

Computer Music Technology 101

Brian Anderson, Clinician

Assisted by:

Tom Johnson, MakeMusic, Inc.

Larry Marchese, Sibelius Music

Mark Lemna, PG Music

Nick Argyrakis, Harmonic Vision

Marc Jacoby, Vandercook College

Bob Sheffield, Audio Biz



Contact:

Brian Anderson

Marketing Manager

McCormick's Enterprises

1.800.323.5201

brian@mccormicksnet.com

Computer Music Technology 101

I. Understanding MIDI

2. Software Technology

- A. Notation
- B. Music Scanning
- C. Sequencing
- D. Digital Audio Editing
- E. Video/Multimedia Production
- F. Performance Software
- G. Intonation Training
- H. Arranging Assistants
- I. Office Administration
- J. Music Theory
- K. Ear Training
- L. Rhythm Training
- M. Keyboard Skills
- N. Music History & Appreciation
- O. Elementary



3. Hardware Technology

- A. MIDI Keyboards
- B. MIDI Synthesizers
- C. Digital Pianos
- D. MIDI Controllers
- E. MIDI Interfaces
- F. Audio Interfaces
- G. Microphones
- H. Digital Recorders
- I. Computer Furniture
- J. Computer Labs*



* Important items to consider when developing your computer lab.

- 1. Have a plan
- 2. What type of computer should I get?
- 3. Synthesizers vs. MIDI Keyboards vs. Controllers
- 4. Electrical considerations
- 5. Networking requirements
- 6. Furniture
- 7. White board vs. chalk board
- 8. Lighting
- 9. Projection
- 10. Audio Equipment
- 11. Storage
- 12. Carpet or no carpet?



Glossary of Common Computer Port & Audio Connections

Reveal the mysteries of computer connectivity.



4 MiniDIN Female Used as the keyboard and mouse port on older Mac computers.



5 DIN Female Used as the keyboard port on IBM PC, XT, AT, and compatible computers.



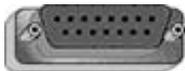
6 MiniDIN Female Used as the keyboard and mouse port on IBM PS/2 and compatible computers.



8 MiniDIN Female Used as the communication ports (modem & printer) on older Mac computers.



DB9 Male Used as the serial port on IBM AT, PS/2 and compatible computers for connecting modems and other RS-232 serial devices.



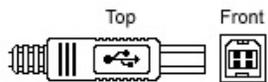
DB15 Female Used as a joystick port on IBM and compatible PC computers. Used as the video connector on most Macintosh computers.



DB25 Female Used as the parallel port connector on IBM and compatibles. Used as the SCSI connector on most Macintosh computers.



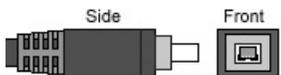
USB Type A Female Used to connect to Universal Serial Bus (USB) peripherals. This port is found on the computer or USB hub.



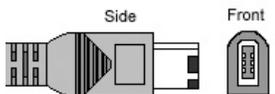
USB Type B Female Used to connect to Universal Serial Bus (USB) peripherals. This port is found on devices like printers and keyboards.



MIDI Port Used to connect MIDI gear to interfaces and other equipment. This is not a computer port, but is on all MIDI capable gear.



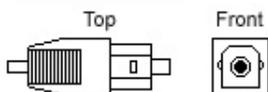
4 Pin FireWire Firewire is also referred to as IEEE-1394 and is capable of high speed data transfers up to 400Mbps.



6 Pin FireWire 6-pin firewire connectors include the ability to carry power on two of the six pins but 4-pin connectors cannot.



SP/DIF Digital S/PDIF (Sony/Philips Digital Interface) transfers audio in high quality digital format. Connectors are RCA type.



Toslink Digital High speed fiber optical cables designed to transmit digital audio. Used with DVDs, DATs, CDs, MiniDiscs, HDTVs and more.



XLR Microphone Cable The three-prong microphone cable that is the standard of the music industry.

Glossary of Computer Music Technology Terms

Analog: Data (signal) presented in a non-digital, continuous form.

Analog Synthesizer: A synthesizer which uses voltage controlled analog modules to synthesize sound. The three main voltage controlled modules in an analog synthesizer are: Voltage Controlled Oscillator (VCO), Voltage Controlled Filter (VCF), and Voltage Controlled Amplifier (VCA).

Audible Range: The range of frequencies that the human ear can hear. A healthy young human can usually hear from 20 cycles per second to around 20,000 cycles per second (20-20,000 Hz).

Baud Rate: The speed at which digital information is passed through a serial interface expressed in bits-per-second. MIDI data is transmitted at 31.25 KBaud or 31,250 bits per second.

Binary: Of or based on the number two or the binary numeration system (base 2). Digital computers use this form of numbering because the values of 0 and 1 can easily be represented by an open or closed switch.

Bit: A Bit is a single piece of information assigned a value of 0 or 1 as used in a digital computer. Computers use digital words which are combinations of bits. A Byte is a digital word consisting of eight Bits.

Bounce: When recording or sequencing, to bounce tracks means to combine (mix) several tracks together and record them on another track.

Buffer: An area of computer memory that is used to temporarily store data.

Byte: A computer word made up of eight bits of data.

Cardioid: (kar' de-oid') A directional microphone with a heart shaped, narrow pattern, which picks up from directly in front of the mic

Channel, MIDI: An information pathway through which MIDI information is sent. MIDI provides for 16 available channels, each of which can address one MIDI instrument.

Chorus: A voice doubling effect created by layering two identical sounds with a slight delay (20-50 mS) and slightly modulating the frequency of one or both of the sounds.

Condenser Mike: A microphone which converts sound pressure level variations into variations in capacitance and then into electrical voltage.

Crossfade: To gradually fade out one sound while fading in another so that a seamless transition is made between the two sounds.

Digital: Equipment that uses quantities represented as binary numbers. In a digital synthesizer every aspect of the sound generation is handled as a numeric calculation. The digital information is not audible and so must be converted to analog form by a DAC before it is output.

Digital to Analog Converter (DAC): A device which interprets Digital information and converts it to Analog form. All digital musical instruments must have a DAC so that we can hear their output.

Digital Audio Tape (DAT): The medium that a machine that records sound digitally uses. They generally use a spinning drum similar to those found in VCR's as opposed to the record and playback heads found on regular analog tape recorders.

Digital Signal Processor: Most signal processors these days are digital. They allow the instant recall of all the parameter settings of the device without having to manually reset all the controls every time a different sound effect is required. Increasingly DSP's are becoming software based, accessed via an audio recording or editing application as a plug-in.

Dynamic Mike: A microphone in which the diaphragm moves a coil suspended in a magnetic field in order to generate an output voltage proportional to the sound pressure level.

FireWire: FireWire is a cross-platform implementation of the high-speed serial data bus -- defined by IEEE Standard 1394-1995 -- that can move large amounts of data between computers and peripheral devices. It features simplified cabling, hot swapping, and transfer speeds of up to 400 megabits per second.

Frequency: The number of cycles of a waveform occurring in a second.

Gain: The factor by which a device increases the amplitude of a signal.

Hard Disk: A storage medium for digital data which can hold more information and access it faster than a floppy disk.

Hard disk recorder: A computer-based hardware and software package specifically intended for the recording, manipulation, and reproduction of the digital audio data that resides upon hard disk and/or within the computer's own RAM.

Hardware-based sequencer: Stand-alone devices for the sole purpose of MIDI sequencing. These systems make use of a dedicated operating structure, microprocessing system, and memory that is integrated with top-panel controls for performing sequence-specific functions.

Hertz/Hz: A unit of frequency equal to 1 cycle per second. Named after Heinrich R. Hertz.

Looping: Looping is the process of repeating a portion of a sample over and over in order to create a sustaining sound. The looped sound will continue as long as the key is depressed. A sound is usually looped during a point in its evolution where the harmonics and amplitude are relatively static in order to avoid pops and glitches in the sound.

Musical Instrument Digital Interface (MIDI): A digital communications language that allows multiple electronic instruments, controllers, computers and other related devices to communicate within a connected network. MIDI is an asynchronous, serial interface, which is transmitted at the rate of 31.25 KBaud or 31,250 bits per second.

MIDI in: This port receives MIDI messages from an external source and communicates this performance, control, and timing data to the device's internal microprocessors.

MIDI out: This port is used to transmit MIDI messages from a single source device to the microprocessor of another MIDI instrument or device.

MIDI thru: This port provides an exact copy of the incoming data at the MIDI in port and transmits this data to another MIDI instrument or device that follows within the MIDI data chain.

Monophonic: A musical instrument that is only capable of playing one note at a time. Music with only one voice part.

Multi-timbral: The ability of a musical instrument to produce two or more different sounds or timbres at the same time.

Multi-track: A way to record a complex musical piece by dividing it into simple tracks, and combining the tracks during playback.

Normalize: A digital processing function that increases the amplitude of a sound file until the peak amplitude of its loudest sample reaches 100% of full scale.

Pan: Refers to moving an audio signal left or right in the stereo spectrum. Also called the balance control. All stereo audio mixers have panning, and most software sequencers allow you to set and change panning.

Patch: A synthesizer sound which is stored in its computer memory. Usually refers to a sound which can be altered, i.e. it's stored in RAM memory. Sometimes also called preset, program, or sound. Comes from the use of patch cords on the original modular synthesizers.

Pitch Bend: A continuous controller which can be applied to synthesized note(s), usually from a joystick to the left of the lowest keyboard note. The sound is a raising or lowering of the pitch and changes as you move the joystick left and right.

Plug-in: A software based application that is accessed via a recording and editing application such as Cubase or Pro Tools.

Polyphonic: A musical instrument that is able to play more than one note at the same time. Music with more than one voice part.

Punch-in: When recording, punching in over-writes a previously recorded track starting at the punch in point.

Punch-out: When recording, punching out stops the recording process started by a punch in, thus preserving the previously recorded track starting at the punch out point.

Quantization: A timing function of a sequencer or sequencing software used to correct human-performance timing errors within a composition.

RAM: Acronym for Random Access Memory. The memory in a computer that stores data temporarily while you are working on it. Data stored in RAM is lost forever when power is interrupted to the machine if it has not been saved to another medium, such as floppy or hard disk.

ROM: Acronym for Read Only Memory. This is computer memory which can't be changed or erased. It is 'burned' into the computer or device. Most synthesizers have some sounds which are in ROM memory and can't be altered. A sign of a more expensive synthesizer is having sounds in RAM memory, implying that you can alter the sounds and save variations as your own.

Sampler: Also called a digital sampler. A type of synthesizer which derives its sounds from recording actual sounds (instruments or non musical sounds) and then storing them in computer memory, either floppy discs, hard drive, or recorded onto CD-ROM. They are used extensively for generating sound effects.

Sample Rate: When digitally sampling a signal, the rate at which level measurements of the signal are taken.

Sequencer: A device which steps through a series of events. A digital sequencer may record keyboard data, program changes, or realtime modulation data to be played back later much like a tape recorder or player piano. Digital sequencers use memory on the basis of events (key on, key off, etc.) while a tape recorder uses memory (tape) on the basis of time.

Signal Processor: An electronic device which audio signals can be routed through to affect the sound of that signal. Examples: echo and reverb units, distortion devices, etc. Most electric guitarists run their instruments through 'pedals' which are small floor units that process signals at the press of a foot pedal.

Signal to Noise ratio (S/N): The ratio between what goes in a device designed to alter or record sound, and what comes out the other end. If what you get out the other end is all distorted or hissy the piece of equipment has a low signal to noise ratio. A very expensive DAT machine for example, will have a high S/N ratio because what you get out will sound very close to what you put in. The same goes for a very expensive digital effects processor, if you want a sound to come out with reverb on it and instead it comes out with reverb and a bunch of hiss you would not be very happy.

SMPTE: Acronym for Society of Motion Picture and Television Engineers who adopted a standard time code in order to synchronize video and audio. SMPTE information is in the form of Hours, Minutes, Seconds, and Frames. There are two types of SMPTE time code, Longitudinal Time Code which can be recorded on audio tape, and Vertical Interval Time Code which is recorded on video tape.

Step Time: A sequencer mode where events are entered one at a time.

Synthesizer: A device that creates sounds electronically through the use of voltage controlled amplifiers and filters. The settings for each sound are usually saved as presets.

Timbre: Tone color. The quality of a sound that distinguishes it from other sounds with the same pitch and volume.

Tone Module: A synthesizer without a piano keyboard. Since Midi allows one keyboard to literally play another, there is little reason to acquire more piano keyboards when wanting to expand your palette of sound choices. Buying tone modules is usually a bit cheaper than the keyboard version, and saves valuable space.

Track: Sequencers borrowed this term from multi-track recording studios, referring to tape tracks. A track is one of a number of locations where a musical part can be recorded and played back. A typical software sequencer has 16-128 tracks.

Velocity Sensitivity: A keyboard which can respond to the speed at which a key is depressed; this corresponds to the dynamics with which the player plays the keyboard. Velocity is an important function as it helps translate the performer's expression to the music. Velocity can be routed to many destinations on the Emulator III and is also translated over the MIDI line.

Wind Controller: A controller 'instrument' which is woodwind-like or brass-like in its fingering. They are blown into and the air stream triggers sounds from a synthesizer or tone module. Many do not have sounds of their own and must be connected (through Midi) to a synthesizer or tone module.