SCHLAPPI ENGINEERING BTMX Logic Adders and Combiners User Manual

Contents

SCHLAPPI ENGINEERING BTMX Logic Adders and Combiners

Specifications

- Voltage Levels:
  - Input/Output Compatibility: Eurorack voltage standards (-12V to +12V, or 24V peak to peak)
- Current Draw:
  - +12V: 26mA
  - -12V: 10mA
- Signal Type:
  - Gate Outputs: 0 or 10V
  - Stepped Outputs: 0 to 9.5V
  - Gate Inputs: 2.8V threshold

Product Usage Instructions:

Module Description and Features
The BTMX is a 4-channel logic function mixer and combiner with an additional stepped output for synced CV and modulation. It can be used independently or in conjunction with other modules for creating complex harmonic and rhythmic relationships at various speeds.

Controls
The module features switches for each logic input and two mode switches. The controls include:

- CONTROL 1-8: Mutes the corresponding input (Up is on, down is off)
- Logic Mode A/B: Selects the logic mode (A: AND, B: OR, XOR)

Inputs
All inputs are logic inputs with a threshold of around 2.8V triggering on the rising edge. Inputs 1-4 form one 4-bit word, while inputs 5-8 form the second 4-bit word.

Outputs
The module provides gate outputs at different levels and an analog stepped voltage output ranging from 0 to 9.5V.

Indicators
All inputs and outputs are equipped with blue LEDs for indicating their current state.

How It Works
The module can be viewed as four separate two-input logic gates with selectable functions or as one logic function accepting two nibbles (four-bit logic word) as input. The gates can be combined to create stepped analog output with specific voltage levels

FAQ

- **Q: What are the voltage levels supported by the BTMX module?**
  A: The module is compatible with Eurorack voltage standards, supporting levels from -12V to +12V, or up to 24V peak to peak.
- **Q: How do I select different logic modes on the BTMX module?**
  A: Use the mode switches labeled Logic Mode A and Logic Mode B to cycle through the available logic modes (AND, OR, XOR).

Technical Information

Voltage Levels
The BTMX is designed for compatibility with Eurorack voltage standards. Inputs and outputs are voltage and current protected and should not but damaged by any level within the Eurorack ecosystem (-12V to +12v, or 24v peak to peak).

SIGNAL TYPE	LEVEL	Notes
Gate outputs	0 or 10V	
Stepped outputs	0 to 10V	
Gate inputs	2.8V threshold	Comparator input stage triggers around 2,8V

Current Draw

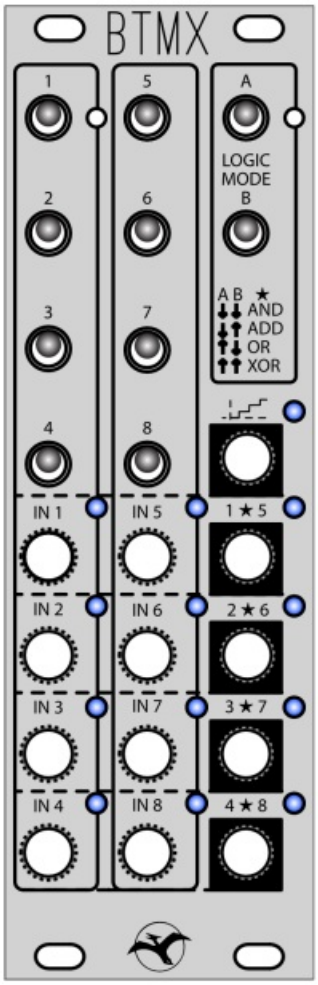
- +12V: 26mA

- -12V: 10mA

Module Description and Features

Introduction

BTMX (BitMix) is a 4 channel logic function mixer and combiner, with an additional stepped output for synced CV and modulation. BTMX works both independently and in conjunction with our existing NIBBLER module and upcoming BTFLD.
Complex harmonic and rhythmic relationships created via 4 different logic functions are available at both audio rate and slower speeds for drums, tempo-synced modulation, and pseudo-random repeatable & riffable movement.



The interface is designed to to be playable, with switches for each logic input as well as two mode switches.

Controls

Switches

CONTROL	DESCRIPTION
1-8	Mutes the corresponding input (Up is on, down is off)
Logic Mode A	Selects the logic mode
Logic Mode B	Selects the logic mode

A	B	MODE
down	down	AND
down	up	ADD
up	down	OR
up	up	XOR

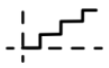
Inputs
All inputs are logic inputs with a threshold of around 2.8V that trigger on the rising edge. All inputs are normalised high (if there is no input and the switch is on then it sends a positive voltage).

INPUT	Description
1-4	The first four inputs are intended as one 4 bit word and feed one side of the logic function
5-8	The second four inputs are intended as a second 4 bit word and feed the second side of t he logic function

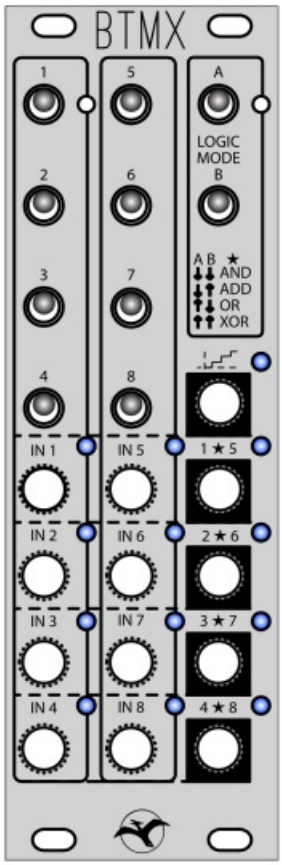
Outputs
Gate outputs are either 0 or approximately 10V

NAME	DESCRIPTION
1 ★ 5	Gate output for the top bit, which represents 8
2 ★ 6	Gate out put for the register bit that represents 4
3 ★ 7	Gate output for the register bit that represents 2
4 ★ 8	Gate output for the bottom bit of the register, which represents 1

Analog stepped voltages output 0 to 9.5V

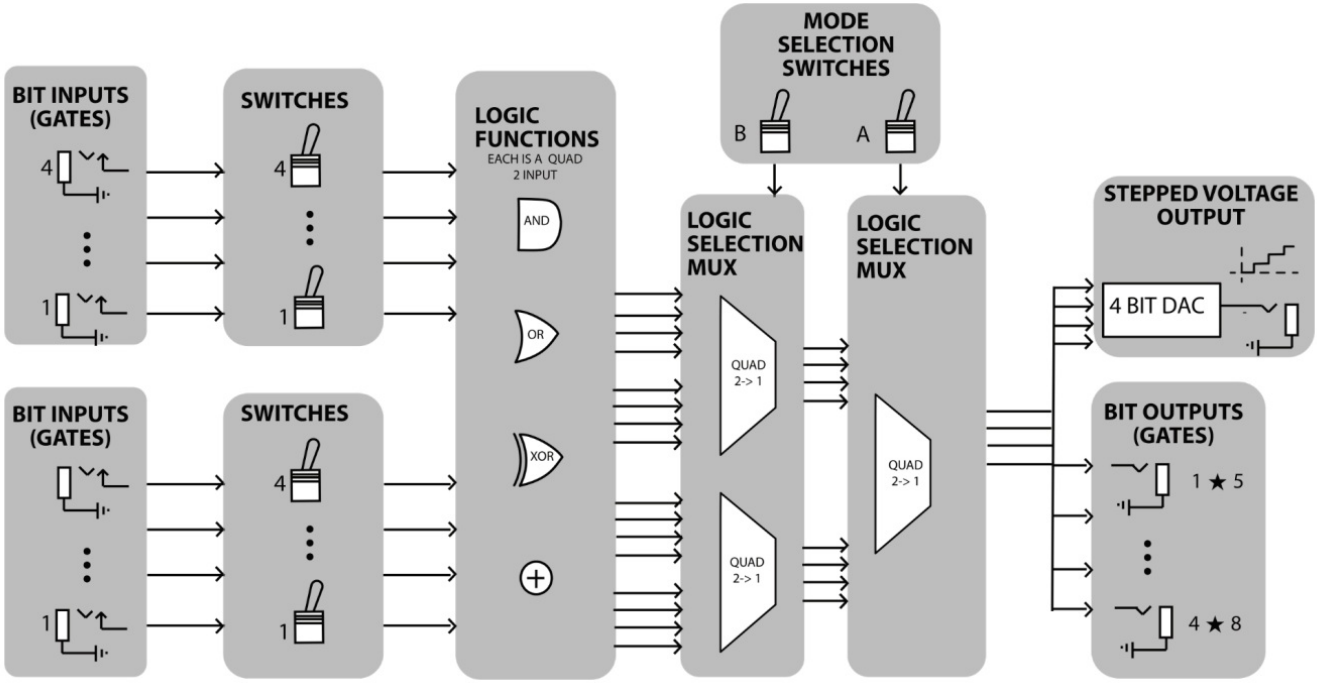
LABEL	NAME	DESCRIPTION
	STEPPED OUT	A weighted sum of the register bits as a stepped analog voltage

Indicators
All inputs and outputs have blue LEDs indicating their current state, at audio rate they may show a solid blue.



How It Works

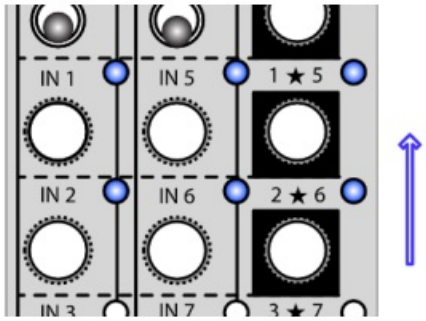
Block Diagram

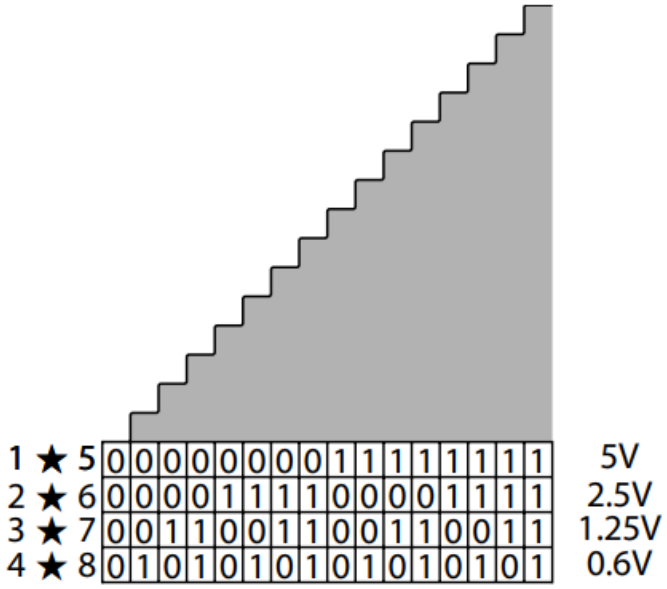


Binary VS Logic Gates
This module can either be viewed as four seperate two input logic gates with a selectable function or one selectable logic function that accepts two nibbles (four bit logic word) as an input.
There are ways that the distinction matters:

For the “ADD” function if two inputs are high then they carry to the next highest bit, creating a hierarchy or

relationship between the gates.
For the stepped analog output the gates are added together with binary weights.
The top bit (1 ★ 5) represents half of the output at approx 5V, the next one down half that for approx 2.5V, then 1.25V, and the bottom is around 0.6V. The actual voltages will add up to around 9.5V.





Logic Modes

A	B	MODE
down	down	AND
down	up	ADD
up	down	OR
up	up	XOR

The two mode switches together select which logic chip output is being used.

- The AND logic function is high if both inputs are high and low otherwise. You can use it to create bursts by pairing a long, slow sequence with a short fast one, gating the fast one with the slow one. When used with unrelated rhythmic sequences this will generally simplify the sequence.
  WATCH OUT: If you have one of the two inputs muted then there will never be an output.
- The OR logic function is high if either input is high. You can use this to combine two unrelated rhythmic sequences into one.
  WATCH OUT: If one input is switched on with no input then the output with always be high. Similarly if a there

are two long slow or very busy sequences being input, it may never go low.

- The XOR logic function is high if either input is high and low if both inputs are high. This means it can be used to combine two sequences but will also guarentee a change in the output state for every change in the input state.

  This probably the easiest to use mode for combining two sequences. Also XOR is nice at audio rate as well.

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AND		
IN	IN	OUT
0	0	0
0	1	0
1	0	0
1	1	1

OR		
IN	IN	OUT
0	0	0
0	1	1
1	0	1
1	1	1

XOR		
IN	IN	OUT
0	0	0
0	1	1
1	0	1
1	1	0

The ADD logic function is high if either input is high and low if both inputs are high, same as XOR, except it will also carry a bit from a lower stage if both bits are high. This means at audio rate with it is a form of phase modulation.

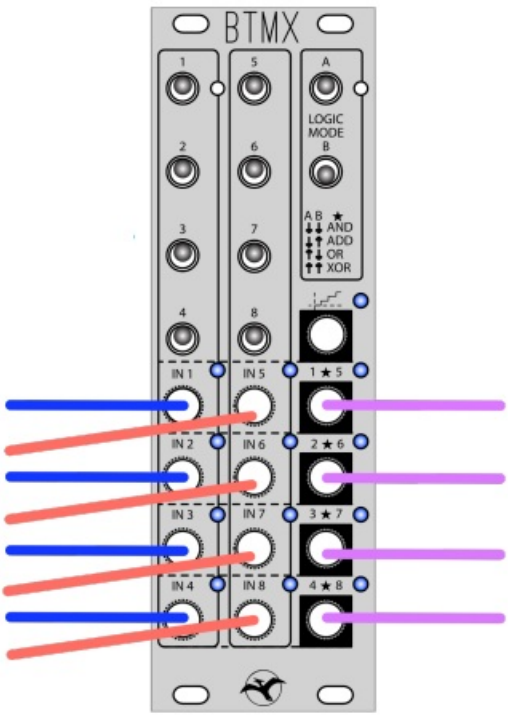
It also means that if you are using it for rhythmic sequences with different outputs going to different instruments (for example kick and snare) it means that your different instrument sequences will affect each other, which can be a bit confusing if you aren't ready for it.

PLUS				
IN	IN	CARRY IN	CARRY OUT	OUT
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

Patches to start exploring with

TRIGGER COMBINER

- Set LOGIC MODE to OR
- Patch triggers into inputs and use switches to mute as desired
- Make sure any unused inputs are switched off or output will stay high
- Patch outputs as desired
- Channels can be chained (an output into the next input. This reduced the total number of inputs but up to 5 triggers can be combined this way, or two sets of three.



GATE COMBINER

- Set LOGIC MODE to XOR
- Patch gates into inputs and use switches to mute as desired
- Make sure any unused inputs are switched off or output will be inverted
- Patch gate outputs as desired
- Try patching the stepped output to a pitch or modulation input
- Try other logic modes

TIP: If using two Nibblers to generator gates try patching one in reverse bit order for a broader set of rhythms. This is done bit patching the bottom bit to the top and so on.

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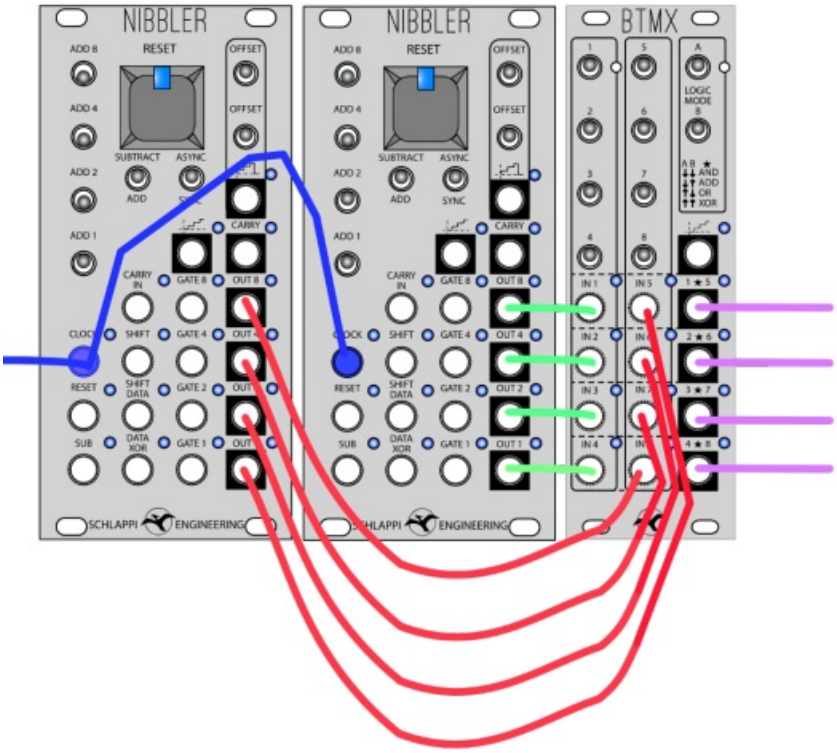
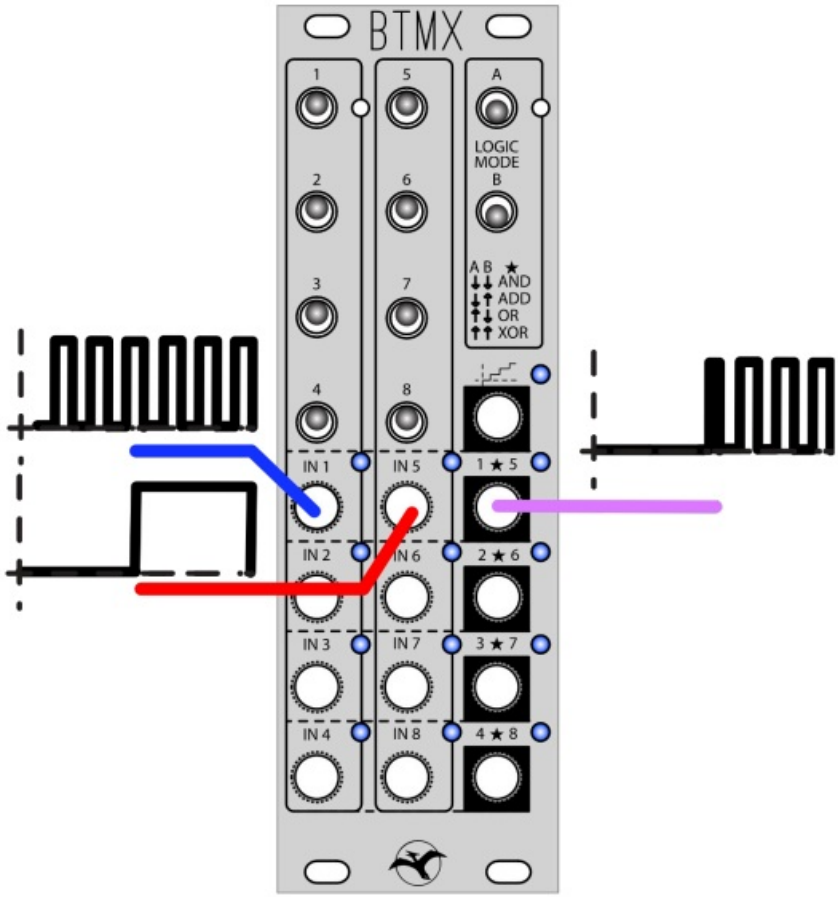


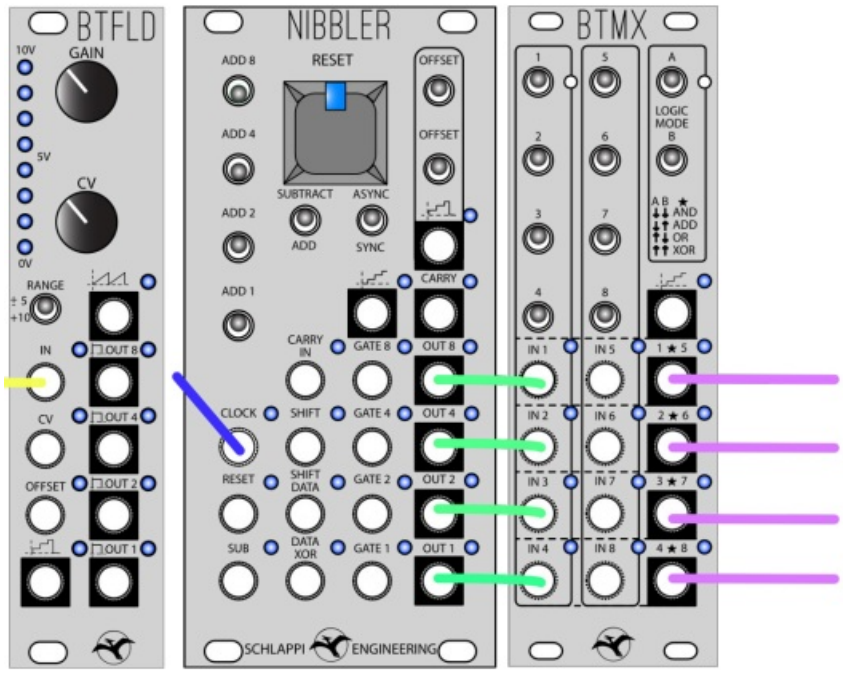
Set LOGIC MODE to AND

- Patch a long, slow gate into one side
- Patch a faster gate into the other
- The output will only be high when both gates are high at the same time



PHASE MODULATION

- Set LOGIC MODE to ADD
- Patch 4 bit audio rate signals into each side (from Nibbler or BTFLD for example)
- Listen to the stepped output
- Mute individual bits as a crude form of waveshaping



Contact Info
If you have any questions please contact Eric Schlappi at: eric@schlappiengineering.com

Documents / Resources

	SCHLAPPI ENGINEERING BTMX Logic Adders and Combiners [pdf] User Manual BTMX, BTMX Logic Adders and Combiners, BTMX Logic Adders, BTMX Combiners, Logic Adders and Combiners, Logic Adders, Combiners

References

- User Manual