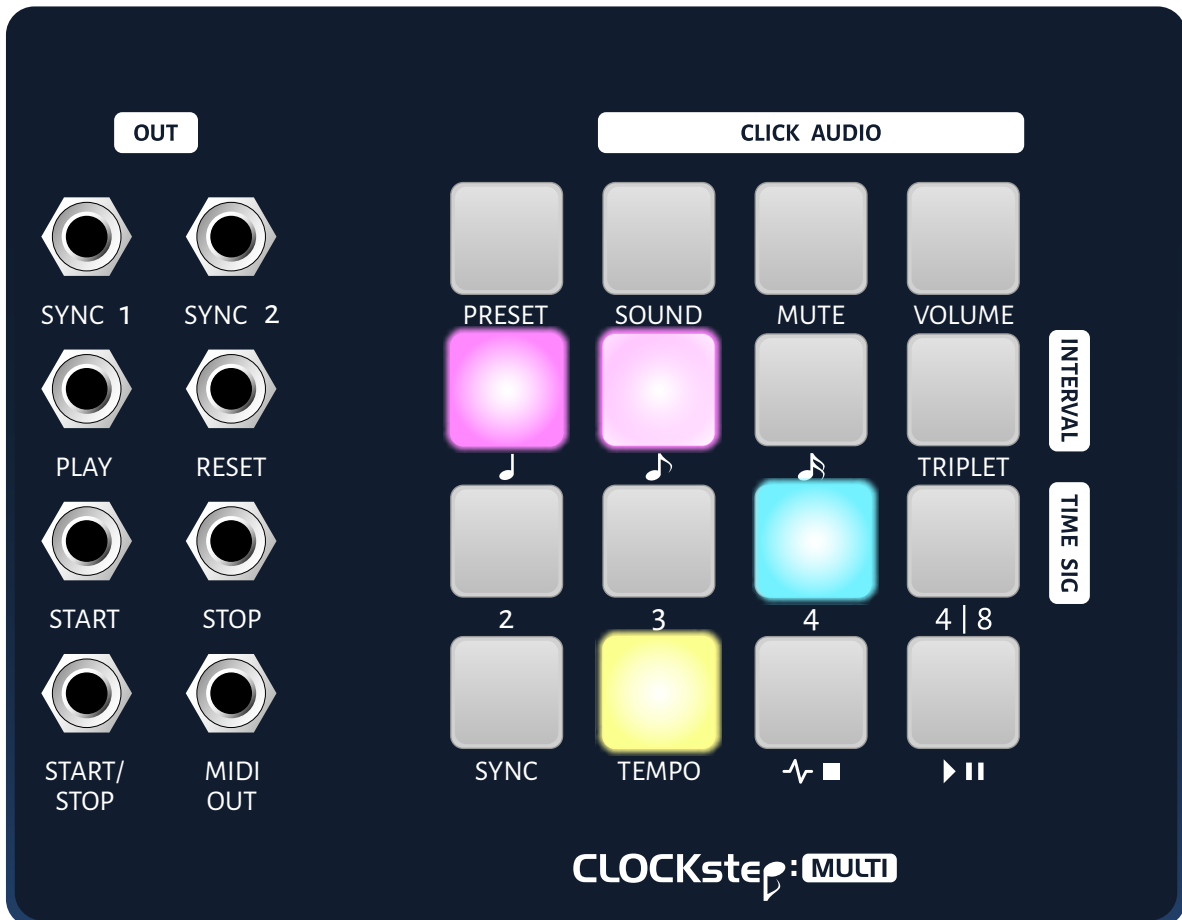


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Introduction



CLOCKstep:MULTI is a Master MIDI Clock, Analog Sync, Transport Controller, Audio Metronome and Sample Accurate Clock bridge all in one box.

Sample Accurate Clock Sync

CS:M can deliver perfectly timed sync between a DAW and other connected MIDI Clock or Analog Sync hardware devices by receiving audio clock input and outputting MIDI Clock and Analog Sync.

Latency Compensator

CS:M can offset the timing of a sync when following a Sample Accurate Clock Source or another MIDI Clock source to help phase align equipment that experience latency.

Analog Sync Outs

The two (2) Analog Trigger Sync Outs can be independently configured for different sync rates.

Up to three (3) more of the Analog Trigger Outs can be configured as Sync Outs for a total of five (5) Sync Outs, each with their own sync rate.

Transport Controller

Transport functions and Clock can be controlled independently from the UI depending on the user's Transport Mode selection.

Audio Metronome

The Audio Click/Metronome is configurable with a selection of 16 Sounds, Subdivision Volumes, Time Signatures and Swing settings.

MIDI Quantize/Repeat

MIDI Commands that come through CLOCKstep:MULTI can be held in memory and delivered to other MIDI devices precisely aligned to the top of a bar.

Presets

All of these features can be organized and stored into 40 Presets.

Patch Bay Connections

SYNC 1 & 2

0/+5 Volt Triggers for sending clock signals. Clock rate is configurable independently for each sync output.

PLAY

0/+5 Volt Gate for sending Transport Start and Stop commands. Signal is HIGH when Transport is started and LOW when stopped.

START

0/+5 Volt Trigger for sending a discrete Transport Start command.

START/STOP

0/+5 Volt Trigger to toggle sending both Start and Stop commands.

RESET

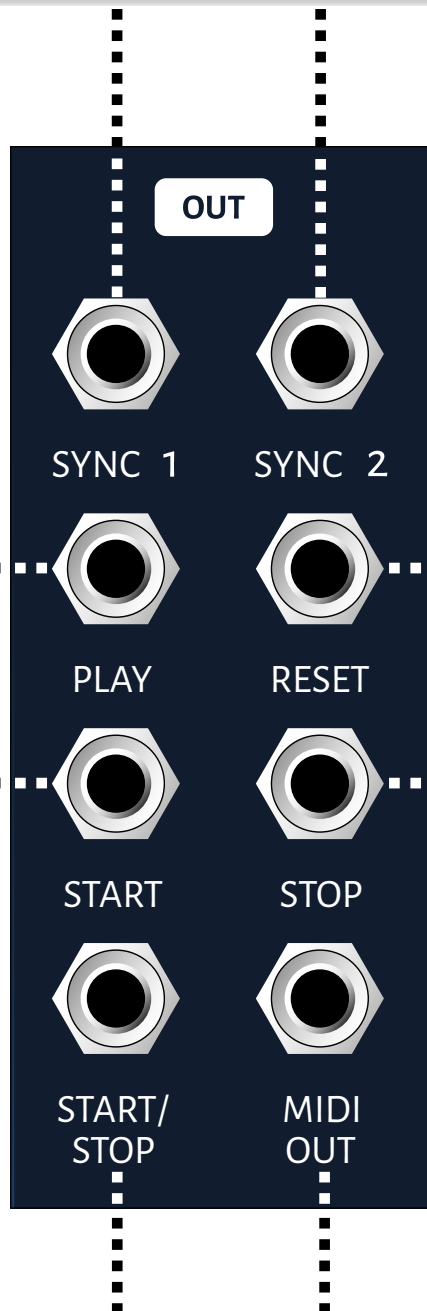
0/+5 Volt Trigger for sending a command to reset a sequence from the beginning. Sent with a Start command, except when resuming from Pause.

STOP

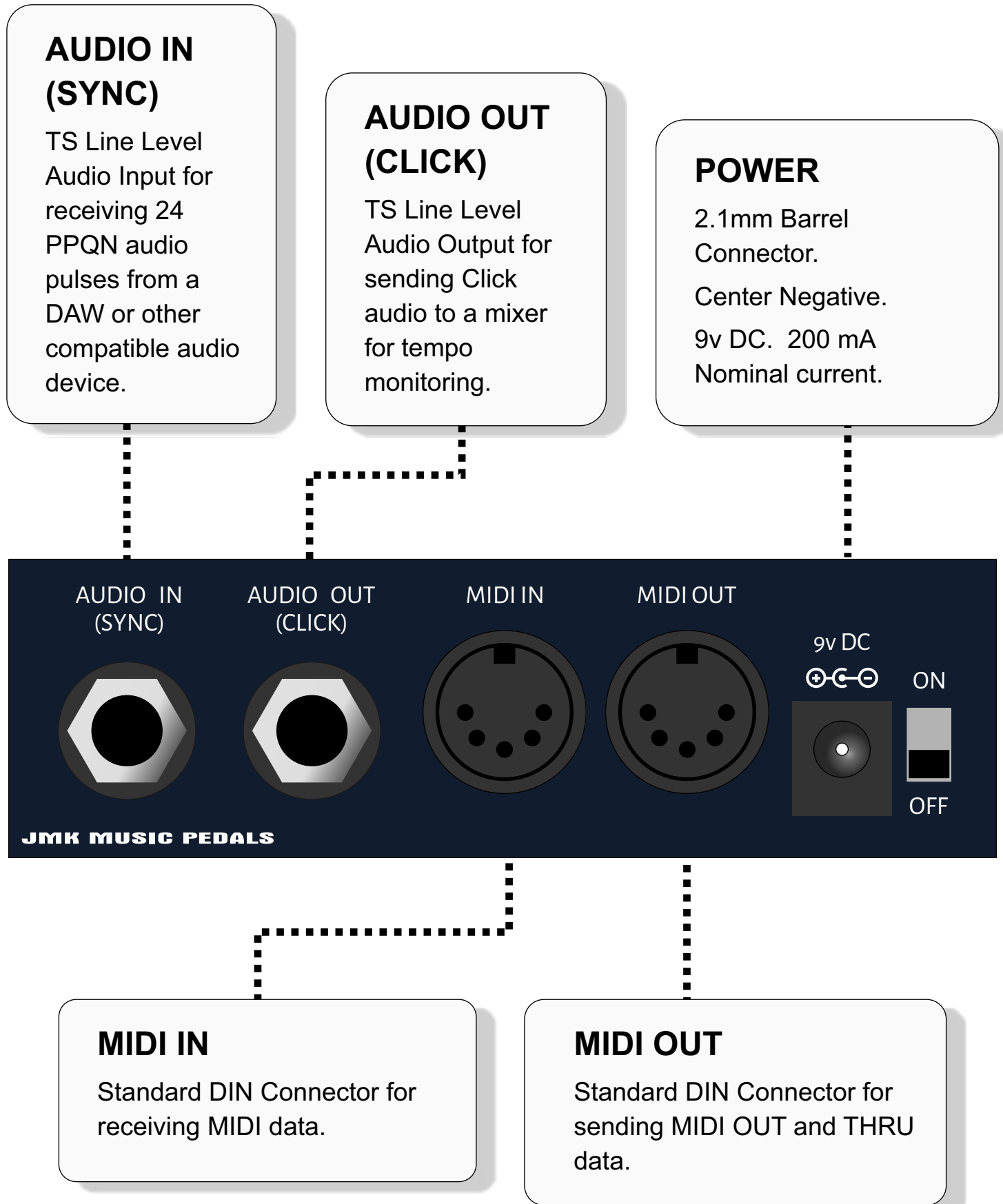
0/+5 Volt Trigger for sending a discrete Transport Stop command.

MIDI OUT

TRS "Type A" MIDI Output which mirrors the MIDI DIN Output.



Rear Connections



USB Connection

On the right side is a USB connection. This is a Class-Compliant MIDI Client connection that will be seen as a 1x1 MIDI connection on a host computer. It's also used for updating the firmware.

User Interface



Main View

Each button's primary function in the Main View is labeled beneath it. Press to activate.

Holding a button may access other functions.

Additional Views

When accessing functions, the arrangement of lights and buttons will change to indicate a new set of choices. In many cases, the new arrangement is for the selection of a value between 1-16.

Exiting a View

The lower right button is consistently used as an **Exit** button to return to the previous view **when you hold it**. It will be lit blue to indicate that it is an Exit button.

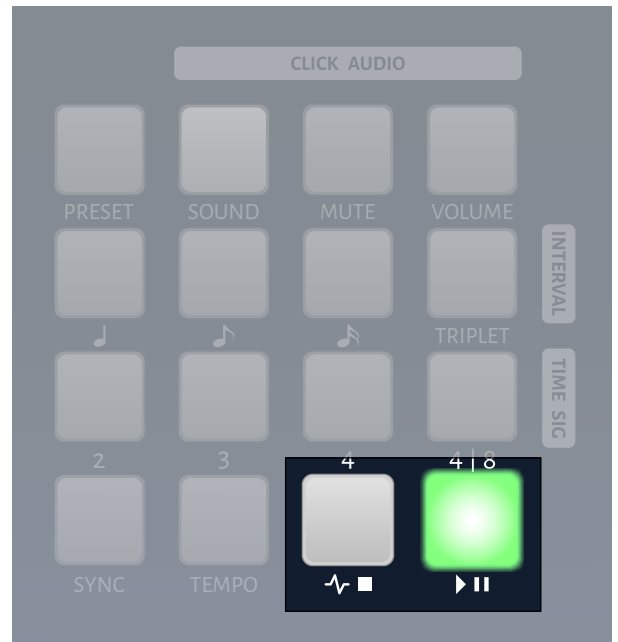
Blue can also be used in some Views to indicate both a **value selection and exit** with 1 press (ie: An Automatic Exit).

Transport and Clock

There are 2 buttons for controlling Start, Stop, Pause and Continue.

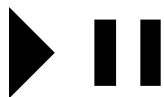
How these buttons work will be determined by the user's choice of **Transport Mode**. The description of each of the modes is covered below.

Changing the **Transport Mode** is covered in the **Global Settings** chapter.



Simple Transport Mode

This is the default mode of CLOCKstep:MULTI.



The Start/Pause button is used to simultaneously begin running the Clock and send Start commands to all connected devices.

While started, this button is used to Pause the Clock, which results in sending a Stop commands to all connected devices.

While paused, this button is used to resume the Clock and send Start/Continue commands to all connected devices.



The Clock/Stop button is used to Stop the unit if it is currently started or paused.

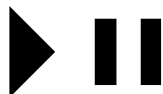
Starting or Stopping the Clock cannot be performed independent of the Transport commands in Simple Transport Mode.

continued ...

Transport and Clock (continued)

Resync Transport Mode

Similar to Simple Transport Mode, but in this mode Pause is replaced by a Resync function.



The Start/Pause button is used to simultaneously begin running the Clock and sending Start commands to all connected devices.

While started, this button is used to Resync the Metronome Bar and all connected devices (by sending Stop, Reset, Song Position Pointer=0 and Start in that order).

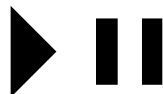


The Clock/Stop button is used to Stop the unit if it is currently started.

Starting or Stopping the Clock cannot be performed independent of the Transport commands in Resync Transport Mode.

Align Transport Mode

A hybrid of the previous 2 modes, this mode offers more functionality from using only 2 buttons.



If the Clock is **not** currently running, the Start/Pause button is used to simultaneously run the Clock and send Commands to all connected devices.

If the clock is currently running, this button sends the Resync command set while simultaneously **aligning** the Metronome Bar to this point.

While started, this button is used to Pause the Clock and send a Stop command to all connected devices.

While paused, this button is used to resume the Clock and send Start/Continue commands to all connected devices.



While started, the Clock/Stop button is used to send Stop commands to all connected devices. This does not stop CS:M's own Clock and Metronome until you press it a second time.

While stopped, this button can be used to begin running CS:M's internal Clock independently of Transport commands, which also begins running the Metronome. Only the Clock pulses are sent to other devices, there are no other commands transmitted.

continued ...

Transport and Clock (continued)

Quantize Transport Mode

This mode ensures that the Start commands are always perfectly aligned with the downbeat of the next Metronome Bar.



If the Clock is **not** currently running, the Start/Continue button will only respond by flashing, indicating that it is in a pending state. The Start commands will be sent once the Clock begins running.

If the Clock is currently running, this button will place Start into a pending state until the top of the next Bar is reached, at which time all of the Start commands are sent (in perfect time with the top of that Bar).

While started, this button is used to Pause the Clock and send a Stop command to all connected devices.

While paused, this button is used to resume the Clock and send Start/Continue commands to all connected devices.



While started, the Clock/Stop button is used to send Stop commands to all connected devices. This does not stop CS:M's own Clock and Metronome until you press it a second time.

While stopped, this button can be used to begin running CS:M's internal Clock independently of Transport commands, which also begins running the Metronome. Only the Clock pulses are sent to other devices, there are no other commands transmitted.

Independent Transport Mode

This mode doesn't have any rules. The Transport and the Clock functions are independent from each other except in the case of Pausing.

continued ...

Transport and Clock (continued)

External Transport Mode

You may find this mode convenient when combined with using External Clock (either Sample Accurate Clock or MIDI Clock sources).

With Internal Clock



This mode only uses the Clock/Stop button to Start and Stop everything when External Clock is not present.

With External Clock

The main reason for wanting to use this with External Clock is that it automatically Starts the Transport based on the detection of the first incoming Clock Pulse.

If using a Negative Offset Latency Compensation setting, there will be a 1 Bar pre-roll before the automatic Start (see the chapter on **Latency Compensation** for more about Negative Offset).

Once the External Clock is running, the button behaviors are:



Will stop the Transport and send out all Stop commands. This will not effect the Clock signal, which is still maintained by the External Clock source.

If the Transport is pending Start, this will cancel the start action.



Will set the Start command to cue for the top next Bar, just like **Quantize Transport Mode**.

If the Transport is pending Start, this will cancel the start action.

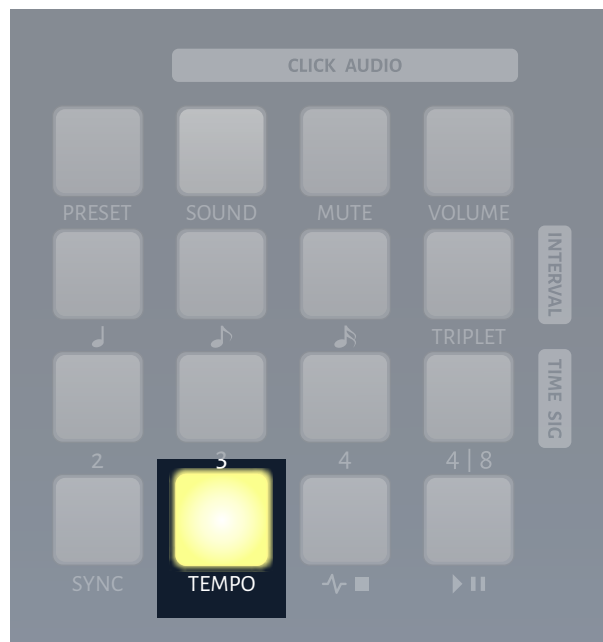
Tempo

Internal Clock rates range from 10 - 255 BPM.

Tap Tempo

Simply tap on the Tempo button to set a new tempo, using a Quarter Note feel.

It'll take several taps in order for the tempo calculation to begin.



Exact Tempo

You can input an exact BPM by **holding** down the Tempo button. The View will change to a calculator 10-key layout. (the numbers overlaying the graphic below are for illustration)

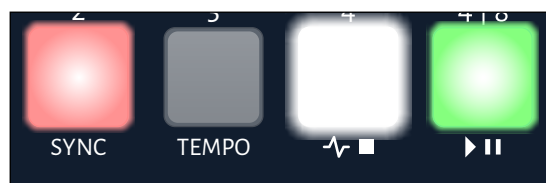
One of the lights in the keypad will be green, but ignore that for the moment. It'll be explained a little further down.

The operation for entering BPM is exactly the same as you would use a 10-key calculator or keyboard, it'll accept 3 numbers in sequence.

As you input the numbers, the column of buttons on the right will turn green from top to bottom to indicate that a digit has been registered.

Only an input that is within the valid BPM range is accepted, so for instance the first number entered cannot be a 5.

Once 3 numbers have been entered, the display will change and the bottom row will look like this image on the right.



Press the Green button (the calculator 'Enter' key) to immediately Execute the new Tempo with a .0 decimal.

Press the Red button to Cancel.

continued ...

Tempo (continued)

Tempo Decimal

If you'd like to enter a 1 point decimal value, press the white button at the final stage, which is located in the same place as a calculator 10-key decimal. The full 10-key layout will appear again, waiting for one more value.



After inputting the decimal value, you will be given only the option of Executing or Cancelling.

Read the Tempo

Sometimes you need to know what tempo CLOCKstep:MULTI is currently set at. This is where the green light shown within the 10-key layout comes into play.

To read the current tempo, hold the Tempo key to bring up the calculator 10-key as if you are going to enter a new BPM. The green light shown in the 10-key is the current value used for each digit. Follow pressing the green lights within the 10-key and you will be re-entering the same BPM value that is currently running. Once at the last stage, you can either Execute or Cancel.

External Clock Tempo

When CLOCKstep:MULTI is following an External Clock, the Tempo button is deactivated. Tempo can only be set by the External Clock device. See the **External Clock Sync** chapter for more details.

Metronome

The Metronome can be configured to get exactly the kind of dynamic feel that you want from a Click Track.

The Metronome settings can be viewed on the UI as 3 logical groups of controls:

Audio Adjustment = 1st Row

Subdivision Dynamics = 2nd Row

Time Signatures = 3rd Row

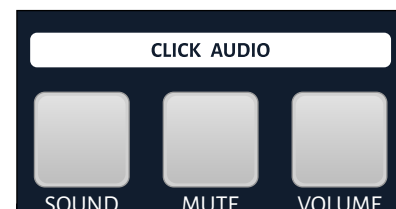


Audio Adjustment

Sound

You can choose from 16 different sounds stored within CLOCKstep:MULTI.

Pressing the **SOUND** button expands the view to make 1 of 16 selections. Choosing a new sound with one of the buttons will instantly load that sound.



Return to the Main View by holding the Exit button in the lower right hand corner.

Special Sound Note: The 16th Sound choice is a very short square wave sample that is mainly used for sending an Audio Sync pulse. See **Audio Sync OUT Enable** in the **Global Settings** chapter.

Mute

Press **MUTE** to turn the Sound engine ON and OFF without effecting the running Clock.

Volume

Pressing **VOLUME** expands the view to select 1 of 16 choices in volume, with lowest volume at the Top Left and the highest volume and the Bottom Right. The selected volume will be permanently stored until you change it again.

Return to the Main View by holding the Exit button in the lower right hand corner.

continued ...

Metronome (continued)

Subdivision Dynamics (Interval)

Quarter, Eighth, Sixteenth Volume

You can set the volume of each of the Audio Click subdivisions just by pressing on the relevant subdivision button, then selecting 1 of the 16 volume levels (upper left to lower right).



For a visual clue, the intensity of the light for each button reflects its volume.

Triplet

Pressing the **TRIPLET** button will change Eighth Notes into Eighth Note Triplets and Sixteenth Notes into a Sixteenth Note Triplets.

Swing

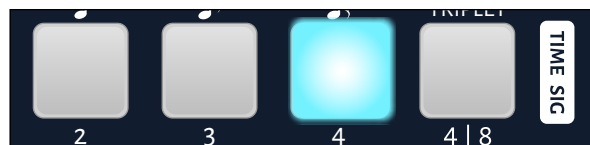
See the Metronome Swing chapter for details.

Time Signatures

Number of Beats (2, 3 & 4)

The **2**, **3** & **4** buttons can each be turned ON or OFF.

When turned ON each button will have their value added to the other ON buttons to equal the number of Beats in the Time Signature. In the image above, only 4 is selected so the Time Signature is 4/4.



If you were to deselect 4 and select 2 & 3, then the result of 2 + 3 equals 5, and the Time Signature would be 5/4.

Deselecting all of the buttons will disable Time Signature and Bar tracking; the loud accent at the beginning of each Bar will no longer stand out above any other quarter note sound.

If the Clock is running, pressing any of these buttons will place them into a pending state and they will begin flashing. The change in Time Signature will execute at the top of the next Bar.

Length of Beat (4|8)

The **4|8** button toggles between Quarter Note and Eighth Note Beats, making the Time Signature $x/4$ or $x/8$. When the button is deselected, the beat length is a Quarter, as in 5/4. When selected it is an Eighth, as in 5/8.

Sync Rates

The rates of the two (2) 3.5mm Analog Trigger Sync outputs can be adjusted to match the rates expected by the external gear that they control.

Each output can have its own independent rate.

Begin to adjust the rates by pressing the **SYNC** button.

Additional outputs can be converted into Sync Outs (see **Global Settings** chapter).



Sync

Pressing the **SYNC** button will display the choices shown to the right.

Press button 1 or 2 to set the sync rate for the related 3.5mm output.

Buttons beneath 1 & 2 may also be lit based on the selections made for “Additional Sync OUT” in **Global Settings**.

The Red and Green buttons are covered in the chapter: **Latency Compensation**.

Hold the Blue button to exit this menu.



Rates

In the sequencing world, sync rates are normally expressed in PPQN (pulses per quarter note), indicating the number of pulses or clock ticks expected during the span of 1 Quarter Note.

PPQN is also used as a rate designation within CLOCKstep:MULTI, but there are a couple exceptions. Very slow rates are expressed as PPM (pulses per measure).

You may find other designations used by sequencers such as PPS (pulses per step). You want to pay close attention to the designation used for sync rates and what they mean when comparing rates between different equipment.

continued ...

Sync Rates (continued)

Standard Rate Selections

There are 14 selections to choose from which correspond to a standard rhythmic subdivisions. On the button pad, they ascend from Left to Right and Top to Bottom, beginning with 1 PPM and ending with 24 PPQN.

“Straight” values are on the 1st and 3rd columns and Triplet values are on the 2nd and 4th columns. If you want to double the rate that’s being sent, select the button that is 2 spaces over from the currently selected one.



continued ...

Sync Rates (continued)

Advanced Rate Selections

Some people like to get weird, so CS:M lets you to unlock **44 total rate selections**. Let chaos reign!

To unlock these advanced rate selections, the Global Setting for **Sync Lock** must be disabled (see **Global Settings** chapter).

With Sync Lock disabled, the behavior of the **Sync Rate** buttons changes. They maintain the same arrangement and primary values as before, however, you may now press the same button multiple times.

As you press the same button again, it will increment the **Sync Rate** to access values that exist in-between the standard settings. This will also cause the button to blink. The blinking will become more rapid with each in-between value incremented. As the selection nears the next standard value, the blinking will shift onto the next button over.

List of all Possible Sync Rate Values (standard 14 in bold):

1.00 PPM (Whole Note)	1.14 PPQN
1.06 PPM	1.20 PPQN
1.10 PPM	1.26 PPQN
1.14 PPM	1.33 PPQN
1.20 PPM	1.41 PPQN
1.23 PPM	1.50 PPQN (Quarter Triplet)
1.33 PPM	1.60 PPQN
1.45 PPM	1.71 PPQN
1.50 PPM (Whole Triplet)	1.85 PPQN
1.65 PPM	2.00 PPQN (Eighth Note)
1.71 PPM	2.18 PPQN
1.85 PPM	2.40 PPQN
2.00 PPM (Half Note)	2.66 PPQN
2.28 PPM	3.00 PPQN (Eighth Triplet)
2.40 PPM	3.43 PPQN
2.60 PPM	4.00 PPQN (Sixteenth Note)
3.00 PPM (Half Triplet)	4.80 PPQN
3.69 PPM	6.00 PPQN (Sixteenth Triplet)
4.00 PPM	8.00 PPQN (32nd Note)
1.00 PPQN (Quarter Note)	12.00 PPQN (32nd Triplet)
1.04 PPQN	16.00 PPQN (64th Note)
1.09 PPQN	24.00 PPQN (64th Triplet)

Presets

You can store and recall up to 40 Presets.

The first 16 Presets can be saved and loaded from the User Interface.

All 40 Presets can be loaded using MIDI Program Change commands. Saving to any location can be done through a MIDI Continuous Control command (**See MIDI IN Implementation**).



Load a Preset

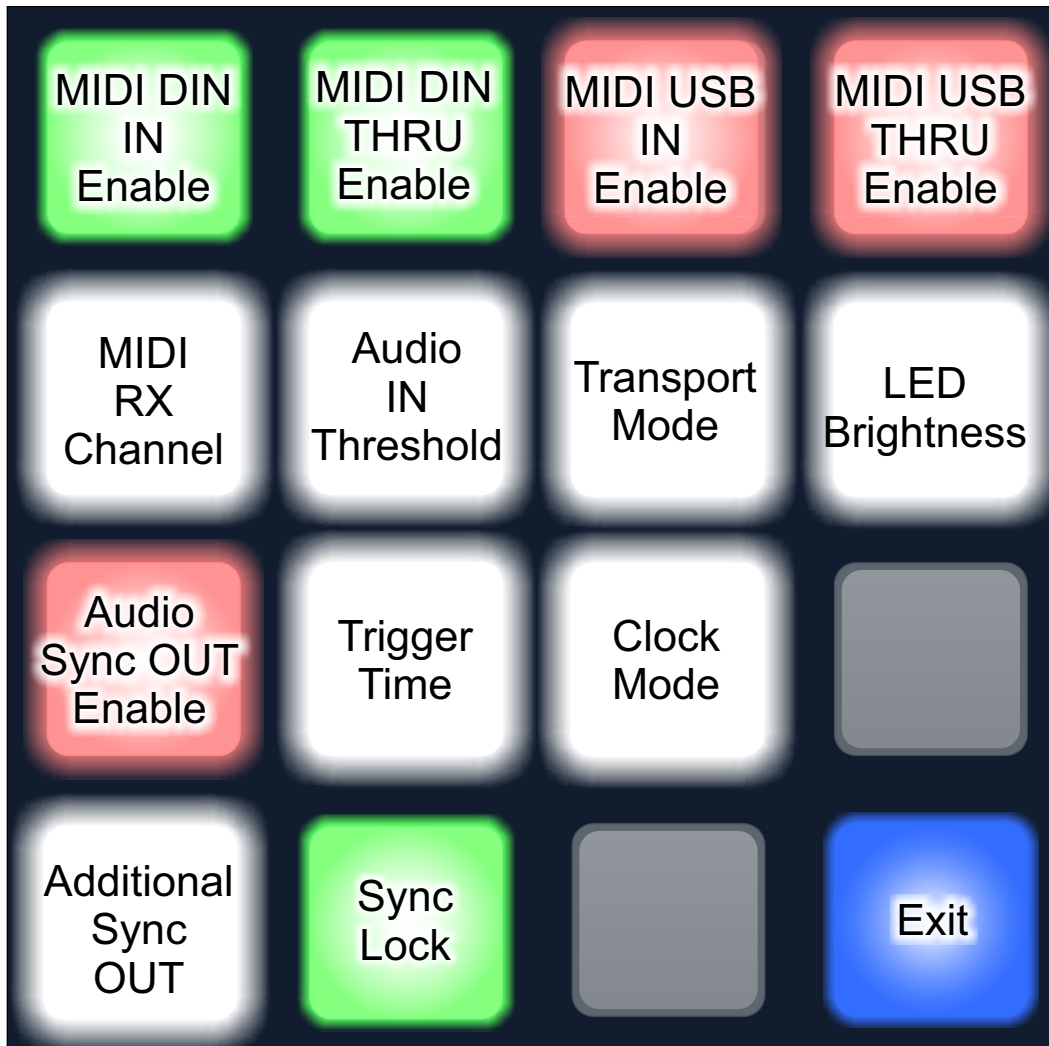
Press the Preset button. A selection of 16 preset locations will appear in the UI with the currently active preset displayed with a blue light. **Press and Release** the preset location you wish to load. The grid will revert instantly to the Main display with the new preset loaded.

Save a Preset

Press the Preset button. A selection of 16 preset locations will appear in the UI with the currently active preset displayed with a blue light. **Press and Hold** the preset location for 2 seconds where you wish to save the current configuration. Once saved, the grid will revert to the Main display with the newly saved preset loaded.

Global Settings

Access the Global Settings by holding down the Preset button for **2 seconds** while in the main UI.



MIDI DIN IN Enable

When enabled, receives remote MIDI commands on the MIDI DIN In port. Green = ON. Red = OFF.

MIDI DIN THRU Enable

When enabled, MIDI data arriving at any MIDI In port will be passed to the MIDI DIN Out port. Green = ON. Red = OFF.

MIDI USB IN Enable

When enabled, receives remote MIDI commands on the MIDI USB In port. Green = ON. Red = OFF.

MIDI USB THRU Enable

When enabled, MIDI data arriving at any MIDI In port will be passed to the MIDI USB Out port. Green = ON. Red = OFF.

continued ...

Global Settings (continued)

MIDI RX Channel

The MIDI Channel that CLOCKstep:MULTI responds to when receiving remote MIDI Commands. Value = 1-16.

Audio IN Threshold

Useful for calibrating the **Sample Accurate Clock Sync** feature to match the level of the audio signal being received. When pressed, a new screen will appear for choosing a threshold setting (blue light) between 1-16. Lower settings will detect peaks in the audio at a lower threshold.

If there is any signal present at the Audio Input, then after a few seconds the setting (blue) could change and you may see a Red and Green lights appear. This is the auto-calibration sequence running.

The Red light represents the noise floor of the signal.

The Green light represents the highest peak detected in the audio, which should be the peak of the incoming audio clock pulses.

Select a setting (blue) somewhere between the Red and Green levels. The auto-calibration will make a recommendation for this setting, but you don't have to accept it. You can select any of the 16 values you wish.

Transport Mode

Pressing this button will display the possible Transport Mode settings.

Transport Modes are detailed in the **Transport and Clock** chapter.

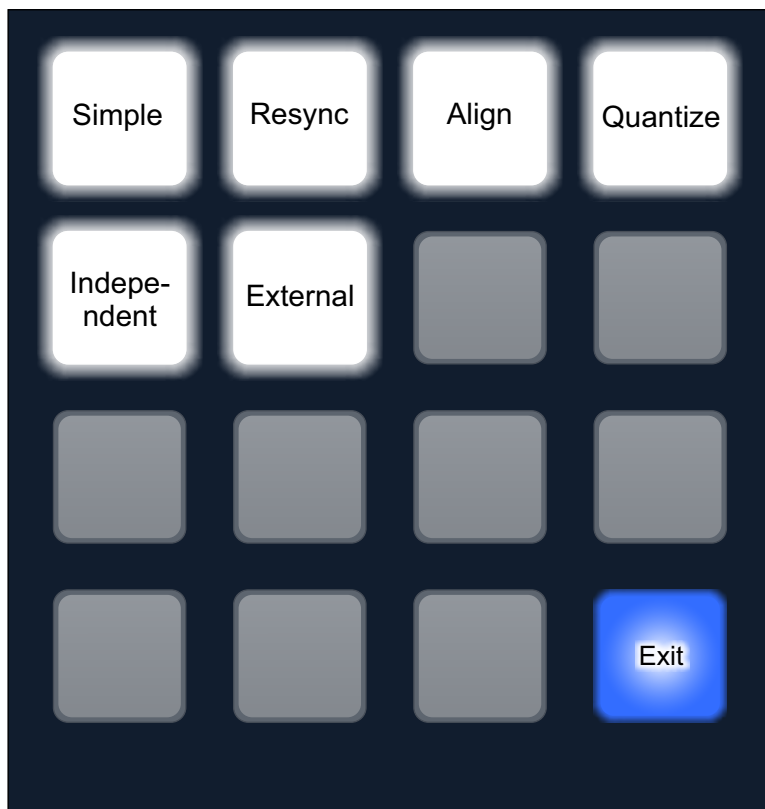
Return to the Global Settings menu by holding the Exit button in the lower right hand corner.

LED Brightness

Press this button to choose the brightness of the display lights. 16 selections are available.

Return to the Global Settings

Menu by holding the Exit button in the lower right hand corner.



continued ...

Global Settings (continued)

Audio Sync OUT Enable

You can turn the Audio Output of CS:M into a 24 PPQN audio clock source. This can be useful for striping Analog Tape or sending the signal into another CS:M's Audio Input to sync them together.

When using this feature, all Metronome functions within CS:M will be disabled and the Audio Output becomes dedicated to this task.

Green = ON, Red = OFF

Trigger Time

The CV signals that are sent from the 3.5mm TRS Patch Bay will stay "HIGH" for a specified number of milliseconds. Some devices that receive these impulses may require a different length of pulse. Use this setting to adjust the length of each pulse that CS:M sends between 1-16 milliseconds (default = 8ms).

Return to the Global Settings Menu by holding the Exit button in the lower right hand corner.

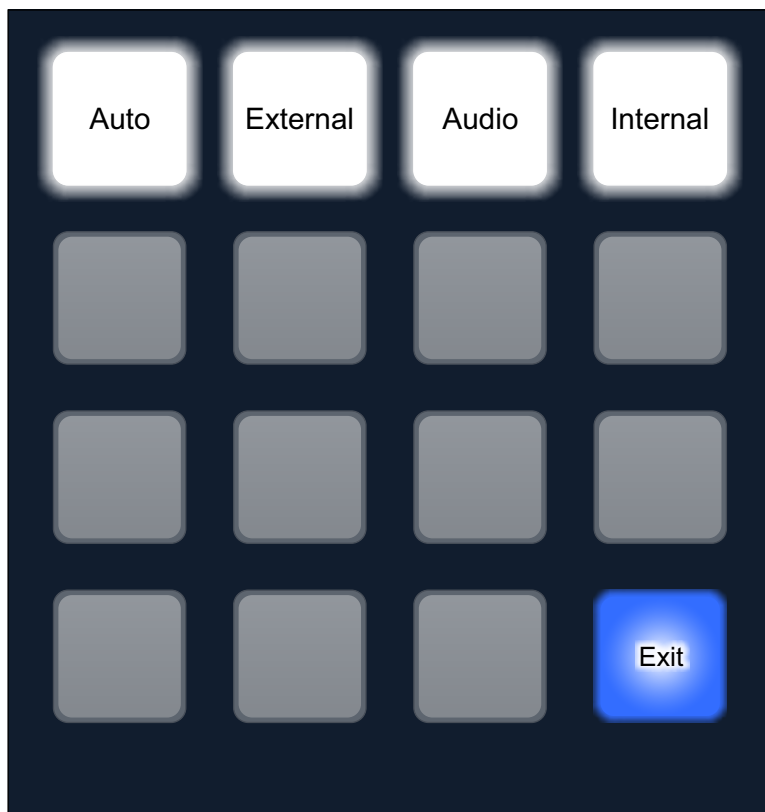
Clock Mode

Auto - Any clock source can be used and will be auto detected.

External - Only external Clock can be used and either MIDI Clock or Audio Clock will be auto detected.

Audio - Only external Audio Clock can be used. Any incoming MIDI Clock messages will also be filtered out.

Internal - Only Internal Clock can be used. Any incoming MIDI Clock messages will also be filtered out.



Sync Lock

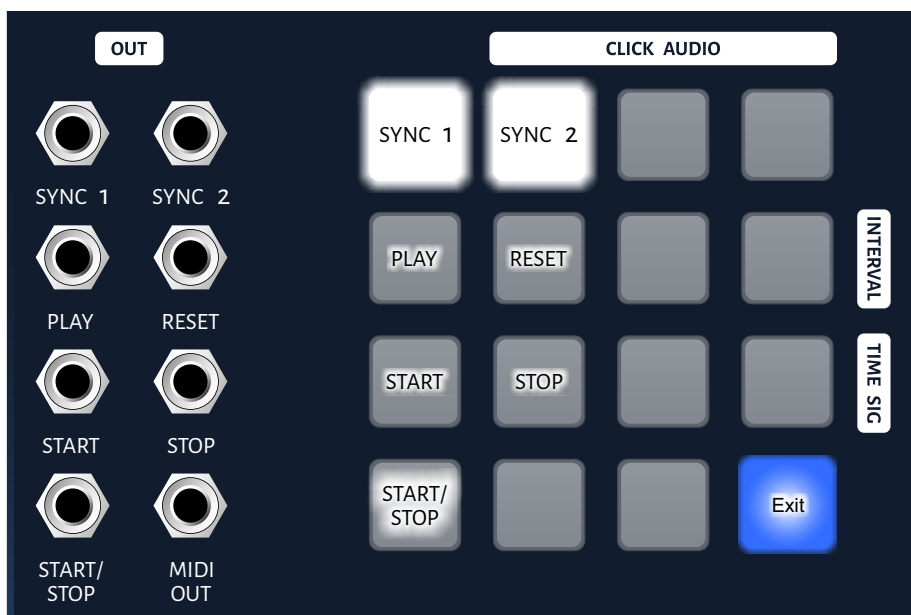
When Enabled, CS:M constrains Sync Rate selection to the standard 14 rhythmic values. When Disabled, Sync Rate selections increase to 44. See the **Sync Rate** chapter

Global Settings (continued)

Additional Sync OUT

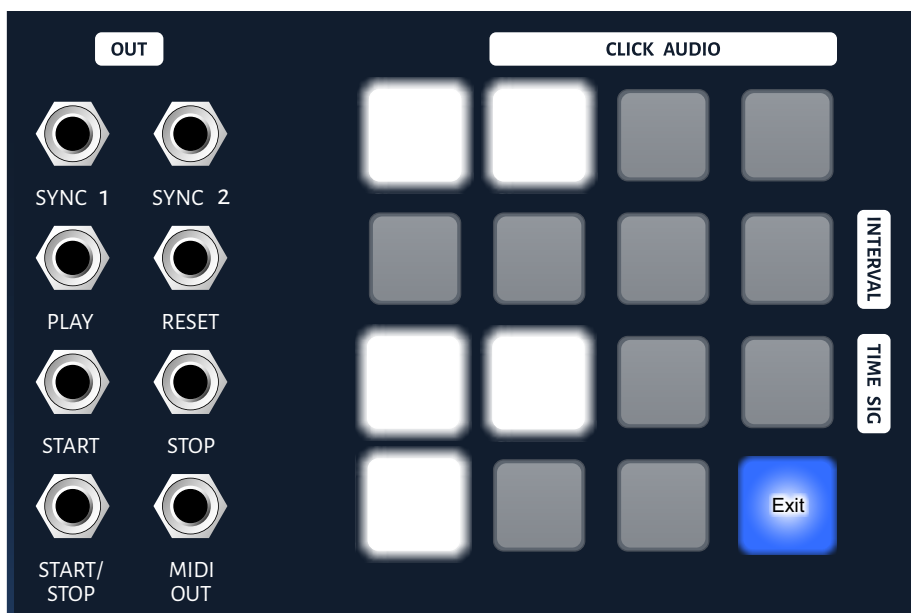
With CS:M, you can convert any of the Analog Trigger Outputs into additional Sync Outputs. Up to 3 outputs can be converted, giving CS:M the potential of having up to 5 independent Analog Sync Outs.

After pressing the **Additional Sync OUT** menu button, you'll see a layout that shows which of the outputs are currently configured for sync. The layout of the buttons reflect the physical layout of the 3.5mm outputs.



SYNC 1 and **SYNC 2** are always enabled and cannot be changed. Press any of the other 5 buttons to either enable or disable sync on the related output.

For example, if you wanted to use the START, STOP and START/STOP outputs for 3 additional sync outputs, press the buttons until the display looks like this:



When enabled, the output's Sync Rate will default to 2 PPQN. That value can be changed and stored independently (see **Sync Rates** chapter).

Return to the Global Settings Menu by holding the Exit button in the lower right hand corner.

External Clock Sync

There are two methods where CLOCKstep:MULTI can follow the clock sent by another source:

External MIDI Clock

'Sample Accurate' Audio Clock

In either case, external clock is detected automatically by CLOCKstep:MULTI. As long as the internal clock is not already running, external clock will automatically take precedence once detected.

When CLOCKstep:MULTI is running under an external clock, the Clock/Stop button (⏸) is lit white. This is how you will know at a glance if CLOCKstep:MULTI is following an external clock.

Also, while running under external clock, the Tempo button has no function.

Apart from those two items, the rest of the operations in CS:M remain virtually the same.



External MIDI Clock

Using an external MIDI Clock is very simple. If MIDI Clock messages are detected on either the MIDI DIN or MIDI USB connections while CLOCKstep:MULTI is stopped, then the behavior will be as if the user pressed the Clock/Stop (⏸) button to run the clock.

The Metronome Click Audio will begin, the Analog Sync outputs will activate and any MIDI Devices connected after CS:M will begin receiving MIDI Clock.

Special Note: MIDI Clock over DIN Connection is preferable to MIDI Clock over USB. However, the tightest form of sync comes from using Sample Accurate Audio Clock.

Sample Accurate Audio Clock

The Line Audio Input of CLOCKstep:MULTI can receive short pulses of audio that will serve as a clock signal. The rate of the pulses should equate to 24 PPQN (64th Note Triplets) at the desired tempo.

This form of sync places CS:M between a DAW and the external sequencing hardware to act as a bridge for sync protocols, and is the tightest possible for a DAW to become the Master Clock for external gear.

Two CS:M's can also be synced together using this method.

continued ...

External Clock Sync (continued)

The ‘Sample Accurate Clock’ method is more reliable and solid than having a DAW send MIDI Clock. The reason for this is beyond the scope of this manual, but simply stated: DAWs are resource intensive applications running on a multi-tasking computer that often do not place a high enough priority on sending MIDI Clock, especially once the project grows to a certain size and available resources become more taxed.

With the ‘Sample Accurate Clock’ method, the DAW sends **audio clock** instead, and due to the virtue of a DAWs ability to prioritize playing tracks of audio at a given digital sample rate, the audio pulses for the clock are guaranteed to be in sync with the rest of the tracks.

Setting up the DAW to send Audio Clock

There are two ways to go.

1. The first is to load an audio file containing only 1 short square wave pulse, and Paste it into the beginning of a new audio track in the DAW. (A suitable audio file is downloadable from the Support section at jmkmusicpedals.com.)

Then use the DAWs “snap to grid” feature for **64th Note Triplets** and Paste a copy of that audio file 23 more times, making up 1 Quarter Note of length. From there, depending on the DAW, you could loop this segment of audio, or use “Select All”, “Copy” and “Paste” repeatedly to grow the length of the track exponentially to make 1 long track of pulses.

2. The second, and easier, method is to install an instrument plugin, such as a VSTi, that will use the DAWs Tempo to send out a 24 PPQN audio signal. At this time, JMK Music Pedals has not created a branded plugin, but we have tested CLOCKstep:MULTI using plugins that are freely available. **See our Support section for a list of any plugins that have been tested.**

If CLOCKstep:MULTI does not respond correctly to the audio, use the **Audio IN Threshold** function found in the **Global Settings** to calibrate CLOCKstep:MULTI with the audio input level, or try adjusting the level of the audio coming from the DAW. A loud signal coming from the DAW will cause distortion on CS:M’s input audio convertor so that the Audio IN Threshold may not be able to cope with the distorted signal.

You must have a dedicated audio output from your computer to send the clock signal. No other audio signals can be present on this channel.

Other control features of CS:M, such as Time Signatures and Transport, can be done over MIDI for maximum flexibility and control. Combining Audio Clock with MIDI Control makes a very powerful system for synchronizing with a DAW.

continued ...

External Clock Sync (continued)

Striping a Tape

Another sync made possible with CLOCKstep:MULTI is striping a multi-track analog recorder with clock data.

CLOCKstep:MULTI's Line Audio Output, which is normally used to send Click Audio, can be re-purposed to send 24 PPQN audio clock instead. See the **Audio Sync OUT Enable** feature in **Global Settings**.

Record this output onto a new track of a multi-track machine at the desired BPM.

When finished, **reverse the connections** between CLOCKstep:MULTI and the recording machine so that the recorded audio is being sent to CS:M to be used as an external audio clock.

You can now record new tracks onto tape while monitoring the Click Audio coming from CS:M and also synchronizing external gear.

Synchronizing Two CLOCKstep:MULTIs

The **Audio Sync Out Enable** feature can also be used to synchronize 2 CLOCKstep:MULTIs without using MIDI Clock. Just set one of the units to send the 24 PPQN signal from its Line Audio Output and the other unit should receive that that signal on its Line Audio Input.

Other Uses

CLOCKstep:MULTI will coordinate with any device capable of either sending or receiving 24 PPQN audio clock. There's nothing proprietary about the audio clock signal; it's as plain vanilla as it gets.

Latency Compensation

Latency is delay in a signal. When syncing external hardware with a DAW, latency can occur for several reasons, but the effect is usually the same: A delay which can be heard while monitoring external hardware.

Latency develops based on the number of Digital-to-Analog or Analog-to-Digital conversions that occur, the amount of buffering present and the timing of the code that may be running to process a signal. The largest contributor to latency is when the user decides to send the audio from external hardware through the DAW for monitoring.

There are a number of ways to mitigate latency, and DAWs typically have a variety of settings capable of dealing with it, but tools outside the DAW can be a convenient way to help deal with it as well.

Latency Compensation in CS:M

When CS:M is following an external clock it has the ability to perform a positive or negative offset in increments of 1 millisecond. Devices following CS:M's adjusted clock can then be time-aligned with other sources of audio, particularly audio coming from within a DAW.

Latency Compensation is adjusted by pressing the **SYNC** button.

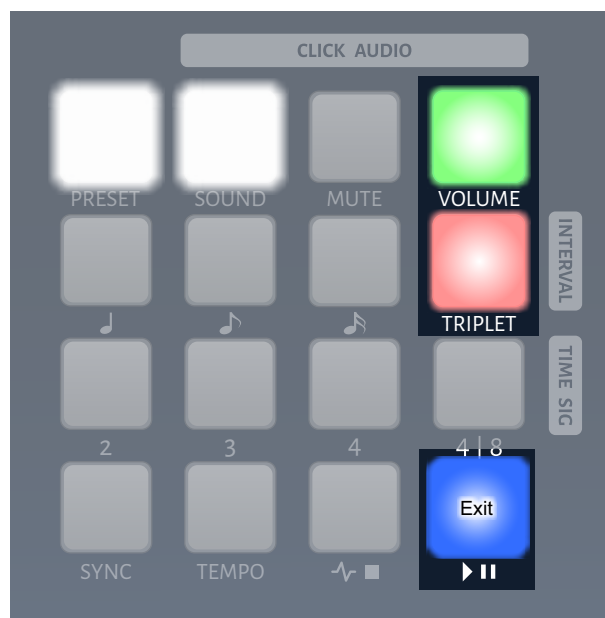


Setting an Offset

The Green and Red buttons will set Positive and Negative offset respectively. You can press the button for a 1ms adjustment, or hold the button to scroll through values faster.

The blinking of the Green or Red light will tell you if there is currently a Positive or Negative value set. If neither light blinks, then there is no offset.

Holding the Blue light exits this menu.



continued ...

Latency Compensation (continued)

Positive Offset

When CS:M is in Positive Offset, the processing is very straight-forward. Every clock pulse coming into CS:M will be delayed by the value of the Positive Offset before being sent out to the connected gear.

The Audio Metronome Click will also reflect the adjusted clock pulses. You can use the Audio Metronome to monitor the amount of the offset, just as if it were an external piece of gear following the adjusted clock.

Likewise, any Quantize feature will also match the adjusted count in determining Bar lines.

Negative Offset

Negative Offset as a concept is just as simple as Positive Offset. Instead of the clock pulses being delayed, **they are sent early**.

However, a device that is following an external clock, like CS:M in this case, can't send clock pulses *earlier than the clock it is receiving*.

So, CS:M accomplishes a Negative Offset by **expecting a pre-roll of at least 1 Bar** of the external clock before starting other devices. The 1 Bar pre-roll provides time for CS:M to make the necessary adjustments to turn a Positive Offset into a Negative Offset and realign the Bars and beats accordingly.

The process of setting a Negative Offset:

- 1) Adjust the Negative Offset until the Quarter Notes beats in the source material and the Quarter Notes of the delayed clock are matched.
- 2) Add at least 1 Bar of pre-roll (ie: count-in) to your DAW project. Clock data must be sent during the pre-roll.
- 3) Start the DAW Project. Within 1 Bar, CS:M's Negative Offset will be aligned correctly. Start the CS:M Transport or external sequencers at the top of any bar.

Note: The **External Transport Mode** is a good choice for automatically managing Transport Start when using External Sample Accurate Clock. More details can be found in the **Transport and Clock** chapter.

MIDI Quantize

With CLOCKstep:MULTI you can quantize incoming MIDI Messages so that they execute at the top of the next Bar *There is no UI for managing MIDI Quantize, it is all achieved through MIDI Commands.*

By sending **CC# 70** to CS:M with the value of a MIDI Channel (**1-16**), you instruct CS:M to capture the next MIDI message it receives on that specified MIDI Channel. The message that is captured is removed from the data stream and placed into memory. Up to **32** MIDI Messages can be placed into memory at once.

Once the top of the next Bar is reached, all captured MIDI messages are sent, aligning them perfectly with the Bar downbeat.

The memory is cleared at the top of every Bar.

NOTE: MIDI Messages will only be considered a match if they come in on the same physical port that **CC# 70** came in on. If the command to capture a MIDI Message came in on the DIN Input, then it will only capture the message on the DIN Input. USB will only capture on USB.

Real-time Messages

MIDI Start, Stop and Continue commands can be quantized by sending **CC #71** with the value: Start = **1**, Stop = **2** or Continue = **3**. There is no need to send both a CC #71 and the Real-time message that you want to quantize, CS:M will generate the desired Real-time message at the top of the next Bar.

Conditions for Quantize

Quantizing messages will only work when CS:M's **Clock is running** and a **Time Signature is being used**. Sending either CC# 70 or CC#71 into CS:M when either of those conditions are not met, CS:M will simply ignore the command and everything with regard to MIDI Messages will behave as they normally would.

Cancelling Quantize Messages

Quantize Messages can be cancelled before the top of the next Bar is reached. **CC#74** is used for this, where a value of **1** will cancel all currently held messages and a value of **2** will cancel just the last message held.

MIDI Repeat

CLOCKstep:MULTI has the ability to capture up to **4 MIDI Messages** and repeatedly send them at the top of Bars. You have control over how many Bars elapse before each message is sent again. *There is no UI for managing MIDI Repeat, it is all achieved through MIDI Commands.*

By sending **CC# 80, 81, 82 or 83** to CS:M with the value of a MIDI Channel (**1-16**), you instruct CS:M to capture the next MIDI message it receives on that specified MIDI Channel. The message that is captured is removed from the data stream and placed into memory. The 4 CC#s correspond to the **4** memory slots where a messages can be stored.

Then you must set a value with **CC# 84, 85, 86 or 87** which will equal the number of Bar intervals between each auto-execution for the 4 corresponding memory slots. A value of **0** disables the auto-execution for that slot. When assigned a value, auto-execution will begin at the top of the next Bar and then the countdown will begin to the next auto-execution.

NOTE: MIDI Messages will only be considered a match if they come in on the same physical port that **CC# 80-83** came in on. If the command to capture a MIDI Message came in on the DIN Input, then it will only capture the message on the DIN Input. USB will only capture on USB.

Behaviors with the Clock and Transport

Execution of repeated messages will occur any time the **Clock is running** and a **Time Signature has been set**.

You can capture messages to repeat before starting the Clock in order to pre-stage memory.

When the Clock is stopped, repeated messages stop and their counters are reset. When the clock is restarted, all repeating MIDI messages will execute immediately and they will resume their independent countdowns to their next auto execution. The exception to this is when continuing from a **Paused** state. Execution will resume using the same countdown as before Pause was pressed.

Stopping the Transport alone without stopping the Clock will not cause execution to stop.

Clearing Memory

Besides the ability to disable any memory slot with the CC#'s 84-87, **CC# 88** can be sent (any value) to clear all 4 memory slots at once.

Memory slots are also cleared when you load a new Preset.

Metronome Swing

This advanced feature allows the Metronome in CLOCKstep:MULTI to “swing” the Quarter, Sixteenth and Eighth Notes so that you can achieve a certain “feel” from the click audio.

When no swing has been applied, the value is said to be at 50%, which means the note is in its natural place exactly between two other intervals. Applying swing delays the note. 66% creates a Triplet feel and 75% is a dotted feel.

Simply hold down the button for the Interval that you’d like to swing. Each interval can be adjusted independently.

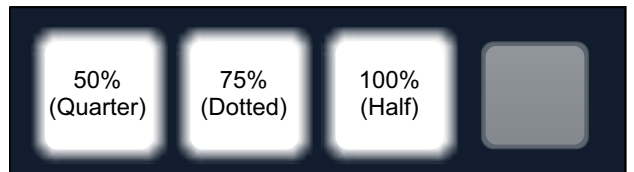


Triplet Function:

When the Triplet function is engaged, the swing setting for Eighth and Sixteenth notes will be overridden. However, your prior swing settings will return when the Triplet function is disengaged.

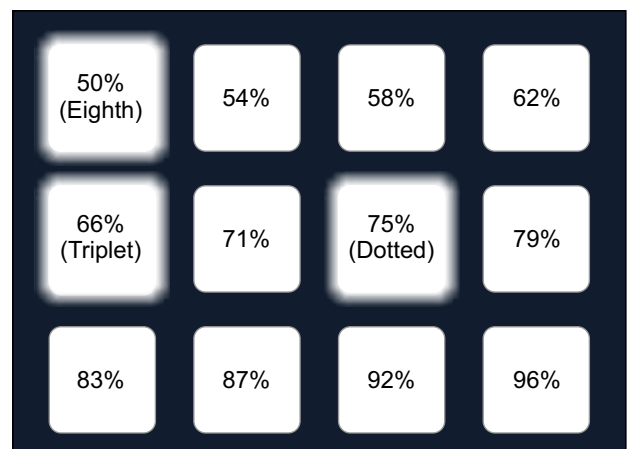
Quarter

Three choices are available:



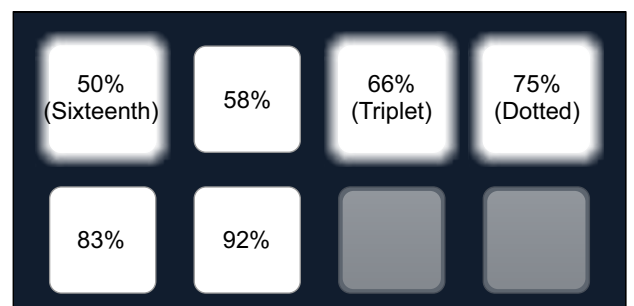
Eighth

12 choices are available:
(Natural intervals are lit more brightly.)



Sixteenth

6 choices are available:
(Natural intervals are lit more brightly.)



MIDI IN Specification

Program Change

You can select one of the 40 Presets stored in CLOCKstep:MULTI by sending a MIDI Program Change command (0-39).

Control Change

Parameter	CC#	Range	Notes
Save Preset	14	0-39	Save the current configuration into the selected Preset location.
Clock/Stop Button	15	Any	Same as Pressing the Clock/Stop button (⏸ ■).
Play/Pause Button	16	Any	Same as Pressing the Play/Pause button (▶)
Clock Start/Stop	17	0, 64, 127	0=Stop, 64=Toggle, 127=Start
Transport Start/Stop	18	0, 64, 127	0=Stop, 64=Toggle, 127=Start
Transport Pause/Continue	19	0, 64, 127	0=Pause, 64=Toggle, 127=Continue
Transport Mode	20	1-6	1=Simple 2=Resync 3=Align 4=Quantize 5=Independent 6=External
Click Sound	30	0-15	Changes the Click Sound.
Mute Sound	31	0, 64, 127	0=Unmute, 64=Toggle, 127=Mute
Quarter Subdivision Level	35	0-15	0=Silence 1-15=Increasing Volume Level
Eighth Subdivision Level	36	0-15	0=Silence 1-15=Increasing Volume Level
Sixteenth Subdivision Level	37	0-15	0=Silence 1-15=Increasing Volume Level
Triplet Mode	38	0, 64, 127	0=Straight, 64=Toggle, 127=Triplet

continued ...

MIDI IN Specification (continued)

Parameter	CC#	Range	Notes
Time Signature	40	0, 1-16, 21-36	0=No Time Signature 1-16=Quarter Note bar (1=1/4) 21-36=Eighth Note bar (21=1/8)
Tap Tempo	45	Any	
BPM (Whole)	46	1, 2, 0-127	Send 1 first to add 100, or Send 2 first to add 200, or Send 10-127 first for BPM rate, or 0-127 to add value to 100 or 200
BPM (Fraction)	47	0-9	Add a decimal point to the current Whole BPM value
BPM INC/DEC	48	0-63, 65-127	Assigned to programmable Rotary Encoders: 0-63=Decrement Current BPM 65-127=Increment Current BPM
BPM Expression Pedal Control	49	0-127	More useful for Treadle-based expression controllers. Changes the current BPM by a relative amount.
Sync 1 Rate	50	0-13	0=1 PPM 1=1.5 PPM 2=2 PPM 3=3 PPM 4=1 PPQN 5=1.5 PPQN 6=2 PPQN 7=3 PPQN 8=4 PPQN 9=6 PPQN 10=8 PPQN 11=12 PPQN 12=16 PPQN 13=24 PPQN
Sync 2 Rate	51	0-13	See Sync 1 Rate

continued ...

MIDI IN Specification (continued)

Parameter	CC#	Range	Notes
Trigger Time	52	1-16	Length of CV signals in milliseconds (default 8)
MIDI DIN Thru Enabled	60	0, 64, 127	0=No, 64=Toggle, 127=Yes
MIDI USB Thru Enabled	61	0, 64, 127	0=No, 64=Toggle, 127=Yes
Quantize MIDI Message	70	1-16	The MIDI Channel number to capture the next incoming message on.
Quantize Real-Time Message	71	1-3	1=Start 2=Stop 3=Continue
Cancel Quantize Messages	74	1-2	1=Cancel All Messages 2=Cancel Last Message
Repeat MIDI Message	80-83	1-16	Repeatable MIDI Slots 1-4. The MIDI Channel number to capture the next incoming message on.
Repeat MIDI Message Bars	84-87	0-127	Repeatable MIDI Slots 1-4. The interval number of Bars that the stored MIDI Message assigned to the slot will repeat on.
Reset All Repeat MIDI	88	Any	Resets all 4 repeatable Message Slots immediately.

continued ...

MIDI IN Specification (continued)

Parameter	CC#	Range	Notes
Quarter Swing	100	0-2	0=Quarter 1=Dotted Quarter 2=Half
Eighth Swing	101	0-11	0=Eighth (50%) 1=54% 2=58% 3=62% 4=Triplet (66%) 5=71% 6=Dotted (75%) 7=79% 8=83% 9=87% 10=92% 11=96%
Sixteenth Swing	102	0-6	0=Sixteenth (50%) 1=58% 2=Triplet (66%) 3=Dotted (75%) 4=83% 5=92%

System Real-time Start

CLOCKStep:MULTI will respond to a Real-time Start command by starting the Transport. (see MIDI Continuous Controller #18 for an alternate way to start the Transport via MIDI).

System Real-time Continue

CLOCKStep:MULTI will respond to Real-time Continue commands by starting the Transport and resuming count at the same place where it was previously stopped. (see MIDI Continuous Controller #19 for an alternate way to Continue the the Transport via MIDI).

continued ...

MIDI IN Specification (continued)

System Real-time Song Position Pointer

The only value CLOCKstep:MULTI will respond to is Zero (0). CLOCKStep will immediately reset the count of the Click Audio back to the beginning.

System Real-time Stop

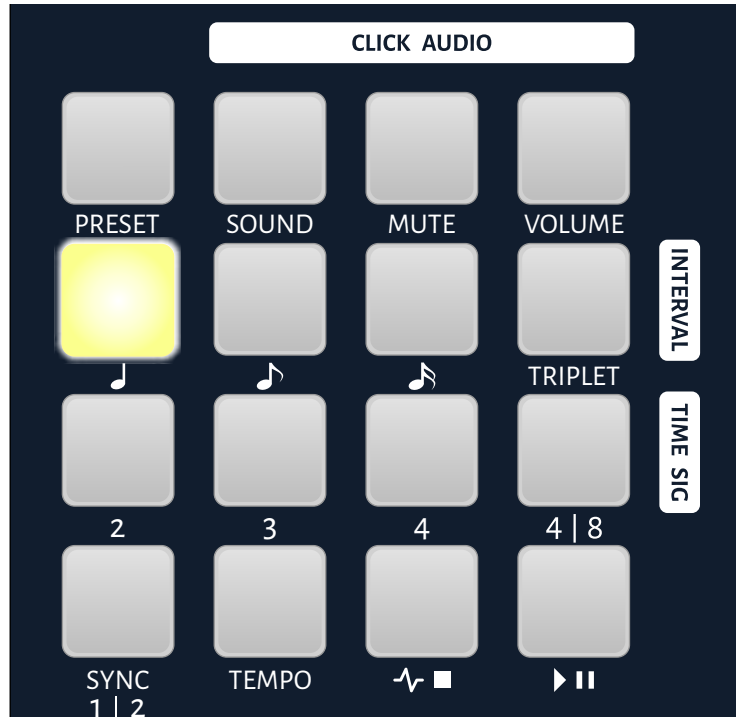
CLOCKstep:MULTI will respond by stopping the Transport. (See Continuous Controller #18 for an alternate way to stop the Transport via MIDI).

System Real-time Clock

Automatically detected. If clock is not already running, then CLOCKstep:MULTI begins following the external MIDI Clock.

Checking Build Version

With the **unit powered off**, hold down the Quarter Note Interval button shown below and turn the unit on.



This 10-key layout will be shown with 1 of the lights appearing green (similar to the Tempo input screen).



Press each green lit button on the 10-key until all 4 digits are read. The result is the 4 digit build version of the software currently installed on CLOCKstep:MULTI.

Products Specifications

Power Requirements 9 volts DC max, 200 mA nominal.

Power Connection 2.1 mm barrel, center negative

I/O Line Audio In/Out,
MIDI IN/OUT DIN,
MIDI IN/OUT USB,
MIDI OUT TRS,
3.5mm TS (x7)

Dimensions 4.7" x 3.65" x 1.72"

Assembled in the USA

Limited Warranty

CLOCKstep:MULTI comes with a 1-year limited warranty on parts and workmanship when purchased new from JMK Music Pedals or an authorized dealer. During the warranty period, and at the sole discretion of JMK Music Pedals, we will either repair or replace your CLOCKstep:MULTI free of charge.

Warranty service does not include damage through misuse, mistreatment or modification of the pedal.

Contact us at support@jmkmusicpedals.com for assistance with a warranty claim.