Sound cards aren't just for games. In the first of a two-part series, Steve Helstrip introduces you to the world of music and MIDI

part 1

# Making music

In just a few short years sound cards have become an essential part of the PC make-up to the extent that no home PC is considered complete without one. Sound cards don't just make games and multimedia applications sound great, though. With the right software they enable you to compose, edit and print your own music. They can help you learn to play the piano, record and edit digital audio and even 'remix' professionally-recorded dance music.

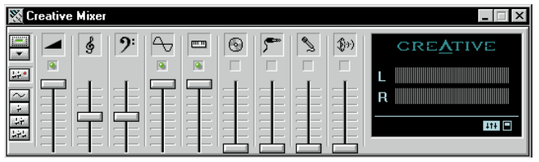
This computer class gives an overview to setting up a basic MIDI (Musical Instrument Digital Interface) studio and looks at the various software options to help you get the most from your PC. We'll also be unravelling the mysteries associated with MIDI and digital audio. In part two, next month, we'll be delving deep into MIDI sequencing and will explain how to piece together an entire song with a step-by-step guide. Until then, let's have a look at what sound cards actually do.

Most of today's sound cards integrate four separate components, each designed to do a specific job. They are the MIDI synthesiser, MIDI interface, digital audio player/recorder, and audio mixer. The synthesiser's job is to play back individual sounds – a piano and trumpet, say – from a set of instructions called MIDI events.

There are two types of synthesisers commonly used in sound cards: FM (Frequency Modulation) synthesisers, and WaveTable synthesisers. In a nutshell, WaveTable works by playing back actual recordings, or samples, of real instruments. Older FM-based synths, on the other hand, generate electronic sounds, which often sound nothing like the instruments they're supposed to.

So how do you play the sounds? This is where the MIDI interface comes in. Around the back of the sound card are several sockets for audio cables. In addition to these, there's a D-type connector which serves as both a joystick and MIDI interface. With the correct cable, a MIDI keyboard can be connected to the sound card and be able to communicate with any music software. We'll discuss MIDI in more detail later on.

Sound cards can also record and play back digital audio using a similar technology to compact discs. When recording digital audio, a chip known as an ADC (analogue to digital converter) converts the input signal into binary code – that's lots of ones and zeros to you and me. This code can then be stored in the computer's memory, or saved to disk. When the file is played back, a DAC (digital to analogue converter) turns the code back into an audible signal. Unlike standard cassettes, or tape, the quality of digital audio can be varied. However, higher quality recordings require more disk space.




You're probably familiar with mixing desks – you know, the big things in recording studios with squillions of knobs and flashing lights. Well, sound cards also have audio mixers. These are usually software-based and allow you to control how loud each component plays, including audio CDs. They also let you control the level of the microphone and auxiliary inputs. Some cards, including Creative Labs' AWE-32, have tonal controls allowing you to crank up the bass, or add a touch of treble.

## More about MIDI

MIDI was developed as a communications protocol for two or more musical instruments, back in the early 1980s, to enable them to 'talk' to each other. Just as computers use modems to communicate and exchange data, MIDI allows musical instruments and computers to exchange information.

Early synthesisers were only capable of playing one instrument at any one time. Therefore, MIDI was developed to allow keyboard players to 'layer' the sounds produced by several synthesisers simultaneously. Today, however, MIDI is used mainly for sequencing.

MIDI doesn't transmit any sound, though, just simple binary information. The ones and zeros that are sent down the cables contain specific instructions. The most common instructions tell the receiving instrument to play a particular note for a duration of time – a note-on message followed by a note-off message. The same instructions contain details of how loud to play a note.

But how does the synthesiser know what sound to play? To be honest, it doesn't. A simple program-change message takes care of that, though. This message tells the synth to select sound number 67, for example, which in the General MIDI specification (*see below*) is a saxophone.

In much the same way that you tune your television set into channels, MIDI instruments are also set to receive on channels. All of today's sound cards are 16-part multi-timbral, which means 16 different instruments can be played simultaneously, each on their own channel. Adding a second MIDI interface opens up the possibility for another 16 instruments to play, providing you have a second synthesiser connected to it. Some MIDI interfaces offer as many as 16 individual outputs, making it possible to access 256 instruments at the same time. This might sound ridiculous, but in large MIDI setups, channels become as important as RAM in the sense that you never seem to have enough of the things.

## General MIDI

As MIDI became more popular through the 1980s, musicians began to face problems when it came to playing MIDI sequences on equipment other than that they were recorded on. The problem was that there were no guidelines for synth manufacturers, and no standard set of sounds that each synthesiser should have. Therefore, when it came to playing back music on a different synth, all the wrong instruments would play. So leading manufacturers clubbed together and came up with a minimum specification, called General MIDI.

For a sound card or synthesiser to be General MIDI-compatible it must contain 128 specific instruments, each stored in a particular program. It must also be capable of playing 16 instruments simultaneously and have percussion or drum sounds mapped out correctly to receive on MIDI channel 10. If a sound card is stamped with the General MIDI logo, it gives no indication as to its sound quality; it just ensures that files written for GM instruments will play back correctly.

## MIDI versus digital audio

Audio can be stored on a PC's hard disk in one of two ways – as a MIDI sequence, or as a digital audio sample. Each has its advantages and disadvantages, described below, and subsequently they are commonly used together in music production.


## MIDI files

A MIDI sequence has the .MID file extension and consists of a list of simple instructions that describe how a synthesiser's internal sounds should be played. The list might begin with an instruction to select a piano sound and go on to say 'play middle C for two beats'. Additional instructions describe how the sound card should set up its digital effects, such as reverb and chorus parameters, and at what tempo the music should play.


The main plus point MIDI has over digital audio samples is its compact file size. Three minutes of 'busy' music will typically be smaller than 100Kb, small enough to fit 10 songs on just one floppy disk. Digital audio, on the other hand, typically requires around 30Mb for three minutes of music recorded at 44.1KHz 16-bit stereo, or CD-quality.

Not all MIDI synthesisers are the same, though, so the quality of MIDI-generated audio will differ depending on which sound card it is being played through. All current sound cards are now based on WaveTable technology and use actual samples of real instruments. Therefore, a piano will sound realistic and digital effects, such as reverb, can improve the sound quality further still. Even so, the pianos on some cards are terrible compared to others. Older FM-based sound cards do not reproduce music accurately and often sound nothing like the composer had intended. For example, a trumpet program, or patch, may sound the same as a cello, and a clarinet like a flute.

## Digital audio files

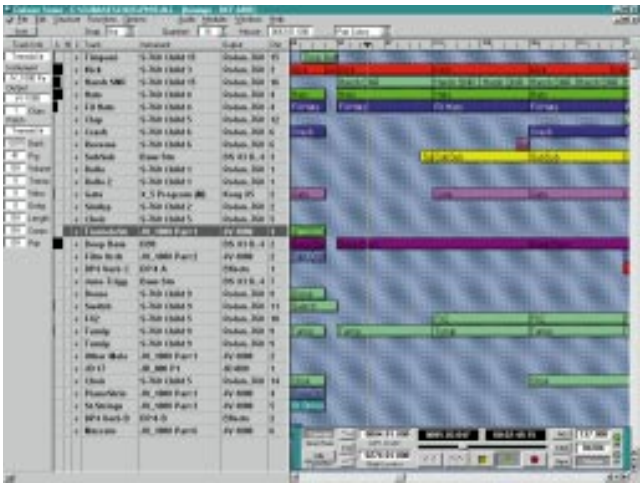
Digital audio files come in many shapes and sizes and are often referred to as samples. The most commonly used format is the Wave file which has the .WAV file extension. As its name suggests, a Wave file is a digitised sound wave. The advantage of digital audio is that any sound can be played back accurately on any sound card. It could be an entire song, or just somebody talking. File sizes differ depending on the sampling rate and resolution of the recording. Sampled audio within games is usually recorded at 22KHz, 16-bit stereo. And although this requires large amounts of disk space, its sound quality is only comparable to a television set. CD-quality samples, which are recorded at 44.1KHz 16-bit stereo, require a massive 30Mb of disk space for just three minutes of audio.

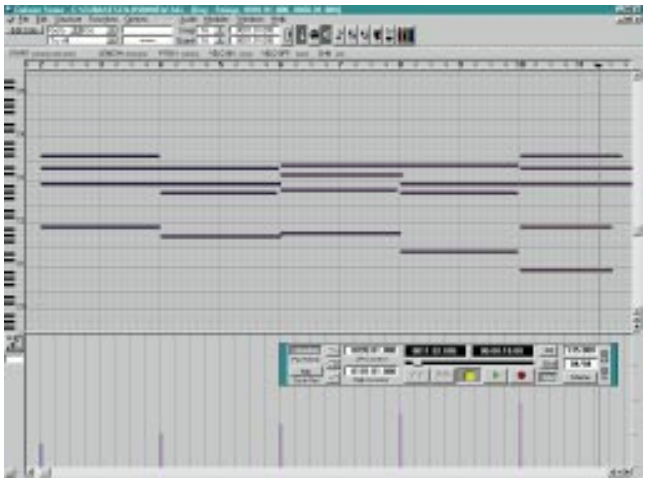
## Get connected

So how do you connect a MIDI keyboard to your PC? Well, first you're going to need a MIDI adaptor kit, costing from around £15. Then, all you have to do is connect the MIDI output from your keyboard to the input of the MIDI interface, and vice versa. This will establish a two-way communication. However, this alone will not enable you to hear the sounds from the sound card – you also need a MIDI sequencer. Lucky, then, that we have a fully-working demo of Cubase on this month's cover CD. In the absence of a MIDI keyboard, you might like to install MIDIKeys. This small utility provides a 'virtual' MIDI keyboard on your screen. When a key is pressed, it sends out MIDI information in exactly the same way as a 'real' MIDI keyboard would.

OK, let's assume that you have installed Cubase correctly and everything appears to be working. What next? A good place to start is to load one of the demonstration songs, or arrangements. Arrangements are made up of one or more ▶

tracks in Cubase and each track is usually set up to play a different instrument. Track names are displayed down the left-hand side of the screen and its contents are displayed as parts, or blocks, in the arrange window. Tracks are colour-coded to help you find your way around.





***Top:** A complex MIDI arrangement set up to play an entire song.*
***Above:** MIDI data displayed in the key editor.*

To hear the arrangement, click the play button on the transport bar, or simply press Enter on the numeric keypad. As the arrangement plays, the song position pointer moves horizontally across the screen denoting time. Instruments, or tracks, can be played solo by pressing S, and be muted by clicking in the M column to the left of the track name. The track info column (far left) tells us more about each track, such as which instrument, or program, is playing; the volume of the track and what channel MIDI events are being sent out on.

Have a go at changing the instruments that are being played by each track. This can be done quickly by clicking on the program change dialog, labelled 'Prg' in the track info column. The tracks volume, pan position and pitch can also be controlled from here. Next month we'll be looking closely at all Cubase has to offer. We'll also demonstrate how to play back and sequence digital audio, in addition to MIDI tracks.

So what other types of music software can you get hold of? There are plenty of programs around to help you learn piano technique and improve your reading skills. One of my favourites is the Pianist series. This is a collection of 11 programs covering classical, jazz, ragtime and gospel styles. Each program comes ▶


## MIDI glossary

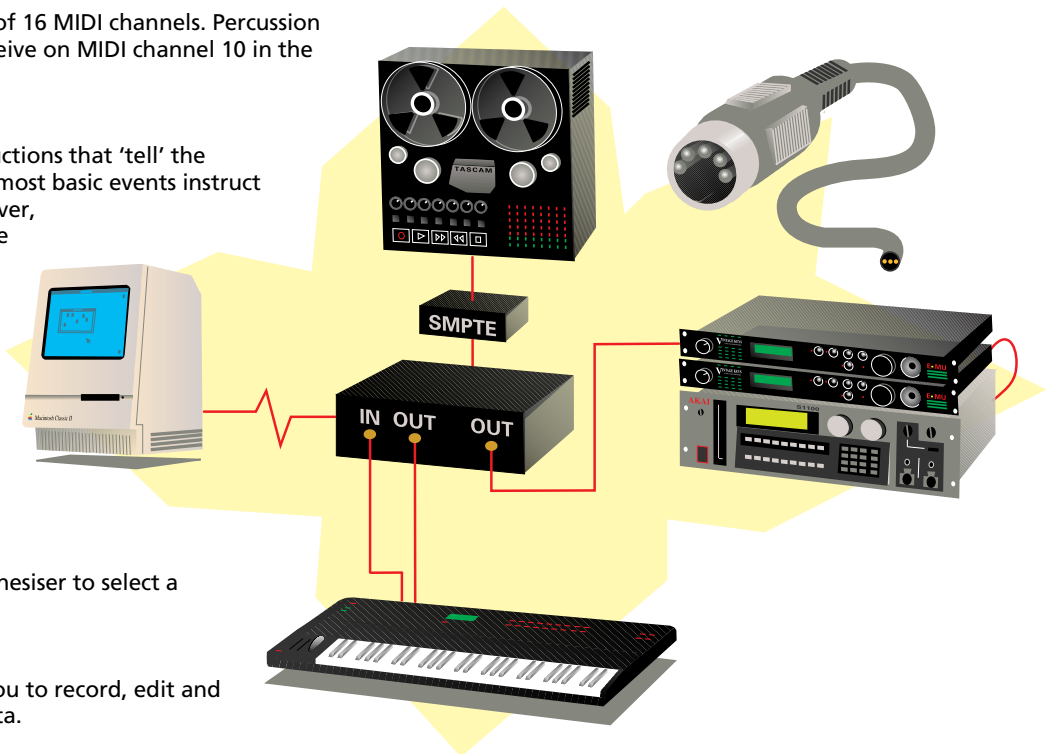
**Channels**
MIDI instruments receive on one of 16 MIDI channels. Percussion sounds, however, are fixed to receive on MIDI channel 10 in the General MIDI specification.

**Events**
MIDI events consist of short instructions that 'tell' the receiving device what to do. The most basic events instruct instruments to play a note. However, more complex events can alter the way instruments sound and which speaker they play from.

**General MIDI**
GM defines a minimum set of rules for synthesisers. These include a description of its instruments and how many sounds it can play simultaneously.

**Program change**
A MIDI event that instructs a synthesiser to select a particular sound.

**Sequencer**
A piece of software that allows you to record, edit and play back many tracks of MIDI data.



with around 90 MIDI files, all professionally recorded with a weighted MIDI keyboard. An on-screen keyboard displays the keys that are being played, and you can also view each piece in traditional notation. In addition, you can test your music knowledge with the trivia quizzes and find out everything you ever wanted to know, and more, about each composer featured in the programs. The accompanying MIDI files can also be imported into any sequencer for further study.

The Pianist series is available for Windows, Mac and Atari ST for £49.95 (incl VAT) from Turnkey on 0171 379 5148.

MixMan is a sample-based sequencer that comes with eight pre-recorded dance tracks. Each song is built up from several tracks of music (vocals, drums, synths, etc), and each can be 'remixed' by structuring the tracks, and instruments, differently. No musical knowledge is needed to come up with something that sounds fresh and new. If you come up with a particularly stompin' tune, you can run it off to cassette and annoy your neighbours, while impressing your mates. At £39.95, this is a 'must have' considering the many hours of fun you'll have creating professional-sounding music.

MixMan is distributed by Time + Space (phone: 01442 870681).

## WaveLab

WaveLab is a 32-bit digital audio editor for Windows 95. It is supplied on CD-ROM and requires less than 5Mb of hard disk space for installation. At first glance, WaveLab looks no different to any other sound editor. It's only when you import a 36Mb file that WaveLab comes into its own. Being a 32-bit application, WaveLab is incredibly quick and allows you, for example, to change the length of samples without affecting its pitch. Samples can also have effects applied to them, such as chorus and digital delays. In next month's Computer Class we'll be looking more closely at digital audio editors, and at ways they can be used to make your music sound more professional. ●

## Software on this month's free CD

There are two pieces of software on this month's CD to accompany this feature. They are MIDIkeys and a fully working demo of Steinberg's Cubase.

MIDIkeys is a 'virtual' MIDI keyboard that allows you to input MIDI data and play instruments by simply clicking your mouse on its keys. This is quite a useful utility, particularly so in the absence of a MIDI keyboard.

Cubase is the industry-standard MIDI sequencing application in use in studios all around the world. Although you cannot save your work with this demo, you can at least get a feel for the package and try all the features it has to offer.

## Win a Roland Portable Music Station

Roland has generously offered us a brand-spanking-new PMA-5 to give away. Despite its diminutive size, the PMA-5 packs in a whole load of features. For starters, there's a General MIDI synthesiser, an eight-track sequencer, an auto-accompaniment section and, wait a minute, is that a MIDI keyboard as well?

It looks more like something from *Star Trek* than a musical instrument, but the PMA-5 is, in fact, a portable music workstation. You operate the PMA-5 using a touch-panel interface similar to Apple's Newton MessagePad. Using a plastic-tipped pen, which fits snugly into the right-hand side of the unit, you can access every feature the PMA-5 has to offer. You can fine-tune your sequences, add digital effects, such as reverb and choruses, and store up to 10 songs in memory.

The PMA-5 sounds absolutely fantastic and can be connected to a PC effortlessly. What's more fun, though, is being able to write tunes anywhere you choose. We don't recommend you take it in the bath with you, though.

We've decided to split the competition over two months. Here's what you have to do. Simply answer the questions below. There will be an entry form included in next month's Computer Class along with three more taxing questions


**1. What is MIDI an acronym for?**
**2. How many songs can the PMA-5 store in memory?**
**3. For a sound card to be General MIDI-compatible, how many instruments must it contain?**