

## MIDI FAQ's--A Very Basic Primer

### What is MIDI?

MIDI is *Musical Instrument Digital Interface*, it is NOT sound, it is not an audio file--it is just a set of instructions to turn notes on and off, and note characteristics.

### When did MIDI begin?

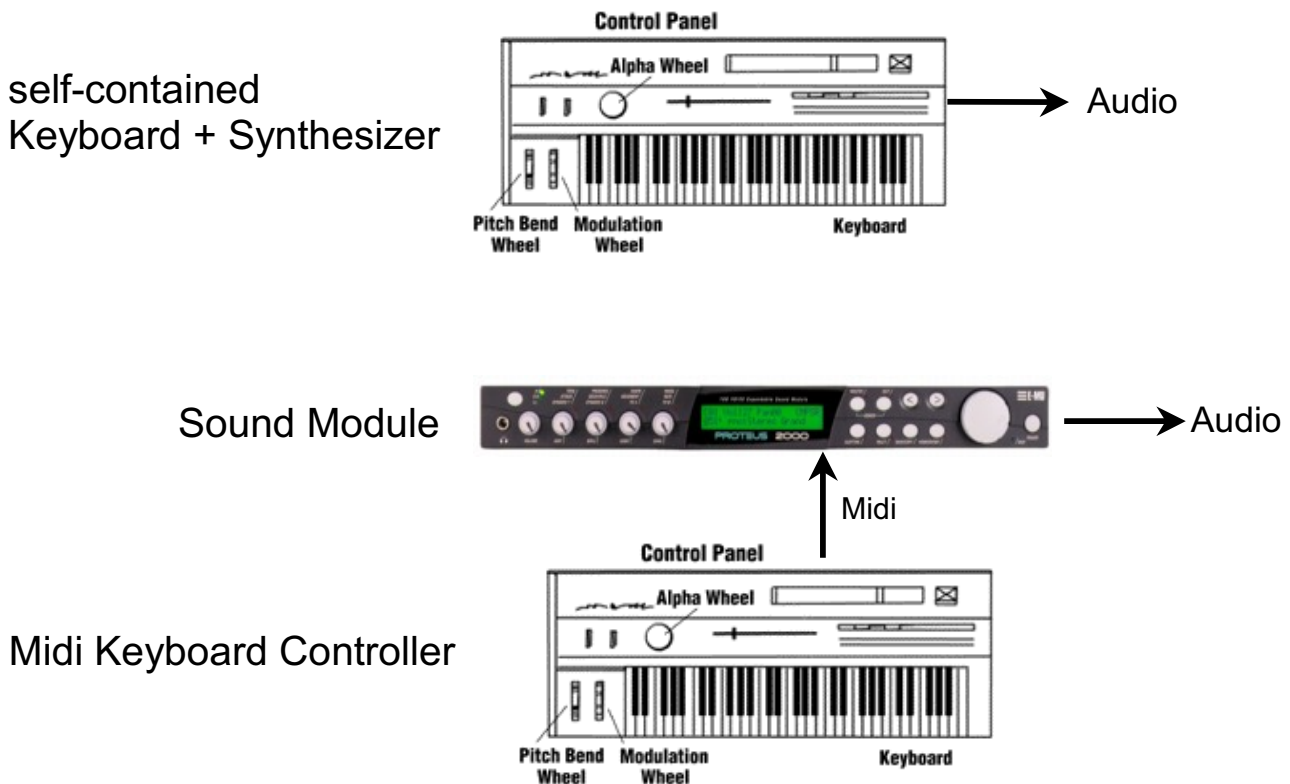
In the early 1980's, manufacturers of electronic music equipment joined to decide on a standard for allowing synthesizers and sound modules to talk to each other.

### What are the Purposes of MIDI?

- 1) Accompaniment for a live performance
- 2) A "Prototype" of a composition--to give the composer and others an idea of what it might sound like, when live musicians play it.
- 3) Serve as an end product--to simulate a live performance.

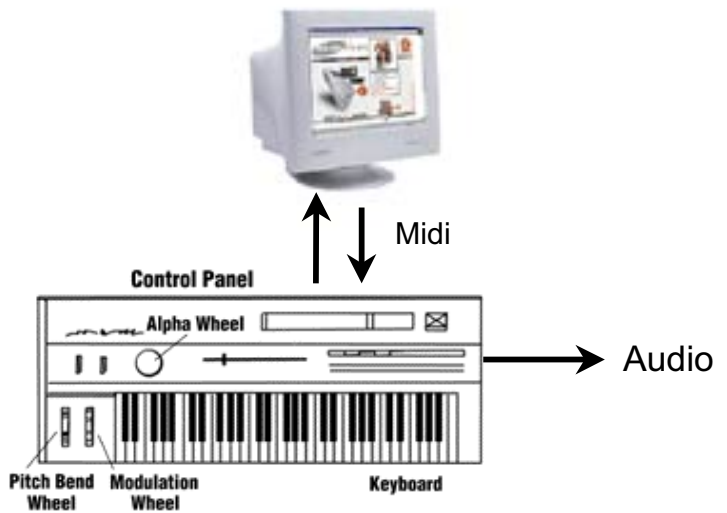
### What are some basic Hardware Setups?

Read this sentence carefully: When connecting a MIDI keyboard to a sound card, you must connect the keyboard's MIDI In to the sound card's Out, and vice versa!



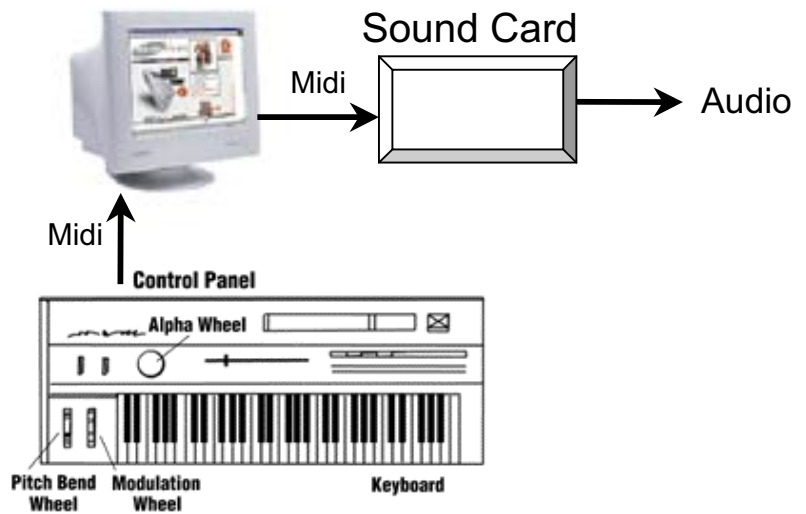
Computer  
(Midi Interface Card)

self-contained  
Keyboard + Synthesizer



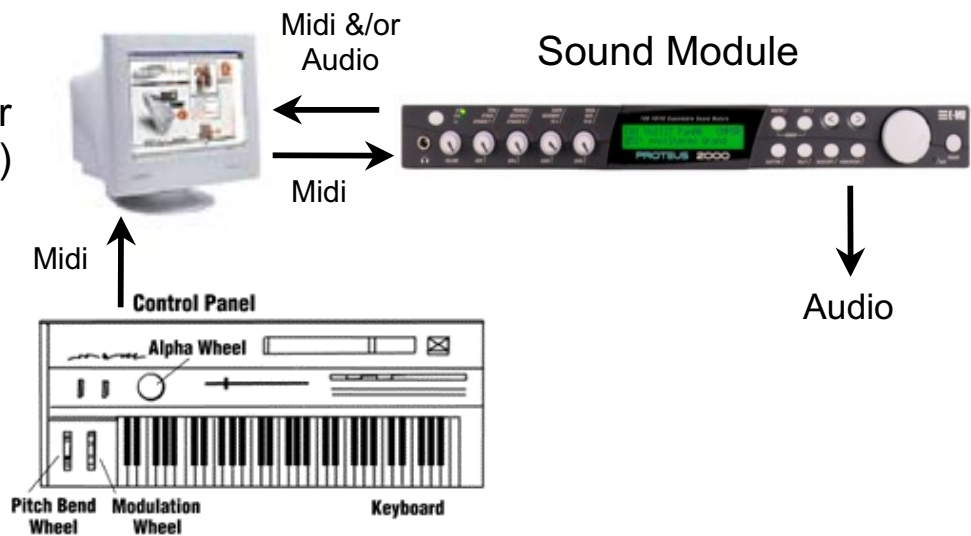
Computer  
(Midi Interface Card)

Keyboard (Midi Controller)



Computer  
(Midi Interface Card)

Keyboard  
(Midi Controller)



### What is the Purpose of the Computer?

The computer is used to run software that acquires, stores, edits, and plays back MIDI messages. Two main types of software: Sequencers and Notation Programs.

### What are the Differences between Sequencing and Notation Programs?

Sequencing program: used to make MIDI music to *sound* good

Notation program: used to make sheet music *look* good.

Examples of Sequencing programs: Cakewalk, Logic, Cubase, (Voyetra) Midi Orchestrator, ...

Examples of Notation programs: Finale, Sibelius, Noteworthy Composer, Mozart, Encore, ...

### Say what? Shouldn't all music sound good?

Yes--But a notation program is very limited in playback realism. A few programs (Musicator, for example) try to do sequencing and notation, but must include compromises. Both types of programs can be very complex, as they use interactive graphics, perform real-time control, and must support a wide variety of hardware options.

Many people start by composing their music using a notation program, generating a MIDI file, and then reading that file into a sequencing program for additional tweaking. I have occasionally gone in the opposite direction--I compose using a sequencing program, make it sound as good as I can, and then bring the MIDI file into a notation program for making a good-looking score.

### What are the Pro's and Con's of Sequencing and Notation programs?

Sequencing Program	Notation Program
Allows subtleties in tempo & volume	Can control tempo & volume, but realism is limited
Potentially exquisite control over timbre, if used with good sound module	Control limited to choosing an instrument
Excellent control over timings, can synchronize with SMPTE/film/TV/other	Control limited to tempo changes, difficult to synchronize
Can make audio recordings of live instruments and voice, blend with Midi accompaniment	No live audio recordings
Can easily vary special effects like reverb, panning, modulation, chorus	Difficult to control special effects
Can record and edit and play back all the subtleties of a live piano performance	All subtleties are lost
Full control over complex synthesizer functions	Very limited control over synthesizer
Depending on sound module and skill of user, can potentially produce extremely good realism	Realism is poor to mediocre, at best.
Multiple views of music--piano roll, music notation, track view, controller view, etc.	Sheet music view only
Can produce sheet music, but is very limited, and often looks unprofessional. Many symbols are missing.	Can potentially produce beautiful, professional-quality sheet music

### So how do I choose a Sequencing or Notation program that suits my interests, and my budget?

Some of these programs are freeware or very low-cost shareware. The high-end programs cost up to \$400 or so. The lower-end programs will run on older computers, while the high-end sequencing programs require the latest, very fast computers.

No program is perfect. Each one is a balance between features, versatility, ease-of-learning and ease-of-use. Some very inexpensive programs have limited feature sets that may be more than enough for some people, while for others, a "missing" feature is crucial.

For example, all of the high-end sequencing programs have comprehensive capabilities for recording and editing digital audio. For me, this capability is superfluous.

The problem with asking people their opinions about these programs, is that it is like religion. People do not like to admit that the program they use is not perfect. In addition, people rarely use more than a single program, so their perspective for making a choice is limited. In addition, programs seem to be geographically segregated. For example, Logic and Sibelius are more popular in Europe, while Cakewalk and Finale are more popular in the US. The reason for this has more to do with marketing and distribution, than with program quality.

Every half-decent program is available in a free "demo" version. Such a version is almost fully functional (saving and/or printing may be disabled), or is only functional for a limited time. One approach is to narrow down your choices to two or three programs, and then try them out. This is especially useful, in case there is some incompatibility with your computer or other hardware. The downside is that you can spend a lot of time really learning how to use a program.

#### **Where can I find free demo's and shareware software?**

You can find everything at: [www.hitsquad.com](http://www.hitsquad.com)

At this site you will also find discussions about the relative merits of the programs and tutorials about audio recording and many related topics.

Another useful site for information about MIDI is <http://harmony-central.com/>

#### **Do I need a Computer in order to Compose Music Electronically?**

Strictly speaking, it is unnecessary. Before computers became powerful enough to handle MIDI, synthesizer workstations and other special-purpose hardware contained sequencers. They are still available, and mostly used for live performances. (Do you want your PC to crash during a performance?)

#### **What are the choices for Producing Sounds?**

1) Self-contained Keyboard/synthesizer can have fantastic sounds for a price, and may be expandable. A lower-end keyboard may have mediocre sounds, but if it has (a) Midi input and output jacks, and (b) touch-sensitive (velocity sensitive) keys, then it may be satisfactory in conjunction with one of the other units described below.

2) Cheapest and simplest approach--internal sound card in your computer. The advantage of this approach is that making an audio file, in preparation for recording a CD, is very easy. "Sound Blaster Live!" is an excellent choice because of its low price, and it is expandable through sound fonts. Yamaha sound cards are said to sound a little better "out of the box", but they are not expandable. Keep in mind, these are "consumer-level" cards, and are shunned by professionals.

3) An external sound module is portable, and very versatile, programmable, and often is expandable. Expert programmers/recording engineers work very hard to give sound modules the best possible set of high-quality sounds. The price range is \$350-\$2000.

4) A software synthesizer (or "soft-synth") takes MIDI messages and converts them to audio signals that can be output through the computer's sound card. The low-end soft-synths are freeware or

shareware, and are useful in a laptop computer that has a low-quality sound card. Some of the high-end soft-synths (like GigaSampler or GigaStudio) require a high-end computer totally dedicated to this task. My recommendation for a low-end soft-synth would be the Roland Virtual Sound Canvas.

5) A hardware sampler contains no "built-in" sounds. You buy libraries of sounds on CD's, and/or make your own. Samplers are expensive, and the sound libraries are even more expensive. But this is what professionals use for the ultimate in realism.

### What are the Pro's and Con's of a Sound Card vs. an External Sound Module?

Sound Card	External Sound Module
Easy to set up	Requires additional MIDI and audio cables
Easy to use	More complicated, but more powerful
Some cards (like Sound Blaster Live!) are expandable, while others are not	Some modules are expandable, while others are not
Relatively inexpensive	More expensive
Requires a computer to operate	Can operate in Stand-Alone mode, without computer. Much better for live performances.
Limited set of effects. Cannot cable to an effects unit.	More effects. If they are insufficient, then simply cable to an effects unit.
Variety of Sounds can be limited, and difficult to locate high-quality sounds. Cannot increase number of MIDI channels	Larger variety of sounds, usually high quality. Can daisy-chain multiple units to add more variety and increase number of channels.
Easy to record an audio file (WAV or AIFF); comes with recording software	Recording an audio file requires an audio card with analog or digital input. This card might include recording software.
Difficult to find decent documentation	Documentation is sometimes poorly-written, incomplete
Control through computer only	Control through computer, and through buttons and dials on unit
Not easy to program new sounds	Designed with programmability of new sounds in mind, through buttons and dials, and/or through special computer software

### Where do I get more information about all of these synthesizers?

The best single web site is [www.synthzone.com](http://www.synthzone.com). After you get a good idea about what you want, go to a local music store and try out and listen before you buy.

### What is my recommendation for producing sounds, for a beginner?

By far, the best value is the "Sound Blaster Live!" Various versions are sold in local stores, from the "Value" edition at about \$80 to the "Platinum" edition at about \$200. These are consumer-oriented cards, so the prices are excellent for the value. They are very popular. "Out-of-the-box", these cards sound OK, but their biggest advantage is their expandability. They share RAM in your computer, and allow you to upload "sound fonts" that increase the realism and variety of sounds. The Sound Blaster Live! is a low-end sampler, that allows you to make your own sound fonts, or to download numerous sound fonts from the Internet, or to purchase from various vendors.

Many of the thousands of sound fonts that are available for free download aren't worth the price. Even most of the ones for sale are not very good. But now there are a few new sound fonts that may

be well worth purchasing. There are two orchestral sound font collections available for \$40 each at [www.soundfont.com](http://www.soundfont.com). They are taken from the excellent E-MU Virtuoso 2000 sound module. Listen to the [sinfonietta.mp3](#) demo file, to hear it in action. Keep in mind, demo's are notorious for being poor demonstrations of the sound quality of synthesizers. Go figure!

To help you decide if Sound Blaster Live! is right for you, there are a few good articles on the net by Ethan Winer: <http://www.ethanwiner.com/soundcards.html> describes an objective test of a few (older) sound cards. <http://www.ethanwiner.com/SoundFonts.html> contains a good description of some of the qualities of the Sound Blaster Live!

### **How do I make a tape recording or a CD of my music?**

If you want to make a tape recording, then simply connect your tape recorder to the audio output signal of your equipment. Cheaper keyboards do not have a true "audio-out" jack; they usually have a headphone jack that can be used. Making a tape recording requires a shielded cable and often requires a plug adapter. Tape recording is easy because it is a one-step process. Sound quality will depend on the tape deck.

Making a CD recording is at least a 2 or 3-step process: 1) Record an audio (WAV or AIFF) file in your computer, 2) Normalize the file, to optimize the volume (this step is optional), 3) "Burn" a CD using a CD-R (CD recorder).

#### ***Step 1***

If you use a sound card to produce sounds, then recording an audio file in your computer is quite easy. Your sound card probably comes with a little utility that can record its sounds directly to an audio file. You simply turn on this utility, and play back a MIDI file through your sequencing or notation program. "What you hear is what you get." Warning: My notation program occasionally "hiccups" during playback. If yours does too, then it is possible to export a MIDI file and play it back through a your sound card's media player.

If you use a self-contained keyboard/synthesizer, or an external sound module to produce sounds, then you need to connect the audio out of the synthesizer to the audio input of your computer's sound card. Now, here the quality of your sound card can be a limiting factor. The low-end sound cards can add audible noise to the music. You record the music using the same utility that is described in the above paragraph. But be warned--"What you hear is *not* what you get."

Some of the high-end synthesizers and sound modules have digital (SPDIF) output jacks. These can be connected directly to the "digital-in" plug of an audio card in your computer. Not all audio cards have such a plug. The advantage of this approach is that the recording is very clean. (Sound Blaster cards are not recommended for this purpose, because, although they have digital-in jacks, they perform frequency re-sampling that is deleterious to sound quality. This defect is not mentioned in their documentation.)

#### ***Step 2***

The purpose of normalizing an audio file is to make its volume as loud as possible, without producing distortion. If you want to record multiple songs on a single CD, then this process helps to ensure that they all have approximately the same volume. High-end sequencing programs have a built-in normalizing function. Some sound cards come with normalizing utilities. There are also shareware programs that perform this function.

#### ***Step 3***

Most CD-recorders come with software that will "burn" a CD-R. The most popular software for this purpose is Adaptec's CD Creator. Keep in mind, that CD's are usually produced as "data CD-ROM's" or as "audio CD's". An audio CD can be played in almost any stereo system (but not in a car's stereo!). A data CD-ROM contains data files, and can only be read by a computer.

### **What is a MIDI message?**

A MIDI message consists of a string of 10 bytes (a set of 0's and 1's). A message tells the synthesizer when to turn on a note, when to turn off a note, what is the note's pitch, how loud it should be, what type of sound should play the note (trumpet, piano, drum, etc.), and many other attributes.

### **What is a MIDI channel?**

Each MIDI "port" or cable can handle up to 16 channels. Each channel can be assigned to any one instrument or sound at a time. MIDI messages can provide what are known as "program changes" or "patch changes" that can alter the instrument playing in the middle of a piece. Some synthesizers and sound cards handle more than 16 channels. They do this by having multiple MIDI ports. By convention, in General MIDI, channel 10 is reserved for unpitched percussion (drums, cymbals, wood blocks, etc.).

### **What is polyphony?**

Polyphony is the number of different simultaneous "voices" that a synthesizer can produce, regardless of the number of different instruments that are playing them. Nowadays, most sound cards and synths have 64 or 128 voice polyphony. You should keep in mind, for some sound modules, that multiple voices or "tones" are used to create one note. This helps to create more realistic sounds that combine multiple waveforms to produce a single note, depending on velocity, aftertouch, and so on. The downside is that this will eat into the total number of available voices.

### **What is a MIDI track?**

For convenience, sequencing programs allow the user to allocate a separate track to separate instruments or sounds.

### **What is Velocity?**

Velocity is an attribute to a note-on message. You can think of it in analogy to how hard you strike a piano key. Like other MIDI messages, it can take a value ranging from 0 to 127. Velocity is used to control the loudness and/or tone quality at the initial moment of playing a note. Velocity has no control over the loudness or tone quality during a note's "sustain" period.

### **What are Volume and Expression controller messages?**

These messages are functionally identical, though convention treats them differently. Both have values ranging from 0 to 127, and both control the instantaneous loudness of an instrument. They have no control over tone quality. Usually, volume messages are used to set the overall volume level of each track or instrument. Multiple expression messages are used to shape the loudness envelope of individual notes, to alter a note's attack and sustain properties.

### **What is a Reverb message?**

Reverb is the quality of sound reflecting on the surfaces of a room or concert hall. Adding an appropriate amount of reverb can greatly increase the realism of a MIDI file, as long as it is not overdone. You can regulate the amount a reverb by sending a reverb message with a value ranging from 0 to 127. Keep in mind, individual synthesizers have many reverb settings, and using a reverb message simply regulates the degree to which a particular setting is invoked. Different synthesizers will react completely differently to a reverb message.

**What is modulation?**

A modulation MIDI message alters the degree to which vibrato is added, by causing oscillations in pitch.

**What is chorus?**

A chorus effect "fattens" a sound to make one instrument sound like many. A chorus MIDI message tells your synthesizer to add a de-tuned and slightly delayed copy of the sound to the original.

**What is pitch bend?**

A pitch bend message will alter the pitch of a note. Good keyboards have a "Mod Wheel" for regulating this effect. By default, the range of a pitch bend is usually one whole-tone up or down. Special instructions to your synthesizer can increase this range. Pitch bend is very useful for simulating special musical effects on wind and string instruments, and the guitar. For example, the effect of a guitarist stretching a string is easily simulated using pitch bend in a sequencing program.

**What is pan?**

You can increase the realism of a MIDI performance by setting the pan of individual instruments, to simulate the stereo placement of a real orchestra or ensemble. Setting the pan to 0 places an instrument to the far left, 63 sets the placement in the middle, and 127 to the far right.

**How do I simulate different articulations?**

A marcato attack on a string instrument is much different from a legato or spiccato bowing. If you are looking for this level of realism in your MIDI music, then:

- 1) you should be using a sequencing program
- 2) your synthesizer must have separate patches (sounds/programs/sound fonts) for each type of articulation.

Suppose you have a trumpet passage that consists of multiple musical phrases. You want the first note in each phrase to sound like it is tongued, and the following notes to follow legato (untongued). First, compose the entire passage in a single track. Make sure that the durations of the legato notes fill in the intervals completely, or even overlap ever so slightly. Assign to this track a patch that has an articulated (tongued) sound. Then add a brand new track, and assign a legato sound to it. Move all of the legato notes to this track.

**How do I simulate a French horn--soft and mellow, then loud and brassy?**

This is easy if you have a relatively fast passage with short notes. You need a synthesizer or sound font that includes "velocity-sensitive" programs. In other words, not only does a high-velocity note sound louder than a low-velocity note, but it will have a brassier tone quality, too.

However, velocity is only a single control on a note. If you want to simulate the change in tone quality that occurs when a crescendo or diminuendo is applied to *a single sustained note*, then this is another matter entirely. You will need to duplicate that note into two tracks. Assign a mellow tone to one track, and a brassy tone to the other. Then you apply a volume or expression cross-fade from one track to the other. In other words, start one track at 0 expression and the other at 100 (or thereabouts). Then apply messages that increase the first track from 0 to 100, while simultaneously decreasing the second track from 100 down to 0.

There is another, entirely different (and expensive) approach to this problem. That is to get a Yamaha VL70-M physical modeling synthesizer. Coupled with a breath controller or a wind controller, this synthesizer is said to come closest to true woodwind expression. A friend (JX



Bardant: <http://www.geocities.com/Paris/LeftBank/1140/> ) recorded one of my saxophone quartets with this equipment--it is very special!

### **Do you have some general guidance about adding realism to MIDI?**

If I were forced to come up with a single rule about MIDI realism, it would be to listen very closely to live musicians. There is no single trick. Even when you know exactly *what* to do, it takes a considerable amount of effort to *do* it.

### **Where can I go for more information about adding realism to MIDI?**

There are many useful references: The article "Add Realism to Your Synthesized Sequences" by Ethan Winer may be found at: <http://www.ethanwiner.com/realism.html>  
It has some good in-depth discussions about several very useful techniques.

You can find my approach in the essay "Philosophy of MIDI Composition" at my web site:  
<http://www.erols.com/druben>

I found the book "The Guide to MIDI Orchestration" by Paul Gilreath to be packed with excellent information. You can find more information about this book at:

<http://www.paulgilreath.com/releases.html>

It is not for the beginner, however--you should be quite familiar with MIDI before opening this book. I supplemented the book with Gilreath's CD "Eyes on the Morrow" for examples of what is achievable through MIDI.

### **Are there any tools that can automate the process of adding realism to MIDI?**

There are various plugins that can increase MIDI realism. I have occasionally used the NTONYX Style Enhancer Micro plugin. One version can operate as a stand-alone program on any MIDI file. The version I have works from within Cakewalk. You select a phrase corresponding to a single instrument. Then you choose a style of playing from among a list of various styles associated with that class of instrument. Then you can alter the intensity of the style. You press a button, and it modifies the MIDI to emulate a live musician. Listen to the result, and if you don't like it, back up and try again. It seems to be best for pop-oriented music. It provides some incredible effects. Its "secret" lies in the way that it simultaneously varies a number of different MIDI messages, including volume, modulation, and pitch wheel, much in the way a musician unconsciously adds expression.

### **How can I convert an audio file into a MIDI file?**

It is possible to take an audio file containing a single voice or instrument, and convert it into a MIDI file. Multiple instruments tend to confuse the software. For complete information, take a look at these two links: [http://www.hitsquad.com/smm/news/9903\\_101/](http://www.hitsquad.com/smm/news/9903_101/)  
<http://www.hitsquad.com/smm/news/867/>

### **How do I post my Music on the Internet?**

A good introductory article by Ethan Winer is at: <http://www.ethanwiner.com/websites.html>

#### **1) General MIDI**

The big advantage of MIDI files is that they are very small and convenient, and easy to upload and download. However, each person's MIDI equipment is different, so your music will sound quite different to each listener. Your music may sound great and well-balanced on your setup--but can sound poorly balanced on another setup. A good introduction to MIDI can be found at:  
<http://nuinfo.nwu.edu/musicschool/links/projects/midi/expmidiindex.html>

General MIDI (GM) is a standard that is in wide use on the Internet. If you plan to post your MIDI files on the Internet, then this is the "format" to use. All notation and sequencing programs can handle this format. It is a convention that says "acoustic piano" is always program #1, "flute" is always program #74, and a helicopter sound is program #126. There are 128 instruments/sounds altogether. But while standards are great for the purpose of portability, General MIDI is rather limiting in terms of the variety of sounds and articulations. If you confine yourself to General MIDI, then you will be ignoring most of the power of your sound equipment.

If you want to put MIDI files on your own personal web site, then you can get useful instructions for writing HTML at this page at the Crescendo plugin site: <http://www.liveupdate.com/midioptions.html>

Whether or not you want to maintain your own web site, there are plenty of online sites where you can submit your General Midi music files. If you would like to get your music reviewed by objective experts (yeah, right!) then think of submitting your music to the Monthly Midi Contest at [www.tosbbs.com](http://www.tosbbs.com). All genres and styles are welcome there. A site that specializes in contemporary classical music is the Cadenza Midi Diary, at: <http://www.cadenza.org/midi/> where a new original Midi file is posted every day.

## **2) Sheet Music**

If you have a notation program, then you can post your sheet music on the Internet for perusal, or for sale. You want to make sure, though, that people who do not have your particular notation program can read your music. Various approaches are possible:

2a) Convert your music into PDF (Adobe Acrobat) format. The advantage of this approach is that it is portable--most computer users have installed Adobe Acrobat reader (which is free), and the print quality is high. The disadvantage of this approach is that the files are rather big. Also, you can only look at the printouts--you cannot play the music. You can download a free evaluation copy of PDF-Creator from this site: [http://www.jawssystems.com/products/products\\_fs.html](http://www.jawssystems.com/products/products_fs.html)

2b) If you own Sibelius, Finale, or Igor notation programs, then you can use their online sites to post your music. Free "plugin" programs allow customers to simultaneously view and listen to your music. The Sibelius site is: <http://www.scorchmusic.com> and is the most advanced. This site allows submissions in both Sibelius and Finale file formats. My advice is to stay away from the Igor notation program, until it is more fully debugged.

## **3) Streaming Audio**

Audio files in WAV or AIFF format are far too big to post online (about 10Mbytes for each minute of music!), so people have resorted to various compressed formats. The most popular is MP3, and the Real Audio format is close behind. Still, these files require lots of online space for large files, about 1Mbyte for each minute of music.

The first step in producing an MP3 file is to record your music into an audio (WAV or AIFF) file, as described in "Step 1" on page 5. After you have done that, you can use an MP3 encoding program to compress the audio file into an MP3 file. The [www.hitsquad.com](http://www.hitsquad.com) site has a long list of MP3 utilities, some of which are MP3 encoders. I use a program called "Right-Click MP3" for this purpose. By the way, encoding an MP3 file is computationally intensive, so if you have a slow computer (like mine!), it can take 20 minutes to encode a 5-minute recording.

There are web sites where you can post your MP3 files for free (like [www.mp3.com](http://www.mp3.com)) and nearly for free (like [www.ampcast.com](http://www.ampcast.com)). Although these web sites state that their goal is to popularize your music, that is just not true. Their first priority is to make money, and are full of advertisements.