MIDI Clock Toolbox

Principle of Operation
This Mozaic script can receive different kinds of clock signals, and convert, multiply or divide them. In addition to the plugin hosts internal clock and a free running or synchronized timer source, both MIDI clock messages and MIDI note/CC messages can be used as both input and output.
Using MIDI note or CC messages as clock pulses comes closest to the clock and synchronization pulses used in some hardware synthesizers. With additional apps or hardware it is for example possible to use these pulses to create click tracks or clock pulses that can be used for Eurorack or other gear.

Credits first
This script was inspired by, and the code is based on “MIDI Clock Tool” from @wim-number37 on Patchstorage. Thank you Wim!

Features
- Use the hosts clock, a free running or synchronizable timer, MIDI clock, CC or note messages as clock source.
- Output MIDI clock, CC or note messages to other apps or hardware.
- MIDI channel and note or CC value can be freely configured.
- By default only Note ON and CC messages with value 127 are generated. But it is possible to send additional Note OFF and CC messages with value 0 after an adjustable delay.
- Convert between these different clock types.
- Change clock speed through either frequency division (more accurate) or synchronization (allows speed multiplication).
- Measure and display the BPM rate of these various inputs and outputs.
- Follow incoming MIDI start/stop messages, or trigger these messages manually.
- Trigger MIDI start/stop messages on the beat of the outgoing pulses.

The User Interface

Pads

1. Displays the approximated BPM rate of the choosen input or output. Tap on the pad to switch through the available inputs and outputs. A green pad indicates that the choosen source is enabled and can send or receive messages.
   Clock and Pulse input can be used as synchronization source for Sync. Mode (explained later).

   The following choices are available:

BPM meter OFF	Disabled to save CPU.
Host BPM	Received tempo of the host application.
Clock input	Received MIDI clock messages.
Pulse input	Received MIDI note or CC messages.
Clock output	Transmitted MIDI clock messages.
Pulse output	Transmitted MIDI note or CC messages.
Timer BPM	BPM rate of the free running timer.

2. Transport control sends MIDI Start/Stop messages. When in Start/Stop TRIG mode, the pending MIDI start message will be sent on the next outgoing beat.
3. Toggle whether to follow incoming MIDI start/stop messages, or not.
4. Start/Stop mode. Three modes are available:

   NO: No Start/Stop messages are sent but the transport control allows starting and stopping of outgoing MIDI clock, note and CC messages.

   YES: Send Start/Stop messages immediately.

TRIG: Cue Start messages to be triggered on the nex outgoing beat. Stop messages are sent immediately.

In YES and TRIG mode outgoing MIDI clock, note and CC messages are transmitted permanently and cannot be stopped with the transport control. This is because many hardware synthesizers cannot handle interruptions of the clock stream because they will loose synchronization.

Knobs

5. Choose input source: HOST, Clock, Note, CC, Timer, Sync.
6. Multi function knob 1:
   - Input channel for Note or CC source.
   - High BPM value for the Timer. E.g. 12 = **12**0 BPM
   - BPM rate averaging/smoothing in Sync. Mode.
7. Multi function knob 2:
   - Note or CC number for the Note or CC source.
   - Low BPM value for the Timer. E.g. 4 = 12**4** BPM
   - Tempo multiplier in Sync. Mode.
8. Tempo multiplier or divider for outgoing MIDI clock. Multiplication is only available in HOST mode. Sending MIDI clock can be disabled by turning the knob to the left (OFF).
9. Prescaler for outgoing Note/CC pulses. This is mainly used to convert from the 24 PPQN of MIDI clock messages to the 1 or 2 PPQN of pulses.
10. Send Note or CC messages (or disable pulse messages).
11. Output channel for Note and CC pulses.
12. Note or CC number for Note or CC pulses.
13. Tempo divider for outgoing Note / CC pulses.
14. Send delayed Note OFF or CC 0 message after x ms.

The **SHIFT** button toggles MidiThru on/off.

The **USER LED** flashes at the speed of the source that is selected for the BPM meter.

The Input Sources

1. **HOST**: This uses the plugin-hosts timer to create clock signals that are synchronized to the hosts clock. The host transport must be running in order to use this source.
   Knob 8 controls the tempo of the outgoing MIDI clock. In HOST mode it is possible to multiply the tempo.
   The tempo of the pulse output can be increased by reducing the

prescaler value (Knob 9).

2. **Clock**: The clock signal is derived from incoming MIDI clock messages. Knob 8 controls the tempo of the outgoing MIDI clock.
   The tempo of the pulse output can be increased by reducing the prescaler value (Knob 9).

3. **Note / CC**: Incoming Note On or CC messages that match the channel and (Note)value set with knobs 6/7 are used as clock source. This mode does not allow tempo multiplication.

4. **Timer**: This uses a free running, unsynchronized timer as clock source. The timer tempo can be set with knobs 6 (High BPM rate) and 7:
   Timer tempo = Knob6 x 10 + Knob7

5. **Sync**.: This mode is very experimental and might create irregular beats. In this mode the timer synchronizes to an incoming clock signal (MIDI clock, note or CC message). The source of the incoming message is selected with Pad1 (BPM meter). Make sure that after selecting an input, the BPM tempo of that input is displayed on the Pad.
   Knob 6 sets the number of measurements used to calculate the timer tempo. Higher values give more accuracy but slower tracking / synchronization. The default value (7) is a good start.
   With Knob 7 the tempo can be multiplied.