TEMPI

CH1 CH2 CH3
CH4 CH5 CH6

SELECT STATE
GATE
MOD
8
6 10
4 12
2 14
CV
TEMPO
A PGM B

CH1 CH2 CH3
CH4 CH5 CH6

MAKENOISE

TEMPI

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes / modifications not approved by the Make Noise Co. could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Make Noise warrants this product to be free of defects in materials or construction for a period of one year from the date of purchase (proof of purchase/invoice required).

Malfunction resulting from wrong power supply voltages, backwards or reversed eurorack bus board cable connection, abuse of the product, removing knobs, changing face plates, or any other causes determined by Make Noise to be the fault of the user are not covered by this warranty, and normal service rates will apply.

During the warranty period, any defective products will be repaired or replaced, at the option of Make Noise, on a return-to-Make Noise basis with the customer paying the transit cost to Make Noise.

Make Noise implies and accepts no responsibility for harm to person or apparatus caused through operation of this product.

Please contact technical@makenoisemusic.com with any questions, Return To Manufacturer Authorization, or any needs & comments.

http://www.makenoisemusic.com

About This Manual:
Written by Tony Rolando and Walker Farrell
Illustrated by W.Lee Coleman

THANK YOU:

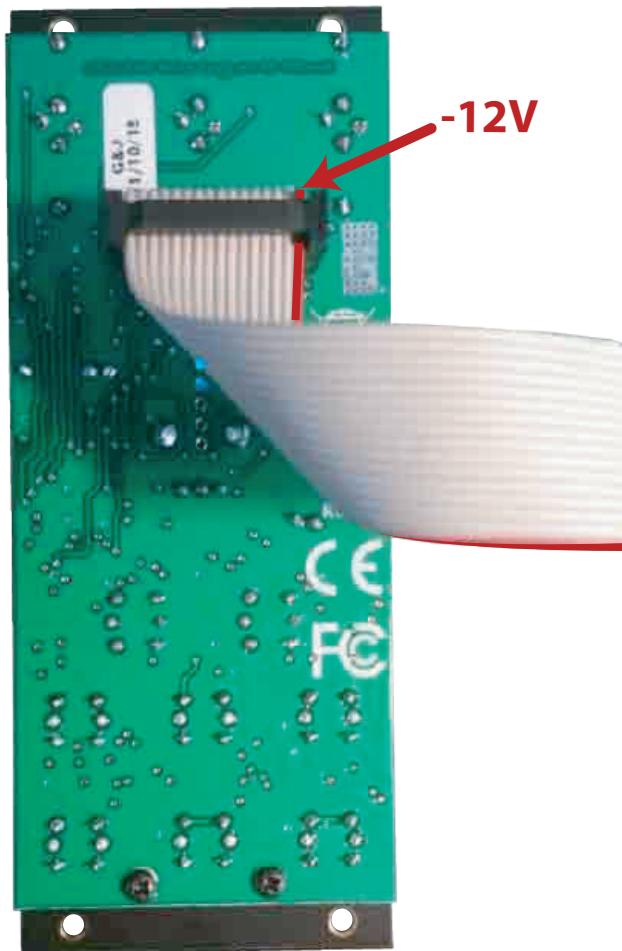|	
TEMPI Beta Analysts:	Walker Farrell, James Cigler, Bana Haffar, Robert AA Lowe, Rodent, Devin Booze, Lee Coleman, Mike Johnson, and Richard Devine
TEMPI Firmware Engineer:	Matthew Sherwood
TEMPI Designer:	Anthony Rolando
Special Thanks:	CTRLSEL-C, CTRLSEL-V, and CTRLSEL-G

Electrocution hazard!

Always turn the Eurorack case off and unplug the power cord before plugging or un-plugging any Eurorack bus board connection cable.
Do not touch any electrical terminals when attaching any Eurorack bus board cable.

The Make Noise TEMPI is an electronic music module requiring 46 mA of +12VDC regulated voltage and a properly formatted distribution receptacle to operate. It is designed to be used within the Eurorack format modular synthesizer system.

Go to http://www.makenoisemusic.com for examples of Eurorack Systems and Cases.

To install, find 10HP in your Eurorack synthesizer case, confirm proper installation of inlcluded eurorack bus board connector cable on backside of module (see picture below), plug the bus board connector cable into the Eurorack style bus board, minding the polarity so that the RED stripe on the cable is oriented to the NEGATIVE 12 Volt line on both the module and the bus board. On the Make Noise 6U or 3U Busboard, the NEGATIVE 12 Volt line is indicated by the white stripe.

Please refer to your case manufacturers' specifications for location of the negative supply

TEMPI is deep, but all you really need to know: patch a clock to the Leading Tempo Input and tap any Channel Button at a clock rate of your choice. The Channel Button's LEDs flash to indicate the current clock rate, which changes in speed to match your taps. A clock of that Tempo is available at each of the respective Channel Outputs. Adjusting the (6) tempi relative to one another will create seemingly-infinite rhythmic variations on the theme that is your patch. Much joy may be had without any further knowledge, but I am certain you will want to know more, so read on.

TEMPI is a (6) Channel, polyphonic, time-shifting module. It provides an intuitive method for the creation and recalling of complex clocking arrangements within a modular synthesizer system.

User Interface:
The primary User Interface and Programming elements for the module are (6) large, illuminated buttons (Channel Button 1-6) and (2) smaller illuminated buttons: PGM_A and PGM_B. The module is able to store up to (64) clock/timing scenarios called States, arranged in (4) Banks of (16) States. A center Bank LED is used to indicate the current Bank by color. Changes in States are indicated by the Channel Buttons' flashing LEDs.

There are Inputs for External Leading Tempo, a Gate Input for Mod, State Select via a CV Input (with Combo Pot for attenuation) and/or Select Gate Input. The primary goal of this module is to have the maximum amount of artist-controlled musical variation with a minimum amount of data input.

Firmware:
This manual is for TEMPI Firmware version **tempi60**. TEMPI modules running **temp60** will have an LED sequence on power up where 3, 4, 5, and 6 flash.
Download the latest firmware from: **http://www.makenoisemusic.com/modules/tempi.**

Programming:

There are two methods of Programming TEMPI's Channels: **HUMAN** and **MACHINE.**

HUMAN Programming is simple:
[Tap] the Channel Button(s) at the rate you would like the associated Channel Output(s) to move.
(by default, Channel 1's Button sets the Leading Tempo, while other channels set divisions or multiples.)

MACHINE Programming is simple:
[Hold] PGM_A for DIVISIONS (÷) or PGM_B for MULTIPLES (*) and [tap] the associated Channel Button the number of times

      corresponding to the desired DIVISION (÷) or MULTIPLE (*).
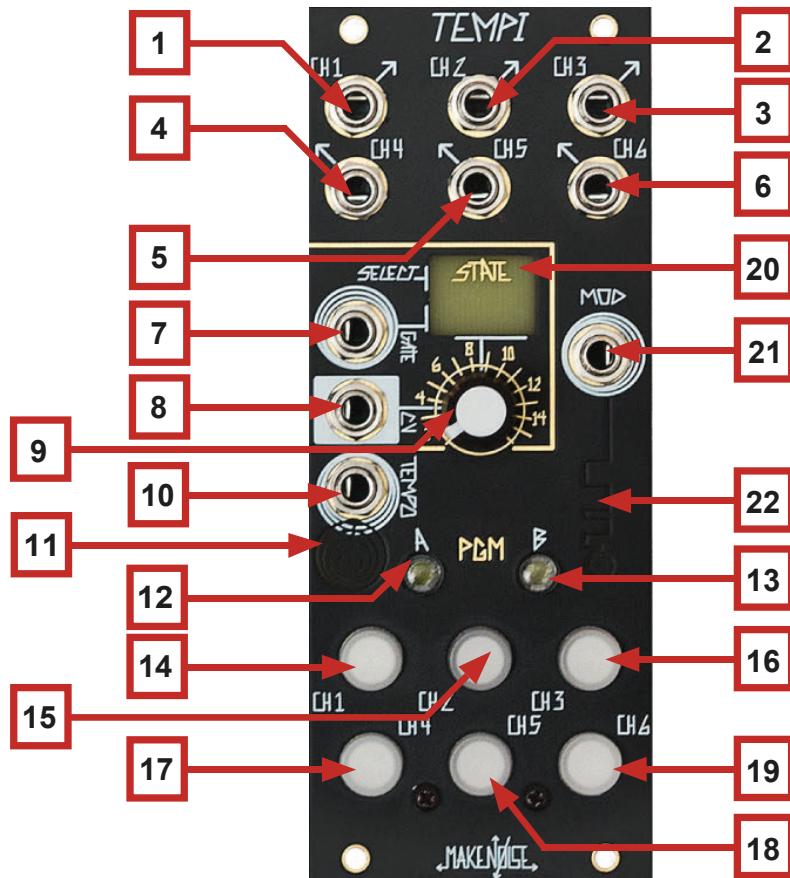
      For example:
To MACHINE Program Channel-3 to "**÷4**" (divide by four): [HOLD] PGM_A + [TAP] Channel Button-3 (4) times.

To MACHINE Program Channel-4 to "***6**" (multiply by six): [HOLD] PGM_B + [TAP] Channel Button-4 (6) times.
Once a Channel is Programmed, whether by HUMAN or MACHINE, it may be fine-tuned by [holding] the associated Channel Button and tapping PGM_A to slow down the clock incrementally or PGM_B to speed it up incrementally.

Note: All (6) Channels are synchronized according to the associated Channel settings and Leading Tempo.

Hint: feel free to skip ahead to Tips and Tricks on Page 28.

TEMPI Panel Controls

1. **Channel 1 Output**

2. **Channel 2 Output**

3. **Channel 3 Output**

4. **Channel 4 Output**

5. **Channel 5 Output**

6. **Channel 6 Output**

7. **State Select Gate Input**

8. **State Select CV Input**

9. **Select CV Attenuator/Combo Pot**

10. **External Leading Tempo Input**

11. **Tempo LED**

12. **PGM_A Button / LED**

13. **PGM_B Button/ LED**

14. **Channel Button-1 / LED**

15. **Channel Button-2 / LED**

16. **Channel Button-3 / LED**

17. **Channel Button-4 / LED**

18. **Channel Button-5 / LED**

19. **Channel Button-6 / LED**

20. **State LED**

21. **Mod Gate Input**

22. **Mod LED**

FACTORY SETTINGS:

When you first power up a new TEMPI, Bank A will be filled with (16) States representing a selection of classic and new Clock Divider/Multiplier settings. All these settings are user-editable and can be overwritten at will. Here's a short description:

STATE 1 All (6) CHannels are "**÷1.**" This setting is also the "Init" for all States in the other (3) Banks.

STATES 2-7 are Clock Divider States:

2. Powers of 2:   ÷1, ÷2, ÷4, ÷8, ÷16, ÷32

3. Primes: ÷2, ÷3, ÷5, ÷7, ÷11, ÷13

4. Integers: ÷1, ÷2, ÷3, ÷4, ÷5, ÷6

5. Evens: ÷2, ÷4, ÷6, ÷8, ÷10, ÷12

6. Odds: ÷3, ÷5, ÷7, ÷9, ÷11, ÷13

7. Fibonacci: ÷2, ÷3, ÷5, ÷8, ÷13, ÷21

STATES 8-13 are Clock Multiplier States:

8. Powers of 2:   *1, *2, *4, *8, *16, *32

9. Primes: *2, *3, *5, *7, *11, *13

10. Integers: *1, *2, *3, *4, *5, *6

11. Evens: *2, *4, *6, *8, *10, *12

12. Odds: *3, *5, *7, *9, *11, *13

13. Fibonacci: *2, *3, *5, *8, *13, *21

14. Multiples and   *2, *3, *4, ÷2, ÷3, ÷4
    Divisions:

15. Phase Demonstration: All (6) Channels are set to the same Tempo, but with (6) unique Phase values.

16. Non-Integer Division Demonstration: Each successive channel is one Fine Decrement slower than the previous, resulting in adjacent Channels going slowly in and out of Phase with each other.

The Factory Settings of the **Program Edit** Page are as follows:

- **Human Resolution 50%**
- **Shift = CW**
- **Run/Stop = OFF**
- **Shift = Jumbled**

The Factory Settings of the **Clock Edit** Page are as follows:

- **All Channels set to output 50% duty cycle Clocks**
- **Channel 1 set to act as Tap Tempo**

To Restore all Factory States, power off the system, hold PGM_A, PGM_B and Button-5 simultaneously while powering on, then release all buttons. Press Button-3, which will be flashing RED, to Restore (and Store) all Factory States.

Human Programming
[Tap] Button1-6

Human Programming of Multiple and
Divisions of Leading Tempo
If enabled on Clock Edit Page, Tap Button1 to set Leading Tempo

Machine Programming

Variable Clock Multiplier / Divisor

[Hold] PGM_A + [Press] Channel Button1-6 n times
for Variable Clock Divisor Coarse adjustment ($1 \div n$)

While still holding PGM_A, [Press]
PGM_B y times for secondary divisor
$1 \div (n2^y)$

[Hold] PGM_B + [Press] Channel Button1-6 n times for
Variable Clock Multiplier Coarse adjustment ($1 * n$)

While still holding PGM_B, [Press]
PGM_A y times for secondary multiplier
$1 * (n2^y)$

[Hold] Channel Button1-6 + [Press] PGM_A
for Variable Clock Fine Decrement

[HOLD] Channel Button1-6 + [Press] PGM_B
for Variable Clock Fine Increment

Phase Adjustment
[Press] PGM_A + PGM_B = On

[Hold] CHannel BUTTON1-6:

+ [Press] PGM_A n times to Phase Fine
Decrement Multiplier/Divisor value

+ [Press] PGM_B n times to Phase Fine
Increment Multiplier/Divisor value

[Hold] PGM_A + [Tap] Channel Button1-6 to Phase
Coarse Decrement Multiplier/Divisor

[Hold] PGM_B + [Tap] Channel Button1-6 to Phase
Coarse Increment Multiplier/Divisor

Mute
[Press] PGM_A = On

[Press] Channel Button1-6 to Mute Channels;
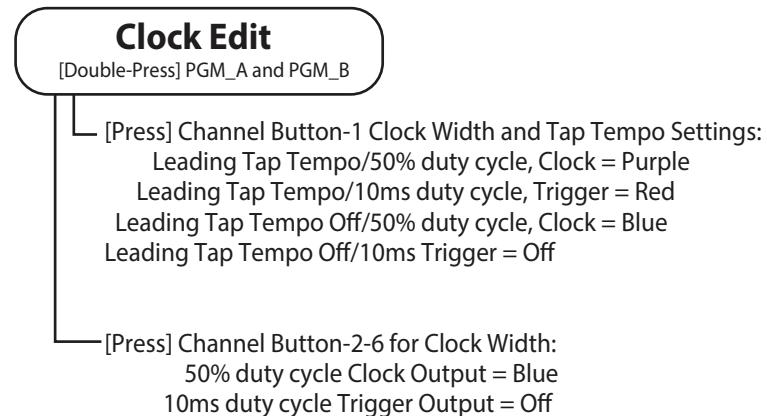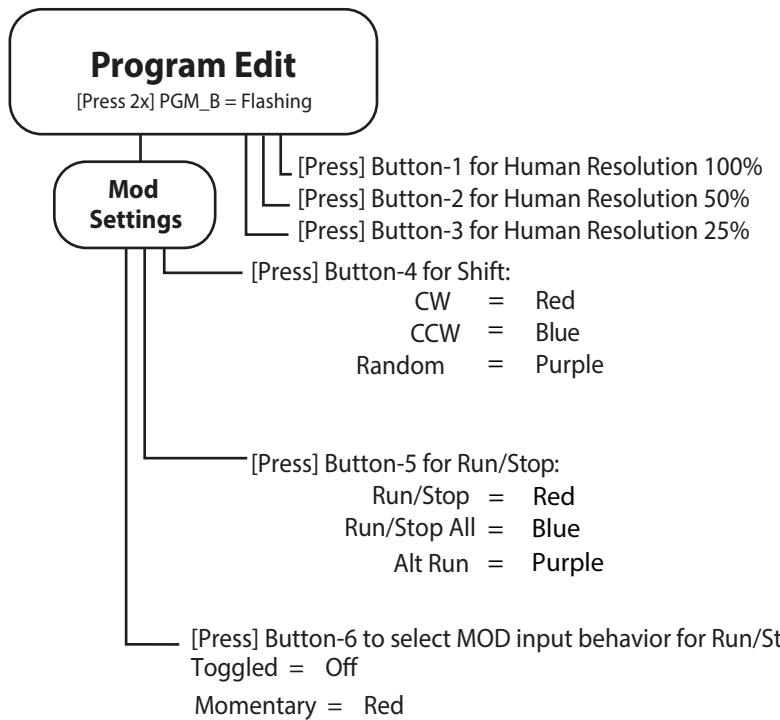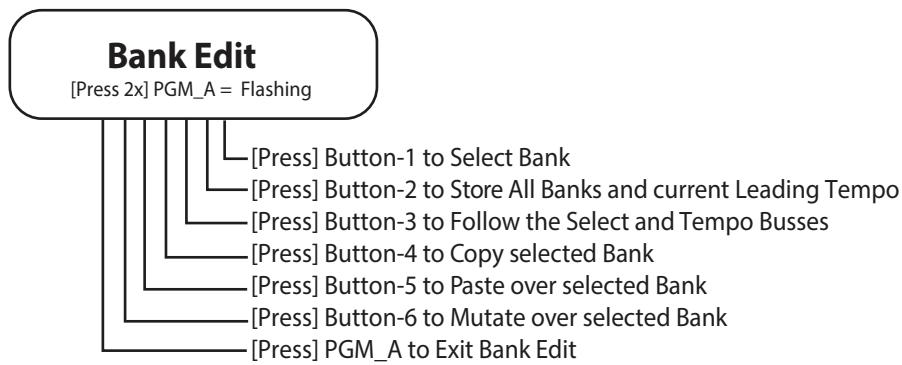Muted Channels = Red

Mod Enable
[Press] PGM_B = ON

[Press] Channel Button-1-6
Mod Enabled Channels = Purple

State Edit
[HOLD] PGM_A + PGM_B

[Press] BUTTON-1 to Recall current State
[Press] BUTTON-2 to Store current State
[Press] BUTTON-3 to Recall current Bank
[Press] BUTTON-4 to Copy selected State
[Press] BUTTON-5 to Paste over selected State
[Press] BUTTON-6 to Mutate over selected State

Bank Edit
[Press 2x] PGM_A = Flashing

[Press] Button-1 to Select Bank
[Press] Button-2 to Store All Banks and current Leading Tempo
[Press] Button-3 to Follow the Select and Tempo Busses
[Press] Button-4 to Copy selected Bank
[Press] Button-5 to Paste over selected Bank
[Press] Button-6 to Mutate over selected Bank
[Press] PGM_A to Exit Bank Edit

Program Edit
[Press 2x] PGM_B = Flashing

Mod Settings

[Press] Button-1 for Human Resolution 100%
[Press] Button-2 for Human Resolution 50%
[Press] Button-3 for Human Resolution 25%

[Press] Button-4 for Shift:

CW	=	Red
CCW	=	Blue
Random	=	Purple

[Press] Button-5 for Run/Stop:

Run/Stop	=	Red
Run/Stop All	=	Blue
Alt Run	=	Purple

[Press] Button-6 to select MOD input behavior for Run/Stop:
Toggled = Off

Momentary = Red

Clock Edit
[Double-Press] PGM_A and PGM_B

[Press] Channel Button-1 Clock Width and Tap Tempo Settings:
Leading Tap Tempo/50% duty cycle, Clock = Purple
Leading Tap Tempo/10ms duty cycle, Trigger = Red
Leading Tap Tempo Off/50% duty cycle, Clock = Blue
Leading Tap Tempo Off/10ms Trigger = Off

[Press] Channel Button-2-6 for Clock Width:
50% duty cycle Clock Output = Blue
10ms duty cycle Trigger Output = Off
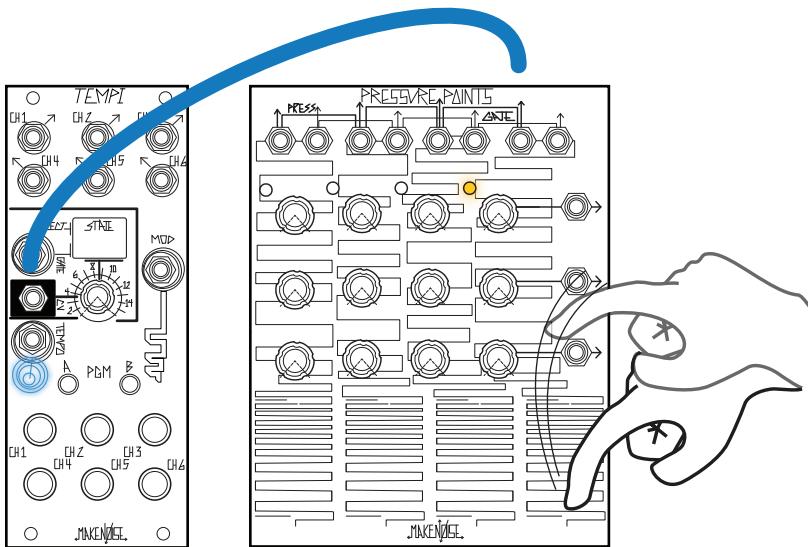
Leading Tempo

There are five ways to determine the Leading Tempo, which synchronize the (6) Variable Clock Outputs of the TEMPI:
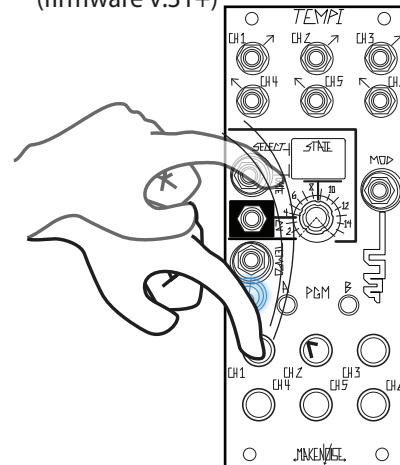
1. With nothing patched to the Leading Tempo Input, the last-Stored Tempo is used (refer to Bank Edit Page's Store Function, described on page 24).

2. When an External Clock is patched to the Leading Tempo Input, the External Clock source is followed after 2 pulses.

3. When an internally-connected bus line is used via the Tempo Bus, the generated Clock signal is Followed (refer to Bank Edit Page's Follow Setting, described on page 26).

4. If Tap Tempo is enabled on the Clock Edit Page, tap Button 1 to set the Leading Tempo.

5. If Tap Tempo is not enabled on the Clock Edit Page, use the State select combo pot and CV input to set the Leading Tempo.

Note: While externally clocking, when changing Tempo from fast to slow, there will be some delay, as TEMPI needs a minimum of 2 Clock pulses to measure the incoming Clock rate and lock into sync. If synchronizing TEMPI to a DAW project, include 2 bars of silence, with sync clock running at the beginning of the composition so TEMPI locks into sync when the composition starts. Also, for DAW Sync, try Run/Stop All (James Cigler mode) described on Page 20.

To Program the Leading Tempo externally via tapping:

Programming with Leading Tap Tempo (firmware v.31+)

Variable Clock Programming:

The Variable Clock Outputs may be Machine Programmed by pressing and holding a combination of PGM_A or PGM_B and/or Button(s)1-6 for the associated Channel Outputs. Each of the Variable Clock Outputs are Multiples or Divisions of the Leading Tempo. When Variable Clock Outputs are Active (Mute Disabled) and/or Mod Disabled, the associated Channel Button LED(s) flash Blue to indicate Clock High/Low.

NOTE: The default Pulse Width of the Variable Clock Outputs is 50% Duty Cycle. This can be changed to 10ms Triggers via the Clock Edit Page, per firmware v.31.

Human Programming

Human Clock Programming combines Multiplier/Divisor and Phase Settings into one simple, tactile process.
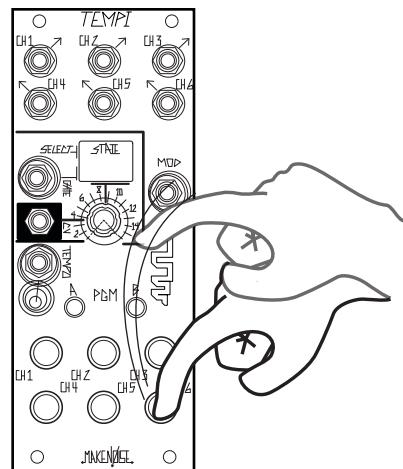
For Human Programming, patch the Leading Tempo (i.e. MULT of the clock patched to Tempo Input or any Channel set to 1:1 using Machine Multiplier or Divisor) so that the timing is audible. Next, Program a Variable Clock by tapping Buttons1-6 to affect the associated Channel Output(s) in order to complement the Leading Tempo, resulting in either a Multiple or Division of the Leading Tempo.

Notice, the User must tap each Channel Button at least twice in order to Program a timing value. Changes happen as soon as algorithmically possible. Previous values for a given Channel are overwritten as soon as a Channel Button is tapped the second time.

While Human Programming, State changes are ignored. It is also possible to Program several Channels at once. This makes it more intuitive to create interesting timing arrangements.

IMPORTANT: these changes are not saved until you Store the State. Without running the Store function (Page 24), changes are not held when the power is cycled. This makes it easy to improvise with alternate versions of a Stored theme.
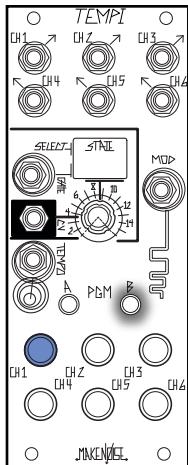
For **HUMAN** Programming:
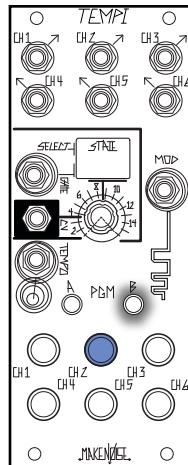

**[TAP] Associated
BUTTON(s)1-6**

RESOLUTION

Human Programming has three levels of Resolution determined by the Program Edit Page (to access, Press PGM_B twice). The Resolution of Human Programming determines how the Variable Clocks are related to the Leading Tempo's Phase and Multiplier/Divisor. The Resolution setting is then indicated by which Channel Button1-3 LED is lit:
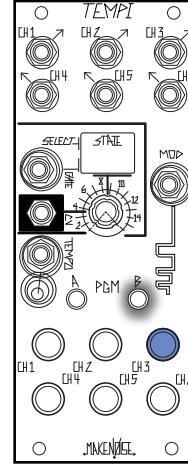

Human Resolution 100%
Results in the strictest relationships. This is the same as Machine Programming Coarse Multipler/Divisor and Phase adjustments (see "Machine" section).

Human Resolution 50%
The Default setting, allowing for something less strict than 100%, but easier to use than 25%.
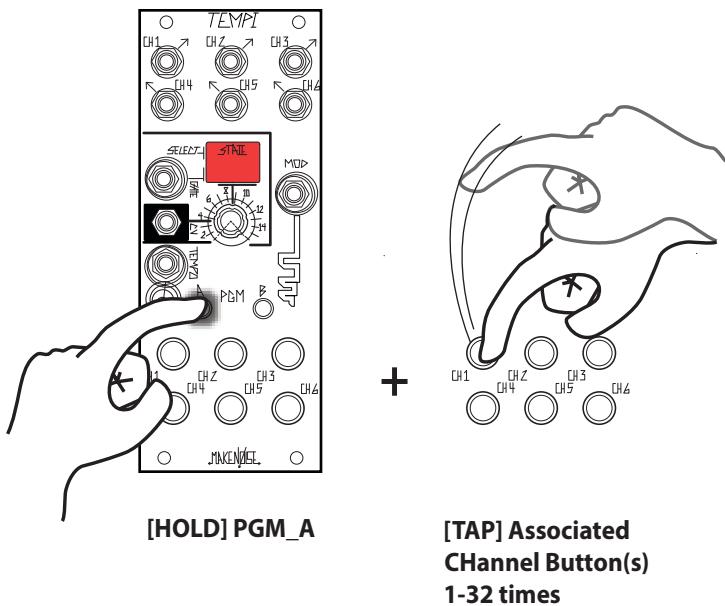

Human Resolution 25%
Establishes in the most free relationships and in theory is the equivalent as Machine Programming Fine Multiplier/Divisor and Phase adjustments.

Machine Programming

There are two types of MACHINE Programming: Variable Clock Multiplier/Divisor and Phase.

Variable Clock Multiplier/Divisor Programming requires a combination of pressing and holding buttons in order to adjust the associated Variable Clock Outputs:
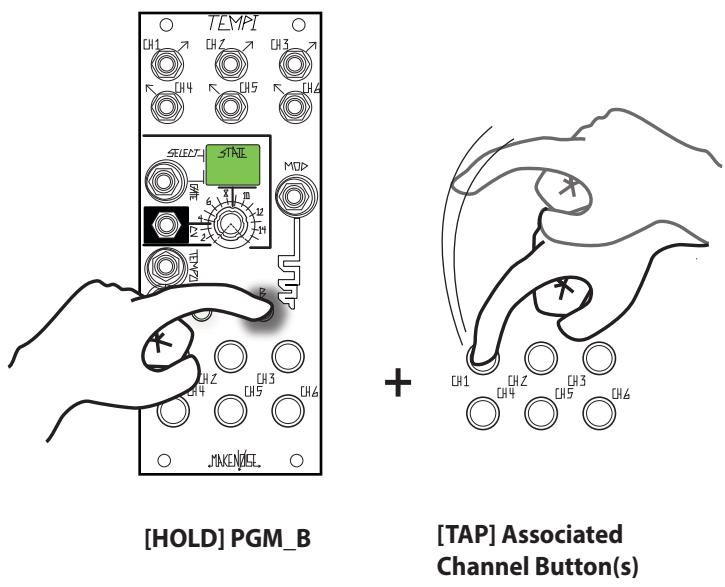
For **Variable Clock Divisor Coarse adjustment**:

[HOLD] PGM_A

+

[TAP] Associated CHannel Button(s) 1-32 times

The user holds PGM_A and taps the desired Channel Button (1-32) times in order to Program the associated Variable Clock Output. It is possible to tap Channel Buttons1-6 simultaneously in order to Program several Channels at once. The TEMPI counts the taps and sets this number as the Divisor value for each Channel. If (32) taps are exceeded, the count stays at maximum number of (32) and the counting of subsequent taps is stopped. Changes take place as soon as PGM_A is released.

The State LED lights red to indicate a Variable Clock Divisor Coarse adjustment. Previous values for a given Channel are overwritten as soon as the associated Button1-6 is pressed while holding PGM_A.

Note: To return to a 1:1 relationship with Leading Tempo (Default), hold PGM_A or PGM_B and press the associated CHannel Button1-6 once.

For **Variable Clock Multiplier Coarse adjustment** :

[HOLD] PGM_B

+
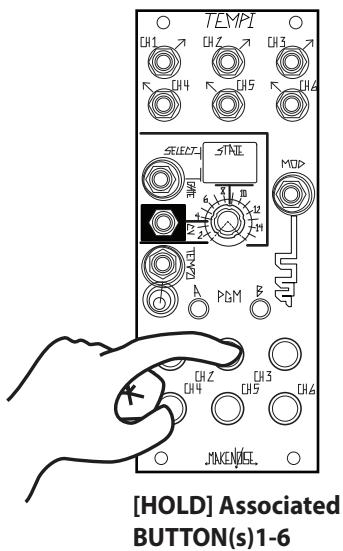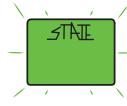
[TAP] Associated Channel Button(s) 1-32 times

The user holds PGM_B and taps the desired Channel Buttons (1-32) times in order to Program the associated Variable Clock Outputs. It is possible to [TAP] BUTTON(s)1-6 simultaneously, in order to Program several CHannels at once. The TEMPI counts the number of and sets this as the Multiplier value. If (32) taps are exceeded, the count stays at maximum number of (32) and the counting of subsequent taps is stopped. Changes are made once PGM_B is released.

The State LED lights green to indicate a Variable Clock Multiplier Coarse adjustment. Previous values for a given Channel are overwritten as soon as the associated Button(s)1-6 is pressed while holding PGM_B.

To return to a 1:1 relationship with the Leading Tempo (Default), hold PGM_A or PGM_B and press the associated Channel Button1-6 once.

Machine Programming Multiplier/Divisor: (cont'd)

For **Variable Clock Multiplier / Divisor
Fine adjustment:**

**[PRESS] PGM_A for
Variable Clock
Fine decrement**

For Variable Clock Fine decrement (i.e. to make slower), hold the associated Channel Button1-6 and press PGM_A. The State LED flashes Red to indicate a Variable Clock Fine decrement has been made.

or

**[PRESS] PGM_B for
Variable Clock
Fine increment**

For Variable Clock Fine increment (i.e. to make faster), hold the associated Channel Button1-6 and press PGM_B. The State LED flashes green to indicate a Variable Clock Fine increment has been made.

**[HOLD] Associated
BUTTON(s)1-6**

You may Fine increment or decrement across the entire possible Variable Clock range, but you may find it is much easier to make a Coarse adjustment and then make a few Fine adjustments to find unique timings.

Double Divisor / Multipliers

During Coarse Machine Programming, while holding down the associated PGM button, press the opposing PGM button to double the divisor or multiplier. This makes it easy to quickly Program a Channel to a Multiplier or Divisor Value of 32 without having to tap 32 times.
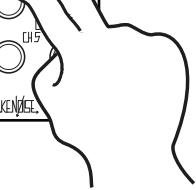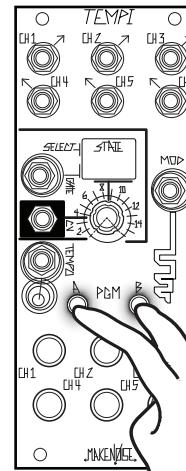
For example, hold PGM_A and press Button-2 twice for ÷2. Next, while still holding PGM_A, press PGM_B once for ÷4, twice for ÷8, three times for ÷16, or four time for ÷32.

The other way to Machine Program is by making Phase adjustments. To enter the Phase Programming Page, press PGM_A and PGM_B at the same time. While in the Phase Page, both PGM_LEDs are on. State changes and Human Programming are ignored. To exit, press both PGM_A and PGM_B.

Next, Phase adjustments are performed in a similar way to the Multiplier/Divisor settings using Coarse and Fine Phase increments and decrements.
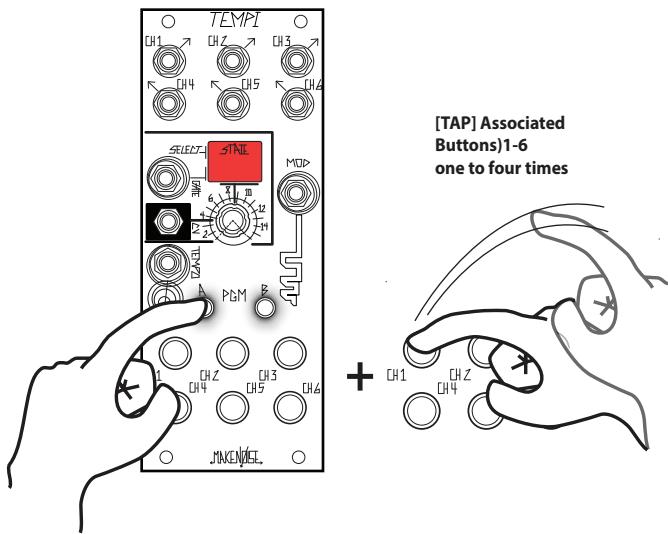
To begin Phase Programming,
[press] PGM_A and PGM_B
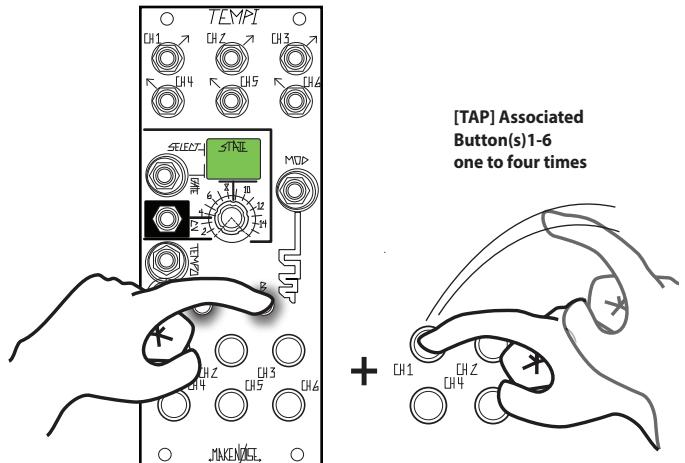

Once in the Phase Programming Page:

For **Coarse Phase decrement:**
[Hold] PGM_A

[TAP] Associated Buttons)1-6
one to four times

For **Coarse Phase increment:**
[Hold] PGM_B

[TAP] Associated Button(s)1-6
one to four times

Hold PGM_A and tap the associated Channel Button(s) 1-4 times in order to Coarse Phase Program its Output(s). Coarse Phase adjustments offset the Phase of the Channel's Output by one cycle of the Leading Tempo. The State LED lights red to indicate a Coarse Phase decrement has been made.

Hold PGM_B and tap a Channel Button(s), (1-4) times in order to Program the associated Channel Output(s).   Coarse Phase adjustments offset the Phase of the Channel's Output by one cycle of the Leading Tempo. The State LED lights green to indicate a Coarse Phase increment has been made.
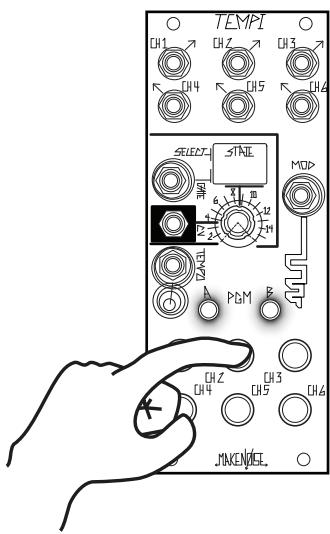
When programming Multiples of the Leading Tempo, Coarse Phase adjustments can be very subtle. Here is why: if the Channel is set to an integral Multiple (e.g. * 4), Coarse Phase will have no audible effect, because the Channel's Clocks are output at the same times at each pulse of the Tempo. If the Channel is set to a non-integer Multiple (e.g. * 4.25), the Channel's clocks will drift in and out of Phase with the Leading Tempo over a period of several pulses of the Tempo. Coarse Phase of a Multiple in this situation only affects the zero-center of this Phase-shifting: a subtle effect.
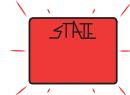
While still on the Phase Programming Page:

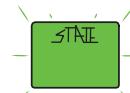For **Fine Phase adjustment:**

[HOLD]
Buttons(s)1-6

[press] PGM_A to
Fine Phase decrement
(i.e. lead ahead of **Leading TEMPO**)

or

For Fine Phase decrement, hold the associated Channel Button(s)1-6 and press PGM_A. The State LED flashes red to indicate a Fine Phase decrement has been made.

[press] PGM_B to
Fine Phase increment
(i.e. lag behind **Leading Tempo)**

For Fine Phase increment, hold the associated Channel Button(s)1-6 and press PGM_B. The State LED flashes green to indicate a Fine Phase increment has been made.

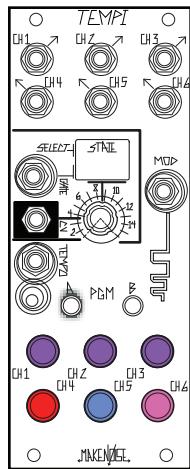For Channels Programmed to be Divisions, Fine Phase adjustments offset the Phase of a Channel's Output by one quarter of a cycle of the Leading Tempo. Likewise, for Channels Programmed to be Multiples, it offsets the Phase of the Leading Tempo.

Coarse Phase adjustments override Fine Phase adjustments. In this way, Coarse Phase adjustments return to integral divisors and multipliers, for instance, 1:1.

To Mute a Channel output, press PGM_A to toggle access the Mute Page. In order to exit the Mute Page, press PGM_A again. The associated PGM_A LED lights to indicate that the Mute page is active. While active, State changes are ignored. To Mute a Channel, now press its associated Channel Button to toggle its Variable Clock Output on/off. When Muted, the associated Channel Button LED is red and flashes with each Rising Edge of each Clock to indicate the currently Programmed Variable Clock.

When a Channel is Active, its associated Channel Button is blue. If a Channel is Mod enabled while Active, the associated Channel Button is purple. Alternatively, if a Channel is both Mod enabled and Muted, its associated Channel Button is pink (see below).

The purpose of Mute is to stop the Clock activity at the Channel Outputs while still allowing the user to Program desired changes. In this way, it is possible to Program a new Variable Clock into a Muted Channel. This is useful for cueing changes during live performance by Machine or Human Programming. Exit the Mute page by pressing PGM_A.

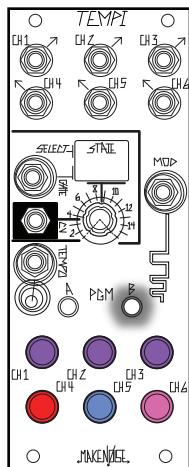|		
Muted, Mod disabled	=	**RED**
Active, Mod disabled	=	**BLUE**
Active, Mod enabled	=	**PURPLE**
Muted and Mod enabled	=	**PINK**

It is possible to Mute several Channels at once. This makes it more intuitive to create interesting timing arrangements.

Please note: these changes ARE NOT SAVED until you Store the State. Without running the Store State operation, changes are not held when the power is cycled. This is useful for improvising with alternate versions of a Stored theme.

The Mod function allows you to Program Shift or Run/Stop behavior. To Program the Mod function, press PGM_B to access the Mod Page, indicated by the PGM_B LED. While on the Mod page, State changes are ignored. To Mod Enable a Channel, press its associated Channel Button. Channels that are Active and Mod Enabled are purple. Channels that are both Mod Enabled and Muted appear pink. If a Channel is Mod disabled, it is either Blue or Red. All Channels will continue to flash to indicate currently-Programmed Variable Clock.

To exit the Mod Page, press PGM_B again.

MOD disabled, Muted	=	**RED**
MOD disabled, Active	=	**BLUE**
MOD enabled, Active	=	**PURPLE**
MOD enabled and **Muted**	=	**PINK**

Progam Edit
[Double Press] PGM_B

MOD SETTINGS

[Press] Button4 for Shift:

CW	=	Red
CCW	=	Blue
Random	=	Purple
Off	=	Off

(must have Run Stop Enabled)

[Press] Button5 for Run / Stop

Run/Stop	=	Red
Run/Stop All	=	Blue
Alt Run	=	Purple
Off	=	Off

(must have Shift Enabled)

[PRESS] Button-6 for Run/Stop MOD option:

Toggled	=	Off
Momentary	=	Red

While Human or Machine Progamming, Mod remains disabled until Programming is completed. This behavior may be used creatively in order to manually "freeze" the Mod functionality.

In order to easily create interesting timing arrangements, it is possible to Mod Program several Channels at once. The Mod function is determined by the Programming of the Mod Settings in the Program Edit page. The Mod Input affects the TEMPI according to the Shift Behavior (causes timing information to move between Mod-enabled Channels at each new Gate) and Run/Stop (causes some or all Channels to Run, Stop, and/or Reset). The Mod LED flashes Magenta to indicate a Mod function has been performed.

If both Shift and Run/Stop are enabled, then the State Select Gate Input is used for Shift and the Mod Input for Run/Stop. When only one behavior is enabled, the Mod Input is used for the selected behavior.

Please note: these changes ARE NOT SAVED until you Store the State. Without running the Store operation, changes ARE NOT held when the power is cycled. This is useful for improvising with alternate versions of a Stored theme.

The Shift Function trades the values for the Variable Clock Outputs and is accessed from the Program Edit page (Double Press PGM_B).

For example, if Channels 2, 3, and 5 are set to be Shifted, the Variable Clock value at Channel 2 is swapped with the Variable Clock value at Channel 5 at the Rising Edge of the Gate patched to the Mod Input, simultaneously replacing the value of Variable Clock 3 with that of the previous Variable Clock 2, allowing Channel 5 to take on the original value of Channel 3…. In other words, it behaves as a Shift Register for the Variable Clock parameter values, where at each Shift command received, the values are passed to the next active Mod Enabled Channel. These changes always occur at the Rising Edge of the signal patched to the Mod Input so that when a Gate High is read, the Mod LED flashes Magenta and the Shift occurs immediately, allowing for an TEMPI Channel patched to the Mod Input to control the Variable Clocks Shifts.

If you leave the current STATE after having Shifted some or all Channels, the Channels will be returned to their original values when you return to the STATE.

Note: Muted Channels are not Shifted. One could emulate a Shifted Mute by Programming a large Division and Shifting. If both Shift and Run/Stop are both enabled (See Page 21), all State selection must be done using the State Select CV and Combo Pot.
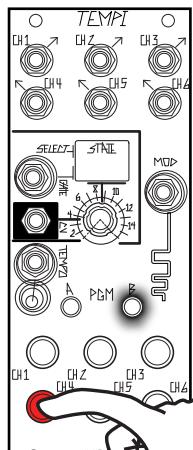
Tip: Shift is also useful for Programming variations of States where you want use the same Channels:

1. Create your initial State.
2. Copy and then Paste to another State.
3. Press PGM_B to enter the Mod Programming Page and set two Channels to be Shift Enabled, Purple.
4. Send a Gate signal to the Mod Input to swap their Variable Clock values.
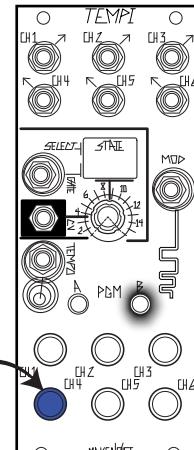5. Set these two Channels back to being Mod disabled.

Use this technique to trade Variable Clock values and create new States.

Using Button-4 on the Program Edit Page, Shift may be Programmed to operate in the following directions:
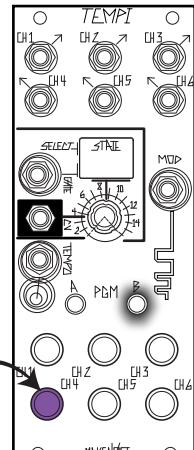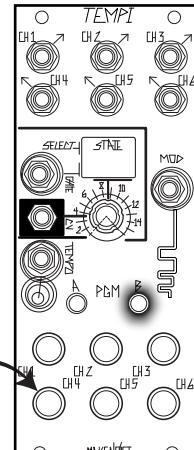
Clockwise, CW
Button-4 = Red

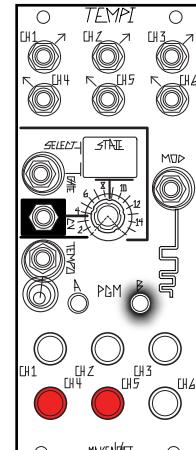**Counterclockwise, CCW**
Button-4 = Blue

Random (aka RODENT Mode)
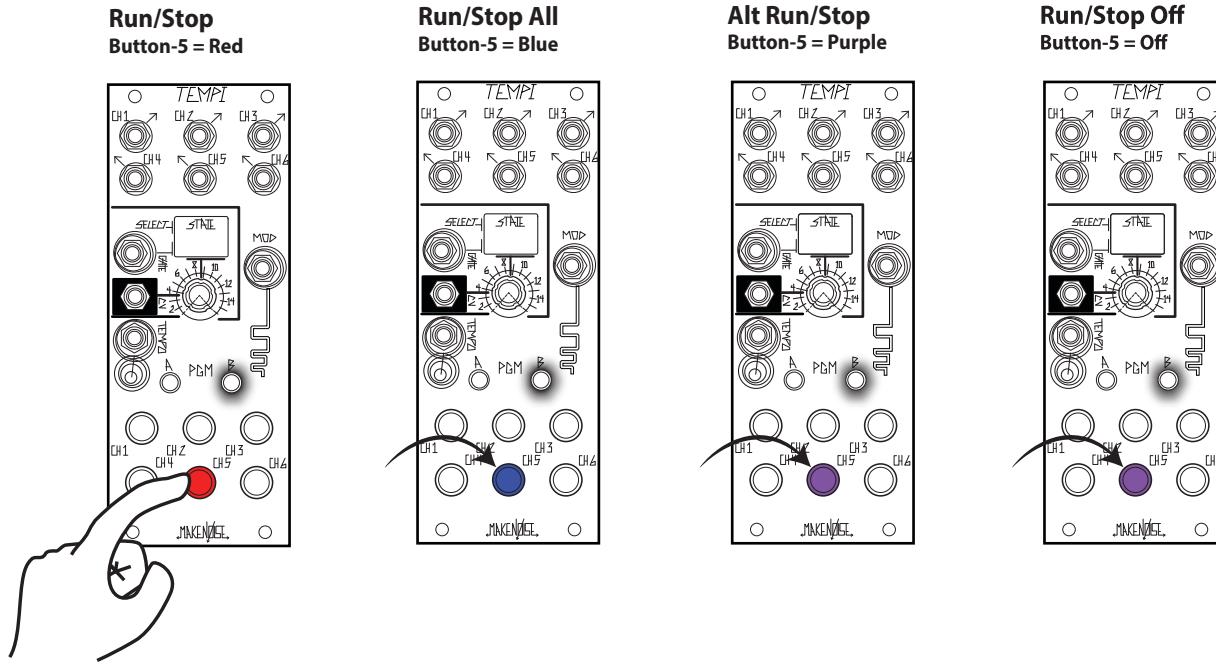Button-4 = Purple

Shift = Off
Button-5 = Off

Run/Stop and Shift
Button-4 and 5 = Red

The Run/Stop Functions allows for modulation of the phase relationships, rests, and the ability to reset the Variable Clock Outputs. When set to Run, the Variable Clock Outputs operate as Programmed. When set to Stop, the Variable Clock Outputs are resting at 0V, or OFF.

There are several types of Run/Stop behaviors to choose from that are Programmed using Button-5 in the Program Edit Page (Double Press PGM_B):

Run/Stop	Run/Stop All	Alt Run/Stop	Run/Stop Off
Button-5 = Red	Button-5 = Blue	Button-5 = Purple	Button-5 = Off

Run/Stop   Button-5 = Red
Run/Stop makes Mod Enabled Channels Run when a signal at the Mod Gate Input goes High and Stop when the Mod Gate Input signal goes Low. The Mod LED is on when the Mod Gate is High and is off when it is Low. Run starts the channel immediately, regardless of phase relationship to the Leading Tempo and preserves that Phase Offset until there is a State change or a Stop (ie. Mod Gate Low). This allows for external modulation of a Channel's Phase relationaship to the Leading Tempo. Mod Disabled Channels are not affected. If a signal patched to the Mod Input is an integer of the Leading Tempo (e.g. 1/1, 1/2, 1/4, 2/1...), Run/ Stop may also be used to Reset a Channel.

Run/Stop All (a.k.a. James Cigler Mode)   Button-5 = Blue
Makes all Channels Run on when a signal at the Mod Gate Input goes High and Stop when the Mod Gate Input signal goes Low, reseting all CHannels on Run. The Mod LED is on when the Mod Gate signal is High and is off when it is Low. Mod Enabled Channels start immediately regardless of phase relationship to the Leading Tempo, preserving that Phase Offset until there is State change or a Stop (i.e. Mod Gate Low). Mod Disabled Channels start in Phase with the Leading Tempo. This behavior is nice for creating compositional structures where you would like a Beginning or End. If synchronizing the TEMPI to DAW project, with the sync clock running, include 2 bars of silence at the beginning of composition so that TEMPI is locked into sync when it first receives the Run signal at the Mod Input. Run/ Stop All is also nice when used with a MIDI to CV module to convert MIDI Note On/Note Off messages to Gate signals that may be used to drive the TEMPI.
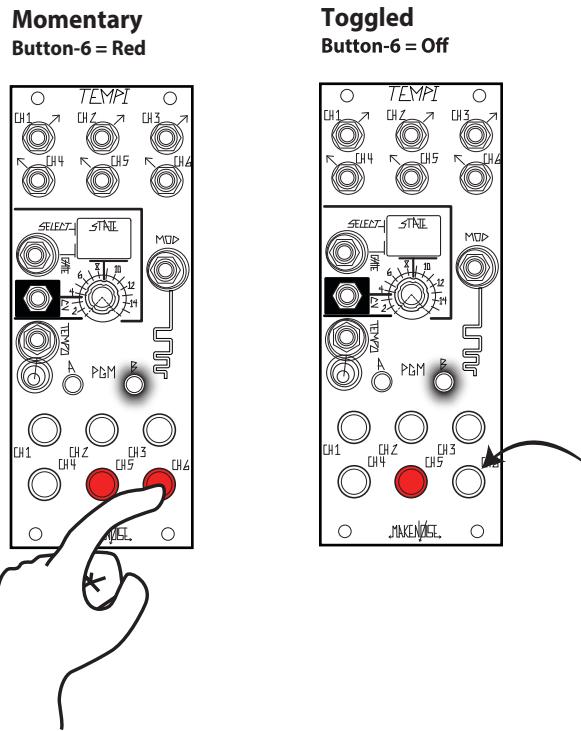
Alt Run/Stop (a.k.a. Robert A.A. Lowe Mode)   Button-5 = Purple
Alt Run/Stop makes Mod Enabled Channels Run when a signal at the Mod Gate Input goes High and Stop when the Mod Gate Input signal goes Low. Mod Disabled Channels have the inverse behavior, Stopping when the Mod Gate Input is High and Running when the Mod Gate Input is Low. The Mod LED is on when the Mod Gate signal is High and is off when it is Low. Channels start immediately, regardless of their phase relationship to the Leading Tempo, preserving their Phase Offset until there is a State change or a Stop (i.e. Mod Gate Low). This allows for external modulation of a Channel's Phase relationaship to the Leading Tempo. If a signal patched to Mod Input is an integer of the Leading Tempo (e.g. 1/1, 1/2, 1/4, 2/1...), it may also be used to Reset a Channel while maintaining Phase with Leading Tempo.

While on the Program Edit Page, Button-6 sets the behavior of the Mod Input jack for Run/Stop and Reset behaviors to be Momentary or Toggled.

Momentary
Button-6 = Red

Toggled
Button-6 = Off

Momentary   Button-6 = Red
MOD input causes Run/Stop-enabled channels to RUN when MOD input gate is HIGH, and STOP when it is LOW.

Toggled   Button-6 = Off
MOD input causes Run/Stop-enabled channels to alternate between RUN and STOP on the rising edge of each successive Gate to the MOD input.

Run/Stop and Shift
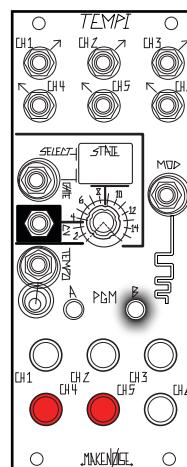Button-4 and 5 = Red

Run/Stop and Shift
On the Program Edit Page, Run/Stop and Shift can both be enabled at once.

The State Select Gate Input is used to Shift Variable Clock Values (see page 19) while the Mod Input is used for Programming Run/Stop behavior (see page 20).

Note: If both Shift and Run/Stop are enabled, the State Select Gate input does not cause TEMPI to change State.

TEMPI stores up to (64) timing scenarios referred to as States arranged into (4) Banks of (16). The State LED indicates Bank by color and a change in State by flashing.

State is selected by either State Select CV or Select Gate, with State Select CV having top priority (when not in Tap Tempo mode, the State Select CV is used to set the Leading Tempo; see note below). The State Select Gate increments the State value at the Rising edge of each Gate. In other words, when a State change is read at State Select CV, that change is absolute and takes priority over State Select Gate changes.
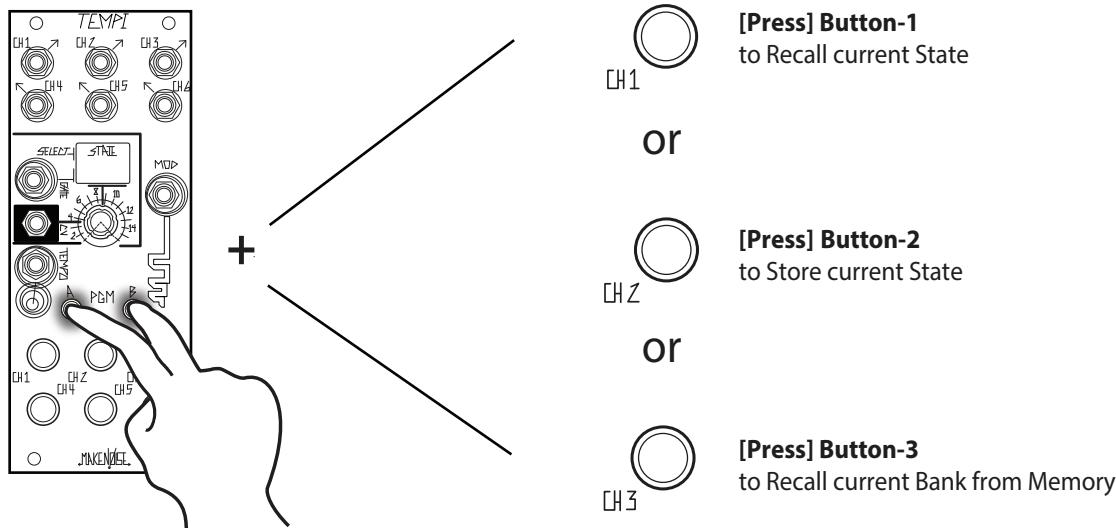
There is a Gate Input for State Select Gate and a Combo Pot/CV Input for State Select CV. With nothing patched to State Select CV Input, the State Select CV Combo Pot operates as a Panel Control which manually selects the State. The State Select CV Range is 0V to 5V.

To Reset to State 1, patch a Gate to the State Select CV Input and set the Combo Pot/attenuator so at Gate High, TEMPI goes to the last State you would like to use (e.g. State 8). Next, patch a Clock or Gate to the State Select Gate Input and step through States 1 through 8. Send a Reset Gate with a short duty cycle to the State Select CV Input and at Gate Low, you will return to State 1. In this way, it is possible to sequence any number of States linearly from State 1 to State *n* before Resetting.

Note: while on the Mute, Mod, Human, Machine, or Phase Programming Pages, State **does not reflect State Select changes via CV or Gate** until the active Programming Page is exited or completed. This behavior may be used creatively in order to manually "freeze" the Mod functionality or State Select modulation. Also, if both Shift and Run/Stop are both enabled, **all State selection must be done using the State Select CV and Combo Pot**, as the State Select Gate is used to Shift values.

Note: If BUTTON1 Tap Tempo has been turned OFF on the Clock Control Page, then the State Select controls are used for control of Leading Tempo. State selection is limited to the Select Bus, and the State Select Gate input (if only one of the Mod input options is active).

To Store or Recall a State
[Hold] PGM_A + PGM_B

[Press] Button-1
to Recall current State

or

[Press] Button-2
to Store current State

or

[Press] Button-3
to Recall current Bank from Memory

Note: State Edit settings are saved on State Store.

State Edit: Copy, Paste, and Mutate State

In order to audition and select a State to Copy, first use the State Select Panel Control to accurately choose the desired State. Note: you may have to remove any modulation source patched to the Select CV Input. When you find the desired State, hold both PGM_A + PGM_B and press Button-4 to Copy. After a State is Copied, you may then decide to Paste an exact duplicate or a Mutated version of the Copied State.

Once Copied, use the State Select Panel Control to audition and select a State into which you would like to Paste. Keep in mind, you will be overwriting what is Stored in the currently-Selected State! To finalize the Paste operation, hold PGM_A and PGM_B and press Button-5.
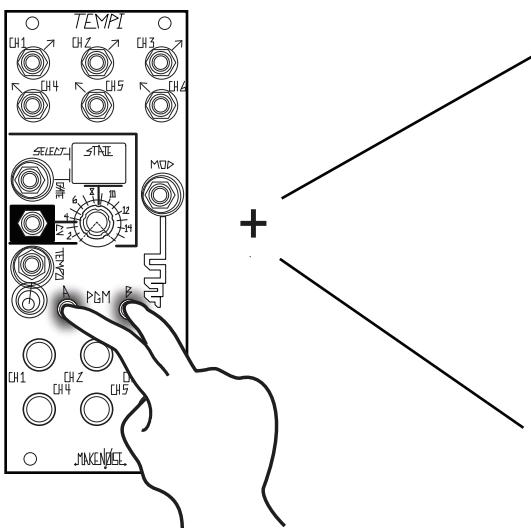
Alternatively, once a State has been Copied, you may use the State Select Panel Control to select a State over which you would like to paste a Mutated copy. Mutate is very similar to the Paste operation, so keep in mind, you will be overwriting what is Stored in the currently-Selected State!

When you find the desired State to overwrite, hold both PGM_A + PGM_B and press Button-6 in order to paste a Mutated version of the previously-Copied State. Mutate works by deviating to a small degree from the values that are already Programmed within a Copied State. To create more dramatic and alarming Mutations, simply, repeat the Copy and Mutate procedures again… and again. Note: is possible to Copy, Paste, and Mutate several times to quickly and easily Program States or Banks.

Please note that these changes ARE NOT saved until you Store the State or Bank. Without running the Store operation, changes are not held after power is cycled. This is useful for improvising alternate versions of a Stored theme.

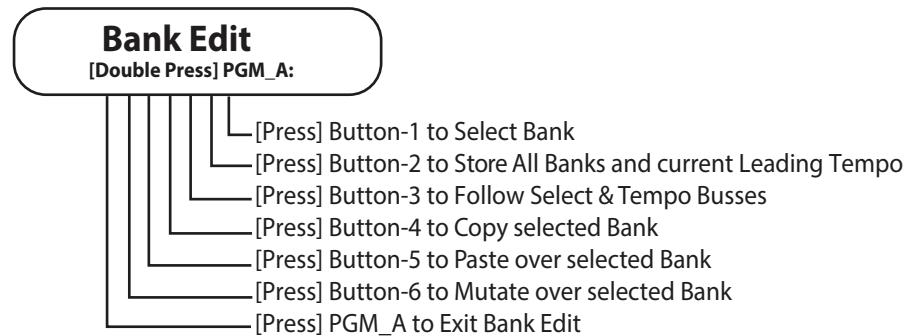To Copy, Paste, or Mutate a State:
[Hold] PGM_A + PGM_B

+

CH4
[Press] Button-4
to Copy a State

or

CH5
[Press] Button-5
to Paste a previously-Copied State

or

CH6
[Press] Button-6
to Mutate a previously-Copied State
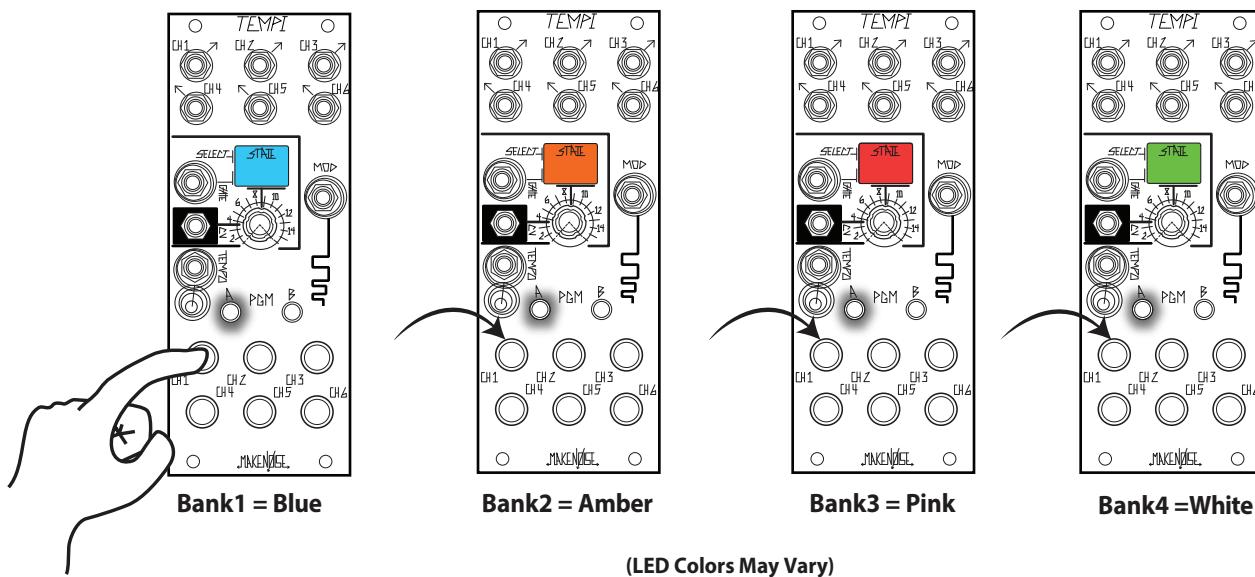
Bank Edit Settings

To enter the Bank Edit Programming page, double press PGM_A. The PGM_A LED flashes in order to indicate Bank Edit.
Double press PGM_A again to exit the Bank Edit Programming page.

Bank Edit
[Double Press] PGM_A:

[Press] Button-1 to Select Bank
[Press] Button-2 to Store All Banks and current Leading Tempo
[Press] Button-3 to Follow Select & Tempo Busses
[Press] Button-4 to Copy selected Bank
[Press] Button-5 to Paste over selected Bank
[Press] Button-6 to Mutate over selected Bank
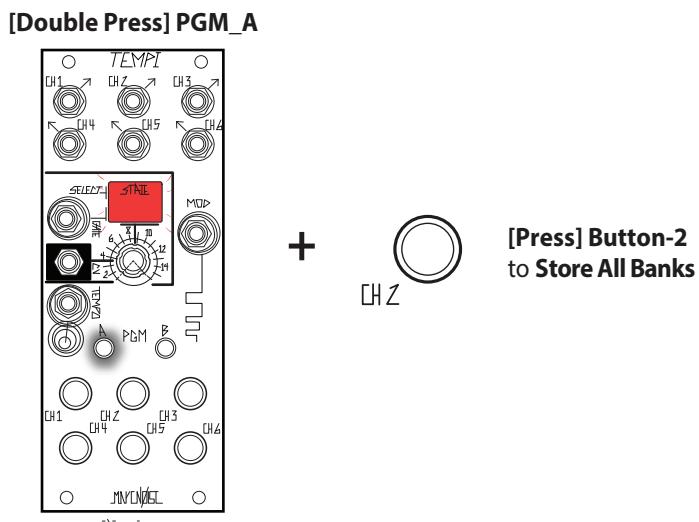[Press] PGM_A to Exit Bank Edit

Select Bank:

While on the Bank Edit Programming page, press Button-1 in order to sequential Select Bank1, Bank2, Bank3, or Bank4.

The State LED color reflects Bank change as follows:

Bank1 = Blue   **Bank2 = Amber**   **Bank3 = Pink**   **Bank4 =White**

(LED Colors May Vary)

Store All Banks:

While on the Bank Edit Page, press Button 2 to Store all contents of all Banks (i.e. All States and Leading Tempo). The State LED
flashes Red in order to indicate Store complete.

[Double Press] PGM_A

+   **[Press] Button-2**
to Store All Banks
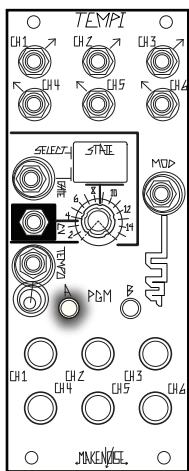
COPY, PASTE, and MUTATE BANKS:

While on the Bank Edit Page, Press Button-1 to select the Bank to Copy. When you find the desired Bank, press Button-4 to Copy. In order to Paste, press Button1 to select the Bank into which you would like to Paste. Keep in mind: you will be overwriting what is Stored in the selected Bank! Lastly, press Button-5 to complete the Paste operation.

Mutate works by deviating to a small degree from the values that are already Programmed within a Copied Bank. While on the Bank Edit Page, press Button-1 to select the desired Bank to Mutate copy. In order to Mutate Paste, press Button-6 to paste a Mutated copy. To create more dramatic and alarming mutations, simply repeat the Copy and Mutate procedures again… and again.

Note: it is possible to Copy, Paste, and Mutate several times to quickly and easily Program a Bank. Mutating a Channel that is Programmed with a 1:1 Multiple or Divisor Variable Clock value will have very little effect.

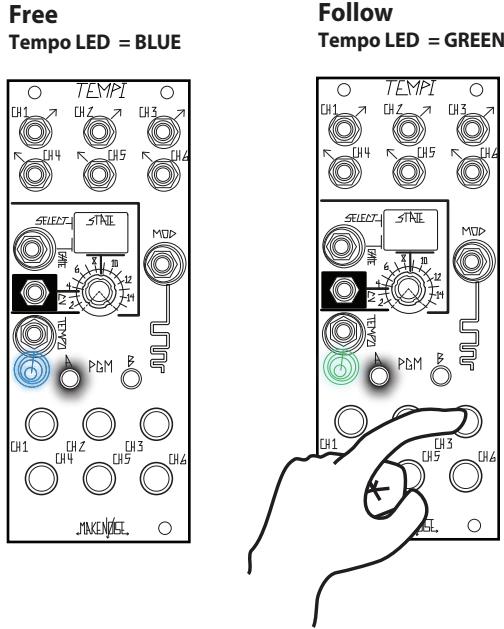To Copy, Paste, or Mutate a Bank:

[Double Press] PGM_A

+

[Press] Button-1
to Select Bank

or

[Press] Button-4
to Copy selected Bank

or

[Press] Button-5
to Paste over selected Bank

or

[Press] Button-6
to Mutate over selected Bank

Free / Follow

While on the Bank Edit Page, press Button-3 to set the TEMPI to Follow the Select Bus. The TEMPO LED changes to GREEN to indicate Follow. Press BUTTON-3 again to set TEMPI to be Free of the Select Bus. This option is indicated by the Blue Tempo LED.

Free
Tempo LED = BLUE
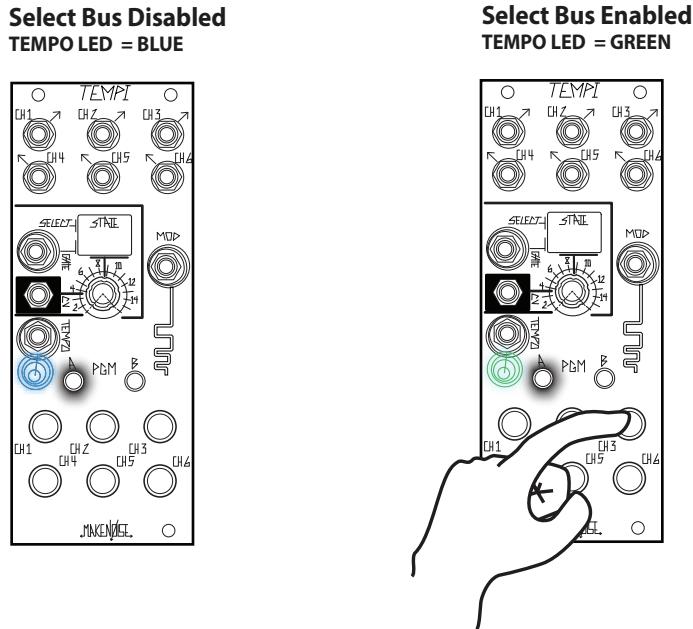
Follow
Tempo LED = GREEN

While set to Follow, the TEMPI receives messages from the Select Bus that help determine the State. **It does not transmit messages.** The Panel Control for State is still useful when the TEMPI is set to Follow. The State Select CV and Gate allow for offsetting and modulating around the State that is selected by the Select Bus.

Please note: changes ARE NOT saved until you go to the Bank Edit Page and press Button-2 to Store All Banks. Without running the Store All Banks operation, changes are held only until the power is cycled. This is useful for improvising alternate versions of a theme.

The Select Bus utilizes the often-inactive CV Bus in the Eurorack system in order to allow remote (i.e. patch-less) control of State Selection for TEMPI and other modules designed with this standard in mind. Any number of TEMPI on the same Bus Board can be controlled simultaneously by thes signals, simplifying the process of macro-control over complex changes in a patch.

It is worth noting, TEMPI only recieves messages over the Select Bus. **It does not transmit**. To engage Bus Control, enter the Bank Edit page and press Button-3. When the Select Bus is enabled, the Tempo LED will flash Green instead of Blue. Now, the TEMPI will be controllable by State Select signals coming through this Bus.
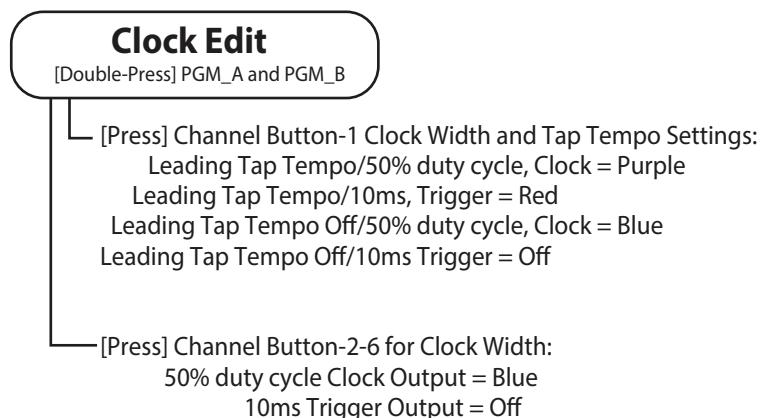
Select Bus Disabled
TEMPO LED = BLUE

Select Bus Enabled
TEMPO LED = GREEN

Before engaging, make sure that no other modules are sending CV, Gate, or other signals (other than Selectsignals) through the Bus.

Clock Edit Page

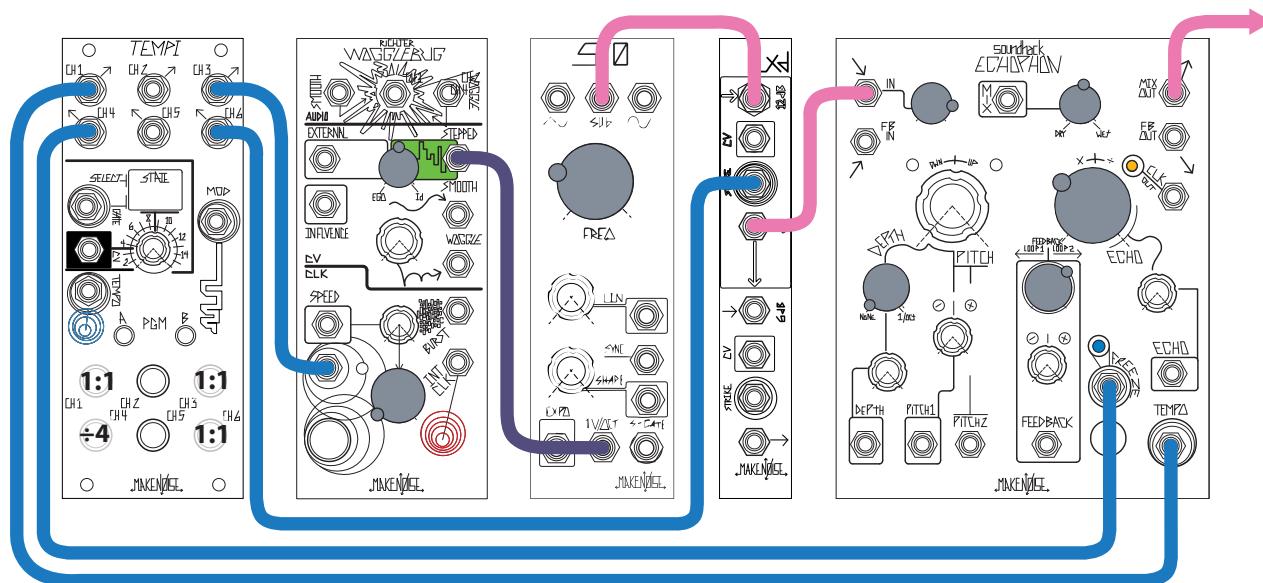To Access Clock Edit Page by double-pressing PGM_A and PGM_B simultaneously.

While each Channel defaults to Clock Output with a 50% Duty Cycle, it may also be set as a 10ms Trigger. Additionally, Channel 1 can be used to set the Leading Tap Tempo. This replaces the Channel 1 Coarse Human Programming behavior until Leading Tap Tempo is disabled again. When Tap Tempo is NOT active, the State control and CV input are used to set Clock Rate instead of choosing State.

Clock Edit
[Double-Press] PGM_A and PGM_B

[Press] Channel Button-1 Clock Width and Tap Tempo Settings:
Leading Tap Tempo/50% duty cycle, Clock = Purple
Leading Tap Tempo/10ms, Trigger = Red
Leading Tap Tempo Off/50% duty cycle, Clock = Blue
Leading Tap Tempo Off/10ms Trigger = Off

[Press] Channel Button-2-6 for Clock Width:
50% duty cycle Clock Output = Blue
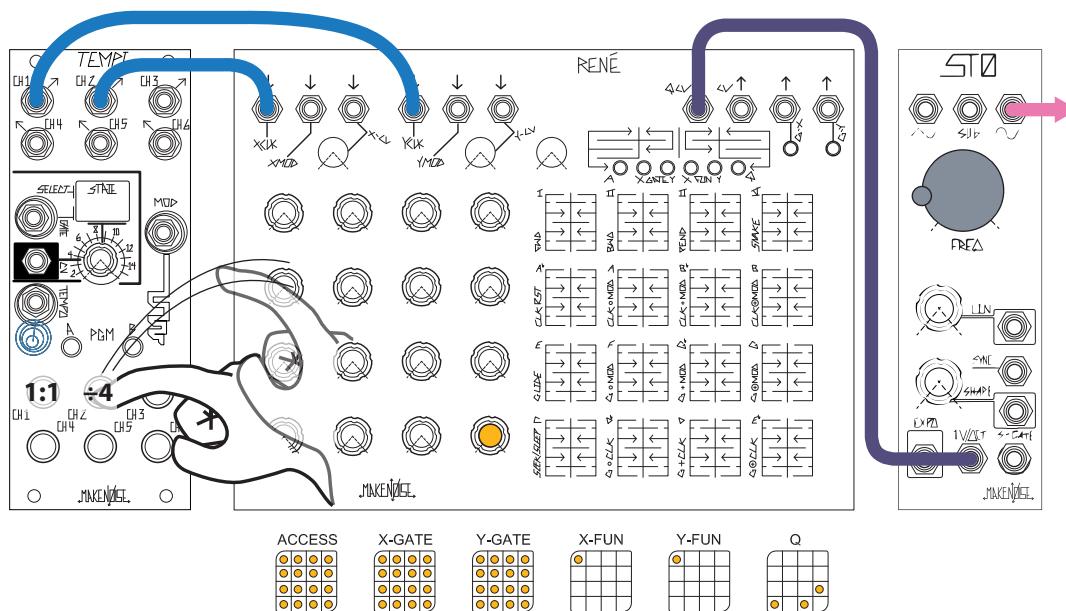10ms Trigger Output = Off

Tips and Tricks

• It is possible to Program several Channels at once. This makes it more intuitive to create interesting timing arrangements while Machine, Human, Mod, Mute, and Phase Programming.

• Coarse Phase adjustments override Fine Phase adjustments. In this way, Coarse adjustments return to Integral Divisors and Multipliers, for instance, 1:1 ratio.

• Mutes are not Shifted. One could emulated a Shifted Mute by programming a large Division and Shifting. For example, this allows for turning off a voice within a patch or stopping a sequence.

• You must first Copy a State or Bank before you can Mutate it.

• If Human Programming and you would like to use only Integer Divisions or Multiples, set Human Resolution to 100% ([PRESS] Button-3 while on Program Edit Page). This will ensure instantly perfect Programming of 'four on the floor' beats, or something similar.

• The State Select CV and Panel Control override any State stepping that occurs. So if you stepped through States with State Select Gate and then changed State Select Panel Control, it immediately takes it back to the Panel Control (or CV) setting. For example, if you set to State 1 then State Step (6) times with State Select Gate to State 6 and then turn the State Select Panel Control to State 2, the next State would be State 3, as the knob position and State Select CV takes priority. This is also true of States selected by the Select Bus.

• It is possible to Program a new Variable Clock into a Muted Channel. This is useful for cueing changes during live performance.

• The Shift function and Modded Channels do not activate without a Trigger or Gate patched to the Mod Gate Input. For Shift, at least (2) Channels must be Mod Enabled. If only (1) Channel is Mod Enabled, it can only Shift with itself (i.e. no audible effect).

• Mutating a Channel that is Programmed with a 1:1 Divisor or Multiple value will have very little effect.

• If a State or Bank is Copied and then Mutated, it is still possible to Paste an un-Mutated iteration of the associated State or Bank.

• To create more dramatic and alarming Mutations, simply repeat the Copy and Mutate procedures again… and again. In this way, it is possible to Copy, Paste, and Mutate for easily Progranming a State or Bank.

• Self-patching the TEMPI's Outputs to the Mod, State Select Gate Input, and even State Select CV Input can be very useful. However, be aware that self-patching to the Leading Tempo input will result in a feedback loop that causes the module to quickly reach maximum or minimum Tempo value (unless the Channel patched to the Leading Tempo Input is set to 1:1, in which case it will have no effect).

• To Reset to State 1, patch a Gate to the State Select CV Input and set the Combo Pot/attenuator so at Gate High, TEMPI goes to the last State you would like to use (e.g. State 8). Next, patch a Clock or Gate to the State Select Gate Input and step through States 1 through 8. Send a Reset Gate to the State Select CV Input and at Gate Low, and return to State 1. In this way, it is possible to sequence any number of States linearly from State 1 to State n before Resetting.

• Tap Tempo will temporarily override the clock at the Tempo input.

• After turning Tap Tempo on and exiting the Clock Edit page, TEMPI will switch to whatever State the State Select knob is pointing to.

Stutterphon:
Patch external Master Clock to ECHOPHON's Tempo Input. Set Echo Time to 12:00 or less for Multiple of Master Clock. Use TEMPI to patch a division of the Master Clock to ECHOPHON's Freeze Gate Input to create stutter effects synchronized to a multiple of master clock. Experiment with Depth setting for subtle pitch-shifting of these stutters or deep harmonizing to add counter melodies.
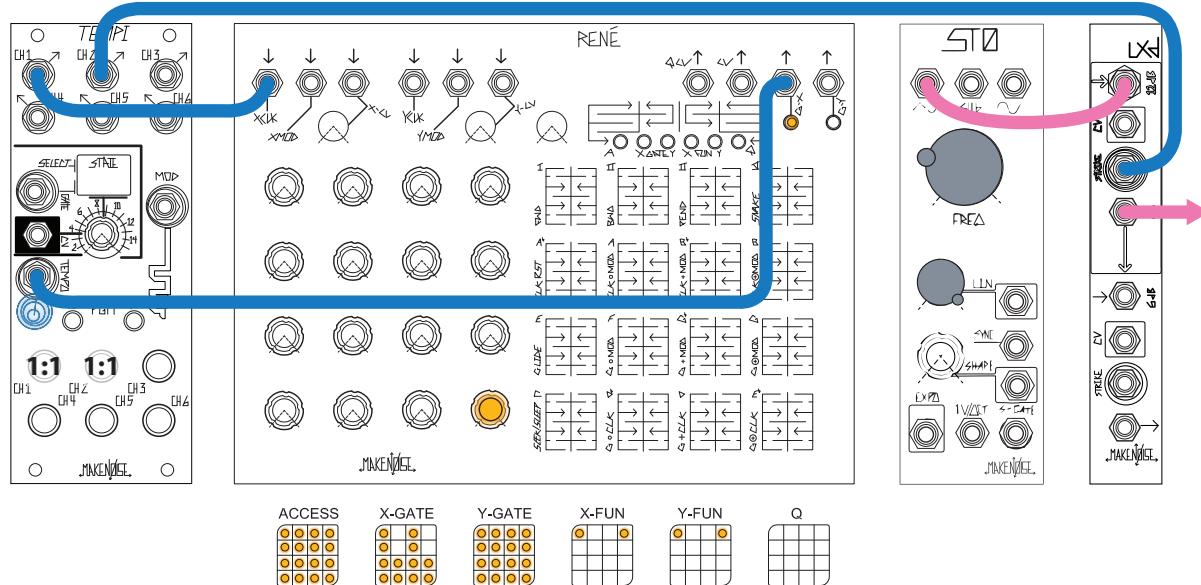

Using TEMPI to drive Rene:
Patch from two Channels of TEMPI's output to Rene's X-CLK and Y-CLK Inputs. Human Program one of the clocks to be a division of the other. Observe the Rene's Cartesian behavior. Optionally, try patching the remaining clocks from the TEMPI to the Rene's X-Mod and Y-Mod inputs and experiment with the various Gate Logic settings on the X-Fun and Y-Fun pages (see Rene Manual, Appendix D).
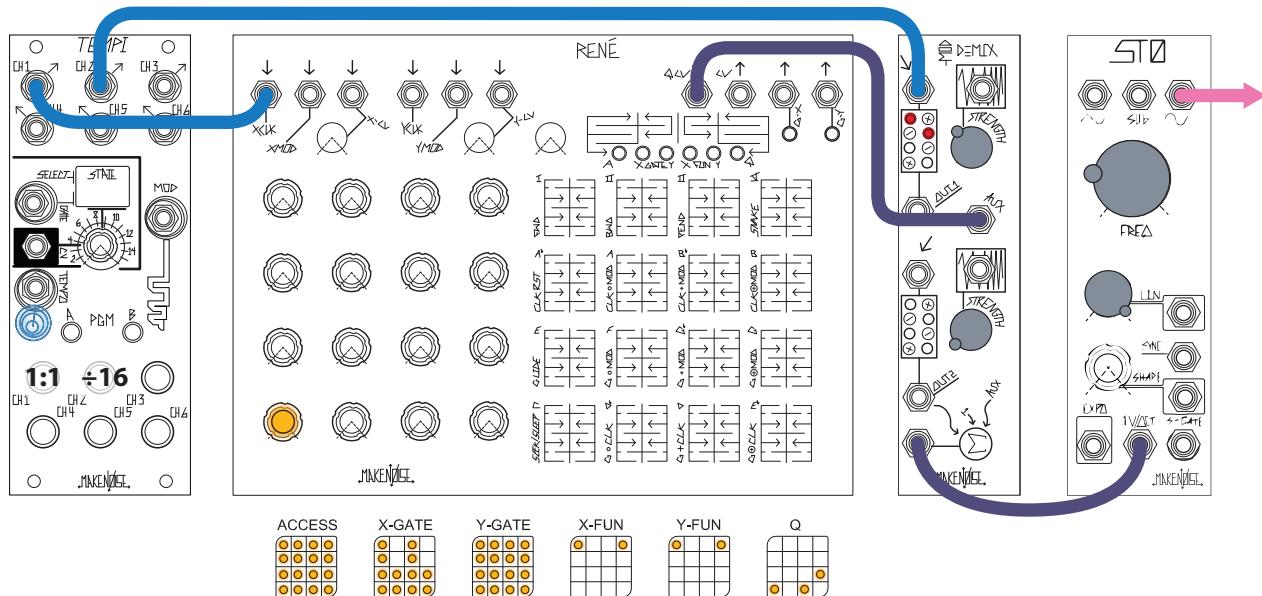
Clock Murmur:
Patch an Output of the Tempi to Rene's X-CLK input to start the sequence. Make sure Snake Mode is engaged via the X-Fun Page. Now, patch from Rene's X-Gate Output back into TEMPI's Tempo Input. Back on Rene, migrate to the X-Gate page and remove every other gate on the top two rows, as illustrated in the chart below.   This feedback loop causes the TEMPI to hickup slightly every time the Gates driving the Leading Tempo change from half-time to 1:1 and back. (Recall: it takes two clock pulses in order for TEMPI to program a new Leading Tempo). To best hear this effect, use one or more of the TEMPI's Outputs to Strike a Low Pass Gate like the Optomix or LxD.

TEMPI Transposition
Patch one of TEMPI's Outputs programmed 1:1 with the Leading Tempo to Rene's X-CLK input to start the sequence. Patch Rene's Qcv Output to the Aux Input on the ModDemix. Next, patch another TEMPI Output programmed to ÷16 to ModDemix's Ch1 Input. With Channel 2's attenuverter full counter clockwise, patch from ModDemix's SUM Output to the 1V/Oct input of an oscillator like the STO in order to sequence it's pitch. The Channel 1 attenuverter sets the degree of the transposition.

The Select Bus utilizes the often-inactive INT.CV Signal Bus Line in the Eurorack bus board system in order to allow Select Bus communication for René, TEMPI and other modules designed to work with the Select Bus standard. Up 20 Select-Bus enabled modules may be used on the same Bus Board. These modules may be controlled simultaneously by Select Bus communications, simplifying the process of macro-control over complex changes in a patch. The following Select Bus Communications are currently implemented:

STATE Select: which STATE is currently active
STATE Default: sets currently Selected STATE to Defaults (these default settings will vary per module)
M-PASTE/ MESH Enable sets a STATE to be Multi-Pasted or MESHed
M-PASTE/ MESH Disable: sets a STATE to NOT be Multi-Pasted or MESHed
M-PASTE: Initiates a Multi-Paste
STORE: writes all programmable parameters to non-volatile memory for storage and recall across power cycles
Revert: restores the last STOREd version of memory

Before setting a module to LEAD or FOLLOW and attempting to utilize Select Bus communications, make sure that your bus board has the INT.CV Signal Bus Line on it and that no modules are sending CV, Gate, or any signals other than Select Bus communications.
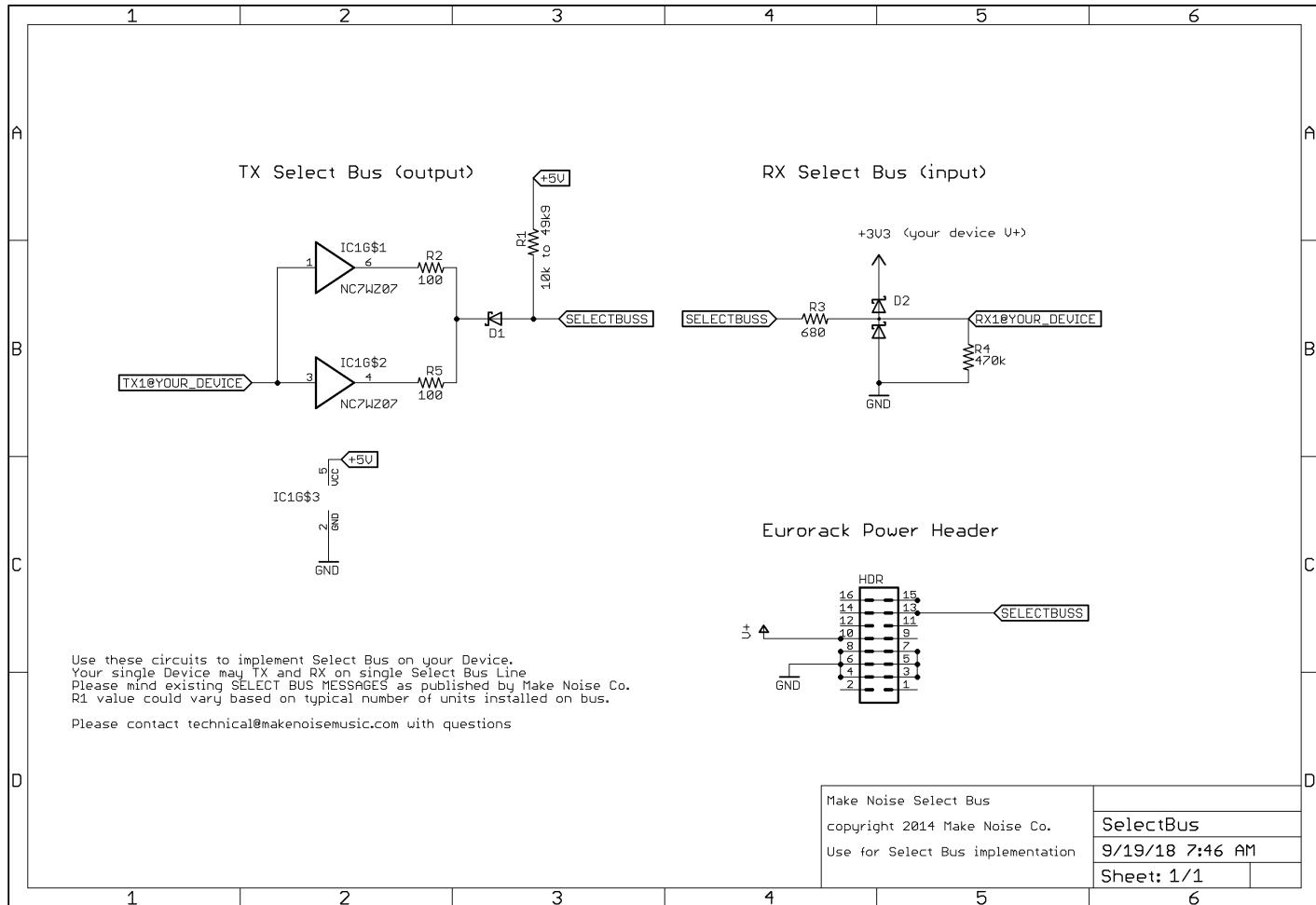
To use the Select Bus, set one module to LEAD and one or more other module(s) to FOLLOW. See the manuals for individual modules for a description of how to do this and for details on what Select Bus communications the module will utilize. See the section in this manual on the Bank Edit Page for information on how to set it with TEMPI.

Modules currently known to communicate with TEMPI on the Select Bus

Make Noise René (TEMPI Follows)

Macro Machines Storage Strip (TEMPI Follows)

Technical Specifications of the Select Bus

// ************ SELECT BUS MESSAGES: ********************************
//   0xC0 followed by a single State # 0 thru 63. This is "State Select" message.
//   0xF4 followed by a single State # 0 thru 63. This is "State Save" message.
//   0xF4 - 0x40 This is "Save All" message.
//   note: 0xF0 is start-of-message marker.
//   note: 0xF7 is end-of-message marker.
//   note: 0x00 0x02 0x2D is MakeNoise Select Bus ID
//   note: 0xST is State number.
//   0xF0 0x00 0x02 0x2D 0x00 0xST 0xF7 where 0 <= ST <= 0x3F. This is "MESH OFF"
//   0xF0 0x00 0x02 0x2D 0x01 0xST 0xF7 where 0 <= ST <= 0x3F. This is "MESH ON"
//   0xF0 0x00 0x02 0x2D 0x02 0xF7   This is "DEFLOAD"
//   0xF0 0x00 0x02 0x2D 0x03 0xF7   This is "REVERT"
//
//   Select Bus is ACTIVE LOW! Refer to published schematic for proper circuit and load.
//   Baud Rate 31250 bps
// ************ END OF SELECT BUS MESSAGES. *************************************

TEMPI Firmware Changelog

New firmware available at http://www.makenoisemusic.com/modules/tempi

1. Voltage Controlled Tempo option added. When Ch1 is not set for Tap Tempo on the Clock Edit Page, the State panel control and CV input now set the Leading Tempo and do not affect State selection. Use the State Gate input, or a leading René on the Select Bus, to select State when Tap Tempo is not active.

2. Select Bus communication improved. When set to FOLLOW, TEMPI will now accept a large number of messages from René for State selection as well as deeper editing. See the René manual for full details on these functions.

    a. Multi-paste, Store, and state changes happen while following if Leader sends the command.

    b. Added Mesh behavior while following.

    c. Turning Follow on goes to leader's last sent state. Follow also enables previously sent Mesh commands.

3. Run/Stop functionality improved, and Jumbled/Unjumbled options replaced with Toggled/Momentary on BUTTON6 on the Program Edit page. Shifted or run/stopped channels' new positions are always reverted upon state change (previously called "Unjumbled" MOD). When Run/Stopped channels are Shifted, any timing offset due to run/stop is preserved until the state or timing of that channel changes.

4. Bank colors have been changed to match those of the René and future modules on the Select Bus.

5. Changed TEMPI's Store behavior to match René. Nothing is Stored until explicitly saved through a Store function. (Example: the Select Bus setting (Free/Follow) was previously Stored immediately upon changing it; now it only Stores when a Store function is performed.

6. Minor bug fixes