

S.M.P.T.E. Time Code

- S.M.P.T.E. is an acronym that stands for Society of Motion Picture Television Engineers. This group created a clock or time based standard first used in television for synchronizing video tape machines for editing purposes.
- Today S.M.P.T.E. time code is used for a variety of different synchronizing purposes including audio, MIDI, video & film.
- A S.M.P.T.E. display reads time as 00.00.00.00.00. From left to right this reads 0 hours, 0 minutes, 0 seconds, 0 frames, 0 sub frames.

S.M.P.T.E. Synchronization

By comparing S.M.P.T.E tracks on two different machines a synchronizer can Lock or synchronize the two machines. This is done by establishing a Master machine whose timing is imposed on a Slave machine by the synchronizer. This is necessary for:

- Video tape editing
- Locking two audio machines for more tracks
- Locking and audio & video machines for sweetening (enhancing audio for video).
- Locking computers to either audio or video or both.
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How S.M.P.T.E. Time Code Works

SMPTE time code is a method of marking tape with a continuous readout of time. (Imagine taking a grease pencil and writing the time every fifteen inches-- you would always know where you are.) This is much more accurate than any mechanical tape counter because there is no slippage and you don't have to remember to reset it. Once a tape is striped (that means the code is recorded) the exact time is always available.

SMPTE code is recorded on one of the audio tracks of a tape recorder. This has two disadvantages; you lose a track for recording, (except with some new digital recorders) and the code can only be read in play mode. SMPTE code is really a modulated tone-- a decoder circuit can convert this tone into data: there is an 80 bit word for each frame. This is enough to tell the hour, minute, second, and frame number with some left over for special uses called sub-code. When SMPTE is on the tape, a variety of gadgets can perform several useful functions:

A SMPTE GENERATOR creates the time code in the first place. You can usually start with any arbitrary time. There are several formats of time code, explained a bit later in this article.

A SMPTE READER simply displays the time-- (some readers will also add this display to a video signal. That is called a "window", and a tape made with this machine is called a window dub.)

A REGENERATOR reads the code and recreates it for recording on another deck. Directly dubbing the signal from one machine to another will not work reliably.

A MIDI TIME CODE GENERATOR converts the SMPTE code into the MTC format, which may be transmitted over MIDI cables.

Synchronizers

A CONTROLLER is an intelligent remote control for a tape deck. It uses SMPTE code to keep track of where the tape is, and can cue the tape up to any desired location. Since the code is not available in fast wind, the controller also gets information from the mechanical tape locator on the deck (these are called tach and direction signals) to roughly spot the tape; it will go into play briefly to confirm the location. A controller has to be specifically designed to work with a particular tape deck. A device that adapts a controller to work with a different tape deck is called an EMULATOR.

A SYNCHRONIZER controls two or more tape decks. One of the decks is designated the MASTER, and the others are SLAVES. (All decks must have SMPTE code on their tape) If the controller is placed in CHASE mode, it will keep the slave tapes lined up with the master. To do this the controller must control the speed of the slave decks as well as transport operation; a group of decks playing this way are said to be locked. There are some variations on locking:

A deck may have an OFFSET-- instead of matching times, the synchronizer keeps the slave a specified distance ahead of or behind the master. This is very handy for copying licks into more than one place on a master. (The related process of copying a section of a tape onto another tape and dubbing it back on at another point is called "flying in" tracks.)

The decks may be in PHASE LOCK, meaning the speeds are kept the same, but the absolute times are ignored. This is useful for matching tapes that have been edited without being re-striped with time code.

If the master or slave code disappears briefly, the synchronizer will use the tach pulses to attempt synchronization; this is called "flywheeling". When the code comes back it may have an unexpected value. If the synchronizer can do SLOW LOCK, it will gradually bring the decks together.

Video decks must be synchronized even closer than SMPTE allows for stable picture when editing. This is called GENLOCK, and is a direct connection between machines.

Frame rates of S.M.P.T.E. (most common)

- 30 frames/second non-drop frame
- 29.97 frames/second non-drop frame
- 29.97 frames/second drop frame
- 24 frames/second
- 25 frames/second

Types of S.M.P.T.E.

(most common)

- Longitudinal time code or L.T.C. recorded on an audio track
- Vertical time code recorded in the video signal.
- M.I.D.I. time code (MTC) used for MIDI sync. (synchronize)

M.I.D.I.

- M.I.D.I. is an acronym than stands for Musical Instrument Digital Interface.

What it is & what it can do.

- MIDI is an interface(standard for connection) consisting of input, output & through connectors allowing standardized communication between musical instrument devices. It was designed to allow devices to send & receive performance data between different manufacturer's synthesizers. For example you can play a Yamaha synthesizer and connect the MIDI output to a Roland synthesizer MIDI input and have it play the same notes.
- These days MIDI is used for many other devices other than just synthesizers. Audio effects processors, mixing consoles, tape machines, computer & even lighting boards use midi.
- The important thing to know is that what MIDI usually sends & receives is not sound or digital audio but performance info, like which note to play & how loud etc.

A Few common Uses for M.I.D.I.

- Sequencing Music
- Remote control of synthesizers & samplers
- Control of parameters
- Computer control
- Data transmission
- Synchronization- Beat clock or MTC
- Remote control of Recorders

Devices That May Use M.I.D.I.

- Synthesizers
- Drum machines
- Samplers
- Sequencers
- Computers (most need an interface)
- Mixing Consoles
- Lighting Boards

What is Sequenced MIDI Music?

- A MIDI keyboard can be connected to a personal computer or hardware sequencer.
- If a computer is used, a MIDI interface is connected to a computer port (ie: USB, serial etc.)
- The sequencer allows recording, playback & editing of the MIDI note information played from the keyboard. This performance info. (MIDI notes) are sent to a sampler or synthesizer which produces the instrument sound.
- Tempo, timing & pitch correction is as simple as moving the note(s) around.

Synthesizers & Samplers

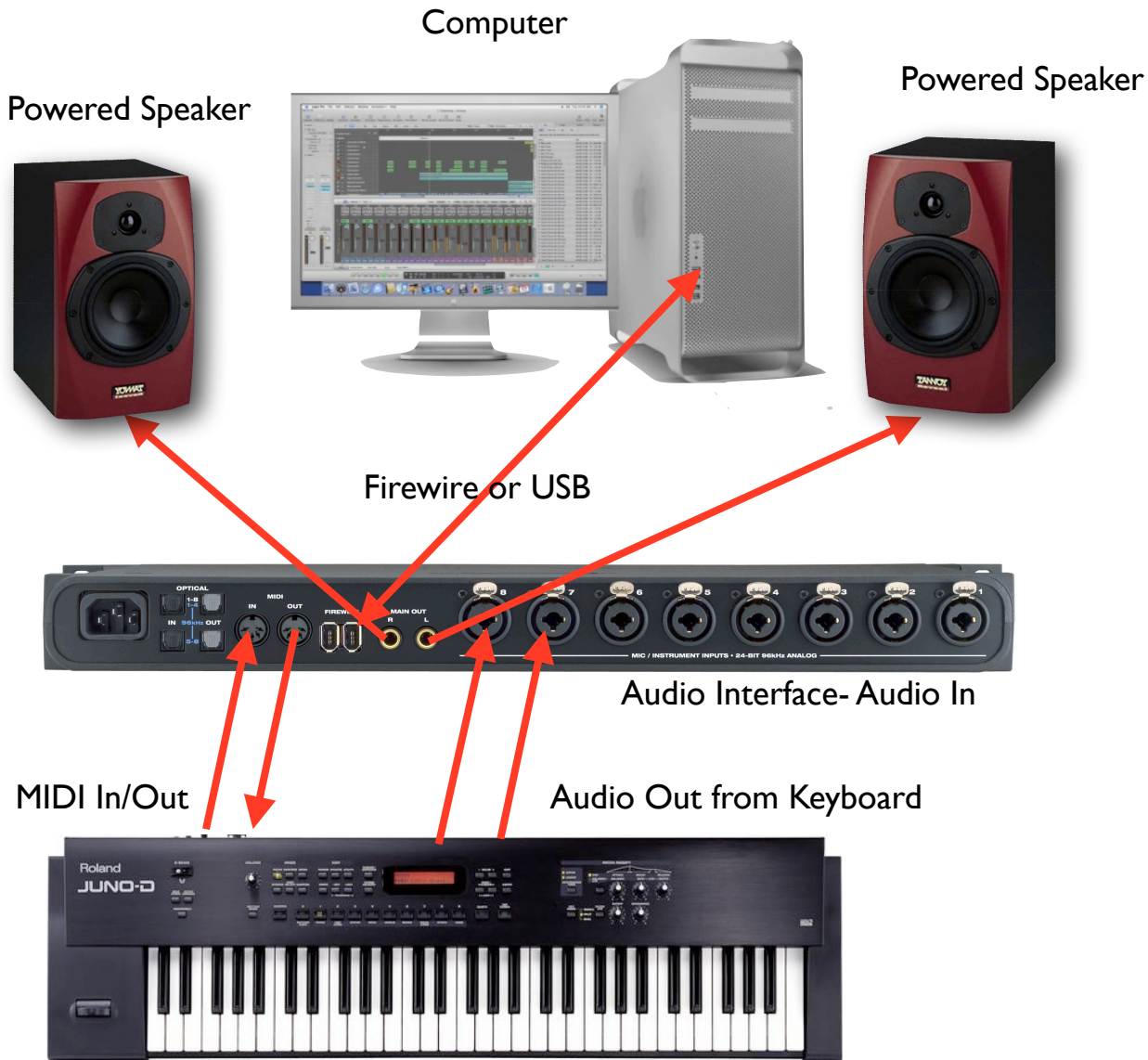
- Samplers are devices that play back digital recordings. (ie: Each individual note of a Grand Piano.)
- Synthesizers create sounds from scratch synthetically.

M.I.D.I. Connectors



- Input is used for incoming data.
- Output is used for out going data.
- Thru is used to pass on data coming in the input connector.

MIDI Sequencer & Sampler



In this diagram a keyboard is both a MIDI controller & a sample playback device.

M.I.D.I. Specifications (partial)

- MIDI information can be transmitted on one or all of separate 16 Channels.
- The receiving device can be set to receive on one or all MIDI channels.
- If a device is set to receive the same information on all channels it is in OMNI mode.
- If it's set to receive on more than one channel different information it's in MULTI mode.
- If it's set to receive on only one channel it's in POLY mode.

Types of data

- Performance data
 - Note on / off
 - Velocity
 - Pitch bend
 - Modulation
 - After-touch
- Controller
 - Volume
 - Pan
 - Assignable parameters
- System exclusive
 - Special data exclusive to manufacturer's devices

Why Sequenced MIDI Music?

- MIDI sequencing allows for quick changes in:
 - Tempo
 - Instrumentation
- Small file size useful for online transmission.
- Converting to and from music notation is easy.