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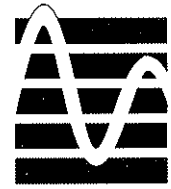

# MIDI

## A COMPREHENSIVE INTRODUCTION

2nd Edition

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## THE MIDI SPECIFICATION

The MIDI protocol specifies conditions in two areas, and manufacturers must meet these conditions to call their product a MIDI device. The areas are the hardware interface, or the physical connection between two separate pieces of equipment, and the data format, or the arrangement and order of data messages that one device transmits to another. The hardware portion of the MIDI specification describes the two parts of the physical connection between different pieces of equipment. The two parts are, first, a MIDI port that converts MIDI data from its digital form to the series of electrical voltages that represent the MIDI data numbers (or vice versa) and, second, a MIDI cable that transmits the voltage signals to the next device's MIDI port, which converts the voltages back to digital data.

### MIDI Ports

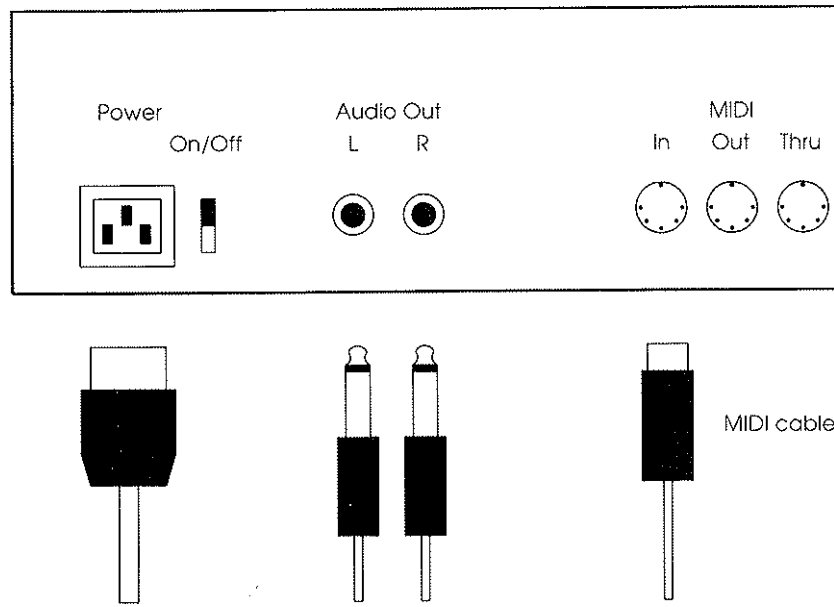
A port, or interface, is a place where two otherwise incompatible systems perform the necessary conversions that enable them to pass data from one to the other. Computers use groups of electrical voltages to represent large numbers. The MIDI cable carries voltages representing only the numbers 0 and 1. Conversion from one form to the other takes place at the MIDI port. Although "MIDI interface" is redundant, it is more commonly used than "MIDI port."

The MIDI specification describes three types of ports, each represented by a female jack designed to receive the five-pin MIDI cable connector, as shown in figure 1.1. At the MIDI Out jack, data are converted from digital to voltage format. The voltages travel along a MIDI cable to another MIDI device. The receiving device must include a MIDI In jack to convert incoming voltages back to their digital format. It is important when connecting MIDI devices to be sure which is sending signals and which is receiving them and to connect the cables accordingly.

A simple example involves using a "master" keyboard synthesizer to control a "slave" keyboard or rack-mount synthesizer so that playing the master keyboard will cause the two to sound in unison. The MIDI cable should plug into the master's MIDI Out jack and the slave's MIDI In. As obvious as this may seem, incorrect cabling is one of the most common causes of MIDI system problems. Check for proper cabling first when such problems occur.

Most MIDI devices have both MIDI In and MIDI Out jacks, but there is a third port defined in the MIDI specification called MIDI

*Figure 1.1* Rear-panel connections on a typical MIDI device, showing the location of MIDI In, Out, and Thru ports.




Thru. It makes a copy of any incoming signals the device receives through its MIDI In port and immediately retransmits them, unchanged, out the MIDI Thru jack (figure 1.2). In a sense, MIDI Thru serves as a Y-connector, which breaks a signal in two. Chapter 7, "Getting It All to Work Together," covers the advantages and pitfalls associated with using MIDI Thru.

## MIDI Cables

A MIDI cable consists of a length of wire with identical connectors at each end, as shown in figure 1.3. The cable transmits neither audio signals nor electrical power. Rather, the changes in voltage transmitted through the MIDI cable represent binary data: the yes/no, on/off signals that, strung together, represent specific numbers whose purpose and meaning are defined in the MIDI protocol.

MIDI cables are generally no longer than 50 feet and usually are much less than that. Voltages become weaker the farther they

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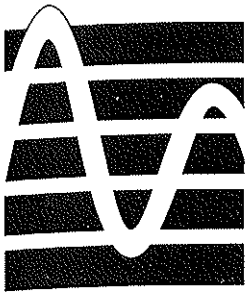

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# Overview

MIDI is an acronym for "Musical Instrument Digital Interface." Despite its impact on the world of music, MIDI is not a musical language, nor does it directly describe musical sounds. Rather, it is a data communications protocol, an agreement among manufacturers of music equipment, computers, and software that describes a means for music systems and related equipment to exchange information and control signals.

The difference between audio information and MIDI data is similar to the difference between a tape recording of a pianist performing a piano sonata and the sheet music for that same sonata. The recording captures the musical information itself, storing the actual sounds that came from the piano.

Data, on the other hand, symbolically represent information for the purposes of storing or transmitting it in a more compact or more easily transmitted form. Thus, each notational symbol in printed piano music stores not the sound of the piano music but the instructions necessary for a human performer to re-create that music. The performer converts the symbol back into the information it represents by striking the key indicated by the note symbol, using the indicated amount of pressure, and holding the key for the indicated length of time. Notational symbols in printed music are thus forms of data.

MIDI represents yet another level of abstraction from piano music. Whereas printed piano music symbolically describes musical sounds, MIDI symbolically describes the electronic steps required to generate the sounds. That is, we can think of MIDI as specifying exactly which electronic circuits should turn on and exactly how

long they should remain on. Printed music describes a musical result that a human performer must interpret and re-create.

The MIDI protocol thus enables us to manage the complex information representing the performance of a musical work on electronic instruments. MIDI represents the information needed to re-create a performance as many individual pieces of data. The MIDI protocol specifies the meaning of each data value and provides a means to store, manipulate, transmit, and re-create the information using symbolic data.

MIDI is important to anyone involved in music making using digital electronics and increasingly so to anyone involved in any art form using digital electronics. The significance of MIDI is that it permits a wide variety of equipment from many different manufacturers to work together in a single system. Each piece of equipment is adhering to the same rules of information management specified by MIDI so that they have a common system of communication.

## MIDI APPLICATIONS

One of the simplest and most widely used applications of MIDI is to connect two or more synthesizers together so that playing one produces the same note on each. That way, a player at a single MIDI keyboard or other controller can produce sounds that have a rich, layered, complex timbre rather than a single, easily identifiable sound. MIDI devices other than just synthesizers can become part of that single system under the control of a single player. There are now MIDI-controlled digital effects processors, mixing consoles, and lighting control panels. As a result, a player at a master MIDI controller can run a complex multimedia setup of lights, sound, and effects by sending MIDI messages from the master controller to the correct device.

More powerful applications of MIDI technology involve a computer, making it an integral part of the MIDI system. The computer can be used to record MIDI messages, much as a tape recorder records audio signals. Because MIDI messages are digital data, MIDI recordings can use the full power of digital computers. With appropriate software, the computer can simulate a multitrack tape recorder using not just 4, 16, or 48 tracks but hundreds of tracks, and in some cases, unlimited numbers of tracks.

Rather than simple recording, playback, and cut-and-splice editing, a MIDI recorder includes powerful facilities that provide the user a tremendous range of creative controls. Certainly, MIDI recordings can be edited—to a precision of hundredths of a beat. In addition, the pitch, rhythm, tempo, or repetition of a single note, a longer passage, or an entire piece can be adjusted quickly and accurately. Each track can hold musical information intended for a particular synthesizer or control information for any MIDI device. The same recording that plays a synthesizer track can control an effects processor or a mixing console, setting reverb, equalization, or mix levels with a precision and accuracy that would be impossible otherwise.

Some MIDI programs are intended specifically for composing. These "intelligent instruments" let composers arrange musical ideas, concepts, and structures, with the computer making some (or many) of the specific decisions about notes, chords, and rhythms. The composer can hear the results as they occur and make changes as the music plays. As programmers apply artificial intelligence concepts to music composition software, the programs are likely to gain a wider range of capacities.

Other computer programs translate MIDI data into printer control data so that the computer becomes a powerful composer's and arranger's assistant. The capabilities of MIDI scoring programs vary widely. However, most such programs will let the composer enter music from a MIDI controller or the computer's typewriter-style keyboard. The composer can also enter tempo, meter, and expression markings and print out the completed score on a graphics printer.

With so many synthesizers and so much complexity, it is only natural to use computers to cut down the volume of data that synthesizer operators must remember. One approach uses patch librarian software, which stores synthesizer settings with appropriate notes and comments, then transmits selected patch data to the correct synthesizer at the correct time. In this way, the synthesizer operator need not be concerned with setting parameters from scratch each time the patch is used but need only select the desired patch from the library.

And, of course, the computer is an ideal tool for education. It is patient, precise, and always available. Music education programs are available for ear training, sight-reading, keyboard skills development, and music theory and are designed for a wide range of skill levels.