



# 4MER

## WAVESHAPER SYNTH

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Version 1.0.0

# TABLE OF CONTENTS

## Contents

Overview	1
Oscillators	2
Filters	6
Effects	7
Envelopes	9
LFOs	11
Modulation Matrix	12
Performance Controls	15
Connections	16
Remote Template	18

# OVERVIEW

## Overview

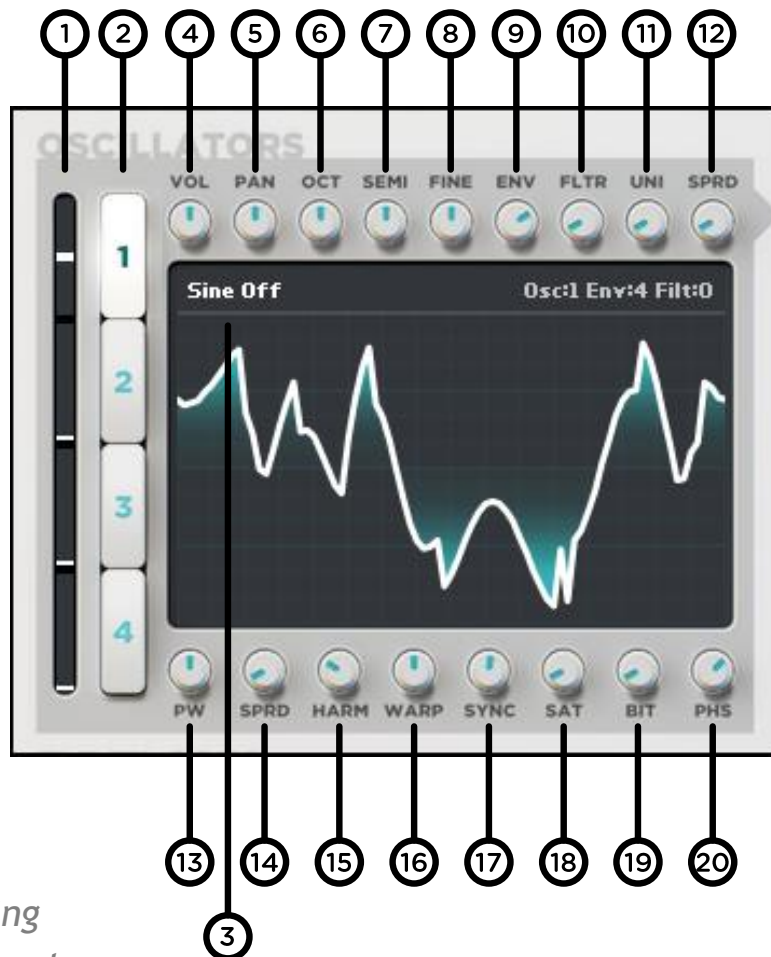


*4MER is a four-oscillator, eight-operator, waveshaping polyphonic synth. It's got four LFOs, five envelopes, two multimode filters, a four-stage tone stack, a reverb and digital delay, and a ten-channel modulation matrix. This manual covers the basic functionality of each part of 4MER.*

# OSCILLATORS

## Oscillators

4MER supports up to four oscillators per note. Each parameter of each oscillator can be set independently. Use the Oscillator Select Buttons (2) to select which oscillator you wish to edit. Then set the Waveform (3), the Oscillator Note Parameter Knobs (4 through 8), the Oscillator Routing Knobs (9 and 10), the Oscillator Unison Knobs (11 and 12), and the Oscillator Waveshaping Knobs (13 through 20) to set the sound of that oscillator.

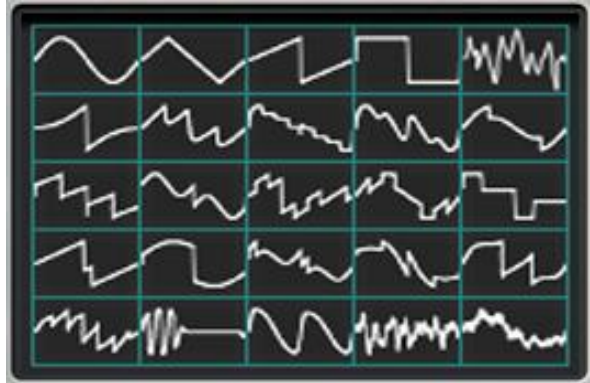


Here's detailed information about each control in the oscillator section:

- 1) These four meters show the individual audio output of each of the four oscillators. Pro-tip: These meters are interactive. You can set the volume of each oscillator (usually controlled with knob 4) by clicking and dragging each meter next to each Oscillator Select Button.

# OSCILLATORS

- 2) To navigate between each of the four oscillators, use the Oscillator Select Buttons.
- 3) 4MER has 25 single-cycle waveforms that serve as the basis for each oscillator sound. Click on the name of the current waveform cycle to see all 25 available waveforms. Then select which waveform you want to use for that oscillator.
- 4) Each oscillator has an independent volume control, which can be set either by the Volume knob (4) or by clicking on the individual Oscillator Meter (1) next to the active Oscillator Select Button (2).
- 5) Each oscillator starts as a mono audio source, and can be panned independently. All four panned oscillator are mixed together to form the stereo source.
- 6) The Octave knob provides a five-octave pitch-offset range for each oscillator. The range is stepped per octave from two octaves below the keyed note to two octaves above the keyed note.
- 7) The Semitone knob provides a two-octave range for each oscillator. The range is stepped per semitone so that you can set a specific pitch offset anywhere between 12 semitones below the keyed note to 12 semitones above the keyed note.
- 8) The Fine tune knob provides a two-semitone range. The range is continuous between one semitone below the keyed note to one semitone above the keyed note.
- 9) Each oscillator can independently use any of 4MER's five envelopes. Use the Envelope Select knob to select which envelope each oscillator uses.
- 10) Each oscillator can be independently passed through 4MER's two multimode filters in any combination. Use the Filter Route knob to run each oscillator through either Filter 1, Filter 2, both Filter 1 and Filter 2, or neither.
- 11) Each oscillator has five-voice unison effect available. When the Unison knob is at zero, the unison effect is disabled and a single oscillator is calculated.



4MER's 25 waveforms

# OSCILLATORS

When the Unison knob is greater than zero, the original oscillator is combined with four detuned copies of the oscillator. The Unison knob determines the relative volume between the original and detuned oscillators. When the Unison knob is low, the original oscillator is most prominent and the detuned copies are lower in volume. When the Unison knob is high, the original and detuned oscillators are close in volume. When at 100%, all five oscillators are at equal volume.

- 12) The Unison Spread knob determines how detuned the unison oscillators are from the original oscillator. Because each oscillator is mono, the unison effect is mono. However, because each oscillator can be panned independently, it's easy to create a unison effect with a stereo spread. For example, you can have Oscillator 1 panned hard left and Oscillator 2 panned hard right. Enable the unison effect on both, and you'll have a 10-voice unison effect with a wide stereo spread. Bring up Oscillators 3 and 4, pan them halfway right and left, and enable unison on those, and you'll have a 20-voice unison filling the entire stereo image.
- 13) The Pulse Width Waveshaper knob alters the waveform cycle much like a pulse width control on typical square waves. However, this waveshaper works on every waveform - not just square waves.
- 14) The Spread Waveshaper knob changes the relative rate through which the waveform is played. The more spread that's applied, the faster the beginning and end of the cycle is played, and the slower the middle is played.
- 15) A secondary harmonic can be added to each oscillator using the Harmonic Waveshaper knob.
- 16) Each oscillator can be warped upon itself using the Warp Waveshaper knob.
- 17) The Sync Waveshaper changes the overall rate that each waveform cycle is played. However, each time the original cycle would have looped, the synced cycle is retriggered. This keeps pitch of the note in tune, while dramatically altering the tonal qualities of the original cycle.
- 18) At the end of the waveshaping calculation, the resulting waveform can gain some warmth or distortion by using the Saturation Waveshaper. When fully saturated, the waveform becomes a series of lo-fi pulse waves.
- 19) The resulting waveform can also be downsampled by applying the Bit Crush Waveshaper.

# OSCILLATORS

- 20) Finally, the phase of the oscillator waveform can be controlled through the Phase Waveshaper knob. Usually the Phase Waveshaper doesn't alter the sound of an individual oscillator, but when multiple oscillators are enabled, the relative phase of the oscillators can greatly alter the resulting sound.

# FILTERS

## Filters

4MER includes two multimode filters. Available modes are:

- LP 6 (Low Pass with 6db falloff)
- LP 12 (Low Pass with 12db falloff)
- LP 24 (Low Pass with 24db falloff)
- HP 12 (High Pass with 12db falloff)
- HP 24 (High Pass 24db falloff)
- Band Pass
- Notch (or Band Reject)



Here's detailed information about each control for each filter:

- 1) Click on the filter type to select a different filter.
- 2) Alter the cutoff frequency of each filter with the Frequency Knob.
- 3) Alter the resonance of each filter with the Resonance Knob.
- 4) This displays an approximation of the filter. Pro-tip: You can set the frequency and resonance of the filter by clicking and dragging inside the display. Dragging left and right changes the frequency. Dragging up and down changes the resonance.



# EFFECTS

## Effects

4MER has three built-in effects: a reverb, a digital delay, and a tone stack.

### REVERB

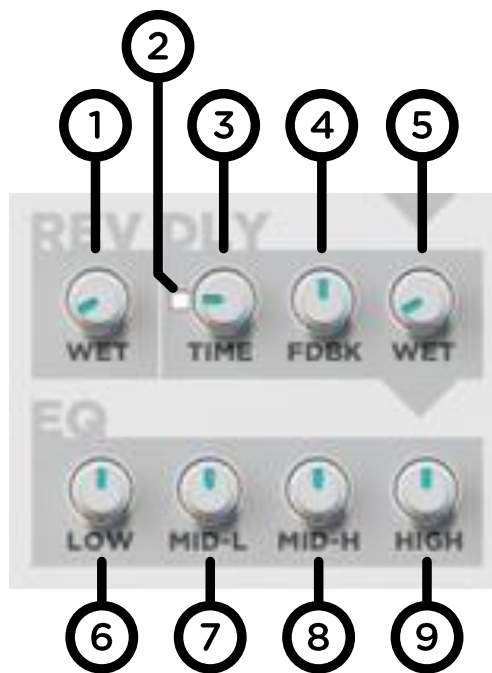
- 1) 4MER comes with a simple reverb. When the Reverb Knob is at 0%, the reverb effect is off. Anything above 0% enables the reverb effect. The Reverb Knob controls the size and volume of the reverb effect.

### DELAY

- 2) The rate of the delay can be free-running or tempo-synced. To toggle between the two modes, click the small button to the left of the Time Knob. When the Tempo Sync Button is on, the delay effect is tempo-synced. When the Tempo Sync Button is off, the delay is free-running.
- 3) To change the rate of the delay, use the Delay Rate Knob. When free-running, the delay range is between 1/100<sup>th</sup> of a second to one second. When tempo-synced, the range is between a sixteenth note and a whole note.
- 4) The Feedback Knob determines how much of the delay signal is fed back into the input of the effect. The range is between no feedback and infinite feedback.
- 5) The Delay Wet Knob controls the volume of the delay effect

### EQ

- 6) Use the Low Knob to control the low component of the tone stack. The low component of the tone stack is a low-shelf filter with a cutoff at 80 Hz.
- 7) Use the Mid-Low Knob to control the middle-low component of the tone stack. The middle-low component of the tone stack is a peak filter with a cutoff at 370 Hz.



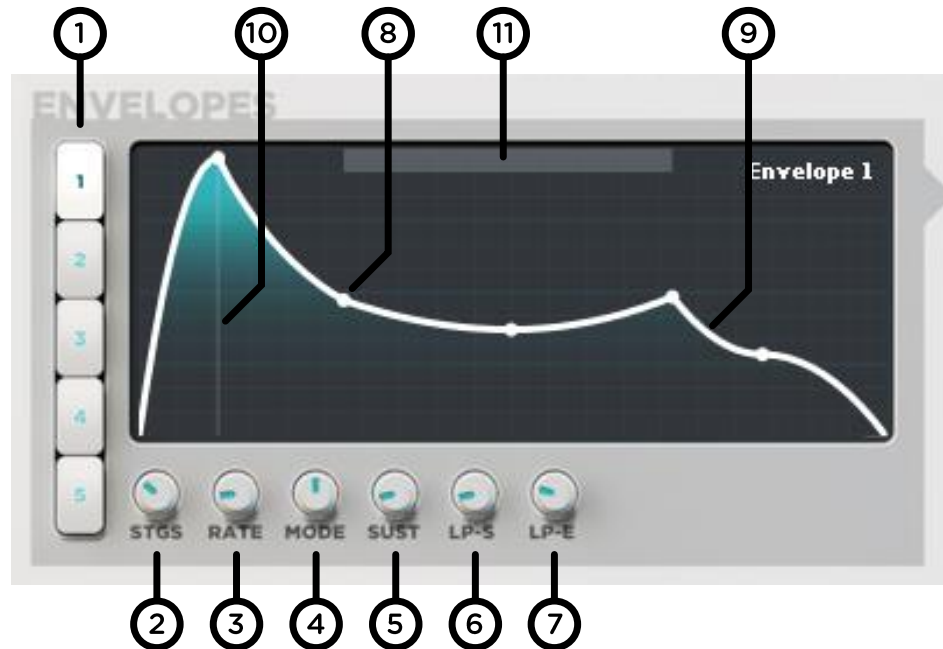
# EFFECTS

- 8) Use the Mid-High Knob to control the middle-high component of the tone stack. The middle-high component of the tone stack is a peak filter with a cutoff at 1.75 kHz.
- 9) Use the High Knob to control the high component of the tone stack. The high component of the tone stack is a high-shelf filter at with a cutoff 7.5 kHz.

# ENVELOPES

## Envelopes

*4MER comes with five independent envelopes. These envelopes can be used to control the volume of each oscillator, or can be used in combination with the modulation matrix to control many other parameters in 4MER.*



Here's detailed information about each control for each envelope:

- 1) Use the Envelope Select Buttons to pick which envelope you want to view and edit.
- 2) Each envelope in 4MER can have between 2 and 16 stages. A "stage" is the area between adjacent points in the envelope. That includes the far left (the beginning of the envelope) and the far right (the end of the envelope) boundaries. So the area between the start of the envelope to the first point is the first stage. The area between the first point and the second point is the second stage. Use the Envelope Stages Knob to select how many stages you want your envelope to use.
- 3) Every time the envelope is triggered, the envelope plays the entire graph that's shown in the Envelope Display - that is, the envelope plays from the far left through to the far right of the display. To change how fast the envelope plays,

# ENVELOPES

use the Envelope Rate Knob. The higher the envelope rate, the slower the envelope plays. So 0% is the fastest envelope. 100% is the slowest envelope.

- 4) Each envelope in 4MER can play using one of three modes: One Shot; Sustain; and Loop. Using the One Shot mode, whenever the envelope is triggered, the envelope plays all the way through without stopping. Using the Sustain mode, when the envelope is triggered, the envelope starts playing up to the Sustain Point (10) and pauses there until the envelope gets a note release message (i.e. when you release a key or the midi note ends) and then it plays through the rest of the envelope. Using the Loop mode, when the envelope is triggered, the envelope starts playing up to the Loop End Point. The envelope then goes back to the Loop Start Point and plays through to the Loop End Point. The envelope continues to play through the looped section (11) until the envelope gets a note release message. At that point, the envelope continues playing from wherever it is in the envelope, through the Loop End Point, and onto the end of the envelope. Use the Envelope Mode Knob to select which mode to use for that envelope.
- 5) Use the Envelope Sustain Point Knob to select where in the envelope to sustain. That sustain point is represented by the Sustain Point Marker (10). The sustain point is only used if the Envelope Mode Knob is set to Sustain.
- 6) Use the Envelope Loop Start Point Knob to select the start of the looped section. The looped section is represented by the Looped Section Marker (11).
- 7) Use the Envelope Loop End Point Knob to select the end of the looped section. The looped section is represented by the Looped Section Marker (11).
- 8) Each point of the envelope can be moved directly by clicking and dragging that point with the mouse.
- 9) The curve of each stage can be set directly by clicking and dragging on the line between two points.

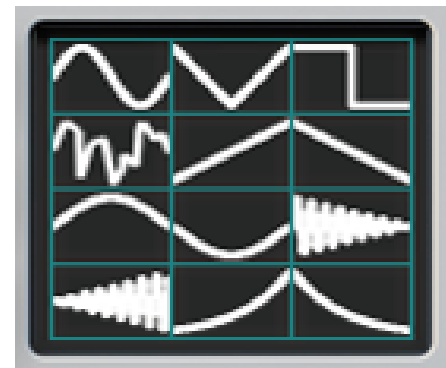
# LFOs

## LFOs

*4MER comes with four LFOs. The LFOs can be used in combination with the Modulation Matrix to modulate most controls in 4MER.*

Here's detailed information about each control for each LFO:

- 1) Use the LFO Select Buttons to pick which LFO you want to view and edit.
- 2) 4MER has 12 LFO waveforms available. Click on the name of the current LFO waveform to see all 12 available waveform options. Then select which waveform you want to use for that LFO.
- 3) The depth of each LFO can be set using the LFO Depth Knob. At 0%, the LFO is a flat line. At 100%, the LFO modulates fully.
- 4) The LFO Rate Knob sets the rate at which the LFO runs. When in Free Running or Free Running Retrig modes, 0% is about 30 seconds per cycle and 100% is about .07 seconds per cycle. When in Tempo Sync Mode, 0% is one measure and 100% is 1/32th note.
- 5) 4MER's LFOs can run using three playback modes: Free Running; Tempo Sync, and Free Running Retrig. The Free Running Retrig mode is like the Free Running Mode, but every time a note was triggered, the phase of the LFO would be reset to its starting position.
- 6) The Phase Knob changes the phase of the LFO.



4MER's LFO waveforms

# MODULATION MATRIX

## Modulation Matrix

*The Modulation Matrix is where you use things like LFOs, envelopes, CV signals, and more, to control the rest of 4MER.*

SOURCE	DESTINATION	AMT	SCALE	AMT
LFO 1	Osc 1 Volume	+100	Multiplies	+100
Envelope 3	Osc 1 Unison Spnd	0	Off	0
Off	Off	0	Off	0
Mod Wheel	Osc 3 Sync	-37	Off	0
CV In 3	Filter 2 Frequency	+20	Envelope 4	-78
Gate	Env 1 Rate	+65	CV In 5	+78
Off	Off	0	Off	0
Note	LFO 4 Depth	+100	LFO 2	+84
Off	Off	0	Off	0
Off	Off	0	Off	0

The Modulation Matrix has ten rows, or “Channels”. To correctly set up a

modulation, you need to set, at a minimum, a Modulation Source (1), a Modulation Destination (2), and a Modulation Amount (3). The Modulation Source is the signal that is going to control some other parameter in 4MER. The Modulation Destination is the parameter that’s going to be controlled. The Modulation Amount determines how much of the Modulation Source should be applied to the Modulation Destination. The Modulation Amount has a range of -100% to 100%. (Pro-tip: To reset the Modulation Amount, double-click on the number.)

But the Modulation Amount doesn’t have to be static, and that’s where the Modulation Scale is used. The Modulation Scale (4) takes another modulation source and applies that source to the Modulation Amount, so not only does the Modulation Destination modulate according to the Modulation Source, the amount of the source that’s applied is modulated by the Modulation Scale. And the amount of scale is controlled by the Modulation Scale Amount (5). (Pro-tip: Like the Modulation Amount, to reset the Modulation Scale Amount, double-click on the Modulation Scale Amount number that you want to reset.)

# MODULATION MATRIX

## MODULATION SOURCE

The modulation sources available in the Modulation Source are:

- LFOs 1 through 4
- Envelopes 1 through 5
- Mod Wheel
- Aftertouch
- CV Ins 1 through 6
- Velocity
- Note

## MODULATION DESTINATIONS

The modulation destinations available in the Modulation Destination are:

- Master Volume
- Portamento
- Waveshaping parameters for all oscillators (Pulse Width, Spread, Harmonic, Warp, Sync, Saturation, Bit Crush, and Phase)
- Note parameters for all oscillators (Volume, Pan, Octave, Semitone, and Fine Tune)
- Unison parameters for all oscillators (Unison Amount and Unison Spread)
- Filter parameters for all filters (Frequency and Resonance)
- LFO parameters for all LFOs (Depth, Rate, and Phase)
- Envelope Rate for all envelopes
- Reverb Amount
- Delay parameters (Free Running Rate, Typo Sync Rate, Delay Feedback, Delay Amount)
- EQ parameters (Low Shelf Amount, Medium-Low Amount, Medium-High Amount, and High Amount)

## MODULATION SCALE

The modulation sources available in the Modulation Scale are:

- LFOs 1 through 4

# MODULATION MATRIX

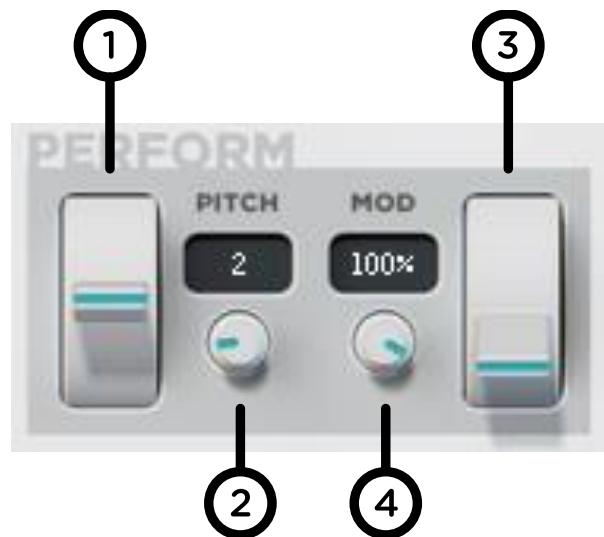
- Envelopes 1 through 5
- Mod Wheel
- Aftertouch
- CV Ins 1 through 6
- Velocity
- Note
- Multiply (This is a static multiplication of the modulation amount, between 0 and 10x.)
- Offset (This moves the center of the modulation from -100% to 100%.)



# PERFORMANCE CONTROLS

## Performance Controls

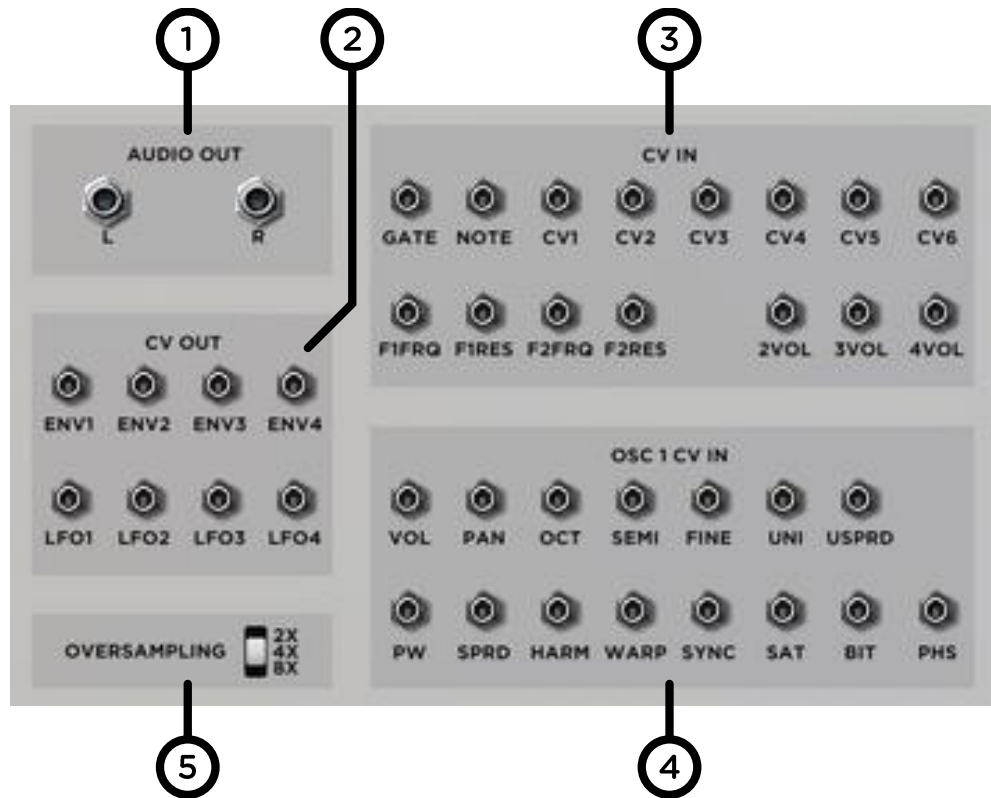
*4MER comes with standard Mod Wheel and Pitch Bend controls. The Pitch Bend Wheel (1) can bend up or down between 1 and 12 semitones. Use the Pitch Bend Range Knob (2) to set the range of the Pitch Bend Wheel. The Mod Wheel (3) can send a modulation signal between -100% and 100%. Use the Mod Wheel Range Knob to set the range of the Mod Wheel.*



# PERFORMANCE CONTROLS

## Connections

*The back of 4MER has many available connections.*



1. 4MER uses standard stereo audio outs. When an instance of 4MER is created, the Audio Out connections are automatically connected to a new mix channel.
2. 4MER's LFOs and Envelopes can be used to control external devices. To do so, connect the CV Out jack from the applicable Envelope or LFO to whatever device or connection you wish to control.
3. To control 4MER by a different Reason device (e.g. Matrix, RPG-8, etc.) connect the Gate and Note CV outs from that external device to 4MER's Gate and Note CV Ins. 4MER also has six generic CV Ins that you can use in 4MER's Modulation Matrix. To use an external CV signal, connect that signal into any of the CV In 1-6, and then select that CV In as a Modulation Source in 4MER's Modulation Matrix. 4MER has a few direct connections available too. You can connect any external CV signal directly into either of the Filter's Frequency and Resonance parameters, or to the Volume of Oscillators 2 through 4. When an external CV signal is controlling the filter or volume parameters, the position of the related knob on the front of 4MER sets the center of the modulation.

# PERFORMANCE CONTROLS

4. Oscillator 1 has a special break-out section where every waveshaper, note parameter, and unison parameter can be accessed directly through CV. Connect any external CV signal to any of the Oscillator 1 CV Ins to control that parameter. When an external CV signal is controlling a parameter, the position of the related knob on the front of 4MER usually sets the center of the modulation.
5. 4MER also allows you to specify how much oversampling the oscillators use. By default, 4MER oversamples the oscillators 4 times (4X). For most sound design applications, this is enough. But sometimes, aliasing can occur if you are creating sounds with either very high frequencies, or sounds with sweeping pitch changes. In those cases, you may want to increase the oversampling to 8X. But beware: the higher the oversampling rate you choose, the more DSP you use. Therefore, the goal in sound design is usually to use as low an oversampling rate as possible to fit your sound. It is a bad habit to always use the highest oversampling rate available. For example, bass sounds usually need very little oversampling. If you use 8X oversampling on a bass, you are likely wasting DSP.

# REMOTE TEMPLATE

## Remote Template

Here's the remote template for 4MER:

```
Scope      Ochen K.      com.ochenk.4MER
//Map      _control_     Master Volume
//Map      _control_     Portamento
//Map      _control_     Note Mode
//Map      _control_     Osc 1 Wave
//Map      _control_     Osc 1 Volume
//Map      _control_     Osc 1 Pan
//Map      _control_     Osc 1 Env Dest
//Map      _control_     Osc 1 Filter Dest
//Map      _control_     Osc 1 Octave
//Map      _control_     Osc 1 Semitone Pitch
//Map      _control_     Osc 1 Fine Pitch
//Map      _control_     Osc 1 Unison Amount
//Map      _control_     Osc 1 Unison Spread
//Map      _control_     Osc 1 Pulse Width
//Map      _control_     Osc 1 Spread
//Map      _control_     Osc 1 Harmonics
//Map      _control_     Osc 1 Warp
//Map      _control_     Osc 1 Sync
//Map      _control_     Osc 1 Saturation
//Map      _control_     Osc 1 Bit Crush
//Map      _control_     Osc 1 Phase
//Map      _control_     Osc 2 Wave
//Map      _control_     Osc 2 Volume
//Map      _control_     Osc 2 Pan
//Map      _control_     Osc 2 Env Dest
//Map      _control_     Osc 2 Filter Dest
//Map      _control_     Osc 2 Octave
//Map      _control_     Osc 2 Semitone Pitch
//Map      _control_     Osc 2 Fine Pitch
//Map      _control_     Osc 2 Unison Amount
//Map      _control_     Osc 2 Unison Spread
//Map      _control_     Osc 2 Pulse Width
//Map      _control_     Osc 2 Spread
//Map      _control_     Osc 2 Harmonics
//Map      _control_     Osc 2 Warp
//Map      _control_     Osc 2 Sync
//Map      _control_     Osc 2 Saturation
//Map      _control_     Osc 2 Bit Crush
//Map      _control_     Osc 2 Phase
//Map      _control_     Osc 3 Wave
//Map      _control_     Osc 3 Volume
//Map      _control_     Osc 3 Pan
//Map      _control_     Osc 3 Env Dest
//Map      _control_     Osc 3 Filter Dest
//Map      _control_     Osc 3 Octave
//Map      _control_     Osc 3 Semitone Pitch
//Map      _control_     Osc 3 Fine Pitch
//Map      _control_     Osc 3 Unison Amount
//Map      _control_     Osc 3 Unison Spread
//Map      _control_     Osc 3 Pulse Width
//Map      _control_     Osc 3 Spread
//Map      _control_     Osc 3 Harmonics
//Map      _control_     Osc 3 Warp
//Map      _control_     Osc 3 Sync
```

# REMOTE TEMPLATE

```
//Map _control_ Osc 3 Saturation
//Map _control_ Osc 3 Bit Crush
//Map _control_ Osc 3 Phase
//Map _control_ Osc 4 Wave
//Map _control_ Osc 4 Volume
//Map _control_ Osc 4 Pan
//Map _control_ Osc 4 Env Dest
//Map _control_ Osc 4 Filter Dest
//Map _control_ Osc 4 Octave
//Map _control_ Osc 4 Semitone Pitch
//Map _control_ Osc 4 Fine Pitch
//Map _control_ Osc 4 Unison Amount
//Map _control_ Osc 4 Unison Spread
//Map _control_ Osc 4 Pulse Width
//Map _control_ Osc 4 Spread
//Map _control_ Osc 4 Harmonics
//Map _control_ Osc 4 Warp
//Map _control_ Osc 4 Sync
//Map _control_ Osc 4 Saturation
//Map _control_ Osc 4 Bit Crush
//Map _control_ Osc 4 Phase
//Map _control_ Env 1 Stages
//Map _control_ Env 1 Rate
//Map _control_ Env 1 Mode
//Map _control_ Env 1 Sustain Point
//Map _control_ Env 1 Loop Start Point
//Map _control_ Env 1 Loop End Point
//Map _control_ Env 2 Stages
//Map _control_ Env 2 Rate
//Map _control_ Env 2 Mode
//Map _control_ Env 2 Sustain Point
//Map _control_ Env 2 Loop Start Point
//Map _control_ Env 2 Loop End Point
//Map _control_ Env 3 Stages
//Map _control_ Env 3 Rate
//Map _control_ Env 3 Mode
//Map _control_ Env 3 Sustain Point
//Map _control_ Env 3 Loop Start Point
//Map _control_ Env 3 Loop End Point
//Map _control_ Env 4 Stages
//Map _control_ Env 4 Rate
//Map _control_ Env 4 Mode
//Map _control_ Env 4 Sustain Point
//Map _control_ Env 4 Loop Start Point
//Map _control_ Env 4 Loop End Point
//Map _control_ Env 5 Stages
//Map _control_ Env 5 Rate
//Map _control_ Env 5 Mode
//Map _control_ Env 5 Sustain Point
//Map _control_ Env 5 Loop Start Point
//Map _control_ Env 5 Loop End Point
//Map _control_ Filter 1 Type
//Map _control_ Filter 1 Frequency
//Map _control_ Filter 1 Resonance
//Map _control_ Filter 2 Type
//Map _control_ Filter 2 Frequency
//Map _control_ Filter 2 Resonance
//Map _control_ LFO 1 Wave
//Map _control_ LFO 1 Depth
//Map _control_ LFO 1 Rate
//Map _control_ LFO 1 Mode
//Map _control_ LFO 1 Phase
```

# REMOTE TEMPLATE

```
//Map _control_ LFO 2 Wave
//Map _control_ LFO 2 Depth
//Map _control_ LFO 2 Rate
//Map _control_ LFO 2 Mode
//Map _control_ LFO 2 Phase
//Map _control_ LFO 3 Wave
//Map _control_ LFO 3 Depth
//Map _control_ LFO 3 Rate
//Map _control_ LFO 3 Mode
//Map _control_ LFO 3 Phase
//Map _control_ LFO 4 Wave
//Map _control_ LFO 4 Depth
//Map _control_ LFO 4 Rate
//Map _control_ LFO 4 Mode
//Map _control_ LFO 4 Phase
//Map _control_ Reverb
//Map _control_ Tempo Sync
//Map _control_ Delay Free Rate
//Map _control_ Delay Sync Rate
//Map _control_ Delay Feedback
//Map _control_ Delay Wet
//Map _control_ EQ Low Shelf
//Map _control_ EQ Mid Low
//Map _control_ EQ Mid High
//Map _control_ EQ High
//Map _control_ Pitch Bend Range
//Map _control_ Mod Wheel Scale
//Map _control_ Mod Source 1
//Map _control_ Mod Source 2
//Map _control_ Mod Source 3
//Map _control_ Mod Source 4
//Map _control_ Mod Source 5
//Map _control_ Mod Source 6
//Map _control_ Mod Source 7
//Map _control_ Mod Source 8
//Map _control_ Mod Source 9
//Map _control_ Mod Source 10
//Map _control_ Mod Scale 1
//Map _control_ Mod Scale 2
//Map _control_ Mod Scale 3
//Map _control_ Mod Scale 4
//Map _control_ Mod Scale 5
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//Map _control_ Mod Destination 2
//Map _control_ Mod Destination 3
//Map _control_ Mod Destination 4
//Map _control_ Mod Destination 5
//Map _control_ Mod Destination 6
//Map _control_ Mod Destination 7
//Map _control_ Mod Destination 8
//Map _control_ Mod Destination 9
//Map _control_ Mod Destination 10
```