envelope quite effectively. The attack rate is very fast, quickly raising the signal to a high level, followed by a short, slightly slower decay to simulate the initial "spike" in a piano envelope. The third rate is slow to simulate the slow decay as the key is held down; the third level is set to 0 in case someone holds the key until the note disappears completely. If you let go of the note prior to reaching level 3, the EG skips to rate 4 and level 4. The fourth rate quickly leads to a fourth level of 0 after the key is released. It's important to note that even though levels 3 and 4 are both 0, the sound level does not rise in between them and fall again. A sound simply follows the appropriate path to 0 depending on the point in the envelope where you take your finger off the key.

Unlike acoustic sounds, electronic sounds can be modified to resemble nothing in the acoustic world. For example, if you have a piano sound with an envelope as in Fig. 4, you might slow down the first and fourth rates and increase the third level to equal the second level to create a sustaining, spacey "piano pad" sound.

Most modern synths include several EGs, one of which can be applied to the filter. This process changes the timbre over time by affecting the filter's cutoff frequency in the same way that

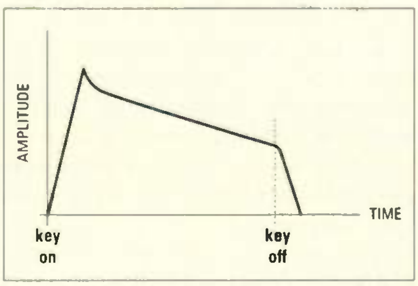



**FIG. 2: The amplitude envelope of a note played on a piano.**

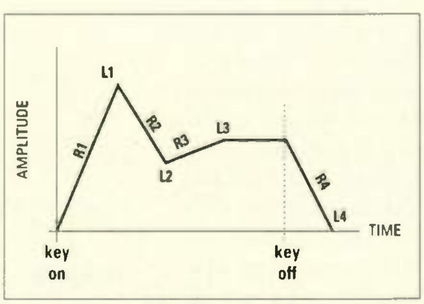



**FIG. 3: A typical synth EG provides four rates and four levels. Once it is reached, the third level remains constant until the key is released.**

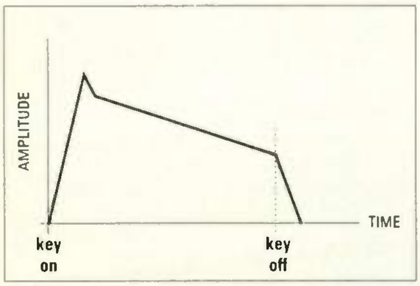



**FIG. 4: The EG depicted in Fig. 3 can be used to simulate a piano envelope quite accurately.**

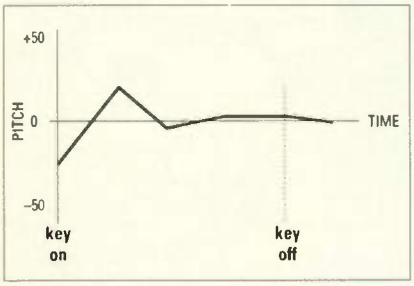



**FIG. 5: A pitch EG controls the frequency of the oscillator. In this example, the frequency can be shifted by as much as 50 cents above or below the nominal pitch.**

the amplitude envelope affects the sound's overall volume. Find a preset with a timbre that changes radically during the course of a note (such presets often have the word "sweep" in their name). Take a look at the EG parameter settings, then try changing the attack time and other parameters to get a feel for the effect of a filter EG.

Another EG often is applied to the frequency of the oscillator. Unlike the amplifier or filter EGs, which output values between 0 and a maximum level, the *pitch EG* varies between a negative value and its positive counterpart, with 0 in the middle (see **Fig. 5**). This allows the pitch EG to vary the frequency of the oscillator above and below its nominal (in-tune) value.

Typically, the pitch EG is used to vary the pitch of the oscillator by small amounts to simulate the small pitch variations in the attack portions of many acoustic instrument sounds. However, you might want to experiment with larger variations to create a wild, pitch-sweeping effect.

## LOW-FLYING OBJECTS

LFOs usually are used to simulate vibrato by applying a slow, regular control signal to the pitch of the oscillator. This signal varies the pitch up and down slightly a few times per second. By applying an LFO to the amplifier, the volume of the sound is slowly modulated up and down, creating a tremolo effect. When it's applied to a low-pass filter cutoff, an LFO creates a regular "wah-wah" effect.

There are three major LFO parameters: *frequency*, *depth*, and *waveform*. The frequency of an LFO usually is between 0.1 and 10 Hz (vibrato rates are in the 4 to 7 Hz range), although some LFOs offer much higher frequencies. The depth parameter determines how much effect the LFO has; at low values, the pitch, cutoff, or volume vary less radically than at high depth values. (Some instruments also include EG depth parameters that determine how much the EG affects the component it's controlling.)

If your LFO has a large frequency range, increase the frequency into the audible range above 20 Hz and apply it to the oscillator. This is a crude form of FM synthesis that results in distinctly different timbres as you play different notes on the keyboard.

The LFO waveform determines the exact pattern of the modulation (see **Fig. 6**). These waveforms create many different effects. The *sine* and *triangle* normally simulate vibrato and tremolo. Apply a *square* or *sawtooth* waveform with a high depth value to the oscillator in a brass patch for European and American siren sounds, respectively. A mechanical, random sound is achieved using the *sample-and-hold* waveform to modulate the filter cutoff and/or oscillator frequency.

## MANUAL MODULATORS

Manual modulators are manipulated in real time to change the sound of a synth as you play. The most common manual modulator is the keyboard, which controls the frequency of the oscillator to produce different pitches as different keys are played. (Any source of MIDI note data plays an equivalent role.) However, there is much more potential for control under those keys. As an example, many instruments let you apply the key number to the filter cutoff with a parameter called *key follow*. As you play higher notes, the sound gets brighter.

The initial volume of each note is determined by the *velocity* with which the key is pressed on most synths; the faster the keystroke, the louder the sound. But velocity can control a variety of other parameters. Velocity can control the filter cutoff in many synths using a parameter called *velocity follow* (often referred to as modulating with velocity). This lets you brighten the sound as you play louder notes.

A parameter called *EG velocity sensitivity* is used to scale the EG levels according to the velocity of the keystroke; the greater the velocity, the higher the levels. As you increase the EG velocity sensitivity, this effect becomes more pronounced. (Again, different manufacturers use different terms for these functions.)

These three parameters—key follow, velocity follow, and EG velocity sensitivity—often are applied to the filter in brass, string, and woodwind patches. As you play higher and louder, the timbre changes radically, simulating the behavior of acoustic instruments. Try adjusting these parameters in a brass or string patch to balance their effect. Then, take them to their extreme values and play high and low notes with different velocities just to hear what happens.

Most modern keyboards are sensitive to *aftertouch*, or *pressure*. After the initial keystroke, extra pressure can be applied to the key with your finger. The amount of extra pressure is used to control many different parameters. For

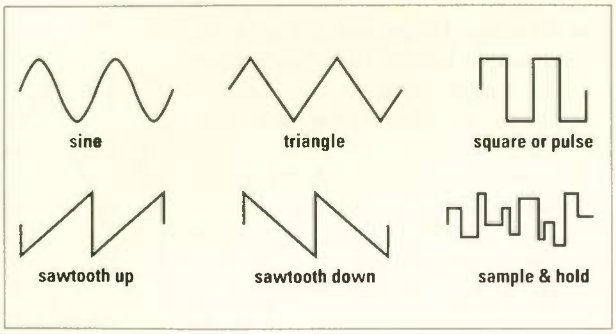



**FIG. 6: Common LFO waveforms include sine, triangle, square or pulse, and sawtooth up and down, as well as a random sample-and-hold signal.**

example, aftertouch changes the timbre of the sound if it's applied to the filter, or bends the pitch if it's applied to the oscillator. Aftertouch also can control the LFO. Greater pressure increases the level of the LFO signal, resulting in a more pronounced vibrato, tremolo, or other LFO-triggered effect.

On the far left of virtually all keyboards are two wheel controllers: the pitch bend wheel and modulation wheel. On some instruments, particularly those made by Roland and Korg, these wheels are replaced by a joystick or other device that moves in two directions independently.

The function of the pitch bend wheel should be obvious: It modulates the frequency of the oscillator up or down as the wheel is moved away from its spring-loaded center position. The maximum range (plus or minus) over which the pitch can be modulated is called the *pitch bend range*. This range usually is set from ±1 to 12 semitones, allowing the pitch to be "bent" as much as one octave up or down from the nominal pitch. On a lead-guitar patch, try setting the pitch bend range to one or two semitones, which is as far as many guitarists bend the pitch in most circumstances. A wider range is harder to control precisely, particularly in the heat of live performance.

▼

**Unlike acoustic sounds, electronic sounds can be modified to resemble nothing in the real world.**

The mod wheel is an all-purpose real-time controller. It can be applied to virtually any parameter on most synths. For example, the mod wheel often is used to control the filter cutoff. This lets you brighten or dull the sound by moving the mod wheel. Like aftertouch, the mod wheel can control the LFO as well. Moving the mod wheel away from the "zero" or "off" position increases the LFO's output level or speed. (With some synths, you can invert this function so that moving the mod wheel away from zero decreases the effect.) If you check out several patches on your synth, you'll find this is one of the most common applications for the mod wheel. Many newer instruments also offer sliders that can be assigned to control a wide variety of different sound parameters, including attack time (an EG adjustment), filter cutoff, and overall volume.

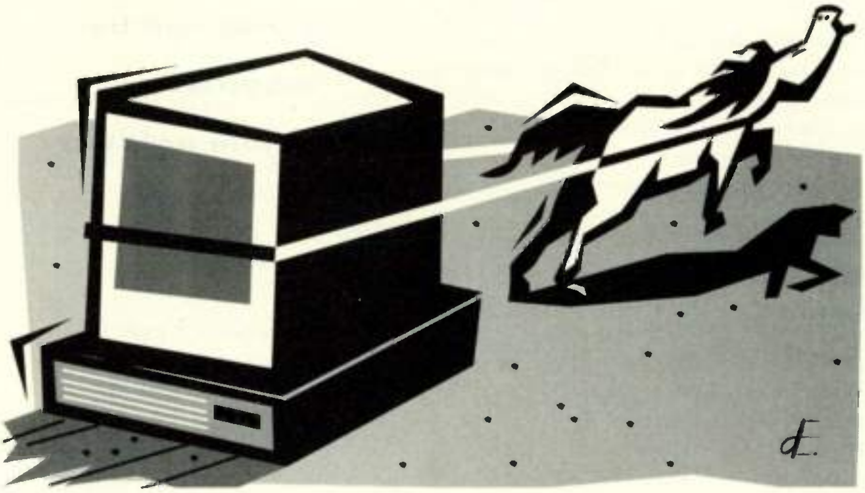
Two types of pedals are plugged into the back of most keyboard instruments: *expression* and *switch* pedals. Expression pedals, often called "modulation"

(continued on p. 115)

# Computer Music Workstations

By David (Rudy) Trubitt

*Music software developers harness the DSP horsepower offered by computer workstations.*



DAVE EMBER

Let's talk about the *other* workstations. Not the keyboard-synth-sequencer combo, but computer workstations: machines that fall somewhere between relatively inexpensive personal computers and high-performance mini and mainframe systems. The definitions are blurry, but I'll try.

I think calling a computer a workstation means it's not an IBM PC or compatible, Apple Macintosh, Atari ST, or Commodore Amiga. Now, before those manufacturers come after me with lit torches, let me qualify that. It's not that any of these machines couldn't be configured as a workstation. It's just that the basic, entry-level machines from workstation manufacturers generally are more extensively (and expensively) configured than baseline personal computers. Workstations have faster processors with more memory and disk space than entry-level personal computers. Also, most workstations run some variant of the multitasking UNIX operating system, support SCSI, and have Ethernet (a high-speed local area network) built in to their basic configuration.

So, to what sort of musical purpose might we turn the PC's larger cousins? This month, we'll take a look at the sonic possibilities of two machines: the Silicon Graphics Indigo and the NeXTstation. Once we cover the particulars of each machine, we'll spotlight two cutting-edge musical applications of this technology.

## SILICON GRAPHICS INDIGO

From a company with a name like Silicon Graphics, Inc. (SGI), you'd expect the computer to have strong visual capabilities, and you would be right. Many of the gee-whiz computer graphics we're used to seeing come from SGI machines. Last summer, the company introduced the IRIS Indigo, which lowered the price of these systems to the four-digit range.

The Indigo is a small box, just over one foot tall and nine inches wide. It's powered by a MIPS R3000 RISC microprocessor, rated at 30 million instructions per second. The system can hold from 8 to 96 MB of RAM and includes a Motorola DSP56001 chip.

On the audio front, the Indigo is equipped with stereo, analog and digital (AES/EBU) audio ins and outs. It supports stereo sampling rates from 8 to 48 kHz, with 16-bit resolution. There also is a mic input and a headphone output. While the Indigo has no built-in MIDI ports, it works with standard Macintosh MIDI interfaces. The base Indigo ships with a 420 MB, 3.5-inch hard drive and has room for two additional SCSI devices. A floppy-disk drive and DAT backup also are possible options. Interestingly, their DAT deck can operate in data or audio mode.

Silicon Graphics' commitment to digital audio is well-represented by musician/programmer Roger Powell of *Texture* and Utopia fame. "SGI views itself as a computer manufacturer, not a software developer," says Powell. "However, we've concentrated on developing the tools to get people started [a library of low-level software routines]. We are developing some simple programs, too.

"We have a third-party developer's program going," Powell continues. "I'm pleased to announce that we'll be working with WaveFrame. They are developing *TidalWave* and *TidalWave Pro,* which are 8-track hard-disk recording and editing applications for the Indigo. In addition, they are interested in using the Indigo as the front end for their existing system to provide much greater performance than they've had with PCs. Also, they may develop a package that will run stand-alone on the Indigo.

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We view them as a key professional-audio developer for our systems."

But what about MIDI? "Again, we've produced a library of basic MIDI calls," says Powell, "One of our key developers in this area is Blue Ribbon Sound-Works, who is well known in the Amiga world. It turned out to be a good fit for them, as the Amiga is multitasking and has a graphics and video orientation. The Indigo represents a powerful implementation of these features, and they're excited about porting their sequencing applications to SGI."

Who might need an SGI machine? Those involved in computer-generated visuals who also work with audio are the most likely candidates. After all, a fair chunk of the Indigo's cost—the base model lists for $9,500—is related to its high-speed graphics. While release dates have not been announced for WaveFrame and Blue Ribbon's products, once they are available, I'd encourage anyone who requires (and can afford) high-performance graphics to consider the Indigo for their MIDI and digital audio needs. While I haven't played with the Indigo, I've had years of good experiences with Silicon Graphics' earlier systems for graphics applications.

## THE NEXTSTATION

Introduced early last year, the NeXTstation uses a Motorola 68040, running at 25 or 33 MHz, holding anywhere from 8 to 128 MB of RAM using 16 MB SIMMs. A base-model machine costs $4,995. The NeXTstation has a slotless, pizza-box-style case, a departure from the 3-slot NeXTcube, which is still available. (Both models have the same computing power.)

One of NeXT's strengths is its user interface, called *NeXTSTEP. NeXTSTEP* includes a suite of objects and object-oriented development tools that greatly simplify programming chores. The underlying operating system that runs *NeXTSTEP* is a variant of UNIX called "Mach," which was developed at Carnegie-Mellon University as a multiprocessing OS for super-computers.

Like the Indigo, the NeXTstation uses Mac MIDI interfaces, although not all are compatible due to serial-port differences. All NeXT machines have CD-quality D/A converters and a microphone input. For sampling applications, you must connect an external analog-to-digital converter to the NeXT's built-in DSP chip. One such peripheral is Ariel's digital stereo microphone, which has its own built-in A/D converters and connects to the DSP port. According to NeXT's Rob Poor, "Our DSP input port is a very efficient way to get real-time data, such as digital audio or digital video, into the machine. These [A/D converter] interfaces can sell for under $500 because a lot of the work is done by the computer's internal DSP."

The DSP chip also can synthesize sounds with up to 9-voice polyphony, using FM synthesis, the Karpus-Strong plucked-string algorithm, waveshaping, and wavetable (sample) playback. A variety of music- and sound-related source code is provided with each machine. "We don't run *Vision* and *Performer*, but these kinds of programs are coming," Poor continues. "The real advantage of the NeXT is integrating MIDI and digital audio."

Lots of digital audio hardware is available for NeXT, and a lack of commercial music software hasn't stopped people from successfully using the machine. Let's look at two applications done with custom software.

## NEXT SOUND

Tom Hajdu and Andy Milburn use NeXT computers to create sound for music, advertising, and film projects. "We write all our own software because there's very little music software available for the NeXT," Milburn says. "We're using the machines as bizarre signal-processing engines. I like to write weird, Rube Goldberg-like software that mutilates sound in an out-of-control way. We dump hours of sound into the Cubes and subject them to random processing. Then, after a day or two of crunching, we cull through the aftermath and find pieces of sounds that are useful. The results are almost always used as components of bigger pieces, although once in a while an emission from the Cube stands on its own."

Regular MTV viewers have heard the duo's work. "There's a spot they've been running for years, called *Words*," says Milburn. "It's just white text on a black screen that comes up for 60 seconds and derides the viewer for sitting still and watching MTV. We've got this creepy, industrial choral track that hammers away behind it. That's mostly the result of extreme time-expansion algorithms that we love to play around with. I think it's human wailing that's been stretched by a factor of 50 or 100, so you get all kinds of gross artifacts."

Although most of the team's software is based on one sort of digital signal processing or another, surprisingly little of their code uses the Motorola DSP56001. "Almost everything I write is in Objective C, with the crunching done by the main CPU," explains Milburn. "I don't do much DSP code. We do use it for more menial tasks, such as rescaling a floating-point file into integers, or Fourier transforms. You end up using the DSP as an engine for brute-force, repetitive calculations and not the more racy, weird things." (SGI also requires developers to do their DSP algorithms on the main processor, as their 56001 is not directly programmable by users.)

## NEXT MUSIC

Musician/programmer Michael McNabb began his relationship with NeXT by working for the company. "When I came onboard as a consultant," says McNabb, "I had this concept for live-performance software that would be smart enough to anticipate like real musicians do while I improvised. When you're playing in a jazz band, every player is subconsciously analyzing the rhythmic and harmonic structure so they can anticipate what's happening. The computer usually lacks this ability."

McNabb sought to develop a program that would listen and respond to his performance. The program he developed, *Ensemble*, is included (with source code) with every NeXT machine. *Ensemble* "listens" to the player's MIDI performance, not to acoustic instruments. Any MIDI controller can be used; McNabb plays a soprano sax running through an IVL Pitchrider. The music he coaxes out of the system is a remarkable, often inseparable blend of saxophone and synthesis.

*Ensemble* is a document-oriented program. Each document is a particular configuration of MIDI input data, followed by MIDI processing, which in turn creates MIDI output data, NeXT DSP-based synthesis, and/or soundfile playback. Each input-to-output group is referred to as an "Instrument," and each *Ensemble* document can have up to four instruments. *Ensemble's* MIDI processing includes note-range limiting; controller, note, and chord mapping; MIDI delay; and data-thinning. A gate function can be triggered by any MIDI controller (such as a sustain pedal) to interrupt and restart the flow of notes into any *Ensemble* instrument.

*Ensemble*'s "ears" result from its use of fractal equations. The fractal melody-generator creates phrases from a preset or dynamically changing set of notes. The specific fractal equation that is used affects the contour of the melody, while sliders give you control over higher-level aspects such as the ratio of notes to rests and note duration. Notes in the set can be weighted arbitrarily by the user, or inferred from the input stream based on how often each note is repeated, how long it's held, or how loud it is.

"In performance," explains McNabb, "I use a dynamic mode, where the note set is built up from the notes that come in from the sax and Pitchrider. You can set how many notes it remembers and whether they're sorted by pitch or by the order they come in. If you sort them by pitch, you get harmony similar to what you're playing, but the melody will probably be different. If you preserve the note order, it plays things more like the melodies you played. It's fun to play against; it comes up with stuff I try to play off of."

The notes produced by each of *Ensemble*'s four instruments can be output as MIDI notes and controller data, or generated by the NeXT's internal DSP. One interesting DSP application is the creation of new harmonics based on the fundamental pitch of the current MIDI note. These added harmonics track Pitch Bend in real time, essentially becoming part of the sound of McNabb's sax. The result of this "additive" signal processing gives his horn a unique, bowed metallic edge.

*Ensemble* requires a lot of computing power. "When I was developing the software, I was using a 68030 version of the machine," says McNabb, "and it turned out to be too slow. It wasn't keeping up with the MIDI processing. Responsiveness is critical, and there's no substitute for horsepower." And computing horsepower is the key workstation advantage.

*After hearing a computer actually participate in a musical performance,* **David (Rudy) Trubitt** *vowed never to sequence again.*

# Breaking into Dance

*By Teri Danz*

*A new market unfolds when you teach your MIDI studio a few dance steps.*

GORDON STUDER

It's midnight. Spotlights throw shades of rainbow sherbet across a crowded club, and the music is louder than a jet engine. Everywhere people are charged up and dancing. And above the surging masses, in an isolated booth filled with turntables, mixing boards, and signal processors, a deejay holds court.

Welcome to the world of dance music, a kingdom of the night populated by dancers hungry for new beats and new sounds, and the deejays, musicians, and producers who keep the party pumping.

## THE MARKET

Dance music runs in a swift marketplace where trends can change every three to six months. The usual practice of cutting a demo tape to interest record companies in a project is all but worthless. By the time an executive decides to sign a dance project, it's old news. The dance scene is one of the last true "do-it-yourself" genres in which many successful records are recorded, pressed, and marketed by the artist or producer.

Self-promotion is crucial because only artists who are immersed in the scene can produce records fast enough to catch trends and burn up the clubs. (And because records happen so fast, make sure any contracts with producers and/or distributors are comprehensive and airtight. People often forget verbal agreements when big money rolls in.)

Also, the dance genre is the last pop market to significantly utilize vinyl. Although CD players manufactured for dance club use are available (see "Crushing Grooves" in the January 1992 EM), many deejays prefer 12-inch vinyl dance singles for the sonic manipulations (scratching, cross-fading, etc.) that comprise their artform.

## HIT ELEMENTS

So what makes a hit dance record? The answer is the same for all pop formats: a great song.

"Dance music is based on repetition and familiarity," says New York producer Floyd Fisher (Nocera's "Summertime, Summertime" and the *Juice* movie soundtrack). "You must pull people in immediately and hold their attention. The beat must be simple and relentless, and the hook must lock onto something that people can remember."

However, a dance hook often is structured differently than straight pop, R&B, or rock choruses. In "Everybody, Everybody" by Black Box, the chorus consists of one word repeated over and over. Such a monosyllabic structure is a definite no-no for pop music publishers, but the song's hypnotic call works wonders on the dance floor. The use of key phrases tailored to pump up a dance crowd ("ecstacy," "get down," "move your body," etc.) also helps a song's chance for success.

## STREET SMARTS

The key to making popular dance records is to remain street smart. Successful artists and producers often are fanatic dancers themselves. (Madonna is a classic example.) It's difficult to anticipate the next trend if you're not "in the trenches" experiencing the grooves and sounds that excite today's club crowds.

In addition, dance music has many forms, and it pays to know the language of each style. The current *house* phenomenon began in the 1970s as a staple of Chicago's underground scene. House characteristically has a bluesy feel, minimalist arrangements, and


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specific instrumental sounds (usually Roland TR-808 and TR-909 drum machines and the Korg M1 keyboard). Its derivations include *deep house* (an integration of Chicago house and New York R&B), *acid house* (a hybrid of hi-NRG and conventional dance music), and *hip house* (a mixture of house, hip hop, and rap).

The latest trend (at press time) is *techno*, the soundtrack for London's Rave Scene of roving all-night dance parties. Techno is fast (126 to 130 beats per minute), heavily sequenced music, that relies on artistically manipulated samples and sound effects.

## HOT TRACKS

You don't have to be a musician to make a dance record. In fact, most dance records are cut by deejays or producers without traditional musical backgrounds. Familiarity with the scene and a sequencer often are the only prerequisites. Anyone who can decipher a drum machine and build cool sounds atop a killer groove is a candidate for dance stardom and "Club MTV" tours.

## THE SECRET OF MY SUCCESS

The basic tracks for my song "Didn't Mean to Fall in Love" were sequenced on an Atari computer with Passport's *Master Tracks Pro* in a home studio. Producer Eric Tiger transferred the finished arrangement to tape in a professional 24-track studio and added live sax, guitar, and vocals. To keep options open, a dance-pop style was chosen for the final mix.

At a song screening session of the Northern California Songwriters Association, a music publisher expressed interest, but suggested a house version. Eric and I hired noted deejay EFX (Nastymix Records) for this important remix. Our 24-track master tape was synched to a Macintosh with *Performer* and pared down to vocals and keyboards. EFX sequenced a new house-style bass line and drum groove. For "sweetening," additional vocals, piano riffs, and sampled sounds were recorded. EFX then mixed extended, radio, instrumental, and club versions of the song.

At EFX's urging, we pressed 120 vinyl records for distribution at the New Music Seminar in New York (a yearly industry showcase for artists and record companies). The response was overwhelming. "Didn't Mean to Fall in Love" hit the turntables at chic Manhattan clubs and record-company parties. Several record pools requested copies for their member deejays. And as the exposure increased, I was sought for radio interviews, club performances, and meetings with prominent deejays. Offers from small dance labels flooded in, and the song is still charting airplay. We presently are recording the follow-up record.

Due to this sequencer-intensive production process, some dance records are produced solely from (tapeless) virtual tracks. This means that all sounds are fired from a MIDI sequencer and sound modules. Even if vocals exist, often these are the only tracks committed to tape. Dance production is a boon to the home recordist, because entire projects can be conceptualized, arranged, rehearsed, recorded, and mastered in the privacy of a bedroom MIDI studio (see sidebar "The Pro Dance Studio").

## REMIXING

The remixing craze started as a device to keep people on the dance floor. Club deejays invented sonic segues by dropping samples and/or taped effects (or dialog) between records. Some deejays used drum machines to program grooves between tunes or extend a song's rhythmic breakdown section. It was only a matter of time before these manipulations were mixed into

### THE PRO DANCE STUDIO

Most dance music productions are sequencer-based, so (in theory) a well-planned home studio is capable of recording as many hits as a commercial facility. It's astounding how many great records are born in someone's bedroom or living room. The following list details the basic equipment needed to produce professional masters.

1. Computer with MIDI interface. (The Macintosh is a dance-industry standard.)
2. Software sequencer.
3. Two or more multitimbral keyboards.
4. Drum machine.
5. Sampler.
6. Multitrack recorder (for vocals and live instruments).
7. At least one professional-quality microphone.
8. Mixing board (with as many channels as you can afford).
9. Two or more signal processors.
10. DAT machine (for final mixes).

commercial dance records. The art-form came full circle, as club deejays who built reputations with their live mixing chops were hired to energize studio mixdown sessions.

Today, remixing is the staple of the dance market. Many artists produce several mixes of a single song to hit different markets. Remixing also keeps a record fresh. Popular dance act C&C Music Factory remixes its tunes every couple of months. Alternative folk artist Suzanne Vega even captured an entirely new audience with a remix. Vega's a capella song "Tom's Diner" was used illegally by some inspired remix producers for a slamming dance version. A lawsuit was imminent until the dance record became a smash club hit. Vega convinced her record company to sign the producers instead of sue them.

The Vega debacle shows how fresh ears, imagination, and blind courage fuels the remix market. Remixes can be relatively faithful to the original version, or veer into uncharted territory. Often, vocals are the only element of the original song used to construct a remix. New grooves, new parts, and new sounds are added to perform the sonic makeover.

## BREAKING THE RECORD

Once you finish a record, you have two options: Shop the master to established record companies, or release it on your own label. Many record companies sign "single" deals with dance artists. Because the artist has already completed the master recording, these contracts involve minimal development money and are therefore easier to attain than pop deals comprising multiple albums and large budgets.

However, if the labels don't want you, embarrass them. Create your own label and chart a smash all by yourself. A great reference is *Releasing an Independent Record* by Gary Hustwit (available through Mix Bookshelf; tel. [800]233-9604, or [510]653-3307). The book lists distributors, pressing plants, and labels. Record pools are another resource. These dance trade services distribute promotional records to deejays and publish their own playlists. Many record pools actively support new artists.

"Try breaking the record at the street and club level before approaching commercial radio stations," advises record-pool director Bobby G (of Soul Disco in San Francisco). "It's tough competing with Paris and Hammer in the big leagues. Gear your marketing towards secondary radio and club deejays and build from there. Then try selling your records on consignment in the big record store chains."

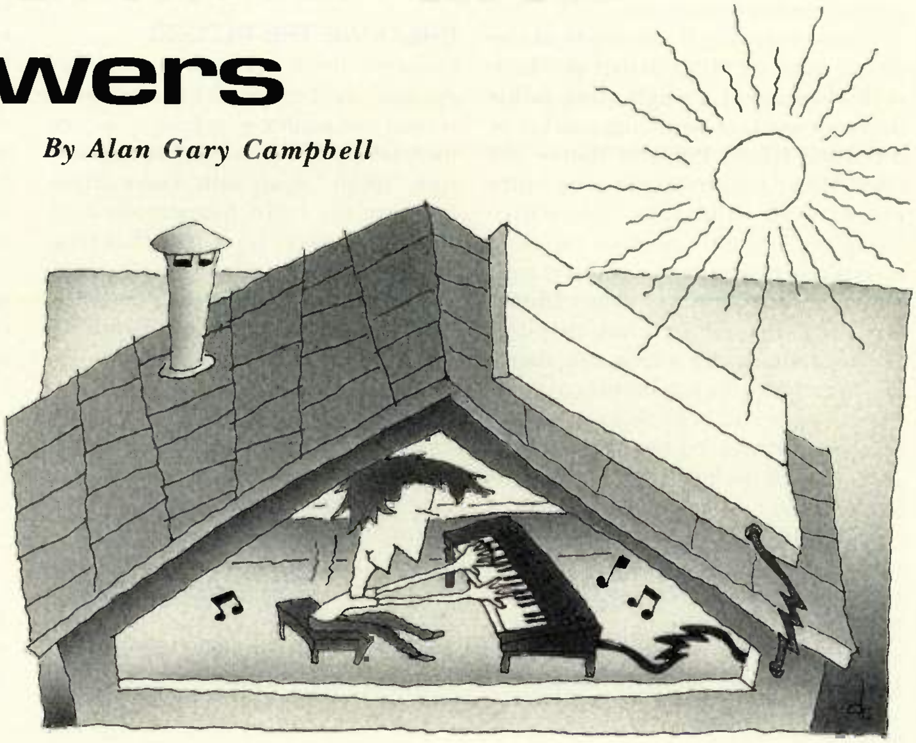
The point is to let people know you're out there. It's not an easy task conquering the dance charts, but perseverance and commitment *can* make it happen. Hammer started by selling records from the trunk of his car. One big hit made him a real estate baron, production company mogul, and star of fast-food commercials. Who says it can't happen to you?

*Soon to be a ten-year overnight success,* **Teri Danz** *is a San Francisco-based singer/songwriter whose artistic star is just beginning to shine.*

# Questions and Answers

*By Alan Gary Campbell*

*Our techno-titan discusses what to wear to the PROM, explains how batteries hurt the environment, and throws some light on solar cells.*



JACK DESROCHER

**Q. I have a lot of effects and two portable keyboards that use batteries. I hear batteries are bad for the environment. Why?**

**A.** Discarded batteries are one of the principal sources of environmental mercury contamination. Recent legislation requires that battery manufacturers provide battery collection centers to prevent this. (To be fair, the mercury content of batteries has been reduced over the years.) The best solution is not to use batteries where other power sources are available.

**Q. I'm sick of spending money on batteries for my equipment. Calculators run on solar cells, why not keyboards and effects?**

**A.** Solar cells can be used to power just about anything. Electronic musical instruments and many effects devices are comparatively power-hungry, however. Moreover, the types of cells available to the experimenter at reasonable prices often are not efficient enough to work properly in low light. Thus, depending upon the characteristics of the cells you are able to obtain, a do-it-yourself solar panel might function indoors in well-illuminated spaces, or it might not. Outdoors on cloudy days, or in a dimly lit club, forget it. (You can use the solar cells to charge battery banks, but at that point you're no longer experimenting with electronics, you're running your own power company.)

Further, individual cells do not have much output voltage, so a series arrangement of numerous cells usually is required, and a large solar panel tends to clash with normal living room decor. Still, any potential aid to the environment is worth a look.

The nominal output voltage of a silicon solar cell is about 0.55 volts under no-load conditions. But all solar cells have some internal resistance (due to impurities in the material), which can reduce the output voltage delivered to a load. The output current can range from milliamperes to amperes, varying with the size and quality of the cell, the intensity and wavelength of light impinging upon it, and the ambient temperature.

For experimentation, solar cells purchased from surplus-electronics dealers, such as those that advertise in *Radio Electronics, et al.*, are fine, but it is best to use cells of the same type on a panel. Broken, chipped, or cracked cells should not be used, even if they appear to have normal output. Cells with minor blemishes probably are okay.

To test the output of a solar cell, place a standard 100-watt incandescent light bulb two inches (50 mm) from the center of the cell, and measure the terminal voltage with a digital multimeter (DMM). Good cells will measure 0.45 to 0.55 volts. Cells of like make and type should have similar output voltages (±10%). Make the measurement quickly; as the cell is warmed by the bulb, the output voltage will drop, causing an erroneous reading. (The light bulb test is intended as a benchmark to identify defective cells; most cells will yield a slightly higher terminal voltage in bright sunlight.)

If the cell checks out, test real-world performance by loading the cell with a low-value, resistor-substitution box (or with discrete resistors) until the load current, as measured with a DMM, equals the cell rating. Then measure the load voltage. Ideally, it should be within 10 to 20% of the terminal voltage. in practice, any cell that delivers sufficient voltage and current for a

specific application can be considered usable. Many surplus cells are "out of spec," but if a 2-amp cell only delivers an amp, that's still a lot of current.

Generally, to construct a modest-size panel, you would select a cell type rated to provide sufficient current (leaving some headroom) and wire a number of cells in series to provide the required voltage. For example, to construct a solar panel to power a Casio CZ-101 synth, which requires 9 VDC at 850 mA, you probably should start with a cell rated at 1.0 to 1.5 amps and test it to measure the terminal voltage at 850 mA. You then can use the following formula (derived from about a dozen rules of thumb) to determine the required number of cells:

number of cells $= 1.1 \times (V_{req'd} + 0.6)/V_{terminal,\ loaded}$

In other words, the number of cells required is equal to the voltage required plus 0.6, times 1.1, divided by the measured cell terminal-voltage at the rated load.

Cells can be connected via lengths of hook-up wire (18 gauge is adequate for currents of one to two amps) and mounted on a lightweight piece of foamcore (available from art-supply stores) with small dabs of silicon sealer. Note that solar cells are heat-sensitive; use a heat sink and work carefully and quickly when soldering the connecting leads. Solder the connections *before* mounting the cells to the foamcore.

**Important:** The output of the panel must be wired in series with a diode to protect the panel from external current sources. Use a 1N4001 (Radio Shack 276-1101) for output currents up to 1 amp, or a 1N5400 (Radio Shack 276-1141) for currents up to 3 amps. The panel output connects to the equipment's DC input jack.

You can support the panel with a cardboard easel, or the like. For maximum output, the plane of the incident light should be (mostly) perpendicular to the surface of the cells.

**Q. Is it possible to make backup copies of the ROMs for my older keyboards? I have a Sequential Circuits Prophet-5 and several other dinosaurs.**

**A.** Yes, you can make copies. For those unfamiliar with the term, ROM is an acronym for Read-Only Memory. When manufacturers want to make a lot of these memory chips, they use a process called *masking*, and the resulting parts are called *masked ROMs*, or just *ROMs*. If, instead, they want to make just a few, they would use Programmable Read-Only Memories, or *PROMs*. If a manufacturer wants to make just a few chips and be able to reprogram them later (for upgrades, etc.), they would use Erasable Programmable Read-Only Memories, or *EPROMs* (pronounced "ee-prahms"). This latter type has a little lens in the middle of the top so the program can be erased by exposure to a special ultraviolet light. (Putting them atop a keg at the beach works, too.)

You can copy ROMs, PROMs, or EPROMs by reading the contents of each into the memory of an EPROM burner, then "burning" (programming) a PROM or an EPROM. This is the principle behind Drum-PROM programmers and the like, though a PROM-burning system that hooks up to a personal computer is more reliable, more versatile in terms of the types and sizes of ROMs it can read and write, and it allows the ROM contents to be stored to disk for backup.

For devices of the same type, an EPROM or a PROM can be used to replace an EPROM, PROM, or ROM; however, it is critical that the substitute part is electrically equivalent to the original, with the same or faster access time. This may seem obvious, but certainty regarding the type of the original ROM can be elusive, especially when manufacturers deliberately obliterate the markings on ROMs to make it difficult to access them without damage in an effort to protect the copyrighted programs contained within.

Moreover, copying a ROM containing copyrighted software is of questionable legality, even if you own the original ROM and intend the copy merely for backup. Clearly, this is a matter that must be evaluated by the individual. Fortunately, ROMs and other parts for the Prophet-5 are still available from Wine Country Productions, 1572 Park Crest Ct., Suite 505, San Jose, CA 95118; tel. (408) 265-2008.

**EM** *contributing editor* **Alan Gary Campbell** *is review editor of* H&B Classical *magazine and owner of Musitech, a consulting firm specializing in electronic music product design, service, and modification.*

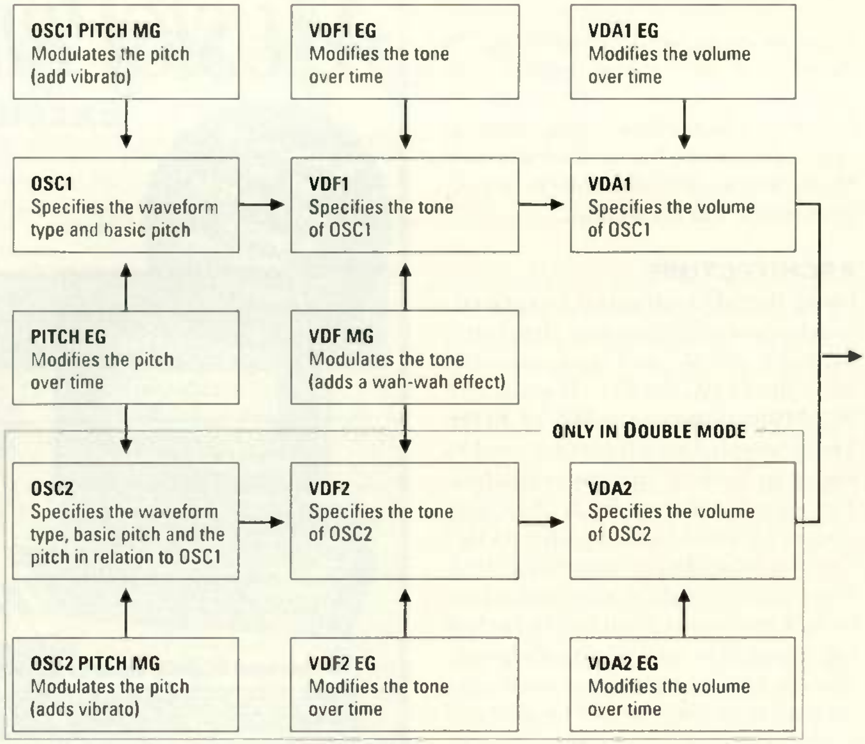



**FIG. 1: The 03R/W provides single or dual oscillator/filter/amplifier signal paths.**

of the four ROM-based drum kits is set up for General MIDI. The internal memory also holds 100 user-programmable Combinations, and 200 more can be stored in a RAM card. Two drum kits can be saved in the internal memory, while there is room for four kits in a RAM card.

In Combination mode, you can play eight Programs simultaneously. Each Program in a Combination is assigned its own key and velocity range. This allows you to layer, split, and velocity-switch Programs in a wide variety of ways. In addition, each Program is assigned its own MIDI channel for multitimbral sequencing.

## EFFECTS

The arsenal of 47 effects—the same as in the 01/W—includes nine reverbs, three early reflections, two stereo delays, dual mono delay, three multi-tap delays, six choruses, three flangers, exciter, enhancer, distortion, overdrive, two phase shifters, tremolo, parametric EQ, and a rotary speaker effect.

Overall, the effects sound quite good. The reverbs are clean and rich, and the exciter really punches up the sound. However, the pre-programmed reverb times are too long. A rich synth pad should have a full chorus and reverb, but why must the strings and woodwinds be drenched in two seconds or more of reverb at a high level? I know this is a matter of taste, and you can tweak the preset effects settings, but sometimes I'd rather add than subtract.

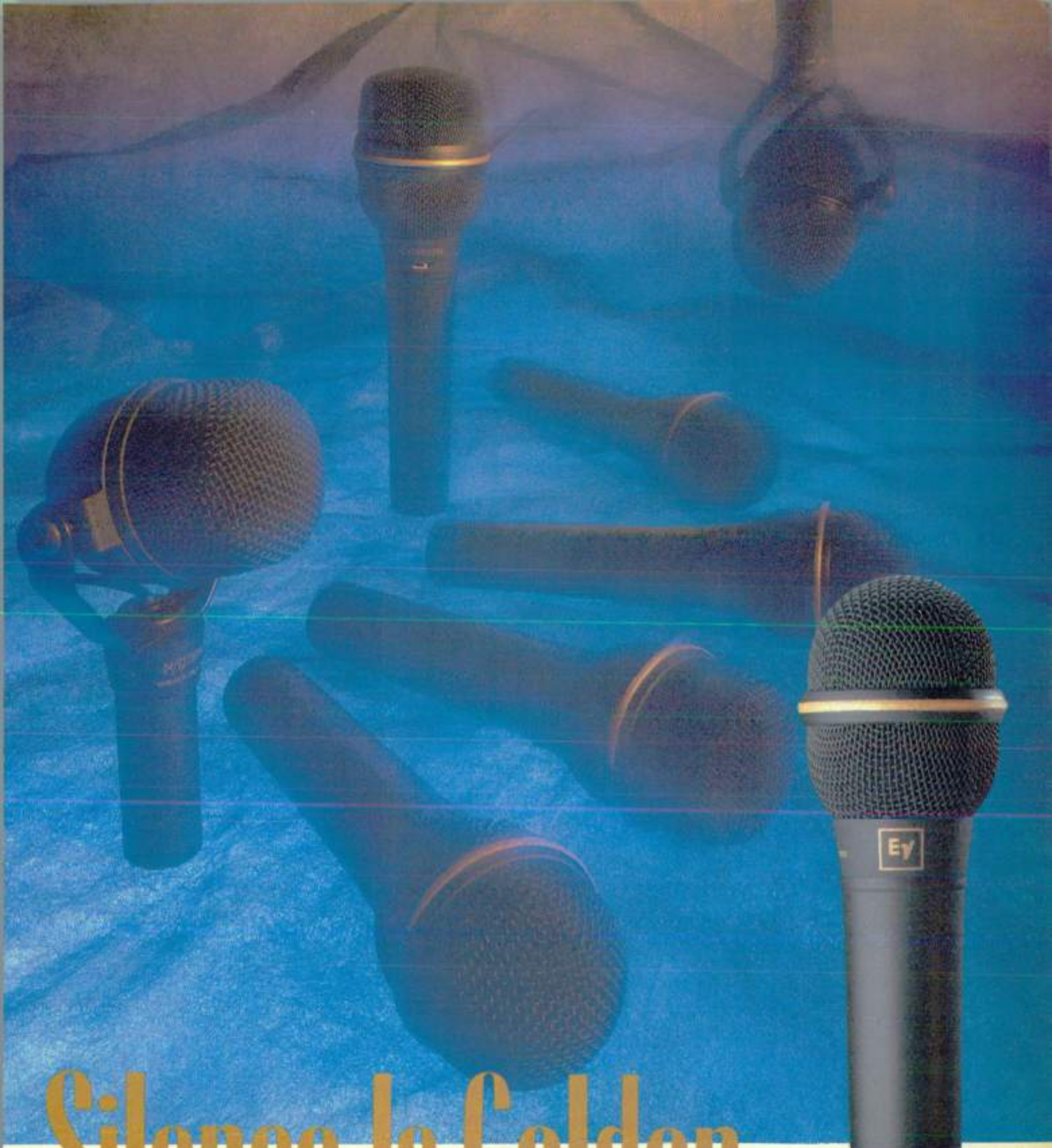
## HOW DOES IT SOUND?

It sounds great! I found the 03R/W quiet, noise-wise. The acoustic piano is smooth, and there's a nice variety of electric pianos to choose from. The

### Product Summary

**PRODUCT:**
03R/W Synthesizer Module
**PRICE:**
$1,300
**MANUFACTURER:**
Korg USA
89 Frost St.
Westbury, NY 11590
tel. (516) 333-9100

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



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# add a little

# ZOOM

385 Oyster Point Boulevard, Suite 7, South San Francisco, California 94080

rosewood acoustic guitar is realistic, and several of the string patches are gorgeous. Woodwinds, basses, and synth sounds are fine overall, with a nice selection in each category. I found it easy to create little pieces using the preset Programs, and many of the sounds inspired me toward new ideas.

On the negative side, the brass samples are disappointing. The muted brass sounds are nice, but the regular trumpet and trombone sounds don't make it. It's not just this instrument, either. It seems that all synths with brass samples fall short. Maybe it's a sound that's too complex to re-create. On the other hand, the synth brass sounds are great, so I generally ended up using them for a brass section.

The GM sounds are nothing special, but they fit the bill for basic instrument emulation. The Combinations, on the other hand, are quite spectacular, with their rich pads and some clever programming.

## CONCLUSIONS

The manual is pretty confusing; the Quick Guide is a lot more informative and easier to digest. The section on sound synthesis provides an excellent source of information for a beginning synthesist. But despite all the diagrams and descriptions, the manual lacked a linear flow. The amount of space devoted to the effects section (33 pages) seemed disproportionate compared to the section on editing Combinations (eight pages). In addition, I recommend that the manual spend more time on auditioning and setting up the drum kits. More information on how General MIDI works wouldn't hurt, either.

Overall, this is a great unit, especially for the price. If you only want to play presets, you could probably live without the RE-1 remote editor. But if you have a hankering for tweaking reverbs, creating sounds, or just changing Programs in Multi mode, I'd heartily recommend getting the RE-1. Buying the remote editor will increase the overall price on the unit, but where else can you get a single-rackspace box to play sounds as divergent as "Polka Box" and "I Miss Jimi"?

**Frank Macchia** *is currently seeking a major record deal for his alter-ego, Frankie Maximum. No reasonable offer will be refused!*

# SynchroVoice MidiVox

*By Scott Wilkinson*

**Singers join the MIDI band with this unique voice-to-MIDI converter.**

MIDI originally was designed to represent and transmit musical performance gestures on keyboard instruments. Since then, however, it has been pressed into service by drum, guitar, wind, violin, and other controllers, with more-or-less adequate results.

Singers who wish to control MIDI instruments with their voice must use a pitch-to-MIDI converter, which typically accepts an input signal from a microphone and translates it into MIDI Note On, Pitch Bend, and Volume messages. Unfortunately, these devices are fraught with some serious problems, including pitch recognition within a complex vocal timbre, ambient noise, and audible delays.

SynchroVoice has developed a unique and intriguing solution to these problems. With their extensive experience in biomedical speech-analysis instrumentation, SynchroVoice designed the MidiVox, which tracks vocal chord movement to generate MIDI note data rather than converting audio signals to MIDI.

## BASIC SETUP

The MidiVox consists of two major components: a neck band called the "biosensor" and a 1U rack-mount interface unit. The neck band is a strip of thermally reticulated polyurethane, which is a soft, spongy foam material. According to the company, this material doesn't become hard or brittle with age. It also is completely hypoallergenic and absorbs perspiration quite effectively.

Attached to the neck band's inner surface are four rectangular, gold-plated sensor pads that are connected together by a ribbon cable running along the outer surface of the band. One of the two center pads sports another ribbon cable ending in a special connector that attaches to the

# ADVERTISER INDEX



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rack-mount interface unit.

The performer wraps the biosensor around his or her neck so that the two center pads are positioned on either side of the Adam's apple. The band is then tied behind the neck. The polyurethane doesn't slip against itself and relaxes to a comfortable tension that rarely needs adjusting once it's properly in place. However, it can be a bit tricky at first to find the correct vertical placement on the throat.

The interface unit includes two MIDI Outs that send the same messages. On the front panel are several controls and LED indicators that I'll describe as we go along. The MidiVox can send only on MIDI channels 1 through 10. Not only that, the channel-selector knob is labeled only with the numbers 1 and 6, leaving you to estimate where to set it for the other channels. SynchroVoice assured me that future units will address all sixteen channels, and the channel selector will be labeled with all sixteen numbers.

System setup is straightforward. Simply connect one of the MIDI Outs from the MidiVox to the MIDI In of a sound source, set the transmit channel on the MidiVox to correspond with the receive channel on the synth, and set the Pitch Bend range on the synth to twelve semitones.

Two buttons on the front panel let you test the connections and settings before you use the MidiVox. Pressing the upper button sends the synth a Note On at A4 (A-440), which is sustained as long as you hold the button. As this note sounds, you adjust the controller's maximum MIDI Volume with a large knob. The level is indicated by a 9-segment, LED bar-graph meter. When you release the button, the MidiVox sends Pitch Bend messages that bend the pitch upward by one octave. The higher A then is re-attacked and quickly released. The other test button performs the same routine one octave lower.

## OPERATION

The MidiVox senses the frequency and volume of your singing with the biosensor pads and then translates this information into Note On, Pitch Bend, and MIDI Volume messages. (For a more detailed explanation of this process, see the sidebar "How Does It Work?") Unlike conventional pitch-to-MIDI converters, the MidiVox is entirely non-acoustic in its operation, which eliminates many pitfalls associated with previous designs.

Two vocal-range settings allow singers

### Product Summary

**PRODUCT:**
MidiVox
**PRICE:**
$1,595
**MANUFACTURER:**
SynchroVoice, Inc.
400 Harrison Ave.
Harrison, NJ 07029
tel. (800) 433-6434
or (201) 485-6869

| EM METERS | RATING PRODUCTS FROM 1 TO 5 |
|---|---|
| FEATURES | ● ● ◖ |
| EASE OF USE | ● ● ◖ |
| TRACKING | ● ● ● ● ◖ |
| VALUE | ● ● ● ◖ |

with high or low vocal ranges to use the MidiVox. The low setting is designed to accommodate the range from C2 (65.4 Hz) to A4 (440 Hz), or higher if you can belt up there, while the high setting is for the range from A3 (220 Hz) to C6 (1,046.5 Hz). On the MIDI side, notes from B1 (note number 35) to C#6 (note number 85) are sent to the synth.

The MidiVox has two volume-tracking modes: Variable and Fixed. The Variable setting sends MIDI Volume messages roughly every 25 ms, depending on the level of your singing, which is indicated on the LED bar-graph display. The Fixed setting maintains a MIDI Volume of 64, which might be useful for weak voices. In both cases, a message that resets the MIDI Volume to 64 is sent after about one second of vocal inactivity.

In my considerable experience with MIDI wind controllers, I've elected to fix and reset the values of Volume and Velocity to 127 rather than 64. This allows other parameters to have the greatest possible effect and better prepares the instrument for whatever comes next. I would like to see SynchroVoice make this change in the MidiVox, so that MIDI Volume values are fixed and reset to 127.

The MidiVox also features two pitch-tracking modes: Continuous and Chromatic. Remarkably, in both cases the MidiVox sends a Note On message after the *very first* cycle of the vocal folds (see **Fig. A** in the sidebar). The MIDI note number in this message corresponds to the note closest to the frequency of that first cycle.

Chromatic tracking is difficult to control, and the company admits it is of little use. Continuous tracking sends Pitch Bend messages roughly every 25 ms after the initial Note On. These messages are interleaved with the Volume messages in Variable mode, which will fill a sequencer's memory quite rapidly and might cause problems with MIDI mergers. The Velocity value of each Note On is fixed at 64. Again, this value should be 127, particularly when using MIDI Volume in Variable mode.

As you sing a glissando up or down one octave from the initial pitch, the MidiVox sends Pitch Bend values from 8,192 ($00 $40 in hex) up to 16,383 ($7F $7F) or down to 0 ($00 $00). Unfortunately, this can't be changed. If the pitch bend range on the synth is set to something other than twelve

## HOW DOES IT WORK?

To understand the MidiVox, it helps to know a little vocal anatomy. What we normally call "vocal chords" are, more precisely, two folds of semi-elastic muscular tissue. By drawing together or separating, they act as a valve in the air way. When their position and tension are met by an ideal air pressure, they can be set into vibratory motion, which results in sound.

The vocal folds are housed within a stiff, protective structure called the thyroid cartilage. The front angle of this cartilage is the Adam's apple. On either side of this angle are flat walls that can be felt with the thumb and forefinger. By humming a note and moving your fingers up and down along the sides of this angle, you can feel the approximate location where the vocal folds attach inside. The area between the two vocal folds is the glottis, and the air pressure that builds beneath the glottis when it's closed is called subglottal pressure.

The inner pads of the MidiVox biosensor are placed on the skin covering the walls of the thyroid cartilage, while the outer pads lie naturally on the sides of the neck. The outer pad on the user's right side is electrically inactive and does nothing but mechanically stabilize the position of the other three pads on the neck.

The inner pads and the left outer pad perform two electrical functions. First, they send an extremely weak radio frequency (RF) signal at 5 MHz through the throat. The amount of electrical resistance encountered by the signal between the inner pads and between the pads on the left side of the neck is then measured and sent to the interface unit, which compares these two levels of resistance.

The resistance between the left pads is constant, while the resistance between the inner pads changes depending on whether the vocal folds are open or closed. The frequency at which the vocal folds are vibrating is determined by measuring the duration of each cycle of changing resistance.

Vocal volume is measured by an accelerometer mounted on the inner pad to the right of the thyroid cartilage. This tiny device measures the rate at which the wall of the throat expands as the subglottal pressure builds up during the closed portion of the glottal cycle. The louder the sound, the faster the throat expands.

These techniques allow the MidiVox to detect a singer's initial pitch by measuring the duration of the first vocal cycle (see **Fig. A**). The reciprocal of this measurement equals the frequency, which is converted into the nearest MIDI Note On and an appropriate Pitch Bend value. The signal from the accelerometer is converted into MIDI Volume values, and changes in pitch generate additional Pitch Bend messages. All of this is accomplished without acoustic contamination from speakers or elsewhere in the surrounding environment.

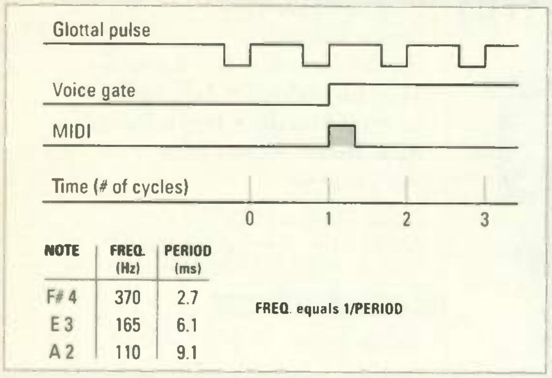



**FIG. A: The MidiVox measures the duration of the first glottal pulse, which is called the period, and calculates the frequency from this value. A MIDI Note On message is sent immediately after this pulse.**

semitones, its pitch bends at a different rate than the voice, which can be quite disconcerting.

I would like the ability to adjust the MidiVox's pitch bend range so that gliding through a user-specified interval with the voice would sweep through all Pitch Bend values. This feature would accommodate older synths that lack a full octave pitch-bend range and newer instruments with a wider range (e.g., the Kurzweil K2000, which has a pitch bend range of six octaves). It also would allow some unusual effects, such as bending the pitch of a synth by an octave while singing a semitone. Vibrato would never be the same.

## IN USE

In my experiments with the MidiVox, I used a Yamaha TG77 as the sound source and connected the second MIDI Out to a Macintosh running Kurzweil's *MIDIScope* program to see what was happening MIDI-wise. As a trained musician with a baritone vocal range but no formal vocal training, I felt qualified to test the unit representing non-vocal musicians. In addition, I enlisted the help of a highly trained female singer (mezzo soprano) and vocal coach with extensive knowledge of vocal anatomy.

The normal operating mode is Continuous pitch-tracking/Variable volume-tracking, with the synth's pitch bend range set to twelve semitones. In this mode, the synth followed the voice quite well, although some patches contributed to an audible delay. The singer noticed a slight delay with most patches, particularly in the pitch bending. She found herself slowing down to wait for the pitch bend to catch up. However, I found the tracking in this mode to be better than any other pitch-to-MIDI converter I've tried.

The company maintains that perceived delays in pitch bending can affect a singer who is unfamiliar with the MidiVox and responds to the delays. This phenomenon is common in vocal choirs when individual singers listen for and respond to other voices around them, which can result in delays as long as 50 ms. The company claims that this effect disappears after about two hours, as a user forgets about the MidiVox and simply sings.

In the normal operating mode, scatting worked surprisingly well. Slight pitch-bend inflections and accents were translated accurately. However, all vowel contrasts and tonal nuances were ignored due to the non-acoustic nature of the instrument and the fact that MIDI doesn't represent timbre.

The best synth patches have relatively quick, unemphasized attacks that sustain fully, such as brass, synth, wind, and some string sounds. However, a few of these patches exhibited a weird warbling effect when the pitch bend range was set to 12. This effect disappeared when the pitch bend range was reduced to 0.

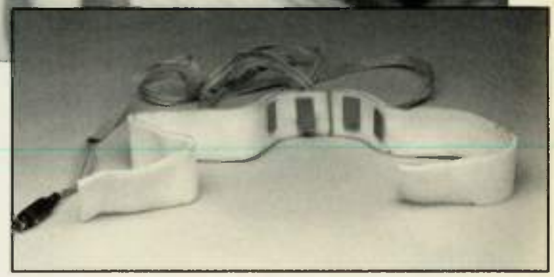
If you don't want to bend the pitch, set the Pitch Bend range on the synth to 0, rather than using Chromatic pitch-tracking. The manual recommends this procedure for sequencing bass parts, but be sure to filter out the unused Pitch Bend messages from the MidiVox. It also is useful with non-bending sounds such as piano.

Unfortunately, these settings often resulted in many wrong notes, no matter how accurately we thought we were singing. This problem stems from the fact that the MidiVox derives each MIDI note number from the first vocal cycle, which often is not precisely at the intended frequency.

Trained singers use two techniques for singing a particular pitch. First, they set up their vocal mechanism by "hearing" the desired pitch in their head before actually singing. This process is remarkably accurate and allows the MidiVox to work as well as it does. Even so, the initial pitch of the note often is not precisely right. The singer must then correct the pitch after hearing the beginning of the note, which takes at least several cycles to perceive. However, if the Pitch Bend range is set to 0, the singer has no opportunity to correct the initial pitch as it's played by the synth.

In a sense, the MidiVox is too accurate; its tracking is too fast. To address this problem, I would like to see a tracking control that adjusts the number of vocal cycles before a Note On is generated. Of course, a tracking control would increase the delay, but it also would allow singers to self-correct their pitch before a Note On is generated. Such a control only would be useful when the pitch bend in the synth is turned off.

We were able to improve the accuracy of our results by singing along with a recorded or sequenced track. Singing

**SynchroVoice's MidiVox tracks vocal chord movement, using biosensor pads mounted on a neckband (right). A rack-mount box (above) translates the results into MIDI data.**

*a cappella* led to significantly more errors and wrong notes as long as the synth's pitch bend was turned off. Setting the pitch bend range to 12 eliminated these problems.

Notes within certain ranges were triggered reliably, depending on the range setting and the singer's vocal range. Outside these ranges, notes triggered sporadically, sometimes shifted by an octave, or didn't trigger at all. This makes sense, since notes at the extreme ends of the vocal range are more difficult to control. Also, my falsetto register was relatively unreliable; someone with better control of their upper range would probably get better results.

In the low range setting (C2 to A4), we both reached the bottom of our vocal ranges with good results. However, triggering became unreliable for me above B3, even though my upper limit is around E4. The female singer achieved good results up to F#4. In the high range setting (A3 to C6), the lower limit of reliability was A3, as expected. I was able to hit the top of my vocal range with no trouble, although her results became unstable at around B4, well below the top of her vocal range and the range setting on the MidiVox.

Variable volume-tracking worked well, although we weren't able to produce a full range of MIDI Volume values. With the dynamic control at the "three o'clock" setting recommended by the manual, and singing from the softest to the loudest possible dynamic at a pitch of A2, I was able to generate Volume values from 12 to 91. At A3, the values went from 45 to 127. This indicates that higher notes are naturally louder, which voice scientists acknowledge. The female singer's ranges were even smaller, which implies that this is an individual phenomenon.

## WISH LIST

Aside from the improvements already mentioned, I would like to see future units include a few additional features. Most important, I want a wireless version. The cable that connects the biosensor to the interface unit is pretty short; even a longer cable would be limiting on stage. I'm told the company is working on this.

I also would appreciate the ability to select MIDI Volume, Aftertouch, or Breath Controller messages in response to changing vocal volume. I use this feature on the Akai EWI wind controller all the time, depending on which sound module I'm controlling. A modern synth is more likely to let you apply Aftertouch to level and other parameters than let you apply MIDI Volume to parameters such as filter cutoff. This can be accomplished with an external MIDI processor such as the Yamaha MEP4, but it would increase the flexibility of the MidiVox to offer it internally.

The manual (twenty unbound pages, stapled in the upper left corner) is completely inadequate. The essential information is there, but it is written largely in scientific lingo, with no detailed or comprehensive explanations. The diagrams are crude hand drawings, and the photograph illustrating the position of the biosensor on the neck is a color snapshot *glued* on the page. Fortunately, the company's new marketing arm reportedly is writing a new manual, which is essential to the ultimate success of the product.

### CONCLUSIONS

On the whole, the MidiVox is an excellent tool for trained singers who wish to control MIDI instruments with their voice. However, like any new instrument (or an electronic version of a familiar one), new techniques must be learned. In particular, initial pitch accuracy is extremely critical if pitch bend is not used. Vocal power and tone are unnecessary, but a high degree of control is crucial. I strongly disagree with the manual's statement that "very little practice will be required."

Singers produce a truly joyous noise. With one of the most expressive instruments at their disposal, these musicians bring us to the heights of ecstasy using no external devices whatsoever. But those who wish to extend their palette of possibilities would be well-advised to check out the MidiVox. With a few refinements, it will certainly become the tool of choice for singers who want to join the MIDI band.

(Special thanks to Joanna Cazden.)

## GHS Music Corp. Sybil 3.0

*By Warren Sirota*

**Enhance your performance options with this unusual PC and Mac program.**

In the me-too world of MIDI software, it's refreshing to find a program that defies immediate characterization. *Sybil*, named after a woman famous for her many personalities, offers several different MIDI processing and sequencing capabilities aimed specifically at live performance.

The program, which was developed by Scorpion Systems, was originally implemented in *HyperCard* on the Macintosh. (The original review appeared in the December 1989 issue of EM.) Since then, *Sybil* has undergone many changes. Version 3.0 of the program over one progression until you're sick of it and then switch to a new one without dropping a beat. Try that with an ordinary sequencer! Also, you can specify another note to send Program Changes from the same map while the loop is playing.

One technique that works well with the sequencer is mapping common drum notes like bass, snare, and hi-hat to several different Sybilized notes each, along with whatever pitched notes you like. This makes it easy to cook, since there are percussive sounds along with each note played by the sequencer.

## OTHER OBSERVATIONS

Without a mouse, I could not expect state-of-the-art convenience. Nonetheless, there are several areas in which the user interface and ease-of-use could be improved.

First, I really didn't care for the copy protection (you get two hard-disk installs). My installation failed when I put the disk into my 1.2 MB drive and didn't succeed until I moved it to a 360 KB drive. Also, the program is installed in the root directory by default, instead of asking you where you want it. Plus, the manual doesn't tell you how to install in another directory. The next time I unfragment my hard disk, I'll have to remember to remove it or I'll lose an install.

There are a number of deficiencies in the program as well. For example, you easily can lose your work when quitting *Sybil* or loading a new map because there is no warning dialog asking if you want to save your data if it's been changed. Another less critical example is that you must type in the note names and octave numbers of the Sybilized region's lower limit; it would be better to simply play it on a MIDI controller.

On the plus side, *Sybil* supports the Key MIDIATOR serial port interface in addition to MPU-401 compatibles and Mac interfaces, so it can be used with laptop computers without slots as well as desktop models. A nice feature for MIDI guitarists is the ability to filter out low-velocity notes, which keeps glitches in the Sybilized region from messing you up.

I've only scratched the surface of the musical effects that *Sybil* can produce. With a program like this, it's difficult to see all the musical ramifications without a good guide and a lot of handholding. Unfortunately, the manual is a disaster. It provides a lot of details, but it doesn't offer any perspective on creating musically useful maps. There are tutorials, but they're more frustrating than illuminating.

## THE BIG PICTURE

*Sybil* represents a unique approach to real-time performance. First and foremost, the program is a player's tool. In a sense, it puts all instrumentalists on an even playing field; even drummers without prerecorded sequences can play solo gigs with full orchestration. The bottom line is that one musician

## GHS MUSIC CORP. TONAL RECALL 2.0

*Tonal Recall* ($120) for PC-compatibles is a 4-track looping sequencer designed by Scorpion Systems for live performance, or the creation of Standard MIDI Files. While it shares many terms and features with *Sybil*, it is more limited in that it has no note-mapping or chaining capabilities, and more powerful in that you can layer four tracks instead of one. It also has a much shorter learning curve.

Setup is simple: Select a control note and an output channel for each of the four tracks, and you're ready to go (see **Fig. A**). To begin, hit the control note for track 1 and start playing. By default, *Tonal Recall* waits for the first note after the control note is played before it starts recording, although you can set it to record as soon as it receives the control note. When you're done with your phrase, hit the control key again, in rhythm. Like *Sybil*'s recorder, the track loops and plays back immediately, with no regard for beats.

The same process is used to lay down the second track. The overall length of the loop is controlled by the first track; the second, third, and fourth tracks have lengths that are multiples of the first. This is an excellent scheme, especially if you keep the first loop short because it gives you length variations without losing rhythmic coherence.

Any track can be muted after it is recorded by playing its control note. When you hit the control note again, tracks 2 through 4 do one of two things depending on a global setting in the main screen: either Re-Record or Play. Track 1 can't be re-recorded unless you erase the entire sequence because it controls the overall timing of the loop.

As with *Sybil*, a number of other toggles activate fixed-interval transposition and harmonization. You also can set up a note to send out one of two sets of up to sixteen Program Change messages while the loop is playing.

This program is a lot of fun, but there is always room for improvement (at the cost of possibly complicating the user interface). For one thing, it would be nice to define separate notes for Re-Record and Play; I found selecting these modes awkward. I'd also like more intelligent harmonization functions, more tracks, and some way of controlling the relative volumes of the tracks in real time.

Note: By the time you read this, GHS should have released version 3.0 of *Tonal Recall*. The primary difference between versions is said to be the look of the program, rather than its functionality.

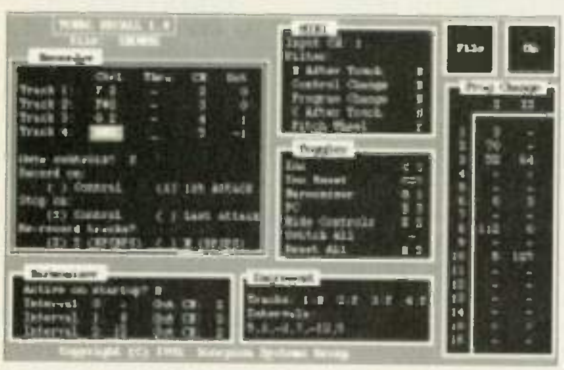


**FIG. A:** ***Tonal Recall*'s main screen lets you select the toggle notes for recording and playback on its four tracks.**

can do an awful lot in real time once the program has been configured for their needs.

But despite its musical potential, I would have concluded that *Sybil* is not worth the agony of the learning curve if I had not spent some time on the phone with the program's creator as he walked me through a few maps and cleared up the function of some of the toggles. Now that I finally understand the program, I see it as a valuable performance tool that's a lot of fun in the bargain.

**Warren Sirota** *is editor of* MIDI Guitarist *magazine, PO Box 75, Jacksonville, OR 97530. Guitar synthesists can call (503) 899-1948 to obtain more information.*

## Cannon Research Frontal Lobe Version III Sequencer

*By Dave Bertovic*

**Formerly a Korg M1 peripheral, the Lobe now thinks for itself.**

Cannon Research's original Frontal Lobe provided expanded sequencer memory for the Korg M1, real-time control of sequence playback, and data storage on a floppy disk. In the first major update, Version II (reviewed in the May 1990 EM) added a number of disk utilities that expanded the Frontal Lobe's ability to back up its memory and worked with the optional PCM Channel, which will be discussed later.

Version III is no longer just an M1 peripheral. It includes everything from the previous versions, but the sequencer section has been redesigned from the ground up as an independent device. Now, Frontal Lobe users can create elaborate MIDI sequences for any sound module with a remarkable number of detailed editing functions usually found only in computer-based sequencing software.

The 15KD model ($749) offers battery-backed RAM capacity for 9,000 notes (including both Note On and Note Off events), while the 64KD ($899) can handle 49,000 notes. RAM upgrades to the 64KD are $160, and you can upgrade from the Version II operating system to Version III for $229. The operating system is loaded from disk but remains in battery-backed RAM until you update it from the disk.

### OVERVIEW

The Frontal Lobe is a free-standing unit, measuring 4 5/8 × 6 1/2 × 2 1/4 inches. The electronics are housed in a plastic case, bringing the unit's weight to a mere two pounds. The top panel is surprisingly simple and sports a 16-character, backlit display and three master control buttons that light yellow, green, or red, depending on the current function. In addition, a pair of value increment/decrement keys are located to the left of the display, a pair of page +/- keys to the right, and a cursor position key just beneath the display. An external, 12 VAC adapter supplies power.

A 3.5-inch floppy-disk drive on the front of the unit provides MIDI data storage. The drive formats, writes, and reads 1.4 MB, MS-DOS-format disks, but also reads 720 KB disks. Each formatted HD floppy can store up to 127 named files, depending on the file size.

The MIDI port assembly (MIDI In, MIDI Outs A and B, and MIDI Thru) is kind of funky. Instead of mounting the jacks directly on the Lobe's rear panel, the manufacturer designed a molded pack of MIDI jacks that dangles from a very short telephone cable. The cable attaches to the rear panel with an 8-pin PhoneNet (telephone) jack.

This design is a result of Cannon Research's decision to produce an extra-small case; there wasn't room to mount the ports in the case as with most other MIDI products. I'd prefer a case that's a few inches larger in return for rear-panel jacks. Worse, the jacks aren't labeled, so you have to guess which is MIDI In and MIDI Out, and the diagram in the manual was erroneous. The company informs me that future units will have labeled jacks. To top it off, the first pack of MIDI jacks I received was broken.

An RS-232 port can be used to send and receive data between the disk drive and an IBM PC-compatible computer. It also connects the Frontal Lobe to the optional Version II PCM Channel hardware and software upgrade ($399), which provides Korg



M- and T-series owners a means of importing their own PCM sample data. The PCM Channel allows the user to download custom PCM sounds from the Lobe to an M1, M1r, M3r, or T-series synth. (Without the Lobe, T-series synths only permit downloads of drum samples.) PCM data can be imported to the Lobe using the MIDI Sample Dump Standard, or from custom disks available from Cannon Research.

An optional, normally-open momentary footswitch permits the user to toggle between operating modes, turn looping on and off, or start and stop sequence recording and playback. The switch also can be used to pause the Lobe during playback; pressing the switch again resumes playback.

## BASIC OPERATION

The Frontal Lobe implements five operational modes: Performance, Sequencer, Disk Utility, Load from Disk, Save to Disk, and Global Parameters. The front-panel buttons select the operational mode, navigate through the pages and parameters, and control performance operations. With the expanded capabilities of Version III, there are more functions than the front-panel buttons can accommodate, so the MIDI keyboard has been pressed into service. In some of the operational modes, the keys on the controller keyboard activate certain functions.

For example, file names and parameter values are entered from the keyboard in all modes except Performance. In Sequencer mode, a front-panel button or footswitch selects Command or Thru mode. In Command mode, each key on a 61-key MIDI keyboard triggers at least one Frontal Lobe command; the manual explains where the 61 function-triggering keys are located on a 76- or 88-key keyboard. Most control keys have multiple functions, and the unit designates certain keys as Shift and Alt to access low-level operations.

When you enter Record in Sequencer mode, the Lobe automatically switches to Thru mode, in which the keys are not interpreted as commands. If you're using a synth keyboard rather than a dedicated MIDI controller, you must turn off Local Control on the synth to disconnect the keyboard from the synth's internal sound engine. When the Lobe is in Thru mode, the note messages are echoed to one of the MIDI Outs and sent back to the connected synth, which then plays the notes normally.

A peel-and-stick label strip identifying all MIDI-accessible operations is included with the owner's manual. This 61-note, C2 to C7 template is mounted just above the synthesizer keyboard and aligned so that each function is listed above the appropriate key.

The user interface it offers is interesting because it uses the master MIDI keyboard for recording, playback, and data entry. Although this approach enables fast execution of most commands, there is an extended learning curve. In that sense, the interface isn't particularly user-friendly.

Fortunately, live performance functions are controlled from the front panel. Equally fortunate, the device supports macros, so you can perform repetitive, multi-keystroke functions (up to 256 keystrokes per macro) with a few keystrokes. Up to 127 macros can be stored on a floppy disk.

Navigating through the operational modes and their associated submenus is accomplished in one of three ways. You can enter the menu's ID number directly from the keyboard, use the increment/decrement buttons on the front panel, or assign the Pitch Bend or Mod Wheel to scroll through the menus. These methods also are used for numeric data entry.

The small display is sometimes quite cryptic, so you need the manual nearby until you get comfortable with the unit. Also, I found it relatively easy to get lost in the pages. This problem would have been eased if the display were 16 × 2. Speaking of the manual, it covers just about everything you'd want to know, but it lacks specific "walk-through" procedures that would be valuable in learning a product such as this. Its organization needs improvement, as does the editing: There are a few typographical errors and an incorrect diagram.

## PATCH LIBRARIAN

The generic Patch Librarian section allows the user to download the memory of any synthesizer or device that is able to transmit its memory contents with MIDI System Exclusive messages. The procedure is quite simple: Format a blank disk, select one of the empty file locations, name the file, and execute the data transfer. A data dump can be initiated from the MIDI device if it provides a MIDI Send command. If it doesn't, the Frontal Lobe can transmit a Request command to initiate the dump.

At any time, the user can enter a command that displays the percentage of memory used on the disk. After downloading the patches in my Oberheim Matrix-12, I discovered that one complete file of Single and Multi Patches consumed only 4% of the disk space. That translates to 25 complete patch files stored on one disk—not bad. I was able to load and save SysEx data for the Matrix-12 and a Yamaha TX802 with no trouble at all; in fact, the whole process was surprisingly quick and hassle-free.

The librarian function also permits multiple device dumps and any untimed MIDI messages, Program Change, Pitch Bend, etc., to be stored in one file. When a file of this type is loaded, all of the necessary SysEx headers and other messages are sent, allowing you to completely set up your instruments before the song is played.

## SEQUENCER FUNCTIONS

The Frontal Lobe provides sixteen tracks on which to record, each of which can contain MIDI data on all sixteen channels. The timing resolution is 96 ppqn. With two independent MIDI Outs, any track can be assigned to either port, which lets you address 32 MIDI channels. The Lobe can import and save type 0 and type 1 Standard MIDI Files.

After specifying the song length, you

### Product Summary

**PRODUCT:**
Frontal Lobe Version III
**PRICE:**
15KD $749
64KD $899
**MANUFACTURER:**
Cannon Research
13338 Loma Rica Dr.
Grass Valley, CA 95945
tel. (800) 628-3394 or
(916) 272-8692

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

**Cannon Research's Frontal Lobe Version III.**

can record a track linearly (once through, then stop), or in Loop Record (the track keeps repeating while new notes are added). A Spot Erase function lets you erase offending notes on the fly. The song length can be one to 999 measures and can be changed at any time, even after tracks have been recorded.

Tempo is variable from 40 bpm (beats per minute) to 250 bpm, and you can program smooth tempo changes to occur between any two points. In each measure, the time signature is selectable from two to 32 beats per measure, with denominators of quarter, eighth, sixteenth, or thirty-second notes.

The Frontal Lobe can filter any or all types of MIDI events by track and/or channel. There are a total of 120 filters in three separate groups for use during recording, playback, and editing. You also can filter events using several modifiers, including duration, the data value of the MIDI event, and rhythmic position. The last modifier allows you to filter out only those notes that fall within a user-specified rhythmic range within the bar (e.g., within ten ticks of the third beat of a measure).

In some ways, the sequencer closely resembles a tape recorder: It can fast-forward or rewind with variable speed (depending on how hard you press the key) while playing the sequence in real time. The sequence actually plays backward as you rewind.

Punch-in and punch-out recording can be automatic or manual (using a footswitch). Step recording includes the ability to define the step size (quarter notes, eighth notes, etc.) and gate ratio (staccato or legato). You can modify individual Velocity values or play back all notes at the same user-programmed Velocity. Automated mute commands can be inserted at various points in a Song, so a section that repeats several times in the tune can play back in different arrangements without actually erasing or copying and editing the data.

The sequencer offers non-destructive editing with a real-time compare function. As a sequence plays, press the Compare key to hear the most recent pre-edit version; when the key is released, the edited version plays.

The Lobe has the ability to search for MIDI events by type using OR search functions. For example, if you program it to find the next Program Change or Controller 5, the device will stop at whichever of the two events occurs next.

Event Edit lets you move MIDI events—notes, Control Change messages, Aftertouch, Program Change commands, SysEx data, even track mutes and MIDI Out port assignments—from one point in the song to another. This powerful feature lets you edit these events, copy-and-paste them to other positions within the song, delete them altogether, or create and insert them anywhere in the track.

Data values, velocity values, tempo, and note length can be modified by Scale or Compand (compress/expand) editing. Scaling simply adds or subtracts a number value from the selected events. For example, if a range of notes is selected, scaling note length by +20 adds twenty clock pulses (at 96 pulses per quarter note) to all selected notes, making their duration slightly longer. Companding multiplies all selected events by a percentage.

If that isn't enough, data can be manipulated by hard clipping (chopping off parameter values above or below a specified range) or soft clipping (a gradual reduction of values above or below a range). You also can compand with an adjustable median (a specified center-point around which companding takes place), and fade-in or fade-out Volume and Velocity.

Additional editing functions include

Event Record, Modify Record, and Thin. Event Record is used to insert MIDI event data, such as SysEx or Program Change messages, at specific points in the sequence. Modify Record allows you to rewrite the data of existing events using controllers in real time. For example, say you want to edit the Velocity values of the notes on track 5, channel 4. Using Modify Record, you can play the song, manipulate the Mod Wheel, and rewrite the Velocity values as the song is playing. This works with any values, including tempo.

If the variations performed in Modify Record are too drastic, or too many controller events exist in a track, the Thin command allows you to delete excess controller data according to a set of user-specified criteria. These criteria include a minimum change in data value and/or a minimum amount of time (in ticks) between specified events. Those events that fall within these user-specified limits are deleted.

Any event can be quantized to the nearest tick, and you can specify how close to the tick an event is moved by percentage. You can define a "dead zone," within which the Lobe won't quantize data, and an "active zone," the maximum area around the step point in which quantization will occur.

Additional features include time shifting a group of events in the track to play earlier or later, and Time Fit, a time compression/expansion feature not usually found in hardware sequencers. This function takes the selected group of tracks, called a region, and adjusts the tempo to be slower or faster so that it plays for a specified length of time. The Change command lets you merge and unmerge any combination of tracks and channels. The included MIDI monitor function is very handy.

## PERFORMANCE FUNCTIONS

The Frontal Lobe permits the user to create a setup file that helps load and send data in a live environment. A user-defined playlist (called a Performance File) of up to 99 songs is stored on disk. When the first song in the list is finished playing, the next song is loaded automatically and waits for the user to press Play. Songs can be skipped at any time to accommodate last-second changes.

Performance mode also permits the user to loop and pause sections of the song with a footswitch, resume playing, edit the arrangement, and adjust the tempo. This helps accommodate the inevitable spontaneity in a live performance.

## CONCLUSION

The Frontal Lobe Version III is an ambitious product. Users of other sequencers, hardware or software, will find that the Frontal Lobe is not lacking in features. The challenge lies in understanding the unit's organization and display abbreviations. The sequencer is learnable, but I would be hard-pressed to recommend this particular product to the first-time user. A larger display would be a big help. I'd also like this unit better if it had regular, reliable, rear-panel MIDI ports.

Looking at the Lobe from a cost standpoint, it ranks highest in list price among currently available hardware sequencers, in a tie with Roland's MC-50 MicroComposer. But the Frontal Lobe is more powerful than most other hardware sequencers, especially if you own an M-series synth. It certainly is worth considering if patience is one of your virtues.

**Dave Bertovic** *is a freelance writer, synthesizer addict, and sound mixer in Los Angeles.*

# Zoom 9030 Effects Processor

*By Geary Yelton*

**Replace your guitar stomp boxes and step into the future.**

The Zoom 9030 looks so much like a cool car stereo that if you were to park your car downtown and leave it sitting on the dash, someone would break in and steal it. The thief would have a tough time figuring out how to put in a cassette, though, and probably would decide it was the fanciest car radio he'd ever seen.

In reality, the 9030 is a multiple-effects processor for guitarists, bass players, and other musicians. Each of its 99 patches contains as many as seven simultaneous effects, including reverb, echo, analog distortion, guitar-amp simulation, pitch shift, wah, flanging, chorus, EQ, analog compression, and more. The optional 8050 Advanced Foot Controller ($249; see sidebar) can be used to change patches and turn effects on and off by remote control.

Though the 9030 can be used with keyboards, a microphone, or a mixing console, it really is optimized for guitarists. Most of the factory patches use distortion and/or amp simulation. It obviously is designed to replace the glut of effects pedals that guitarists collect on the floor in front of them. Some of the factory patches even are designed to duplicate guitar effects from particular songs. (You haven't really played Heart's "Barracuda" until you try patch 2.) But if you're unwilling to give up your favorite stomp box, the 9030 features an external effects loop with programmable volume for connecting other effects processors. You even can turn external effects on and off with the 8050 foot controller.

## PHYSICAL FEATURES

There are two monophonic inputs on the 9030: one on the front for low-level instruments such as guitar and bass and one on the back for higher-level sources such as keyboards and mixers. Only one input can be used at a time; plugging something into the front input disables the back input. A 3-color LED indicates input level and a red LED indicates clipping.

Stereo output jacks are provided, though if the output mode isn't switched to stereo, they provide identical signals. In addition to mono or stereo selections, the output mode settings let you choose between Amp for a guitar amplifier and Line for other sound systems, mixers, and tape recorders. Also on the front is a stereo headphone jack, which is great for jamming into the night without an amp.

With a total of eleven buttons and six knobs, the 9030 has more controls than most half-rack modules. In addition to the audio in and out jacks, a pair of back-panel jacks is provided for the external effects loop. MIDI In and Out ports (the Out can be switched to Thru) are supplemented by a port for the 8050 controller. The 9030's 9-volt power supply is another one of those fat little boxes that take up too much

Zoom's 9030 Effects Processor (lower right) is optimized for electric guitar applications. The optional 8050 Advanced Foot Controller provides nine footswitches and inputs for two volume or expression pedals.

space on your power strip. Then again, remember that just one 9030 can replace several independent effects boxes.

On the front panel, the effect indicator is a 3 × 3 grid of LEDs that shows which effects modules are turned on. If they're lit up red, they're part of the current patch. If they're green, they're unused. (In effect, red means "go," and green means "stop.") The same LEDs turn amber when Bypass is activated.

In Play mode, the fluorescent, 40-character main display shows the name of the patch and, below that, the output mode and master volume. The master volume is changed with data entry knob 1, and it can be stored independently for each patch.

Play mode is limited to just three functions: selecting patches, changing the master volume, and bypassing the effects. In Edit mode, where you actually change effects parameters, you can't change patches.

Here's a cute feature: If you press both patch change buttons as you turn the power on, a commercial for the 9030 scrolls across the main display, Times Square-style.

## PROGRAMMING

The 9030's basic architecture is easy to grasp. You have a choice of nine effects modules. Each module contains a group of related, individual effects from which to choose: reverb, compressor/limiter, analog distortion, amp simulation, EQ, and external loop, with other effects divided among three remaining modules called EFF 1, EFF 2, and SFX. Up to seven modules can be used in a single patch, but the EFF 1 and 2 modules can't be used at the same time as SFX.

Pressing either the left or right edit button enters Edit mode, where you define which effects are used and their parameter settings. Use these buttons to scroll from one effects module to another. The selected effect flashes red on the effect indicator grid. The effect's parameters show on the main display, and you can change their values with the four data-entry knobs. For effects with more than four variable parameters, extra pages are revealed by pressing the Utility/Page button.

Finding your way around in Edit mode is intuitive, especially if you've programmed a multi-effects unit before. Many of the front-panel buttons serve double duty, depending on the mode. I'll bet most guitarists want to learn how to program even less than keyboardists, however, so the factory patches need to be good. Fortunately, they are. And if you accidentally alter

### Product Summary

**PRODUCT:**
9030 Effects Processor

**PRICE:**
$749

**MANUFACTURER:**
Zoom Corp. of America
385 Oyster Point Blvd.,
Suite 7
South San Francisco, CA
94080
tel. (415) 873-5885

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

or erase some of them, they can be recalled from ROM at any time.

### INDIVIDUAL EFFECTS

If you're learning a song, and you're trying to sound like the record, you want to copy the effects as closely as possible. For guitar parts, the 9030 gives you a good range of sounds from which to start. If you can't duplicate a guitar tone with the palette of possibilities found here, you probably don't need another effects processor; you just need to learn how to use the effects at hand.

Most of the 9030's individual effects have a single parameter page with only four parameters. That isn't a lot, but it's sufficient for most applications. A second page allows the user to select the only parameter that can be controlled externally.

The reverb module features two fine-sounding hall reverbs, two early reflections, and two discrete delays. The equalizer module has a 3-band parametric EQ with variable mid frequency, as well as a 4-band EQ that simulates the graphic EQ found on some guitar amps.

Three types of distortion (all analog) are available: hard distortion, overdrive (which simulates a tube amplifier turned all the way up), and crunch (slight tube distortion). All three sound really good. The digital guitar-amp simulator offers some interesting parameters, including Color and Box. Color selects between an even response, a classic tube sound, a boosted high end, and a "modern sound" with boosted highs and lows. The bass-amp simulator has more or less the same Color parameters. Box lets you determine the size of your simulated speaker cabinet and allows you to choose between compact, combo, or stack. The differences give you a lot of tonal variety.

The Effect 1 module contains twelve mono effects. Most effects parameters are straightforward and in many cases duplicate the knobs on dedicated

## ZOOM 8050 ADVANCED FOOT CONTROLLER

The Zoom 8050 Advanced Foot Controller is an optional remote unit that provides nine footswitches and two pedal inputs. It connects to the 9030 via a supplied multi-pin cable. The 8050 has two modes, Standard and Extended, which can be selected by a small switch on the back panel of the unit. MIDI parameters are edited by holding down a footswitch and simultaneously flipping this back panel switch.

In Standard mode, the 8050 is used to send patch changes. In fact, without an external MIDI controller, the 8050 is the only way to directly enter patch numbers on the 9030. With only nine footswitches, one of which is dedicated to turning bypass on and off, it takes some fancy footwork to specify patches 1 through 99. Two Bank switches (labeled Up and Down) scroll through banks of ten patches, and five Number switches select either patch numbers 1 to 5, or 6 to 10, from within each bank. The remaining switch, called the Group switch, determines whether the Number switches are 1 to 5 or 6 to 10. The patch change isn't actually sent until you press a Number switch. Most switches have LEDs for visual feedback. I know this arrangement sounds confusing, but it's not difficult to grasp once you try it, though it's not especially intuitive.

In Extended mode, pressing the Group switch lets you turn individual effects on and off from the 8050. In this mode, the five Number switches control compression, distortion, either EFF1 or SPX, EFF2, and reverb. Having a switch for each effect gives you the same type of control you might have if the effects were separate stomp boxes.

With a standard volume pedal plugged into either expression pedal input, specified parameters can be continuously controlled in real time. This is necessary to make use of the Pedal Wah, for example. The 8050 also has a MIDI Out port; if you connect it to an instrument's MIDI In, you can use the 8050 to change patches, or you can assign the pedal inputs to control any continuous controller you indicate.

stomp boxes. The phaser offers depth, speed, peak (resonance), and level parameters. The pitch shifter lets you transpose pitch up to an octave up or down. "Metallic" is a ring modulator with vibrato. The comb filter is a fixed phase shifter. The octave effect doubles the input with a pitch two octaves below. The Pedal Wah effect simulates a linear wah-wah pedal, but only if you have the 8050 foot controller and an external rocker pedal.

Four of Effect 2's twelve effects are in stereo. In addition to variations on the previous module's effects, it has step, auto-pan, and a couple of one-second delays. Step works and sounds a lot like the sample-and-hold circuits on old analog synthesizers. One of the delays lets you set its delay time by tapping out a tempo on the 8050.

The 9030's Special Effects module contains more complex sounds, most with an additional page of parameters. The harmonized pitch shifter lets you define a scale to generate diatonic harmonies. It requires careful playing technique, not unlike playing a MIDI guitar controller. According to the manual, Super Cry provides "an excludingionally [sic] clear vocoder-like sound." In fact, it sounds like an auto-wah with a choice of filter envelopes. Bomber is an annoying effect that triggers the sound of an explosion, which the manual says is "useful for intros and endings." Not! Zitar is supposed to simulate the sympathetic resonances of a sitar, but I just don't hear it.

## DOCUMENTATION

The 9030's operation manual is clear, thorough, and well-organized. It's divided into a quick identification of controls, displays, and ports, followed by a 6-page tutorial, detailed information on modes and individual effects, suggested applications, specifications, and the MIDI implementation. The only thing I missed was a list of the effects and parameter settings used in the factory patches.

It's more difficult to find your way around in the 8050's manual. Every page is in five languages, which means only two or three paragraphs of actual information fit on a single page.

## CONCLUSIONS

I tried the 9030 with electric guitars, basses, samplers, synthesizers, miked voice and acoustic guitar, and a recording console. I mixed down a complex MIDI performance using it as the only effects processor. I played it through guitar amps, a home stereo, and a studio sound system. Some tasks it handled great, and others were less than satisfactory.

**For the guitarist with a home studio, the Zoom 9030 is better than any dedicated effects pedal.**

For guitar, this thing is outstanding. If you're a rock 'n' roll guitarist or bassist, you definitely should give the 9030 a try. Every guitarist I showed it to loved it both for live performance and recording. It even works as a preamp between a guitar and a power amp. For the guitarist with a home studio, it's better than any dedicated effects pedal.

For vocals, the 9030 probably isn't as useful as some other multi-effects units in its price range, but it's okay in a pinch. Its reverb sounds fine, but it's not terribly flexible. If you're a synthesist, you're likely to be disappointed, at least with the factory patches. If you're willing to look below the surface, you'll find features that could make your synths sing, but you'll definitely have to program it yourself.

The distortion effects, especially the crunch, are quite a bit noisier than other late-model effects processors. Apparently, noise is the price you pay for real analog distortion. Compared to the sound of a collection of stomp boxes connected in series, however, the 9030 is quiet. Its built-in effects loop means you don't have to sacrifice your old effects pedals. While it doesn't automate them, it lets you use them to supplement its own processing.

If you're a guitarist, I recommend that you get the optional 8050 foot controller. You need it to change patches quickly and to turn individual effects on and off from within a patch. You also need it if you want to use footpedals to control real-time parameters.

If you want replace an outdated guitar-effects rig, this may be the box you're looking for. If you like the sound but just can't afford the 9030, don't hesitate to check out the less-expensive, preset-oriented Zoom 9000. Either Zoom box is guaranteed to expand your tonal vocabulary.

**Geary Yelton** *is a musical futurist currently working as a graphic artist in Atlanta, Georgia. His books include* The Musical PC *and* Music and the Macintosh.

# thoughtprocessors ShowTune (PC)

*By Dennis Miller*

**Transcribe your MIDI Files with this nifty notation package.**

Who says you can't build a better mousetrap? Nobody told thoughtprocessors, Inc., makers of *ShowTune*. The new DOS-based MIDI File-to-standard-notation transcription and printing program for PCs and compatibles is a good solution to a common problem facing many musicians: getting quick, clean printouts of the Standard MIDI Files scattered all over their hard disks.

*ShowTune* is a scaled-down version of thoughtprocessors' *The Note Processor*, a top-notch notation program (reviewed June 1990). *ShowTune* reads in up to eight tracks of a type 0 or 1 Standard MIDI File and splits complete files according to channel assignment, or individual tracks by pitch range. After transcribing the file, it displays and prints up to twelve staves on a page, with up to eight staves per system, and allows certain types of editing, including some impressive page layout and formatting options. The program includes a basic sequencer for playing back your files. And, best of all, it provides access to hundreds of musical symbols to polish up the appearance of your printed page.

*ShowTune* requires an IBM PC or compatible with 640 KB RAM, a hard disk, and a graphics card. It supports numerous dot-matrix, inkjet, and laser printers and can be used with a mouse. The program lists for $79 and is not copy-protected. Included with the package is a coupon allowing you to receive full credit on an upgrade to *The Note Processor*.

## ON WITH THE SHOW

*ShowTune*'s main features are accessed from a menu line that appears atop the opening screen. By using Alt-key combinations, you can perform any function listed in these menus, or you easily can maneuver around the program with a mouse. Certain areas of the program, such as the Tracks window, require you to enter numerical data, but you can't use the mouse to increment values the way you can in many *Windows*-based programs.

Working with *ShowTune* involves following several logical steps. First, load up a MIDI file. Then choose a system template from one of the preset layouts (single-line, 2-hand piano, 4-part chorus, etc.), or design your own with the Free option. Next, follow the prompts as the program asks you for the title of your piece and a name for each part. In the Format window, choose Automatic Format if you're going to use the same number of measures per staff and staves per page throughout your score, or Manual Format if you need the flexibility of changing things (six measures per line in one system, five in the next, etc.). Other options are available at this point—you can add a header or footer to each page, set top and bottom margins, and turn page numbering on and off—but in many cases the default values are adequate.

Depending on the type of file you have, you may need to stop in the Track window. This screen integrates playback functions with settings that affect the way your music is displayed. For example, the Meter control, found at the top of the screen, determines the metronome accent during playback and the time signature written into the first measure of your score. The First Bar feature lets you play and transcribe a sequence starting at a point beyond its beginning.

Like the main screens of many IBM sequencers, the Track window shows a list of all tracks in your file, complete with name, channel assignment, play status, and so on (see **Fig. 1**). In most cases, *ShowTune* simply assigns each track in your original sequence to a successive entry in its own track list. By default, each track becomes a separate staff when you display your score. If your needs are more complicated—for example, if you want to split a single track into separate left- and right-hand parts—simply choose the Split option and specify which tracks to use and what pitch to split around. Assign a staff in your template to each new track, and you're all set.

## THE NEXT PAGE

When everything's in order, move to the Page Editor, where you'll find your music displayed in standard notation. Although it is not as fancy as a full-blown notation program—there are no cut-and-paste or undo options, for example—plenty of features are available to refine the appearance of your music.

At the bottom of the Page Editor are two rows of icons: The top row shows symbols that represent various functions or "actions," such as scrolling up and down the screen, changing zoom level (100, 50, 25, 12 or 6% of full size), and deleting or inserting characters. The bottom row displays musical symbols you can place on your page. Dozens of standard characters, from dotted barlines to tuplets to grace notes, are available. It even in-

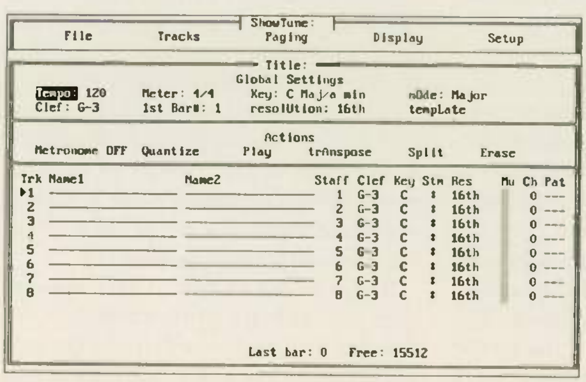



**FIG. 1:** ***ShowTune*****'s Track window combines elements of a sequencer with settings that affect the notation of MIDI files.**

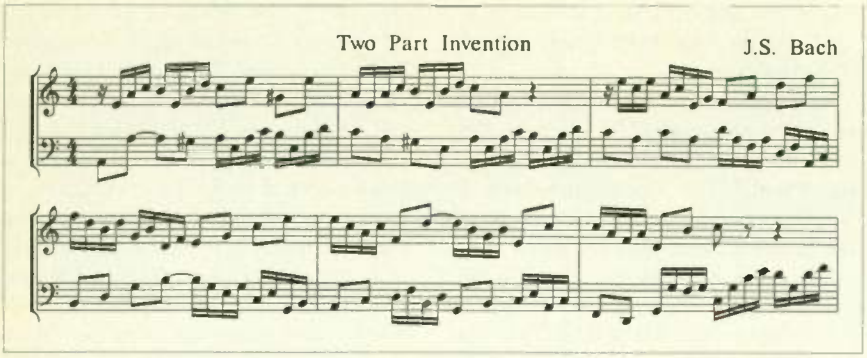



**FIG. 2:** ***ShowTune*** **supports a wide range of printers and produces quality output.**

cludes a single-line text editor for creating lyrics. What you see is not all you get, however: Another 200 or so symbols can be added by using the Alt-key combinations listed in the appendix of the manual. Unfortunately, you can't substitute your own preferences for the symbols that appear at the bottom of the screen.

*ShowTune* is particularly good at drawing characters that extend across the screen. To create a slur, for example, simply highlight the slur character, select Insert, then click at the start and end positions. Creating crescendo and diminuendo markings is just as easy, and a line drawing tool can be used to create simple shapes of your own design.

There are only two things I don't like about the editor. First, when you select a musical character to insert, it's a bit hard to position it exactly on the screen because the program doesn't provide precise feedback on where the symbol will appear. I'd rather see the cursor become the musical symbol so you could drag the character right into place. The second, related problem involves trying to select a symbol for deleting or moving. I often found it necessary to click several times on the symbol to find the exact spot that highlights it. A small handle on each character would be a much more effective solution.

## Product Summary

**PRODUCT:**
*ShowTune* MIDI File transcriber
**PRICE:**
$79
**REQUIREMENTS:**
IBM PC or compatible with 640 KB RAM, hard disk, graphics card, MPU-401-compatible MIDI interface
**MANUFACTURER:**
thoughtprocessors
584 Bergen St.
Brooklyn, NY 11238
tel. (718) 857 2860

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

## THE LAST ACT

*ShowTune* is an excellent program, but it isn't suited for every situation. Its 4,000-note limit won't let you transcribe your next symphony in a single pass, for example. On the other hand, I used it to print numerous complex sequences, and in the few cases where it did run out of memory, I simply split my original MIDI file into two parts and had the program print the correct page and measure numbers for the continuation.

The quality of the program's printed output is very high, especially on a laser printer (see **Fig. 2**). If you can use the defaults for all, or most, of the settings (most options can be saved as defaults, by the way), you'll find the whole transcription process incredibly quick and easy. Moving from MIDI file to printed music actually can take less than a dozen keystrokes.

If you've got lots of Standard MIDI Files that you're dying to view and don't need the features of a full-scale notation program, *ShowTune* could be just right for you.

**Dennis Miller** *is on the music faculty of Northeastern University in Boston, where his tasks include telling the world about the joys of MIDI.*

**● FROM THE TOP**

**(continued from p.75)**

pedals, serve the same function as the mod wheel and sliders and can be applied to almost any parameter. In particular, expression pedals often are applied to the amplifier for overall volume control, or the filter for timbral control. They also can trigger the LFO. Some musicians modify their expression pedals by spring-loading them, which makes the pedal a good substitute for aftertouch or the pitch bend wheel (though you only can bend in one direction).

Switch pedals most commonly are used to sustain a sound after releasing a key, much like the sustain pedal on a piano. (In this situation, the EG behaves as if the key is still depressed until the pedal is released.) However, these pedals are used in different ways. For example, you can program a synth to call up a different patch by stepping on a switch pedal. Some synths let you create a customized "chain" of patches that are called up sequentially each time the pedal is pressed.

Also, you often can engage *portamento* with a switch pedal. This causes the synth to glide smoothly between notes instead of changing abruptly as different notes are played. The time it takes to glide from one note to the next is determined by the *portamento time* parameter.

There are plenty of situations in which you need both hands for playing. For example, you might need to play a comping or lead part with the right hand and a bass part with the left hand. In situations such as these, pedals, aftertouch, key following, and velocity following are particularly useful, as you can't manipulate the pitch bend wheel or mod wheel. You should keep this in mind when tweaking patches intended for live use.

## TH, TH, THAT'S ALL FOLKS

Now it's time for you to fire up your instrument. I think you'll find it rewarding to create your own sounds, and your music will benefit from a unique sonic signature. Remember that experimentation is the key to understanding, so hit the edit button and start tweaking.

**EM**'*s technical editor,* **Scott Wilkinson** *derives great satisfaction from tweaking as many parameters as possible.*

3 or 4 ms if he wasn't careful.

What about instruments for which playing all the notes at the same time is essentially impossible, such as strumming a guitar? Nigel Redmond of Ear Level Engineering performed some subjective tests with the Strummer and Key Strummer *HyperCard* stacks he packages with his *HyperMIDI* extensions for the Macintosh.

"I generally make the delay time 10 to 20 ms between each note," according to Redmond. "With five delays between the six strings, we're talking about a 50 to 100 ms span. The shorter span would be a quick strum for rhythmic playing, while the longer span is a relaxed strum. Of course, you can go much slower for arpeggiated chords, but anything more than a couple of milliseconds faster than this range sounds artificial. With no delay between strings, it doesn't sound like a guitar, regardless of how good the guitar samples are." However, if the delays are under the Haas limit, they fuse into a piano-like chord and won't sound like a guitar.

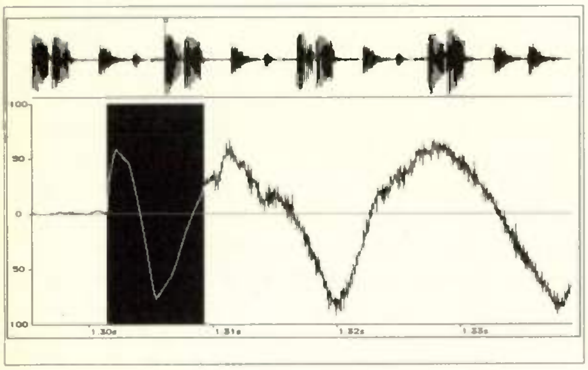


**FIG. 5: Kick hitting before hi-hat.**

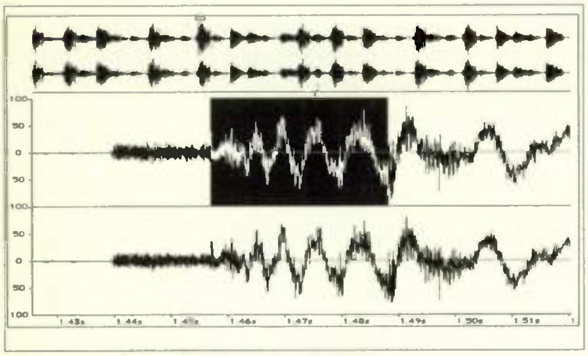


**FIG. 6: Hi-hat/snare/kick hit sequence.**

What about drummers? I studied samples of many different rhythm patterns, and found a couple of consistent trends:

- Drummers vary their timing from bar to bar and from beat to beat by several milliseconds, even when trying to play straight time;
- Drummers rarely hit two drums at exactly the same time.

To illustrate the second point, look at **Figs. 5** and **6**. The top of the screen displays the overall "loop" of a few measures; the larger scrawl below is a single isolated hit. The highlighted section in **Fig. 5** illustrates a drummer hitting the kick drum before the hi-hat in a fairly slow, straight-ahead groove. **Fig. 6** displays a sequence of hi-hat/snare/kick from a hip-hop groove with the snare highlighted in the middle. (I isolated parts of the composite sound both for the purpose of illustration and to help my own ears pull the sound apart. When played normally, they fuse into one overall percussive hit.)

These figures display only one hit in the pattern. But as I studied each hit, I discovered another trend. Drummers tend to do things in the same order.

For example, although the drummer in **Fig. 5** hit the kick anywhere from 8 to 13 ms before the hat, he always hit the kick before the hat. Likewise, even though the same drummer was a little slow on the second hit of two quick kicks, he was always slow (not fast) by roughly the same amount. This phenomenon repeated itself through many drummers and across many styles of music. In other words, good musicians may not be perfect, but they are not random, which is what the humanize feature in some sequencers seems to assume.

## APPROACHES

More than one musician suggested the following procedure for sequencing. If you need a solid time reference to lay down the initial tracks, play to a click or a tightly sequenced drum pattern. Once you have the first track down, turn the click or guide track off and overdub the rhythmic pulse (which typically is the drum or bass part) to fit the music. If the click is stopping you from getting the initial ideas down, turn it off and just play against yourself. Or, you can set up a click that falls on the offbeats so you're not trying to land on that knife edge. Clicks and rhythm loops only keep the tempo constant; everything in between is expression. (Speaking of expression, don't underestimate what a well-phrased vocal performance can do to enhance the feel.)

Trust your own performance to compensate for your instruments. Quantization assumes that the slaved instruments are perfect (or at least repeatable), which may not be the case. Perhaps sequencers eventually will include the ability to make timing adjustments based on pitch or absolute millisecond offsets (features currently provided by external boxes such as the Aphex Feel Factory and JLCooper FaderMaster). These features help compensate for late instruments and delay string strums or layered drum hits. Also, don't underrate dynamics and accents; they may be more important than absolute timing.

No matter what you try to do, unstable clicks and randomly delayed notes from instruments can throw you off. Perhaps this is something that should be tested in equipment reviews. Some reviewers have attempted this already, but I rarely see it applied directly to the music that gets produced with the device.

In the end, we must trust our own ears over anything else. A story from computer scientist Kent Crispin emphasized this point. "Some time ago, I sequenced several pieces from the notebook for Anna Magdelena Bach. I was trying to make them sound 'good.' It was a quite interesting experiment because *some* of the pieces sounded great when played in a completely mechanical way; fully quantized and no velocity differences. Other pieces sounded terrible; they really needed a human touch."

(I would like to thank all of those who contributed to on-line electronic discussions with me regarding this article. And special thanks to sample guru Bob Daspit.)

*MIDI pundit* **Chris Meyer** *keeps getting himself in trouble by asking—and then trying to answer—difficult questions.*

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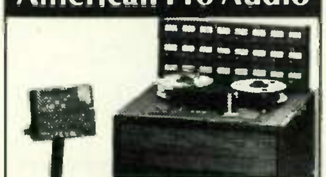

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# Passion and Predetermination

Will expressive sequencing redefine the nature of performance?

*By Max Mathews*


PATTE WOOD

Modern electronics have changed recording techniques so much that it's more accurate to describe CDs as being constructed, rather than recorded. Computer editing systems, long available in devices like the Synclavier, now exist on inexpensive personal computers. For synthesizer music, multitrack sequences provide the power of a multitrack studio at a fraction of the cost. The results are indeed rich. It is only a slight exaggeration to say that live concerts serve to share emotions between performers and their audiences, but for truly wonderful sound, few experiences top listening to a great CD on the super system in your living room.

However, let us not abandon performance hastily. Possibilities already exist for electronic aids that can revolutionize the nature of performance.

In order to appreciate these possibilities, consider the many real-time tasks facing a performer. For traditional music, he or she must possess technique to accomplish the rapid and demanding information processing and motor control involved in translating written notes into the movements required to play the instrument. Simultaneously, the performer must add expressive life to the performance by subtle variations in factors such as timing, loudness, and timbre. Finally, great performers also bestow a personal communication or "soul" to the music; they bring it to life.

Although the real musical interest in the performance often lies in its passion, the performer must learn technique almost to the state of reflexive action before he or she can devote the conscious mind to expression and soul.

How can electronics help the performer? I believe one of the most interesting possibilities lies in supplying the performer the predetermined parts of music (over which he or she has no choice), so that the mind is free to fully concentrate on expression. In traditional music, the predetermined parts are the sequence of notes—the score—specified by the composer. These predetermined events can be represented as a sequence in a computer, so that the correct upcoming note automatically plays upon the performer's next gesture. However, the timing, timbre, and dynamics of that note would be completely controlled by the performer. This kind of program is called an "expressive sequencer."

Expressive sequences already have demonstrated their power as control programs for synthesizers. In this case, timbres are limited to those produced by a synthesizer, and although these are ever-broadening limits, they do not satisfy some musicians. But a new resource is here: A computer's digitized sound files also are sequences, and there are no limits to the sounds that can be recorded on a sound file. However, there *are* important limits to which expressive changes can be made during the reproduction of the sound files in real time by the performer and his or her computer.

At present, most computers only are fast enough to do time-domain transformations in real time. (The types of modifications done in a sampling synthesizer give a reasonable feeling for the potency of already existing and proven manipulations.) But soon more powerful computer chips will extend these limits to frequency-domain operations such as vocoding. The combination of unlimited sound files and frequency-domain transformations is mind boggling.

But now let us return to my comments at the beginning of this editorial and ask: What is the difference between playing a CD and performing a sound file? It seems that the definitions of reproducing prerecorded sounds and performing are a little blurred. Maybe deejays are as much performers as violinists, pianists, or any other sound-producing musician. Perhaps we need a new definition of performance.

I propose that this redefiniton center on what the performer adds or changes about the sounds in the process of converting them from a dormant form to acoustic vibrations traveling toward the ear of the listener. My definition focuses on communication between the performer and the listener; that is, the soul of the music.

Of course, definitions are less important than music. Musically, I believe performer programs will provide more possibilities for active (and pleasurable) participation in the process of creating musical sounds. They also will allow the evocation of satisfying personal interpretations of musical pieces, whether these pieces are scored on paper, stored as a sequence in computer memory, or stored as a soundfile on some disk.

The future promises to be new, interesting, and different.

**Max Mathews**, *one of the founding fathers of computer music, is a researcher at Stanford University's Center for Computer Research in Music and Acoustics (CCRMA).*

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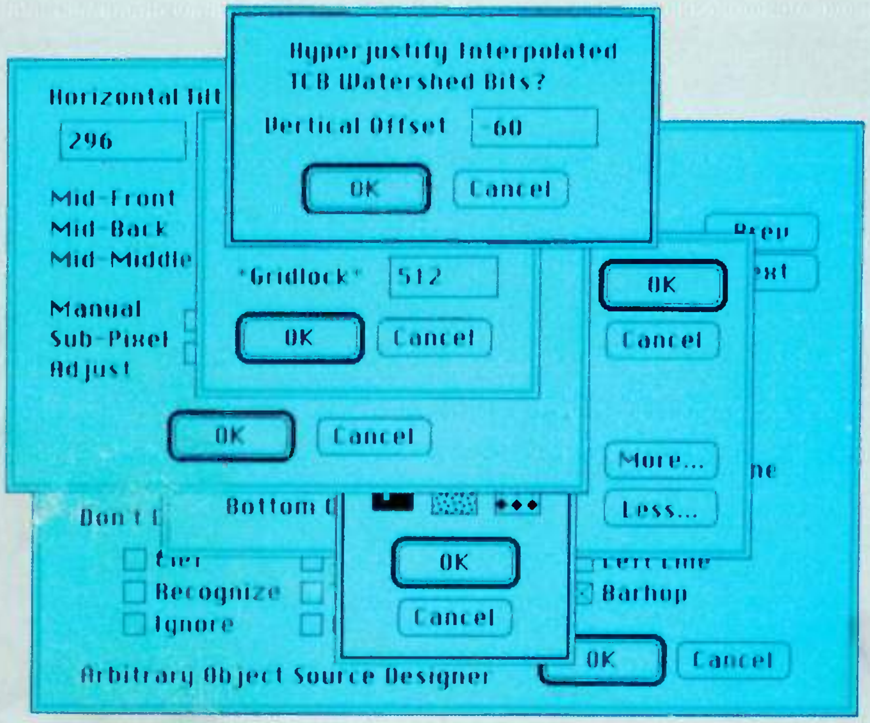


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