Human Computer Interface Technology

Input Controllers: Serial and MIDI
October 13, 1999

I. Theremin Demo

- How does this instrument/controller work?
- Why does it sound like a voice?
- What's wrong with the way it works?

- What does it have to do with computing?

II. MIDI

- The Electrical Standard.
- The Software Protocol.
- What's Wrong With MIDI?
- What's Right With MIDI?

IIb. MIDI continued, Extensions

- General MIDI
- GS, and XG

- MIDI Level 0 and Level 1 Filespec, extensions.
- Commercial: ZIPI, XMIDI
- MusicKit, WIMP, Open Synth Control, SKINI.

IIc. MIDI continued

Standard Controllers on MIDI Keyboards:

- Wheels, Aftertouch, Switches, Pedals
- Ribbons, Joysticks, Breath Input, Other?

III. Wierd MIDI and Other Controllers:

Either Based on Standard Instrument Paradigms:

- Wind: WX7, Casio MIDI Sax, EWI, Other
- Guitar Controllers
- Drums
- Others: Violins, Video Harp

IIIb. Other Controllers continued:

Non-Standard Instrument Paradigms:

- BioMuse
- Radio Baton
- Lightning, Thunder
- AxIO

IV. Specific Design Case: A Wind Controller

A Clarinet must sense:

- Key depressions (switches or better)
- Breath pressure
- Reed "bite" pressure

Non-Web References:

- Roads "the computer music tutorial", MIT Press, 1996.
- Junglieb "General MIDI", Music Books Plus, 1995.
- Rothstein "MIDI: A Comprehensive Introduction", Music Books Plus, 1995.

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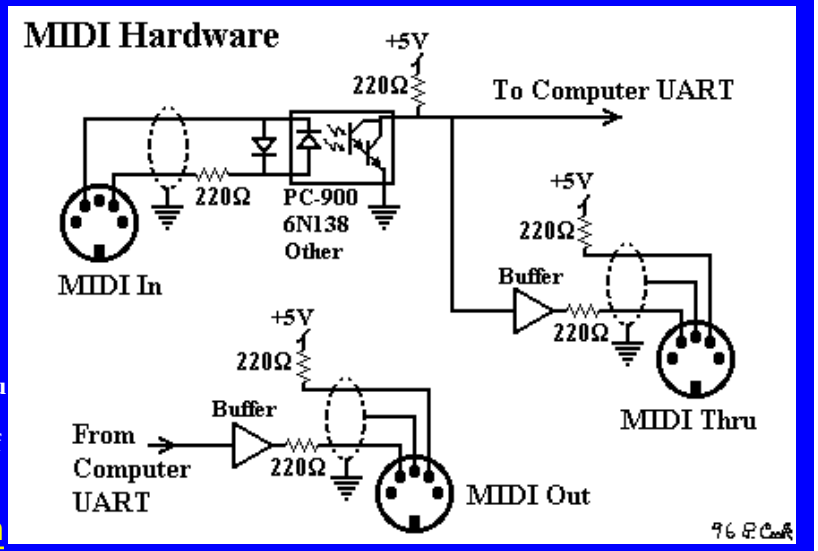
II-1. MIDI Electrical Standard

A **MIDI in** interface uses an opto-isolated current loop. 5 Volts flows through a total of 660 Ohms (min.) of resistance. There is a protection diode in case someone wires up somethingbackward. **MIDI out** is just a buffer and some resistors. **MIDI thru** is a buffered pass-through of the **MIDI in** signal.



More Information on Building MIDI Interfaces

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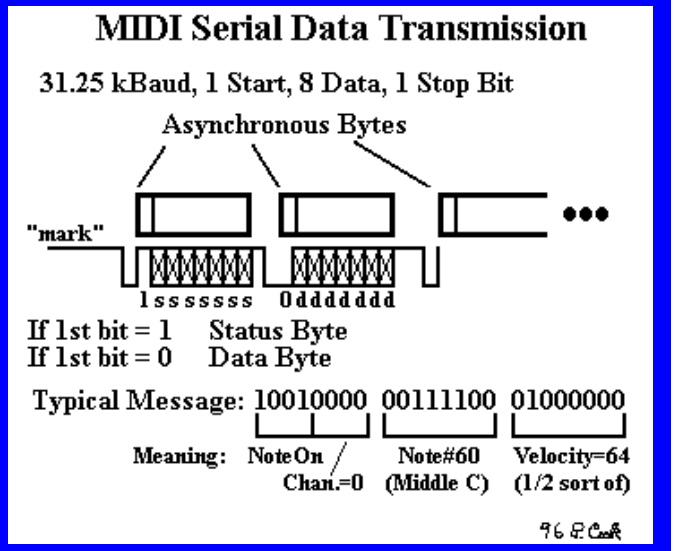
II-2. MIDI Transmission Standard

MIDI is transmitted as asynchronous bytes at 31250 bits per second. One start bit, eight data bits, and one stop bit means a maximum transmission rate of 3125 bytes per second. If the first bit is set, the byte is a **Status Byte**. The Status Byte determines the length of most messages, which are usually one, two, or three bytes in length. **System Exclusive** messages are variable length, and have a beginning and ending status byte.



More Information on Message Types And More Information

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II-3. MIDI has Problems:

- Bandwidth (Max 1.5 KHz updates)
- Maximum Cable Length (15 M)
- No Synchronous Events
- Keyboard-ist Message Bias
- No Tagged Messages (or too few channels)
- The List Goes On and On . . .

II-4. MIDI is useful because:

- It is ubiquitous, and a standard
- It's extensible (sort of),
  at least it has been
  extended in interesting ways
- It's pretty good, if you
  understand the limitations
- There's (still) little else out there

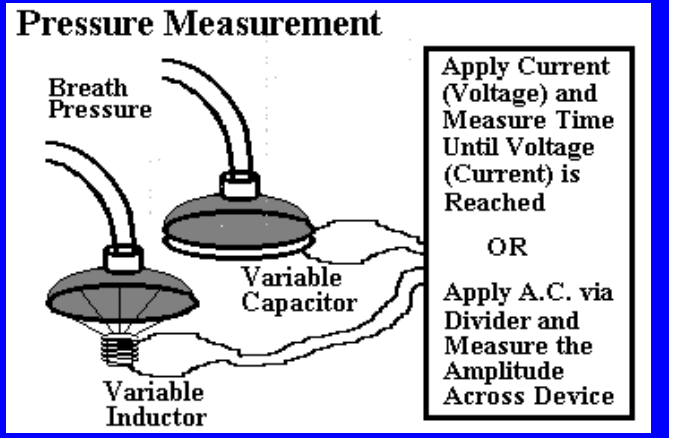
A Number of Useful Extensions to MIDI:

- MIDI Time Code (MTC)
- MIDI Machine Control (MMC)
- MIDI Show Control (MSC)
- And others.

IVa. Measuring Breath Pressure

Two means of measuring pressure (there are others
of course). A diaphram which moves in response
to pressure changes can be connected to an
inductor with moveable coil or core.
(A small speaker, which contains a coil of wire
suspended around a magnet, can be used for this)

A capacitor can be constructed in which one plate
moves in response to changes in pressure.



Measurement of Inductance or Capacitance can be accomplished by timing transient D.C. response, or measuring response to a fixed frequency A.C. signal.

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IVb. WX7 Reed "Bite"

Measuring "Bite" Pressure

Using a strain guage to sense "bite" on a clarinet-like reed.

More Information on Strain Guages

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