PITTSBURGH MODULAR
TIMETABLE
(CLOCK DIVIDER / PATTERN GENERATOR / SUB-OSCILLATOR)



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www.PittsburghModular.com

What is the Timetable?

The Pittsburgh Modular Timetable is a pair of clock dividers that share a common clock and reset. The first clock divider produces /2, /4, /8, and /16 divisions of the input signal. The patterns generated in the 2nd section range from /2, /4, /8, and /16 divisions to more complicated patterns depending on several factors, some adjustable in real time, some not.

Timetable User Interface
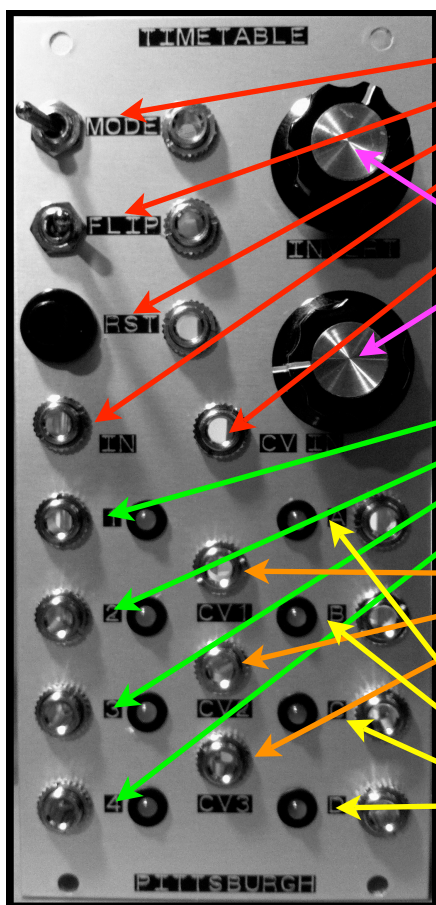
Input:
Mode Switch / Mode CV Input
Flip Switch / Flip CV Input
Reset Button / Reset CV Input (RST)
Clock Input (IN)
Invert Knob
CV Input (CV IN)
CV In/Feedback Knob

Output:
1 - Clock Divider 1 Output 1
2 - Clock Divider 1 Output 2
3 - Clock Divider 1 Output 3
4 - Clock Divider 1 Output 4
CV1 - Control Voltage Output 1
CV2 - Control Voltage Output 2
CV3 - Control Voltage Output 3
A - Clock Divider 2 Output 1
B - Clock Divider 2 Output 2
C - Clock Divider 2 Output 3
D - Clock Divider 2 Output 4

Timetable Input Control Descriptions

Mode Switch / Mode CV Input:
Clock Divider 2 can be advanced by either the main clock (Clock Input), or the last stage of Clock Divider 1. With no CV and the Invert Knob fully counter-clockwise this just extends the count for longer divisions.

Clock Divider 2 stuttering can occur when the Mode Switch is switched to either the Left or Right (assuming a CV source is available) from the center position.

More often than not the Flip command occurs in between the rising & falling edges of the clock, so the counter gets advanced twice instead of once - this doesn't happen when patching one of the Clock Divider 2 outs to the Mode CV Input. ANDing an external pulse with one of the Clock Divider 2 outs or using a trigger as the clock should reduce the number of double advances.

Mode Switch Settings:
Left - Clock Divider 2 is advanced by the last stage of Clock Divider 1
Center - Clock Divider 2 is advanced by the Main Clock
Right - Mode is controlled by the voltage level of the Mode CV Input
      <1v - Clock Divider 2 is advanced by the Main Clock
      >1v - Clock Divider 2 is advanced by the last stage of Clock Divider 1

Flip Switch / Flip CV Input:
Flip turns Clock Divider 2 into a simple type of A/D Converter or Waveform Follower. With this setting Clock Divider 2 follows the waveform of the Flip CV Input or if the Flip CV Input is not patched, the waveform of CV Output 1.

Flip Switch Settings:
Left - Clock Divider 2 follows the waveform of CV Output 1
Center - Clock Divider 2 acts as a standard clock divider
Right - Clock Divider 2 follows the waveform of the Flip CV Input

Reset Button / Reset CV Input:
The Reset Button instantly resets both Clock Divider 1 and Clock Divider 2.
The Reset CV Input resets both Clock Divider 1 and Clock Divider 2 when the CV input voltage rises above 1v.

Timetable Input Control Descriptions Continued...

Clock Input:
Clock advances when the CV input voltage rises above 1v.

Invert Control:
Controls the polarity of the Clock within Clock Divider 2. The Invert Knob is nominally fully counter-clockwise. At clockwise, each stage of Clock Divider 2 is inverted, but, its not just the outputs that get inverted, as each stage feeds the next to create the divisions the whole count is affected. The easiest way to explain it is it's like offsetting the count backwards.

CV Input / Feedback Control:
The voltage of the CV Input is added to the Invert voltage based on the setting of the CV Input / Feedback Knob. The CV Input is normaled to the output of CV 1 so when nothing is patched into the CV Input, an internal feedback loop is created.

With an external CV (one that goes +V and -V) then 12 o'clock is 0 (null).

With no external CV connected there is a positive only CV normalled into the CV In/Feedback Knob so anywhere between middle and fully counterclock-wise is 0 (null) so long as the Invert knob is fully counterclockwise, because, with the Invert knob counterclockwise only +V CVs have an effect. The trip points are spread thru 0-5V, so at around 1V the first stage is inverted & so on.

So, with no Invert Knob offset and a positive only CV there is no difference between 12 o'clock and fully counterclockwise because the +V voltage is be-ing inverted and there is nothing to subtract from so its just ignored.

To see this in action, with nothing plugged into the CV, turn the CV amount fully CCW & slowly move Invert from CCW towards CW; you'll see the inter-nal CV kick in around 9 o'clock-ish.

Timetable Output Control Descriptions

Gate Outputs 1-4
(Responses are affected by the Reset Button)

1 - Gate output is a /2 division of the Clock Input
2 - Gate output is a /4 division of the Clock Input
3 - Gate output is a /8 division of the Clock Input
4 - Gate output is a /16 division of the Clock Input

CV Outputs
(Responses are affected by Mode, Flip, Reset, Invert Knob, CV Input, and CV Input / Feedback Attenuator)

CV1 - Stepped, bipolar voltage derived from Clock Divider 2
CV2 - Inverted difference between CV1 and CV3
CV3 - Stepped, unipolar voltage derived from Clock Divider 2

Gate Outputs A-D
(Responses are affected by Mode, Flip, Reset, Invert Knob, CV Input, and CV Input / Feedback Attenuator)

A - Gate output is a /2 division of the Clock Input
B - Gate output is a /4 division of the Clock Input
C - Gate output is a /8 division of the Clock Input
D - Gate output is a /16 division of the Clock Input

Timetable Patch Examples

Sub-Ocillator

Patch the square or pulse output of an oscillator into the Clock Input of the Timetable. Patch any of the Clock outputs (1-4, A-D) as you would the audio output of an oscillator. The different clock divisions will produce octave drops in the original signal. The CV Reset Input can be used as a gate.

Switching Mode or Flip on Clock Divider 2 with CV

Set the Invert Knob all the way counter clockwise and CV In / Feedback Knob to 12 o'clock, all of the switches to the center position and press the Reset Button.

Patch a clock source into the Clock Input. Patch any of the clock outputs (A-D) into the gate input of an Envelope Generator or VCA controlling an audio source.

To switch Mode, add a CV source to the Mode CV Input and switch the Mode Switch to the right. Switch the Mode Switch to center to disengage the Mode CV Input.

To switch Flip, add a CV source to the Flip CV Input and switch the Flip Switch to the right. Switch the Flip Switch to center to disengage the Flip CV Input.

Both Mode and Flip can (and probably should) be used at the same time to create interesting patterns.

Positive or Negative Waveform Follower

Set the Invert Knob all the way counter clockwise and CV In / Feedback Knob to 12 o'clock, all of the switches to the center position and press the Reset Button.

Switch the Flip Switch to the left position. Patch a clock source into the Clock Input. Patch any of the clock outputs (A-D) into the gate input of an Envelope Generator or VCA controlling an audio source.

Patch an LFO into the CV Input and turn the CV In / Feedback Knob all the way to the right. The A-D outputs will follow the CV Input waveform while it is positive. Turn the CV In / Feedback Knob all the way to the left. The A-D outputs will follow the CV Input waveform while it is negative.

Timetable Input Control Descriptions Continued...

Rhythmically Derived Control Voltages
Set the Invert Knob all the way counter clockwise and CV In / Feedback Knob to 12 o'clock, all of the switches to the center position and press the Reset Button.

Patch a clock source into the Clock Input. Patch an LFO into the CV Input and turn the CV In / Feedback Knob all the way to the right. Patch a clock source into the Clock Input. Patch any of the CV Outputs 1-3 into a CV input of an oscillator, filter, or other module. Adjust the rate of the LFO sent to the CV Input, the Invert Knob, and the CV In / Feedback Knob to vary the CV Output.

Rhythmically Derived CV Outputs as Clock Sources
Set the Invert Knob all the way counter clockwise and CV In / Feedback Knob to 12 o'clock, all of the switches to the center position and press the Reset Button.

Patch a clock source into the Clock Input. Patch an LFO into the CV Input and turn the CV In / Feedback Knob all the way to the right. Patch a clock source into the Clock Input. Patch any of the CV Outputs 1-3 into the gate input of an Envelope Generator or VCA controlling an audio source. Adjust the rate of the LFO sent to the CV Input, the Invert Knob, and the CV In / Feedback Knob to vary the Pattern of the CV Output.

Odd and Even Beat Clocks
Set the Invert Knob and the CV In / Feedback Knob all the way counter clockwise, all of the switches to the center position and press the Reset Button.

Patch a clock source into the Clock Input. Rotate the Invert Knob fully clockwise. The Clock Divider 1 (1-4) outputs will fire on the odd beats and the Clock Divider 2 (A-D) outputs will fire on the even beats.

Modifying the Timetable

**Adjusting the CV Output of CV1, CV2, CV3**

The CV Output of CV1, CV2, and CV3 can be adjusted by using the trimpot located on the left side of the Timetable module. The trimpot adjusts the voltage range of all 3 CV Outputs. There is no "Correct" position for this trimpot. The factory setting is about 10 o'clock
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Replacing CMOS Logic Chips

Clock Divider 1
Clock Divider 2
Power Header +12v Top / -12v Bottom
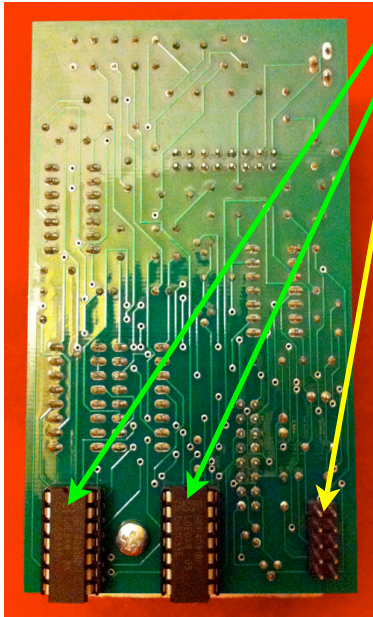
The Timetable uses two separate CMOS Logic chips to determine the clock division behavior of Clock Divider 1 and Clock Divider 2. Modifying the behavior of one or both of the Clock Dividers is as easy as switching an IC chip on the Timetable module. Fortunately we have made this process as simple as possible by locating the two chips on the back of the Timetable module*. The default set of ICs is two 4081 CMOS AND Logic chips. Changing the logic chip changes the functionality of the Timetable creating a new set of clock division behaviors to explore.

Four Different CMOS Logic chips will work with the Timetable.
4001 CMOS NOR
4070 CMOS XOR

4077 CMOS XNOR
4081 CMOS AND

Modifying the Timetable Continued...

Timetable Mod Packs

The Timetable Mod Pack is an easy way to get the full set of CMOS chips compatible with the Timetable. The Mod Pack also includes an IC Extractor Tool to make the process easier. The Timetable Mod Pack is available at all of the Pittsburgh Modular retailers or directly from Pittsburgh Modular.

The Timetable Mod Pack includes:
1x IC Extractor Tool
2x 4001 CMOS
2x 4070 CMOS
2x 4077 CMOS

* Please turn off the modular power supply before switching CMOS Logic chips.
  Unless your modular cabinet has an open back, the Timetable must be
  removed from the cabinet to replace the chips.

Timetable Specs

Size: 12hp
Depth: 50mm
Power: +-12v
Power Usage: TBD
Power Cable is attached red stripe (-12v) down.

The Timetable circuit was designed by Thomas O'Connor.

Questions, Comments, Support: richard@pittsburghmodular.com