

- A VCO 1:** Main VCO, Controls Sub Osc
- B VCO 2:** Secondary VCO, Tune is offset from VCO 1 tune
- C VCO Hard Sync**

Hard sync forces the start of the waveform of VCO2 to the start of VCO1. The result is an in phase waveform that can be further shaped using the VCO2 Tune control

- I : VCO2 Tracks VCO1 Pitch, offset by VCO2 Tune Knob
- II: VCO2 pitch is ONLY controlled by VCO2 Tune Knob
- O: Sync off

D VCO Reset Trigger

A VCO reset determines how the VCO output behaves in relation to a note-on gate. When a reset trigger is used, the VCO waveform will always start when it receives a gate

- I : VCO1 (only) resets on note on
- II: VCO1 and VCO2 reset on note on
- O: Both VCOs run free

E Master Tune

+/-1 Oct, Controls VCO1, VCO2 and Sub Oscillator Pitch

F VCO2 TUNE

+/-3 Oct, Offsets from Master Tune Pitch (except in Sync Mode II)

G Mixer

Mixer for all the tone sources
 Ext Audio: Rear Panel Input, Pre-Filter
 O1, O2, Sub: These start to clip at 80%
 Noise/ Digital OSC: Level Control for Noise or Digital OSC 3

H Sub Oscillator Octave

1 octave, 2 octave, and 2 octave PW modulated

I Noise/Digital Osc Edit

Toggles Edit mode for Noise/DiOSC Parameters. Edit Mode uses the LFO Rate, Fade, and Shape Controls to adjust parameters. When Pressed, LFO LED will turn green indicating Edit Mode.

Double pressing turns the LFO LED orange, changes the Noise MIXER Channel to the Digital Osc, and enters Digital Osc Edit Mode (via LFO Controls). Pressing again will exit Edit Mode

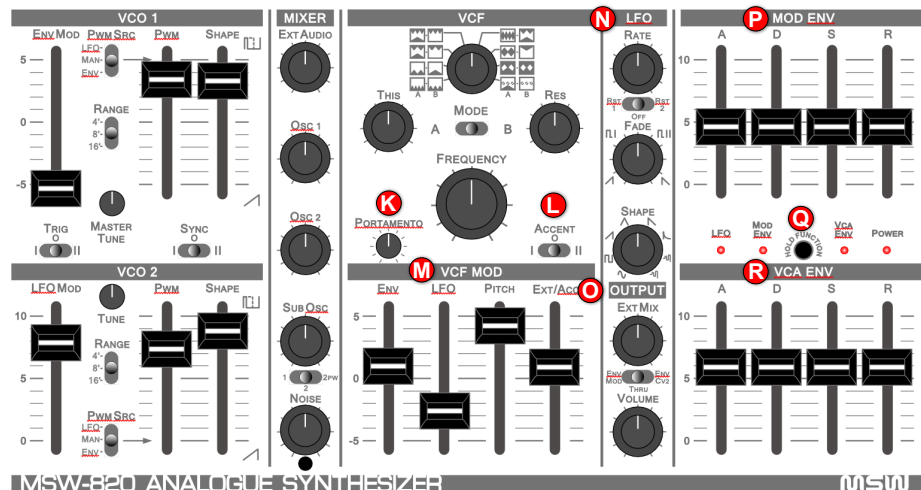
J 16 Mode Pole Mixing Filter

THIS Knob: Attenuverter that modulates the VCF Frequency at audio rates with the triangle output of VCO 1

Mode Toggle Switch: Switch between Mode Bank A and B

Mode Rotary Switch: Switch between the 16 filter modes

Mode A	Mode B
-24 dB/Oct Low Pass	-18/Oct dB Low Pass
-12 dB/Oct Low Pass	-6 dB/Oct Low Pass
-12 dB/Oct High Pass + -6 dB/Oct Low Pass A	-12 dB/Oct High Pass
-18 dB/Oct High Pass + -6 dB/Oct Low Pass	-18 dB/Oct High Pass
-24 dB/Oct Band Pass	-12 dB/Oct High Pass + -6 dB/Oct Low Pass B
-12 dB/Oct Band Pass	-6 dB/Oct Band Pass
-12 dB/Oct Notch + -6 dB/Oct Low Pass	-12 dB/Oct Notch
-18 dB/Oct Allpass + -6 dB/Oct Low Pass	-18 dB/Oct Allpass



K Portamento

Controls the portamento time between notes

L Accent

Note Accent is triggered by sending a 5V trigger into EXT CV or MIDI Velocity > 100. Accent amount is controlled via Acc Slider
 I : Accent Bump on VCF ONLY
 II: Accent Bump on VCF and VCA
 O: Accent off

M VCF Modulation Mixer

Please Note! These are all attenuverters and zero is NOT at the Bottom

ENV: Modulate VCF Frequency from MOD Envelope Generator

LFO: Modulate VCF Frequency from LFO

PITCH: Modulate cutoff from Pitch CV (Either MIDI or CV IN)

EXT/Acc: Modulate with EXT CV (back panel) or Accent Level if activated

N LFO

LFO Consists of 4 controls and can run freely or be reset by Note-On Gates

Rate: 0.1 Hz to 22 Hz

Reset: Controls when the LFO wave starts

Fade: Reset Mode 1 or OFF, LFO Delay with fade in
 Reset Mode 2, phase of the waveform

Shape: Fades between 8 waveforms: Sine, Square, Ramp, Tri, Saw, Expo Decay, Random, Smoothed Random

O Main Output

External Mix Level: Controls the level of the EXT INPUT from the back panel. The switch controls how this signal is routed before going to the Main Output:

THRU : Signal is routed directly to Main Output

ENV MOD: Signal is routed to VCA2 controlled by MOD ENV

ENV CV2: Signal is routed to VCA2 controlled by CV2 Input

Volume: Main Output of the Synth MIXER and EXT MIX/VCA2

P Mod Envelope Generator

Triggered by Note-On (MIDI or Gate)

Q Manual Envelope Trigger and Indicator LEDs

LFO: Red-LFO Rate, Green-Noise Edit, Orange-DiOSC Edit

Mod Env & VCA Env: Envelope Activity

Manual Trigger Button: Triggers both Envelopes Manually

Power: Green-Power On, Orange-MIDI Activity,
 Flashing Red-Bootload Mode

R VCA Envelope Generator

Triggered by Note-On (MIDI or Gate)

Rear Panel



POWER/USB: 5V USB C, 300 mA MIN. USB MIDI
MIDI IN: 3.5MM TRS MIDI Input (PSIMIDI, TRS A or B)
CLOCK: 3V-5V. LFO RATE, RATE knob becomes clock divider
GATE: 3V-10V for Note-On. Supersedes MIDI Gate
V/Oct: 0-10V. Supersedes MIDI Pitch
EXT CV: 0-10V, Controlled by "EXT CV" VCF Mod Slider
CV2: VCA 2 Level Input (envelope, etc.)
AUDIO IN: Routes to MIXER EXT AUDIO and OUTPUT EXT MIX
SYNTH OUT: Main Output

The Digital Sections: Noise, LFO, & Digital OSC

MSW-820 contains 3 digital signal generators. All 3 use the LFO controls Rate, Fade, and Shape to modify their own parameters

Low Frequency Oscillator (LFO):

8 LFO Shapes. with Rate and Fade (aka LFO Delay). LFO is hard wired as a modulation source for VCF, VCO 1 PWM, VCO 2 Pitch, VCO 2 PWM

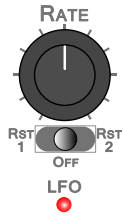
Noise Generator:

8 Noise Shapes. Noise is triggered by a Note ON and has its own volume envelope with a fixed Attack and a Decay controlled by the Rate knob. The Fade knob controls a noise type specific Parameter

Digital OSC:

The DiOSC is a pitch tracking third oscillator with 8 digital waveforms. The DiOSC is triggered via Note On and has its own volume envelope with a fixed Attack and a Decay controlled by the Rate knob. The Fade knob controls a DiOSC wave specific parameter.

The Low Frequency Oscillator (LFO)

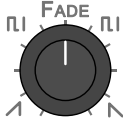


The primary control for LFO is the Rate knob ranging from 0.1Hz - 22 Hz (0.05-10 Sec). There are two reset modes (RST). Mode 1 resets the wave to a Note ON, Mode 2 Resets to Note ON with the Fade knob controlling the phase of the waveform

The LFO LED indicates the LFO Rate in RED



Holding the HOLD FUNCTION button while turning the Rate knob turns the LFO off, moving the rate knob normally turns the LFO back on

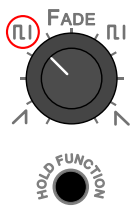


The Fade knob controls the start time of the LFO after a Note ON. Default behavior is a Fade IN when the LFO reset mode is OFF or RST 1. When the LFO is in RST 2, Fade will adjust the Phase of the LFO waveform with respect to the reset.



Holding the HOLD FUNCTION button toggles between the 4 options for Fade: Fade In, One Shot 1, One Shot 2, and Fade Out. To select the Fade mode, Press and hold the HOLD FUNCTION Button and turn the Fade knob to one of the 4 positions to change (see appendix 1)

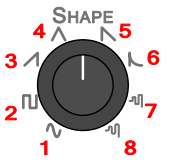
The Low Frequency Oscillator (LFO) Continued



One Shot 1: When this fade Mode is selected the LFO will generate ONE cycle of the selected waveform length of which is controlled by the Rate knob. The Fade knob works as a decay control in this mode. In this mode, the LFO reset behaves normally: RST1 generates 1 LFO waveform from the start, RST off generates 1 LFO waveform from a random spot on the waveform, RST2 generates 1 LFO waveform with the Fade knob controlling the start position of the single wave



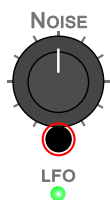
One Shot 2: When this fade Mode is selected the LFO will generate ONE cycle of the selected waveform length of which is controlled by the Rate knob. The Fade knob works as a decay control in this mode. In this mode, the LFO reset behaves normally: RST1 generates 1 LFO waveform from the start, RST off generates 1 LFO waveform from a random spot on the waveform, RST2 generates 1 LFO waveform with the Fade knob controlling the start position of the single wave



The Shape knob selects LFO waveform. The waveforms fade into each other so there are many possible variations. The Waveforms are:

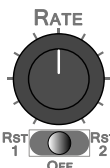
- 1: Sine
- 2: Pulse (50%)
- 3: Ramp
- 4: Triangle
- 5: Sawtooth
- 6: Exponential Decay
- 7: Random
- 8: Smoothed Random

The Noise Generator

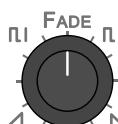


The Noise output feeds the noise Mixer channel. To enter the edit mode of the noise parameters, press the button below the noise level knob.

The LFO LED will turn solid green indicating Noise Edit Mode. To return to LFO mode, press the Noise button again

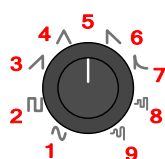


In Noise Edit Mode, the Rate knob controls the decay of the noise when triggered by a Note ON. Turning the knob all the way counter clock wise will turn the noise on continuously and turning the knob clockwise will decrease the decay time. The reset switch has no effect on the noise.



The Fade knob in Noise Edit Mode serves as a general purpose edit knob that adjusts a specific parameter for each noise type:

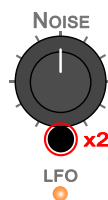
- 1: White - Env to LFO Rate
- 2: Pink - Filter Freq
- 3: Blue - Filter Freq
- 4: Crackle - Density
- 5: Thunder - Filter Freq
- 6: Red - Rate
- 7: Synced - Frequency
- 8: Toad - Frequency
- 9: Pipe - Feedback



The Shape knob selects 9 Noise flavors. The noise types cross fade into each other so there are many possible variations. The noise types are:

- 1: White Noise
- 2: Pink Noise (Falling frequency content)
- 3: Blue Noise (Rising frequency content)
- 4: Crackle
- 5: Thunder
- 6: Red (Brownian) Noise
- 7: Synced Noise
- 8: Synced Toad Noise
- 9: Pipe

The Digital Oscillator (DiOSC)

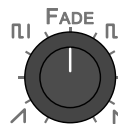


The DiOSC output feeds the noise Mixer channel replacing the Noise. To toggle between Noise Mode and DiOSC, double press the noise button.

The LFO LED will turn solid orange indicating DiOSC Edit Mode. To return to LFO mode, press the Noise button again

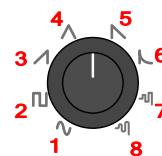


In DiOSC Edit Mode, the Rate knob controls the decay of the DiOSC when triggered by a Note ON. Turning the knob all the way counter clock wise will turn the DiOSC on permanently, and turning the knob clockwise will decrease the decay time. The reset switch has no effect on the DiOSC



The Fade knob in DiOSC Edit Mode serves as a general purpose edit knob that adjusts a specific parameter for each DiOSC type:

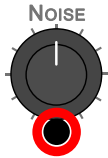
- 1: Hillagator - Select Harmonic
- 2: Donk - FM Amount
- 3: Fattner - Detune
- 4: Batsaw - Spread
- 5: Hypnotoad - Octave
- 6: Reso - Frequency
- 7: Formic - Frequency
- 8: Hexperc - FM Amount



The Shape knob selects the 8 DiOSC flavors. The DiOSCs do NOT crossfade

- 1: Hillagator - Sine Wave
- 2: Donk - Basic 2op FM
- 3: Fattner - Single Saw
- 4: Batsaw - 4 Saws
- 5: Hypnotoad - Noise Wavetable
- 6: Pseudo Reso - Synced + windowed sine
- 7: Formic - 2 Synced Sines
- 8: Hexperc - hex inverter drum osc

The Tuner



There is a tuner function built into the MSW-820. Pressing and holding the Noise Button for 5 secs will play a A440 tone on the Noise Mixer Channel and trigger both envelopes open. This allows for easy tuning of OSC1 and 2 by using each channels tune knob to match the pitch playing on the noise channel. Long press the noise button to exit tuner mode.

MIDI Control

CC#	Name	Values	
1	Mod Wheel	0-127	
3	Bend up amount	0-127 >> 2	0-16 bend semis = 0,0.1,0.25,0.5,1,2,3,4,5,6,7,8,9,10,11,12,24
9	Mod Wheel LFO > pitch	0-127 >> 2	0-16 bend semis = 0,0.1,0.25,0.5,1,2,3,4,5,6,7,8,9,10,11,12,24
14	LFO shape	0-127	
15	LFO fade mode	0-127 >> 5	0-3 fade in oneShot 1, oneShot 2, fade out
20	LFO rate	0-127	
21	LFO fade	0-127	
22	LFO reset to phase	0-127	
23	LFO freeze	≤63 off, ≥64 on	
24	AT > filter	0-127	
25	AT > LFO > filter	0-127	
26	AT > Lfo Rate doubler amount	0-127	follows sync divisions when synced
27	enable MIDI accent	off < 30 < ms	above 31, CC is actual milliseconds
29	bender > filter amount	0-127	
30	NOISE / O3 mode switch	≤ UP, ≥64 DN	
31	AT > Lfo Rate up/dn	≤ UP, ≥64 DN	
74	"EXT CV" filter amt	0-127	
85	NOISE select	0-127 >> 4	
86	Bend Down amount	0 = use bend up amount	0-16 bend semis = 0,0.1,0.25,0.5,1,2,3,4,5,6,7,8,9,10,11,12,24
87	NOISE rate control	0-127	
89	NOISE ramp control	0-127	
120	all notes off	any	

<u>System Exclusive</u>	<u>Default</u>	<u>Function</u>	
f0 7d 08 10 0c xx f7	0	Change Channel	0-15 0 = Channel 1, 1 = Channel 2, ...15 = Channel 16
f0 7d 08 10 0b f7		Boot to Bootloader	
f0 7d 08 10 0f f7		Calibration	
f0 7d 08 10 0a f7		Save and exit Calibration	
f0 7d 08 10 0d xx f7	2	Root Octave	0-5
f0 7d 08 10 0e xx f7	LAST NOTE	Note priority	0-2 0 = LOW NOTE, 1 = HIGH NOTE, 2 = LAST
f0 7d 08 10 09 f7		Clear cal	set all cal vals to 0
f0 7d 08 10 08 f7		Factory reset	set CC options to 0