

# MIDI and Sequencer

## MIDI

MIDI is short for Musical Instrument Digital Interface. Originally intended to link synthesisers and keyboards, it was quickly adopted for the personal computer. Rather than transmitting sounds through cables, it transmits information about how music is produced. The command set includes note on, note off, key velocity, pitch bend commands to control synthesizers, making it relatively easy to change the pitch, volume and duration of individual notes during performance. MIDI is a protocol to communicate with synthesisers and samplers, designed for recording and playing back digital music. With MIDI it is possible to record performances and edit them in much less time than when working with digital audio recordings. MIDI can be considered as a musical digital language used to send and receive these messages. The important thing to understand is that MIDI data is not sound data. Rather, it is the alphabet that the digital instruments and computers use to process musical information. A computer cannot recognise MIDI information without a special interface. Only computers furnished with a MIDI interface will respond to MIDI. When used as a musical instrument, the sound waves produced by the computer are normally sounds that were previously sampled to its memory. However, it is also possible to program the computer to synthesise such sounds from scratch. Today, all personal computer sound cards support MIDI because it provides a straightforward connection standard for electronic musical instruments, capable of linking every type of musical and audio device.

## MIDI channels

In a MIDI signal there are 16 channels numbered from 1 to 16. MIDI channels are not separate physical connections. Rather a MIDI channel is like an electronic address that labels a packet of digital information, specifying its ultimate destination. Each MIDI channel corresponds to a distinct stream of data and could be related to a different timbre (or instrument).

## MIDI messages

The MIDI specification describes a language of messages sent from device to device. They are sequence of bits than can parse 10-bit words. One or more words comprise a MIDI message. There are different types of MIDI messages. The basic type is the Channel voice message:

- note on
- note off
- pitch bend
- ...

For example, the "note on" voice message sends a 3-byte message as follows: Note: the term "Velocity" refers to how hard a key of the keyboard is played. Channel mode message: MIDI control having numbers from 121 to 127 are reserved for channel mode message. System common messages: these messages are not sent to a particular channel, and do not correspond to a note or controller. They are sent to the system as a whole. These messages include: song selection, drum machine timing and system exclusive types. System exclusive messages: these messages can handle any kind of system message and are basically used by manufacturers to implement special features on their equipment. Every manufacturer has their own system exclusive message; virtually anything can be handled by system exclusive messages. System real-time message: there messages are concerned with the synchronisation of devices in real-time; for example, drum machines.

## MIDI modes

MIDI modes are devoted to governing how each piece of equipment handles the MIDI channels. There are 4 standard MIDI operating modes:

- Mode 1. Omni on/poly
- Mode 2. Omni on/mono
- Mode 3. Omni off/poly
- Mode 4. Omni off/mono

Mode 1: This is the basic operating mode supported by all MIDI equipment. It is normally the default mode. In this mode, channel information is ignored and the equipment responds to data in any channel polyphonically. Mode 2: This is similar to mode 1, but the note information is not handled polyphonically. The device still responds to note information in any channel, but it will assign just one voice to all notes. Mode 3: This mode ignores note information that is not from a specific channel. Polyphonic operation is possible on up to 16 channels, in that it enables several instruments to be independently sequenced by a computer or other controlling device. Mode 4: In this mode, each instrument is assigned to a separate MIDI channel and it is possible to have 16 different sounds sequenced independently. Each channel will respond monophonically.

## General MIDI

General MIDI, referred to as GM or General MIDI System level 1, is a standard system for MIDI files. It is a standard instrument assignment for the 128 available program numbers. The heart of General MIDI (GM) is the Instrument Patch Map. This is a list of 128 sounds, with corresponding MIDI program numbers. Most of these are imitative sounds, though the list includes synth sounds, ethnic instruments and a handful of sound effects. The sounds fall roughly into sixteen families of eight variations each. Grouping sounds makes it easy to re-orchestrate a piece using similar sounds. The Instrument Map is not the final word on musical instruments of the world, but its pretty complete General MIDI also includes a Percussion Key Map. This mapping derives from the Roland/Sequential mapping used on early drum machines. As with the Instrument Map, it does not cover every percussive instrument in the world, but it is more than adequate as a basic set. To avoid concerns with channels, GM restricts percussion to MIDI Channel 10.

## Sequencers

Central to any computer music system is the sequencer. A sequencer is a program in a computer or stand-alone keyboard synthesiser that puts together a sound sequence from a series (or sequence) of MIDI events. The MIDI sequencer allows the user to record and edit a musical performance without using an audio-based input source; it works as a virtual multi-track recorder for MIDI information. The performance is recorded as a series of events or actions that would ordinarily be played on a keyboard instrument. The MIDI sequencer does not record the actual audio, but rather the events related to the performance - what note was played at what time, how hard the key was pressed, when the sustain pedal got depressed, and so forth. This data is then played back into a MIDI synthesiser or sound module. Using this method, it becomes simple to select a piano sound for a musical passage and later decide that the passage would work better as an organ sound. One can simply change the sound program on the MIDI keyboard to alter the sound without needing to re-record the entire musical passage. The note and timing information is relayed and stored using MIDI data. A typical MIDI signal contains all musical note information like note length, pitch, volume and the type of sound (i.e., instrument) to be triggered. In short, sequencers are MIDI recording and playback devices.

## Playing Music

Sequencers have transformed the creation of music. All we need to make music today is a computer, a sequencer, a soundcard with MIDI interfacing capabilities and a MIDI controller such as a keyboard. Devices that respond to MIDI information are technically called MIDI receivers; these include keyboard synthesisers, sound modules, drum machines, samplers and sequencers. Some devices act as both MIDI controllers and MIDI receivers. A MIDI drum pad machine is also a type of MIDI controller and there are MIDI controllers in the form of guitars and wind instruments.

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