

Getting Started with MIDI

HOW TO USE YOUR MAC TO CONTROL MUSICAL INSTRUMENTS, AUDIO EQUIPMENT, AND EVEN THE LIGHTS

BY JIM HEID

In 1982 the largest companies in the electronic music industry overcame their normally secretive and competitive urges and agreed to cooperate. The result of their collaboration was not a hot new musical instrument, but a 13-page

document that has literally changed the way the world makes music.

That document described the Musical Instrument Digital Interface, or MIDI. MIDI was developed to enable musicians to connect electronic instruments to each other and to computers. The MIDI specification spells out the types of wires and connectors that unite musical instruments, as well as the commands and codes that MIDI-equipped instruments transmit and respond to. Generally, any piece of equipment with MIDI—whether a musical instrument or a computer—can talk with any other piece of MIDI gear.

On a basic level, MIDI lets you create a network of two or more instruments that you can play from just one instrument. Musicians often use this technique, called *layering*, to play multiple instruments simultaneously to obtain a richer sound. On a somewhat more advanced level, MIDI lets you connect one or more instruments to a computer to record and play back music and add accompaniments. This aspect of MIDI has helped create a new phenomenon—the home recording studio. And at its most advanced level, MIDI lets you combine a computer-controlled network of instruments with audio equipment and even stage lighting to automate an entire performance environment.

With its appealing graphics and easy operating style, the Macintosh has become a popular computer among musicians. And fortunately, most MIDI applications do not require a top-of-the-line computing setup. A Mac Plus can handle most basic MIDI tasks as well as the high-end Mac IIx can. This month, I'll describe some of the technicalities behind MIDI and spotlight some entry-level as well as professional MIDI hardware and software.

MIDI Basics

MIDI data can travel in two directions at the same time—from an instrument to a computer and from a computer to an instrument, for example. To accommodate this two-way traffic, every MIDI device has two connectors: *MIDI In* and *MIDI Out*. Some devices have another connector as well, *MIDI Thru*, which can be used for chaining MIDI devices together.

Peer behind the Mac and you'll notice there are no such connectors. Unlike some personal computers (specifically a few Atari models), Macs don't come equipped for MIDI but need a separate piece of hardware—a *MIDI interface*, which connects to the Mac's modem or printer port and provides MIDI In and MIDI Out connectors. Several are available for the Mac, ranging from Apple's (408/996-1010) \$99 Apple MIDI Interface to Mark of the



Unicorn's (617/576-2760) \$495 MIDI Time Piece and J.L. Cooper Electronics' (213/306-4131) \$349 SyncMaster. The higher-end MIDI interfaces provide more MIDI In and MIDI Out connectors and allow the Mac to be synchronized with an external device such as an audiotape recorder (see "Mac MIDI Interfaces").

"The Ins and Outs of MIDI Connections" shows three different ways to connect MIDI instruments with an interface to relay MIDI data (also called *messages* or *events*) between instruments and a Mac.

But what kind of data? First and foremost, *note data*. When you play a MIDI instrument's keyboard, it tells the Mac which keys were pressed and for how long. *Velocity-sensitive* keyboards also note how hard each key was pressed, letting the Mac capture the varied dynamics of your performance.

Incidentally, MIDI instruments don't necessarily have to have piano-like keyboards. They can take other forms, ranging from the self-explanatory *MIDI guitar* and *drum pad* to the not-so-self-explanatory, saxo-
(continues)

MAC MIDI INTERFACES

Model	Company	MIDI In Connectors	MIDI Out Connectors	Sync Support	Retail Price
Altech 1 x 3	Altech Systems	1	3	no	\$99.95
Altech 2 x 6	Altech Systems	2	6	no	\$149.95
Apple MIDI Interface	Apple Computer	1	1	no	\$99
MacNEXUS	J. L. Cooper Electronics	1	3	no	\$89.95
SyncMaster	J. L. Cooper Electronics	2	6	yes	\$349
MIDI Time Piece	Mark of the Unicorn	8	8	yes	\$495
Professional Plus	Opcode Systems	1	3	no	\$125
Studio 3	Opcode Systems	2	6	yes	\$495
Studio Plus Two	Opcode Systems	2	6	no	\$225
MH-01M	Passport Designs	1	1	no	\$130
MIDI Transport	Passport Designs	2	4	yes	\$495

phone-like *wind controller*. MIDI-equipped accordions are available, as are retrofits that add MIDI to organs and acoustic pianos. Instruments that generate MIDI data are often called *controllers*. Many musicians combine one controller with several *sound modules*—boxes containing sound-generating circuitry and MIDI connectors, but no keyboards. E-mu Systems' (408/438-1921) remarkable Proteus is one popular sound module.

MIDI instruments can receive or transmit data on any of 16 independent *channels*—electronic mailing addresses that accompany MIDI data and specify its destination. Not only can you specify the channel MIDI instruments use to transmit data, you can also configure them to respond to data sent on all MIDI channels (*omni* mode) or only to certain ones (*poly* mode).

This ability to channel MIDI data is important because many MIDI setups comprise more than one instrument, some of which may be *multitimbral*—capable of simultaneously producing different types of sounds, such as those of a drum set and a horn section. If you couldn't assign certain MIDI data to certain channels, there'd be nothing to stop one instrument from playing another's part.

Note data is by no means the only kind of information that can travel on MIDI cables. Here are some MIDI messages that instead of playing notes play other roles in the performance.

- *Program changes* instruct an instrument to switch sounds—from

piano to strings, for example.

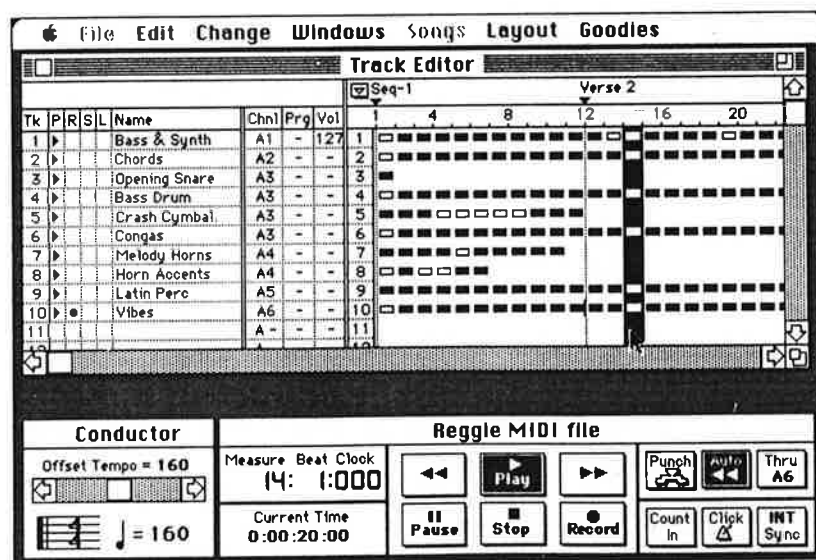
- *Continuous data* generally modifies the way a sound is played. For example, many instruments have *pitch bend* wheels or levers that let you slide between pitches the way guitar players do when they bend a string. Another kind of continuous data is *aftertouch*, which describes how hard a note key is being held down. By pressing harder on a key after you've pressed it, you might add vibrato or cause a string sound to get progressively louder. Not all keyboards send aftertouch, but those that do allow for a greater range of expression.

- *Clock or sync data* carries information about the timing of a MIDI performance. It's often used to synchronize a network of MIDI instruments to an audiotape recording.

- *System-exclusive data* is information pertinent to a specific model of MIDI instrument, such as the contents of its internal memory, or the MIDI-channel assignments of its sounds. By transferring system-exclusive data to the Mac, you can store and alter an instrument's sounds, and then transfer the data back to the MIDI instrument.

Software to Make Music By

Without a computer, MIDI data plays a valuable but limited role—it lets you play numerous instruments using just one controller. MIDI data becomes much more useful when it's combined with a computer and software that can store and manipulate it. The most popular of MIDI software is the *sequencer*, a kind of tapeless tape deck that lets you build your own arrangements by recording parts one *track* at a time. You might start with a drum or bass track to establish a rhythm, and perhaps specify that it *loop*, or repeat continuously. Next, you might add a guitar melody, then some strings to sweeten things up. During playback, you route the tracks to the appropri-



Laying Down Tracks

Sequencers (such as Passport Designs' Pro 4, shown here) let you record and play back MIDI data. The dark bars on the right indicate the presence of MIDI data in those measures. At the top of the window is a *marker* (here named Verse 2), which you can create to quickly access a specific point. Most sequencers provide these basic features.

ate instruments—or to the appropriate sounds within a multitimbral instrument—by specifying a different playback channel for each one (see “Laying Down Tracks”).

On the surface, a sequencer seems similar to a multitrack tape recorder or to a digital audio-recording system such as Digidesign's (415/726-0280) Sound Tools (see “Getting Started with Digital Sound,” November 1989). But a sequencer doesn't store sound; instead, it stores the sequence of MIDI data that describes what you played.

That storage technique has a few significant pluses. First, MIDI data requires far less disk space than digital audio data does. A ten-minute stereo recording made with Sound Tools requires 100MB of disk space; a ten-minute MIDI sequence might use 30K or so. Also, because the MIDI data in a sequence isn't tied to a particular sound, you can change an instrument's settings before or during playback to hear how that electric guitar part sounds when played by an acoustic guitar—or maybe an oboe. Or, you can work up an arrangement using an economical home system and then take your disk into a recording studio and play the sequence using state-of-the-art gear.

And because you're working with MIDI data, you can continue adding tracks without compromising the sound quality. With an audio recording, each time you bounce two or more tracks to a single track to free up a track for recording, the sound quality of the older tracks suffers. With a sequencer, the tracks exist in the Mac's memory, not on audiotape. So you can add as many tracks as you have memory for, and every playback is an original performance.

Perhaps best of all (at least for those of us who can't practice eight hours a day), you can use a sequencer's extensive editing features to correct misplayed notes or to add more dynamic expression. You can cut and paste sections of a recording—for example, to remove extra verses or repeat a part. And with a sequencer's *step recording* mode, you can manually enter difficult parts one note at a time, or *slow down the tempo* and record them at a more leisurely pace. Is it cheating? Some might say so, but

it lets you make better music, and the results go a long way toward soothing your guilt.

Sequencer Features

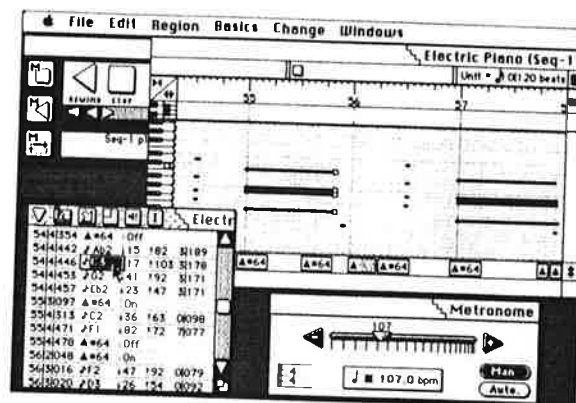
Let's take a closer look at the kinds of features you'll find in the sequencers currently or soon to be available for the Mac.

For correcting or inserting notes in existing tracks, two basic schemes exist. *Graphic* editing displays a track's contents on a music staff-like grid, except that notes are shown as horizontal bars representing longer notes. Graphic editing lets you select and drag notes from one position to another using the mouse.

Event list editing displays a track's contents as a table of MIDI data. It doesn't give you the click-and-drag convenience of graphic editing, but it allows for greater precision, since you can type and edit the exact values that describe individual notes or other MIDI data. Better sequencers provide both types of editing windows (see “Editing Tracks”).

For tweaking the timing of notes, sequencers provide *quantizing* features, which cause the program to move notes to the nearest note value you specify. If used excessively, however, quantizing can give sequenced music an overly mechanized feel; after all, no one plays every note *exactly* on time. To eliminate this undesirable side effect, most sequencers let you specify a margin within which notes aren't quantized, and thus you can neaten up your playing without making it sound robotic. Some sequencers also provide a *humanize* option, which does the opposite of quantizing: it nudges notes off their exact beat values to improve the feel of a passage that was overly quantized or entered using a step-recording mode.

Many pieces of music don't have the same tempo throughout. To accommodate such pieces, sequencers provide a special track, often called a



Editing Tracks

Higher-end sequencers such as Mark of the Unicorn's Performer (shown here) offer two types of note-editing windows: graphic (upper right) and event-list (lower left). The entries reading #64 indicate the press and release of a MIDI keyboard's sustain pedal.

conductor track, that stores tempo information. Using the conductor track, you can create a *tempo map* that describes the tempo changes in the piece. With some sequencers—including Mark of the Unicorn's Performer, Opcode Systems' (415/321-8977) Vision, Steinberg-Jones's (818/993-4091) forthcoming Cubase, and Electronic Arts' (415/571-7171) Deluxe Recorder—you can specify the tempo by tapping a key on a MIDI keyboard.

If you combine a sequencer with external equipment, such as a multitrack audiotape recorder, you'll need a sequencer that can be locked to synchronization codes sent by that external source. By recording a *sync track* on a tape recorder and feeding that track into a sync-supporting MIDI interface such as MIDI Time Piece, you keep the sequencer and recorder in exact synchronization. You can use sync to add sequenced electronic music to an acoustic recording, or to create a multitrack audio recording using a single MIDI instrument to record one track at a time, synchronizing the sequencer's playback with the tracks you've already recorded on tape. Sync features are commonly used in TV and movie soundtrack production, in which MIDI sequences are synchronized to visual action. In these cases, a sequencer is synchronized to a film editor or videotape recorder using the industry standard SMPTE (Society of Motion Picture and Television Engineers) time code.

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If you're a pro, you might end up using more than one sequencer. Fortunately, virtually all support the standard *MIDI file* format, which enables sequencers—even ones running on different computers—to exchange recordings. Often MIDI files are also used along with *scoring* programs—the next stop on our MIDI tour.

Music Processors

Scoring programs let you print music using conventional notation. They do for composers what word processors do for writers—they let you easily correct and revise a piece without a lot of erasing (see "Scoring Software").

Even more exciting, scoring programs can transcribe music as you play it on a MIDI keyboard. Real-time music transcription has been a fantasy of musicians for years, and the dream still hasn't been completely fulfilled. The primary problem is one I mentioned before—nobody plays every note exactly on time. A real-time transcription is likely to have a large number of awkward rests and unusual note values you'll need to clean up using the scoring program's editing features. Scoring programs help you get better results by quantizing data as you play it (or load it from a MIDI file), but don't expect perfect notation the first time around. These real-time entry features are most effective when used as a starting point.

At this writing, numerous scoring programs are available for the Mac, including Mark of the Unicorn's Professional Composer, Passport Designs' NoteWriter and Encore, Coda's (800/843-2066) Finale and MusicProse, Electronic Arts' Deluxe Music Construction Set, and Great Wave Software's (408/438-1990) ConcertWare+MIDI. Deluxe Music Construction Set and ConcertWare+MIDI provide beginner-to-intermediate-level scoring features. The rest are geared toward professionals and offer more control over the elements of a score. You'll want to evaluate each program to find the one that best handles the notation requirements of the style of music and the instruments you're writing for.

Sounds Good

Another useful category of MIDI software is the *editor/librarian*, which lets

you manage, alter, and save a MIDI instrument's sounds by manipulating the system-exclusive MIDI data I mentioned earlier. You might use an editor/librarian to tweak an existing sound to your liking or to create a new sound from scratch. You can alter a MIDI instrument's sounds using its front-panel knobs and switches, but an editor/librarian makes it easier by taking advantage of the Mac's graphical operating style. For example, giving a sound a sharper, more percussive quality might require 15 minutes of twiddling with an instrument's knobs while squinting at its small, calculator-like display. With an editor/librarian, you can edit an on-screen version of the sound, clicking and dragging its components until you get the sound

you want. Editor/librarians are available for all popular MIDI instruments, and some, such as Opcode's Galaxy, can work with numerous instruments.

Similar to editor/librarians are *sample-editing* programs such as Digidesign's Sound Designer II or Passport Design's Trax, scheduled to ship in June for \$99.95.

CHOOSING A SEQUENCER

Sequencer software firms keep a close eye on the competition, releasing updates so often that you'll rarely find any one program well ahead of the others. Given that, here are some issues that are likely to influence your buying decision.

▪ **Program design** As with any kind of program, some sequencers are easier to use than others. I'm partial to Performer and Pro 4. Vision provides a few more features, but it's harder to learn. Try a few programs and pick the one you feel comfortable with.

▪ **Memory requirements** Memory efficiency is critical with sequencers, since the length and complexity of your songs is limited by the amount of free memory available. Performer, with its flashy user interface, requires 2MB of RAM for serious work; most other programs can run comfortably with 1MB.

▪ **Copy protection** Most software makers stopped this practice years ago, but this inconvenience persists in the sequencer world. Before a protected sequencer will run, you have to insert a master floppy disk or perform a convoluted installation process on your hard disk. It's annoying, and potentially devastating if you use a sequencer at live jobs ("Sorry, folks—no music tonight. The band's master disk went bad."). Of the sequencers shipping at this writing, only Pro 4, Deluxe Recorder, and Dr. T's Music Software's Beyond are not copy protected.

▪ **Cost** For most musicians, money is an object. The best buy in sequencers is Passport Design's Trax, scheduled to ship in June for \$99.95.



Scoring Software

Notation programs such as Finale 2.0, shown here, let you commit music to paper by entering notes individually from a tool palette, playing a MIDI instrument, or importing a MIDI file created by a sequencer. The latter two approaches sound especially appealing, but music entered directly from a performance often requires extensive quantizing to compensate for minor timing inaccuracies.

GETTING STARTED HOW TO

port Designs' entry-level Sound Apprentice. Sample editors let you manipulate the digital sound samples that sampling instruments such as Ensoniq's (215/647-3930) EPS and E-mu Systems' Emulator III play. (For details on digital sound and samplers, see "Getting Started with Digital Sound," November 1989.)

If you have a sampler, you might also want to investigate Digidesign's TurboSynth software, which lets you design synthesized sounds on the Mac and then transfer them to a sampler for playback. TurboSynth gives a sampler—whose normal purpose is to play back digital recordings of real instruments—the sound-generating versatility of a synthesizer.

Every Combo Needs a Manager

If you try to run several MIDI programs simultaneously under MultiFinder, you may experience compati-

bility problems. That's because some MIDI programs monopolize the Mac's communications chips, preventing other programs from using them.

But chances are all your MIDI programs will peacefully coexist under MultiFinder if you use Apple's MIDI Manager, an enhancement to the Mac's system software that lets multiple MIDI programs run under MultiFinder and even share the same MIDI data. Instead of accessing the hardware directly, programs access the MIDI Manager, which in turn deals with the hardware.

For users of the Mac Portable, MIDI Manager isn't an option, it's a necessity. The Portable's battery-conservation features make it incompatible with MIDI software that directly accesses the machine's communications chips. If you have a Portable, use MIDI Manager version 1.2 or later. Apple also recommends using version

System 6.0.5 or later to eliminate other possible compatibility problems with the Portable's modem and printer ports.

Alas, at this writing, not all MIDI programs have been updated to work with MIDI Manager. Opcode System's Vision does, but Mark of the Unicorn's Performer won't until later this year.

Sequencers, editor/librarians, and scoring programs are the primary players in the MIDI software world. On the fringes, you find programs such as Ars Nova Software's (805/564-2518) Practica Musica, Coda's Perceive, and Hip Software's (617/661-2447) Harmony Grid, which are all designed to help you train your musical ear and learn music theory. Also on the outskirts of MIDI territory, programs such as Coda's MacDrums, Primera Software's (415/525-3000) Different Drummer, and Dr. T's Music Software's (617/244-6954) UpBeat, which help you cre-

THE INS AND OUTS OF MIDI CONNECTIONS


Here are three ways to connect MIDI instruments to a Macintosh MIDI interface. The simplest technique (A) involves connecting one instrument's MIDI Out to the MIDI interface's MIDI In, and vice versa.

To connect multiple instruments to a MIDI interface that provides just one MIDI In and one MIDI Out connector, you might use one instrument's MIDI Thru connector, as shown in (B). However, this chaining technique can cause delays in the transmission of MIDI data if used to connect several instruments.

For advanced MIDI setups such as the one shown in (C), it's better to use a MIDI interface that provides numerous MIDI In and MIDI Out connectors, such as Mark of the Unicorn's MIDI Time Piece. With this technique, each instrument's MIDI In and MIDI Out connectors attach to independent MIDI In and MIDI Out connectors on the interface. The MIDI interface shown in (C) also provides an audiotape synchronization feature for use with a MIDI sequencer. To synchronize a sequencer to an audiotape, you first record a sync tone on one track of the tape. When you play back the tape, the interface reads the sync tones and controls the sequencer's playback speed to keep the taped and sequenced music synchronized.

ate slick drum and rhythm patterns, as well as avant-garde programs such as CTM Development's OvalTune (formerly published by Intelligent Music) and Dr. T's Music Software's groundbreaking "M," both of which turn the Mac into a MIDI controller. With these last two programs, you can record some basic phrases and then modify their playback during a performance by moving the mouse or clicking on various buttons and dials. My favorite program in this category of *performance software* is Scorpion Systems Group's (415/864-2956) sYbil. OvalTune and "M" turn some aspects of music making over to the computer, but sYbil puts all the creative control in your hands.

There are also MIDI programming tools such as Altech System's (318/226-1702) MIDI Basic and MIDI Pascal, and Hip Software's fascinating HookUp, a graphical programming language that lets you create MIDI-accompanied animations not by typing arcane programming commands, but by attaching icons to each other. You can even find prerecorded MIDI sequences, such as Passport Design's Music Data series, which includes elaborately produced sequences of hundreds of Top-40, rhythm-and-blues, country, and classical music pieces. You might use a canned sequence to fine-tune your arranging or improvisation skills, or as an accompaniment to a live performance. And you can also find MIDI support in multimedia programs such as MacroMind's (415/442-0200) Director. Director's MIDI support lets you trigger a sequenced piece of music or a sound effect at a particular time during an animation.

In short, you'll find as many ways to use the MIDI standard as there are ways to make music. It just goes to show you what a little cooperation can do. 

See *Where to Buy* for contact information.

Jim Heid is a Macworld contributing editor. His latest book, coauthored with Peter Norton, is Inside the Apple Macintosh (Brady Books, 1989). America Online subscribers can contact him directly by sending a message to Jim Heid.

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